발 간 등 록 번 호
11-1191000-000007-10
기관 2020-028

승 인 번 호
제 105001 호

Survey of Research and Development in Korea, 2019

Key Figures of Korea R&D Activities

Korea Institute of S&T Evaluation and Planning

2019
Survey of Research and Development in Korea

Ministry of Science and ICT

KISTEP Korea Institute of S&T Evaluation and Planning

Contents

Survey of Research and Development in Korea, 2019

2. R&D Personnel

3. R&D Activities of the Business Enterprise Sector

Ⅲ APPENDIX

〈 TABLE 〉

〈 FIGURE 〉

I SURVEY OUTLINE

The Purpose of the Survey

- To supply basic data on Korea's R&D activities (R&D human resources and expenditure) that can be used in setting up the national R&D policy and to provide a reference to experts in various fields to help them better develop their R&D planning
- To provide the OECD with data on Korea's R&D activities that can be used in comparative studies among member countries, which contributes to enhancing the nation's credibility

The Basis and History of the Survey

- According to the Framework Act on Science and Technology Act Article 26, Act No. 2, 'Designated Statistics' under the Statistics Law: No. 105001 (July 16, 1982)
- Since initiated as a project titled "A Status Survey of Research Institutes" in 1963, the survey has annually announced the previous year's research and development performances.

The Coverage and Method of the Survey

- Field of R&D covered in the survey : natural sciences, engineering & technology, medical & health sciences, agricultural sciences, humanities and social sciences according to the "OECD Proposed Standard Practice for Surveys of Research and Experimental Development : FRASCATI MANUAL"
- Methods used in the survey : self-reporting survey via mail or the Internet, supplemented by telephone survey
- Organizations covered in the survey : public research institutes, higher educations, medical institutes, business enterprises

※ The number of surveyed organizations (as of 2019)

Classification	Public Research Institutes	Higher educations	Medical Institutes	Business Enterprises	Total
Number of the Surveyed Org.	868	418	437	65,372	67,095
Number of the Retrieval Org. (Recovery Rate)	851 (98.0%)	414 (99.0%)	424 (97.0%)	61,999 (94.8%)	63,688 (94.9%)

- Survey base period : R&D personnel/researchers and the amount of capital are based on the last calendar date (December 31) of the previous year while sales and R&D expenditure are based on the whole previous calendar year (January 1-December 31)
- Survey items : general information, researchers(gender, degree, major), R&D expenditure (type of R&D, source of funds, type of costs)

Survey of Research and Development in Korea, 2019

Ⅱ KEY FIGURES[1)2)]

R&D

science

technology

1. R&D Expenditure

2. R&D Personnel

3. R&D Activities of the Business Enterprise Sector

1) The figures in this report are calculated based on rounding off to the nearest integer.

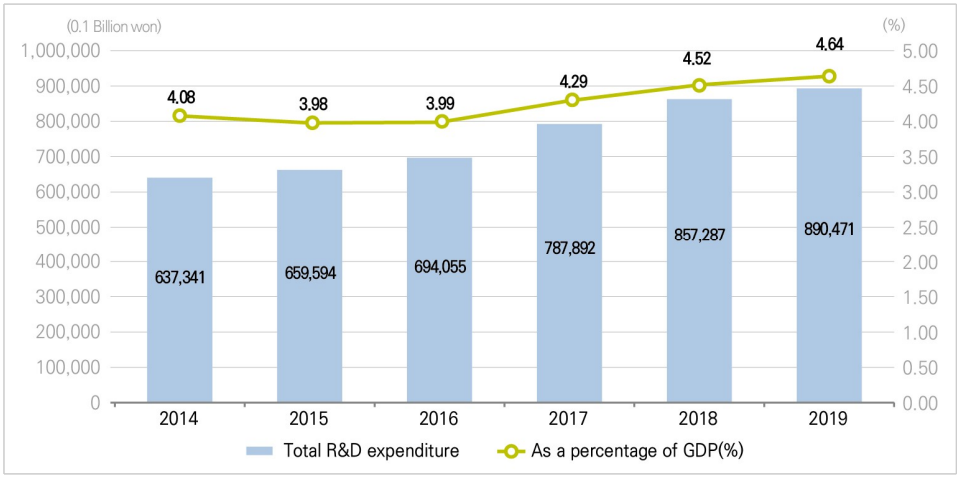
2) Due to the adjustment of GDP, data from oversea, and etc., some data are subject to change.

1. R&D Expenditure

Total R&D Expenditure

☑ Korea's total R&D expenditure in 2019 has increased by 3.3184 trillion won or 3.9% from the previous year to 89.0471 trillion won.

〈Figure 1〉
R&D expenditure and as a percentage of GDP (Korea)

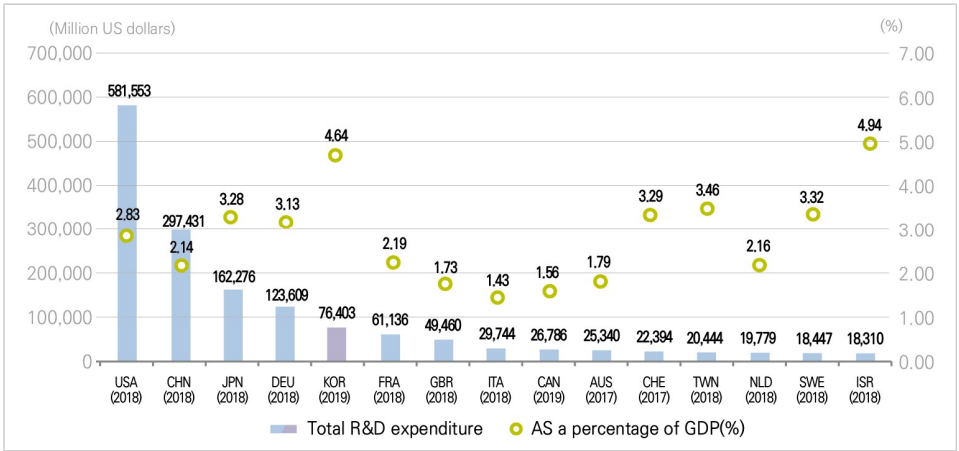


* Due to the adjustment of GDP, data from oversea, and etc., some data are subject to change
* Source: Ministry of Science and ICT, KISTEP (Korea Institute of S&T Evaluation and Planning), and Annual R&D surveys by Bank of Korea

☑ Exchange Rate*-adjusted R&D expenditure of Korea accounts for 76,403 million dollars, ranking 5th in the world. Its R&D to GDP ratio has increased by 0.12%p to 4.64%, and ranked 2nd in the world.

* 2019 Exchange rate of 1,165.50 won per US dollar is applied in accordance with OECD's application to R&D related data.

〈Figure 2〉
R&D expenditure by country



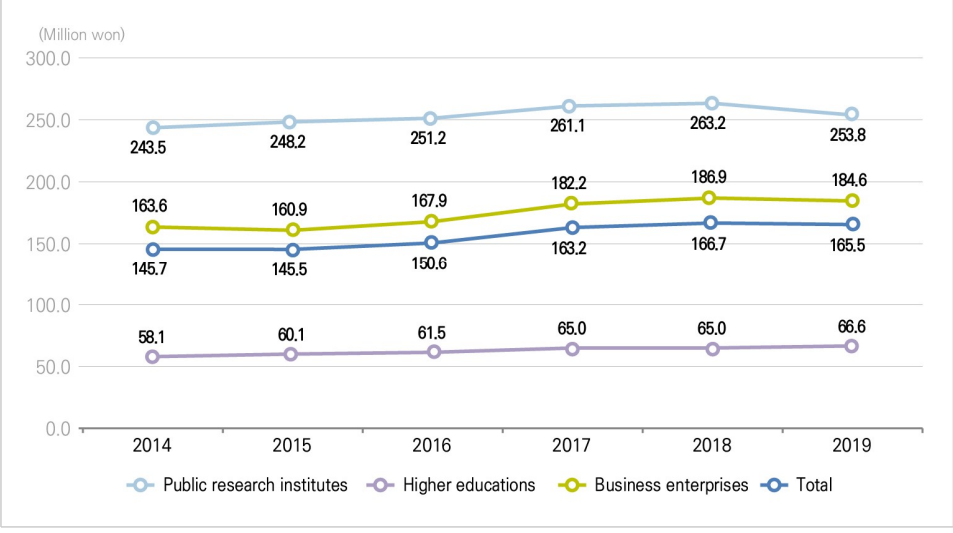
* The world ranking was based on the latest data of its member and major non-member countries), compiled and released by the OECD (*Main Science and Technology Indicators 2020-1)*
* Source : OECD, *Main Science and Technology Indicators 2020-1, 2020*
* USA: United States. CHN: China, JPN: Japan, DEU: Germany, KOR: Korea, FRA: France, GBR : United Kingdom, ITA: Italy, CAN: Canada, AUS: Australia, CHE: Switzerland, TWN: Chinese Taipei, NLD: Netherlands, SWE: Sweden, ISR: Israel

R&D Expenditure per Capita and per Researcher

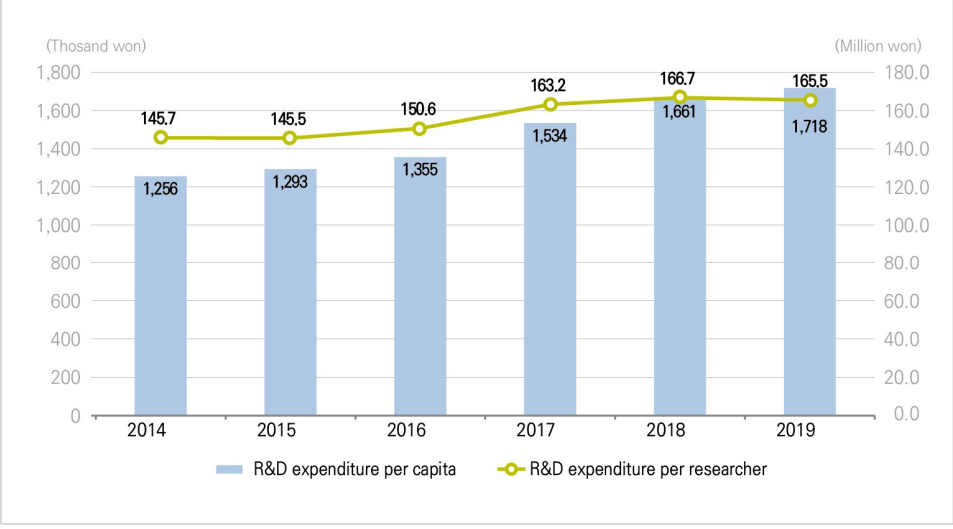
☑ Korea's R&D expenditure per capita is 1,718 thousand won and R&D expenditure per researcher is 165.5 million won.

- R&D expenditure per capita has increased by 57 thousand won or 3.4%, and R&D expenditure per researcher by 1 million won, a 0.8% decrease from the previous year.

〈Figure 3〉
R&D expenditure per researcher by sector of performance (Korea)



〈Figure 4〉
R&D expenditure per capita/per researcher (Korea)

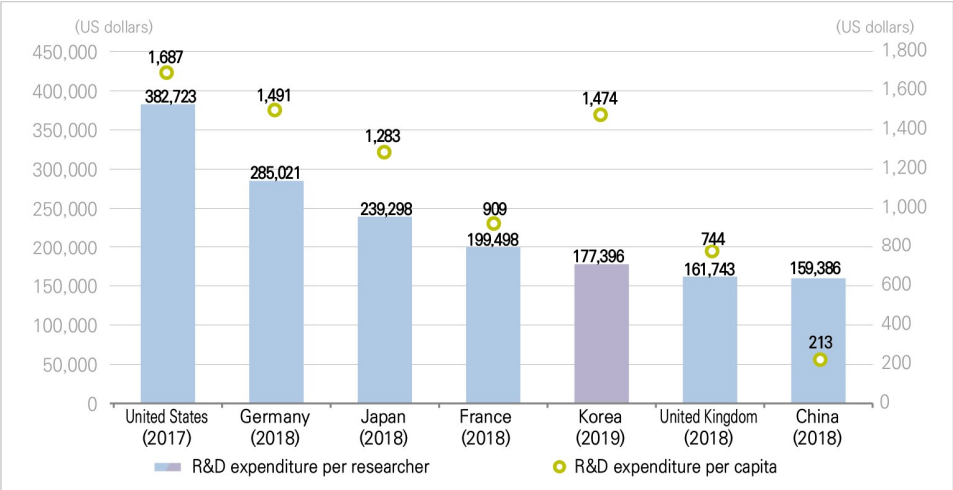


☑ The nation's R&D expenditure per capita (1,474 USD) is lower than United States & Germany, but higher than other major countries. The nation's R&D expenditure per researcher(FTE)* (177,396 USD) is less than that of the major countries like United States, Germany, Japan and France.

- The United States records the highest R&D expenditure per capita (1,687 USD in 2017), followed by Germany (1,491 USD in 2018), Korea(1,474 USD in 2019), and Japan (1,283 USD in 2018).
- Korea's R&D expenditure per researcher(FTE) is one of the lowest with China (159,386 USD in 2018) and United Kingdom(161,743 USD in 2018). The United States records the highest (382,723 USD in 2017) followed by Germany (285,021 USD in 2018)

* The full-time equivalent(FTE) of R&D personnel is defined as the ratio of working hours actually spent on R&D during a calendar year.

〈Figure 5〉
R&D expenditure per capita/per researcher(FTE) (Major countries)



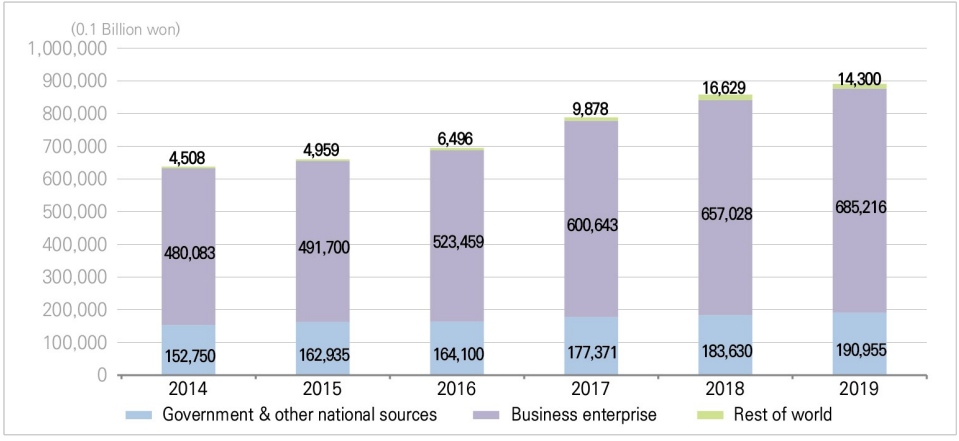
* Source : OECD, *Main Science and Technology Indicators 2020-1,* 2020

R&D Expenditure by Source of Funds

☑ As for Korea's R&D expenditure by source of funds, the government & the other national sources accounts for 19.0955 trillion won; the business enterprise, 68.5216 trillion won; and the rest of the world, 1.4300 trillion won.

- That is an year-to-year increase of 732.5 billion won or 4.0% for the government & the other national sources, increase of 2.8188 trillion won or 4.3% for the business enterprise, and decrease 232.9 billion won, or 14.0% from the rest of the world.

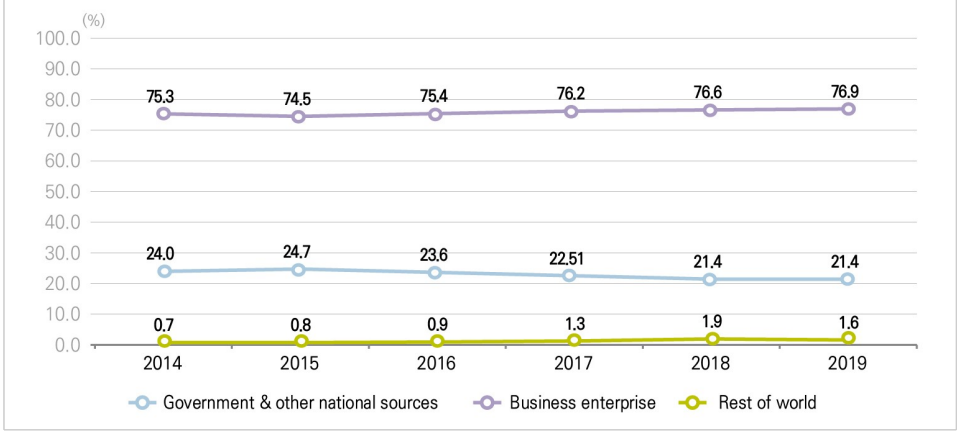
〈Figure 6〉
R&D expenditure by source of funds (Korea)



☑ In Korea's total R&D expenditure, government & other national sources accounts for 21.4%, the business enterprise, 76.9%, and the rest of the world, 1.6%.

- The percentage of the government & the other national sources is similar to previous year, and the business enterprise increased by 0.3%p, but the rest of the world decreased by 0.3%p.

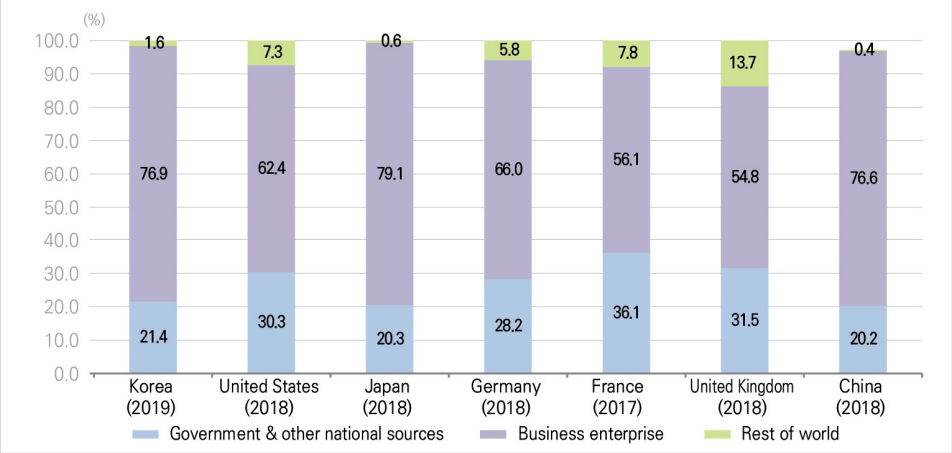
〈Figure 7〉
R&D expenditure rate by source of funds (Korea)



☑ The percentage of the government & the other national sources of Korea is relatively lower than that of major countries except China and Japan.

- Government & other national sources of France(2017) took up 36.1%; United Kingdom(2018), 31.5%; United States(2018), 30.3%; Germany(2018), 28.2%.

〈Figure 8〉
R&D expenditure rate by source of funds (Major countries)



* Source : OECD, *Main Science and Technology Indicators 2020-1*, 2020
* Total sum of China is less than 100.0%

〈Table 1〉
R&D expenditure rate to GDP by source of funds (Major countries)

(Unit : %)

		Government & other national sources	Business enterprise	Rest of the world	Total
Korea	2016	0.94	3.01	0.04	3.99
	2017	0.97	3.27	0.05	4.29
	2018	0.97	3.46	0.09	4.52
	2019	1.00	3.57	0.07	4.64
United States	2016	0.86	1.74	0.16	2.76
	2017	0.86	1.76	0.20	2.81
	2018	0.86	1.76	0.21	2.83
Japan	2016	0.67	2.47	0.02	3.16
	2017	0.68	2.51	0.02	3.21
	2018	0.67	2.59	0.02	3.28
Germany	2016	0.85	1.92	0.17	2.94
	2017	0.86	2.03	0.18	3.07
	2018	0.88	2.07	0.18	3.13
France	2016	0.80	1.24	0.17	2.22
	2017	0.80	1.24	0.17	2.20
	2018	-	-	-	2.19
United Kingdom	2016	0.54	0.86	0.26	1.66
	2017	0.54	0.90	0.24	1.68
	2018	0.55	0.95	0.24	1.73
China	2016	0.42	1.60	0.01	2.03
	2017	0.42	1.62	0.01	2.05
	2018	0.43	1.64	0.01	2.08

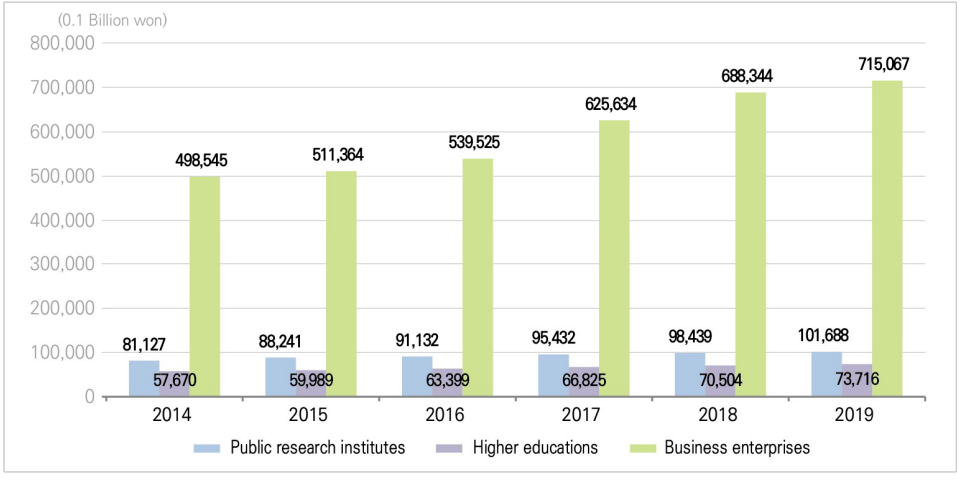
* Source : OECD, *Main Science and Technology Indicators 2020-1*, 2020
* Total sum of China is less than 100.0%

R&D Expenditure by Sector of Performance

☑ R&D expenditure by business enterprises is 71.5067 trillion won; public research institutes, 10.1688 trillion won; and higher educations, 7.3716 trillion won.

- That is an year-to-year increase of 2.6722 trillion won or 3.9% for the business enterprises; 324.9 billion won or 3.3% for the public research institutes; and 321.2 billion won, or 4.6% for the higher educations.

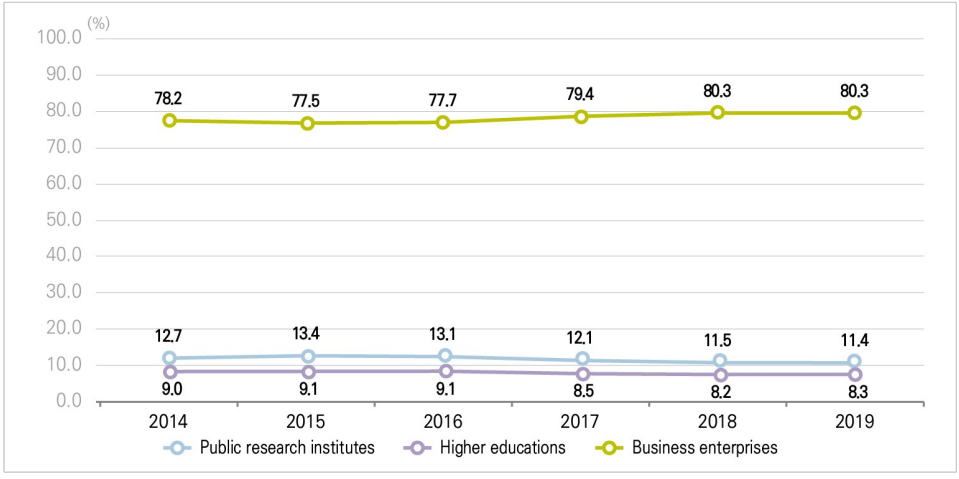
〈Figure 9〉
R&D expenditure by sector of performance (Korea)



☑ The rate of the R&D expenditure by business enterprises in Korea is 80.3%; and that of public research institutes, 11.4%; and that of higher educations, 8.3%.

- That is an year-to-year increase of 0.01%p for the business enterprises, but a decrease of 0.06%p for the public research institutes, a increase of 0.05%p for the higher educations.

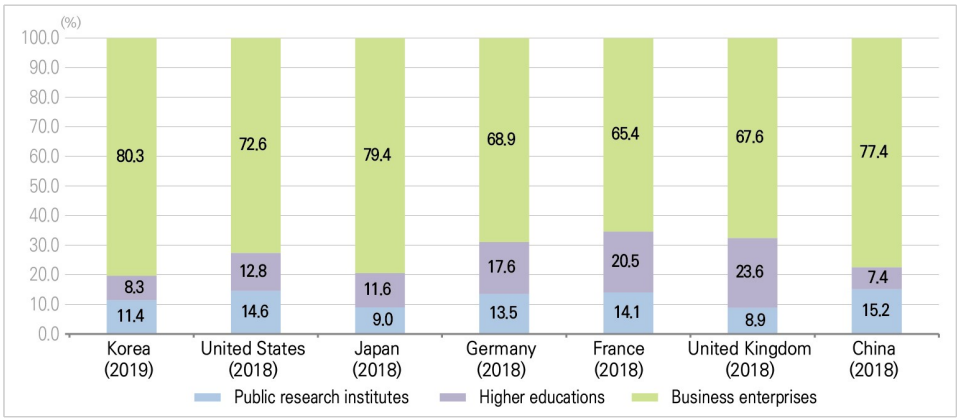
〈Figure 10〉
R&D expenditure rate by sector of performance (Korea)



☑ The business enterprises of Korea accounts for 80.3% of the total R&D expenditure, which is higher than major countries such as Japan of 79.4% in 2018 and China of 77.4% in 2018.

- On the contrary, the rate of the R&D expenditure by higher educations is 8.3%, lower in comparison with major countries except China of 7.4% in 2018.

〈Figure 11〉
R&D expenditure rate by sector of performance (Major countries)



* Source : OECD, *Main Science and Technology Indicators 2020-1*, 2020

〈Table 2〉
R&D expenditure rate to GDP by sector of performance (Major countries)

(Unit : %)

		Public research institutes	Higher educations	Business enterprises	Total
Korea	2016	0.52	0.36	3.10	3.99
	2017	0.52	0.36	3.41	4.29
	2018	0.52	0.37	3.63	4.52
	2019	0.53	0.38	3.73	4.64
United States	2016	0.40	0.36	2.00	2.76
	2017	0.40	0.37	2.05	2.81
	2018	0.41	0.36	2.05	2.83
Japan	2016	0.28	0.39	2.49	3.16
	2017	0.29	0.39	2.53	3.21
	2018	0.30	0.38	2.60	3.28
Germany	2016	0.41	0.53	2.00	2.94
	2017	0.42	0.53	2.12	3.07
	2018	0.42	0.55	2.16	3.13
France	2016	0.32	0.46	1.45	2.22
	2017	0.31	0.46	1.44	2.20
	2018	0.31	0.45	1.43	2.19
United Kingdom	2016	0.14	0.40	1.11	1.66
	2017	0.14	0.39	1.14	1.68
	2018	0.15	0.41	1.17	1.73
China	2016	0.33	0.14	1.63	2.10
	2017	0.32	0.15	1.64	2.12
	2018	0.32	0.16	1.66	2.14

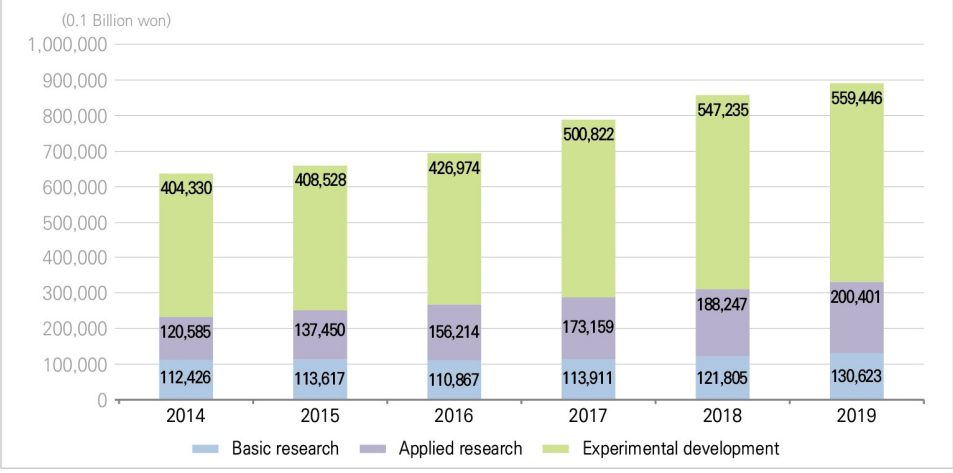
* Source : OECD, *Main Science and Technology Indicators 2020-1*, 2020

R&D Expenditure by Type of R&D

☑ 2019 Korea's R&D expenditure on basic research, compared to the previous year, has increased by 881.8 billion won or 7.2% to 13.0623 trillion won.

- R&D expenditure on applied research has increased by 1.2154 trillion won or 6.5% to 20.0401 trillion won.
- R&D expenditure on experimental development has increased by 1.2211 trillion won or 2.2% to 55.9446 trillion won.

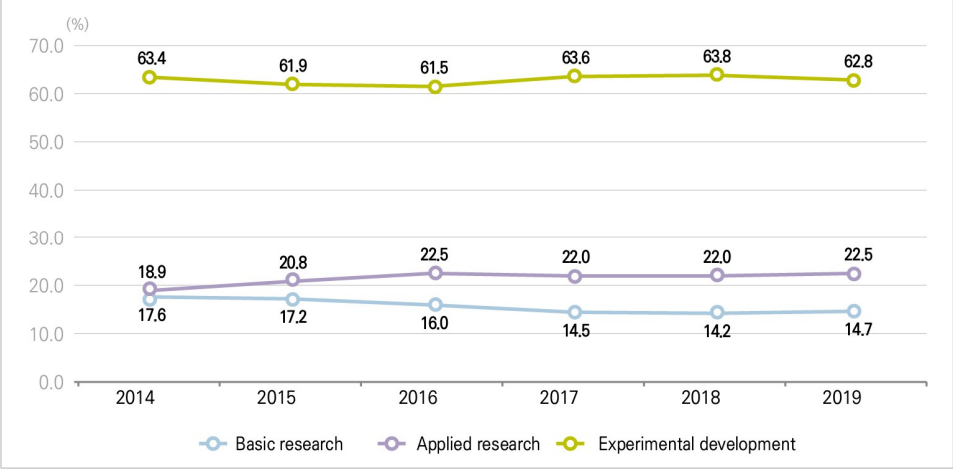
〈Figure 12〉
R&D expenditure by type of R&D (Korea)



☑ The percentage of expenditure on basic research stands at 14.7%; applied research, 22.5%; and experimental development, 62.8%.

- The percentage of spending on basic research and applied research have risen by 0.5%p and 0.5%p each from the previous year, but that on experimental development has recorded a 1.0%p decrease.

〈Figure 13〉
R&D expenditure rate by type of R&D (Korea)



☑ The percentage of the public research institutes have decreased in experimental development but showed a increase in basic research and applied research.

- Public research institutes and business enterprises focused on experimental development, but higher educations comparatively focused on all research areas.

〈Table 3〉 R&D expenditure by sector of performance and type of R&D (Korea)

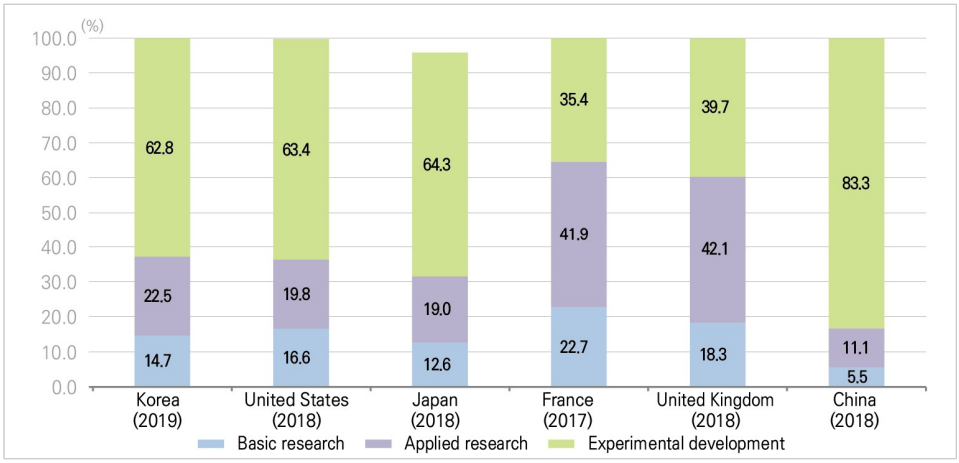
(Unit : 0.1 billion won, %)

		2014	2015	2016	2017	2018	2019
Public research institutes	Basic research	25,301	28,797	24,789	23,222	23,536	25,164
		31.2%	32.6%	27.2%	24.3%	23.9%	24.7%
	Applied research	17,327	18,724	23,230	25,716	25,690	27,340
		21.4%	21.2%	25.5%	26.9%	26.1%	26.9%
	Experimental development	38,499	40,720	43,112	46,494	49,213	49,184
		47.5%	46.1%	47.3%	48.7%	50.0%	48.4%
Sub total		81,127	88,241	91,131	95,432	98,439	101,688
Higher educations	Basic research	21,712	21,195	22,091	24,649	25,335	29,375
		37.6%	35.3%	34.8%	36.9%	35.9%	39.8%
	Applied research	18,465	19,840	21,164	20,605	23,026	21,662
		32.0%	33.1%	33.4%	30.8%	32.7%	29.4%
	Experimental development	17,493	18,954	20,144	21,571	22,143	22,680
		30.3%	31.6%	31.8%	32.3%	31.4%	30.8%
Sub total		57,670	59,989	63,399	66,825	70,504	73,716
Business enterprises	Basic research	65,413	63,624	63,986	66,040	72,934	76,085
		13.1%	12.4%	11.9%	10.6%	10.6%	10.6%
	Applied research	84,793	98,886	111,820	126,838	139,532	151,399
		17.0%	19.3%	20.7%	20.3%	20.3%	21.2%
	Experimental development	348,339	348,854	363,719	432,757	475,879	487,583
		69.9%	68.2%	67.4%	69.2%	69.1%	68.2%
Sub total		498,545	511,364	539,525	625,634	688,344	715,067
Total	Basic research	112,426	113,617	110,867	113,911	121,805	130,623
		17.6%	17.2%	16.0%	14.5%	14.2%	14.7%
	Applied research	120,585	137,450	156,214	173,159	188,247	200,401
		18.9%	20.8%	22.5%	22.0%	22.0%	22.5%
	Experimental development	404,330	408,528	426,974	500,822	547,235	559,446
		63.4%	61.9%	61.5%	63.6%	63.8%	62.8%
Total		637,341	659,595	694,055	787,892	857,287	890,471

☑ Korea's spending on basic research is relatively lower than major countries

- The percentage of Korea's R&D expenditure on basic research is lower than France(22.7%, 2017), United States(16.6%, 2018), United Kingdom (18.3%, 2018) but higher than Japan(12.6%, 2018) and China(5.5%, 2018)

〈Figure 14〉
R&D expenditure rate by type of R&D (Major countries)



* Source : OECD, *R&D Statistics 2020*, 2020
* Total sum of United States, France and Japan is less than 100.0%

〈Table 4〉
R&D expenditure rate to GDP by type of R&D (Major countries)

(Unit : %)

		Basic research	Applied research	Experimental development	Total
Korea	2016	0.64	0.90	2.45	3.99
	2017	0.62	0.94	2.73	4.29
	2018	0.64	0.99	2.88	4.52
	2019	0.68	1.04	2.92	4.64
United States	2016	0.47	0.56	1.72	2.76
	2017	0.47	0.56	1.78	2.81
	2018	0.47	0.56	1.79	2.83
Japan	2016	0.40	0.60	2.02	3.16
	2017	0.42	0.60	2.05	3.21
	2018	0.41	0.62	2.11	3.28
France	2016	0.50	0.94	0.79	2.22
	2017	0.50	0.92	0.78	2.20
	2018	-	-	-	2.19
United Kingdom	2016	0.30	0.73	0.63	1.66
	2017	0.29	0.72	0.67	1.68
	2018	0.32	0.73	0.69	1.73
China	2016	0.11	0.22	1.77	2.10
	2017	0.12	0.22	1.78	2.12
	2018	0.12	0.24	1.78	2.14

* Source : OECD, *R&D Statistics 2020*, 2020
* Total sum of United States, France and Japan is less than 100.0%

R&D Expenditure by Type of Costs

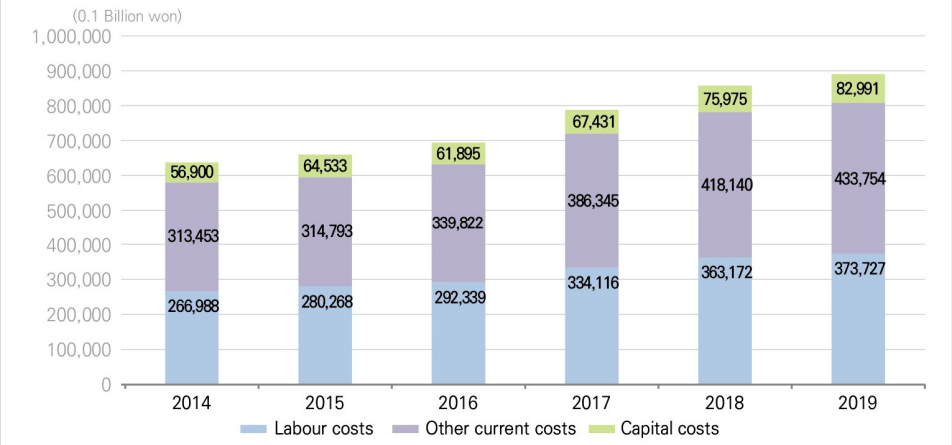
☑ Of the total R&D expenditure in 2019, the current costs is 80.7480 trillion won and the capital costs accounts for 8.2991 trillion won.

- The current costs is comprised of labour costs of 37.3727 trillion won and other current costs* of 43.3754 trillion won.

  * Other current costs includes raw material cost, direct expenditure, indirect expenditure and other current costs except labour costs.

- The current costs increased by 2.6168 trillion won, 3.3% and the capital costs increased by 701.5 billion won, 9.2% compared to the previous year.

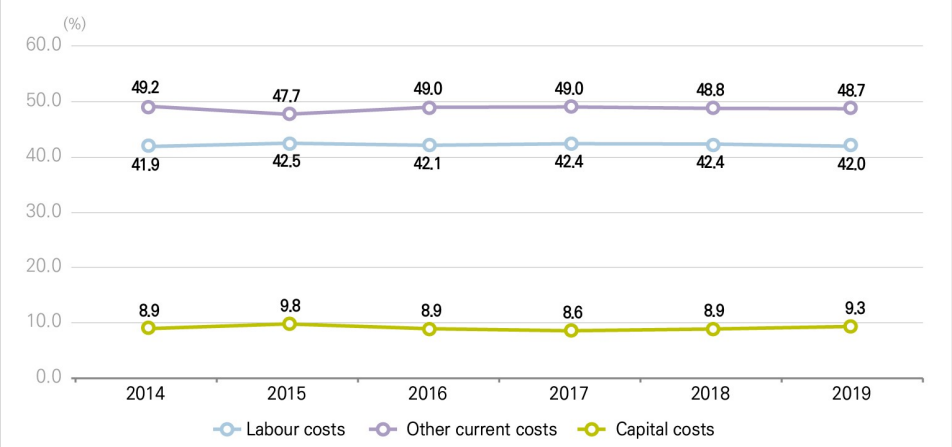
〈Figure 15〉 R&D expenditure by type of costs (Korea)



☑ The current costs accounts for 90.7% of the total R&D expenditure and the capital costs takes up 9.3%.

- This is a 0.5%p drop for the current costs, but a 0.5%p rise for the capital costs from the previous year.

〈Figure 16〉 R&D expenditure rate by type of costs (Korea)



〈Table 5〉
R&D expenditure by type of costs (Korea)

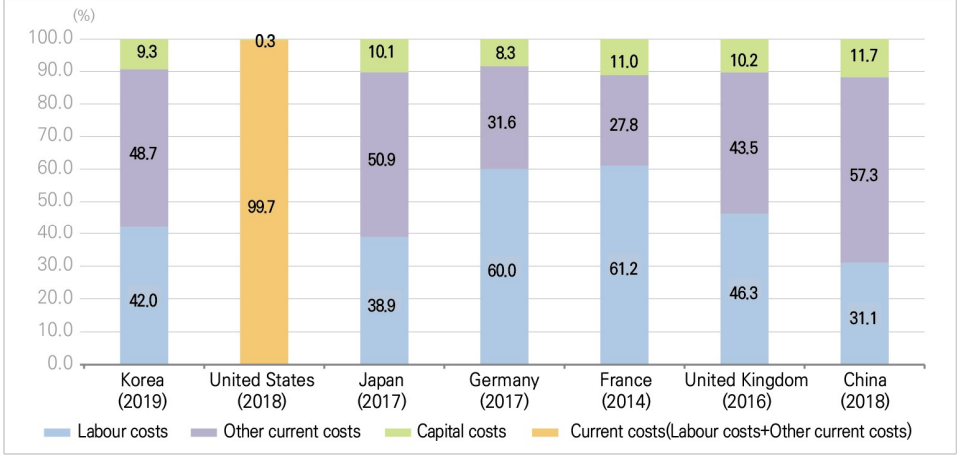
(Unit : 0.1 billion won, %)

			2014	2015	2016	2017	2018	2019
Current costs	Labour costs	R&D exp.	266,988	280,268	292,339	334,116	363,172	373,727
		rate	(41.9)	(42.5)	(42.1)	(42.4)	(42.4)	(42.0)
	Other current costs	R&D exp.	313,453	314,793	339,822	386,345	418,140	433,754
		rate	(49.2)	(47.7)	(49.0)	(49.0)	(48.8)	(48.7)
	Sub total	R&D exp.	580,441	595,061	632,161	720,461	781,312	807,480
		rate	(91.1)	(90.2)	(91.1)	(91.4)	(91.1)	(90.7)
Capital costs	Machinery	R&D exp.	42,771	45,424	46,603	45,688	54,586	56,967
		rate	(6.7)	(6.9)	(6.7)	(5.8)	(6.4)	(6.4)
	Land	R&D exp.	2,310	3,190	1,973	2,830	3,759	3,727
		rate	(0.4)	(0.5)	(0.3)	(0.4)	(0.4)	(0.4)
	Buildings	R&D exp.	6,959	11,825	9,085	12,624	8,418	11,948
		rate	(1.1)	(1.8)	(1.3)	(1.6)	(1.0)	(1.3)
	Computer software	R&D exp.	4,861	4,093	4,235	3,996	5,059	5,467
		rate	(0.8)	(0.6)	(0.6)	(0.5)	(0.6)	(0.6)
	Other intellectual properties	R&D exp.	-	-	-	2,293	4,153	4,882
		rate	-	-	-	(0.3)	(0.5)	(0.5)
	Sub total	R&D exp.	56,900	64,533	61,895	67,431	75,975	82,991
		rate	(8.9)	(9.8)	(8.9)	(8.6)	(8.9)	(9.3)
Total		R&D exp.	637,341	659,594	694,055	787,892	857,287	890,471
		rate	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

☑ Compared to major countries, the percentage of expenditure on labour costs of Korea is higher than that of Japan (38.9%, 2017) and China (31.1%, 2018), but lower than that of Germany (60.0%, 2017), France (61.2%, 2014) and United Kingdom(46.3%, 2016).

- Capital costs of Korea is lower than that of major countries except United States (0.3%, 2018), Germany(8.3%, 2017).

〈Figure 17〉
R&D expenditure rate by type of costs (Major countries)



* United States does not classify current costs into labour costs and other current costs.
* Source : OECD, *R&D Statistics 2020*, 2020

〈Table 6〉
R&D expenditure rate to GDP by type of costs (Major countries)

(Unit : %)

		Labour costs	Other current costs	Capital costs	Total
Korea	2016	1.68	1.95	0.36	3.99
	2017	1.82	2.10	0.37	4.29
	2018	1.91	2.20	0.40	4.52
	2019	2.26	1.95	0.43	4.64
United States	2016	2.76		0.01	2.76
	2017	2.81		0.01	2.81
	2018	2.82		0.01	2.83
Japan	2016	1.23	1.61	0.32	3.16
	2017	1.25	1.63	0.33	3.21
	2018	-	-	-	3.28
Germany	2016	-	-	-	2.94
	2017	1.84	0.97	0.25	3.07
	2018	-	-	-	3.13
France	2016	-	-	-	2.22
	2017	-	-	-	2.20
	2018	-	-	-	2.19
United Kingdom	2016	0.77	0.72	0.17	1.66
	2017	-	-	-	1.68
	2018	-	-	-	1.73
China	2016	0.62	1.21	0.27	2.10
	2017	0.63	1.23	0.25	2.12
	2018	0.67	1.23	0.25	2.14

* United States does not classify current costs into labour costs and other current costs.
* Source : OECD, *R&D Statistics 2020*, 2020

R&D Expenditure of 6Ts

☑ IT(Information technology) is the highest among 6Ts in terms of R&D expenditure, which is 33.0158 trillion won.

- Second highest is NT(Nano technology) of 8.8185 trillion won, followed by ET(Environment technology)of 7.7641 trillion won.
- Compared to the previous year, IT has increased by 2.2829 trillion won or 7.4%; NT by 80.8 billion won or 0.9%; ET has decreased by 199.5 billion won or 2.5%.

☑ The percentage of the IT, NT, and ET expenditure is 37.1%, 9.9%, and 8.7% respectively.

- Compared to the previous year, IT has risen by 1.3%p but NT and ET have dropped by 0.3%p and 0.6%p each.

〈Table 7〉
R&D expenditure by 6Ts (Korea)

(Unit : 0.1 billion won)

	2014	2015	2016	2017	2018	2019
IT (Information tech.)	219,391	213,099	234,879	287,317	307,329	330,158
	(34.4)	(32.3)	(33.8)	(36.5)	(35.8)	(37.1)
BT (Biology tech.)	48,097	59,946	56,137	62,111	66,401	76,262
	(7.5)	(9.1)	(8.1)	(7.9)	(7.7)	(8.6)
NT (Nano tech.)	83,587	86,609	85,499	76,201	87,377	88,185
	(13.1)	(13.1)	(12.3)	(9.7)	(10.2)	(9.9)
ST (Space tech.)	7,088	13,049	12,230	11,603	14,789	15,436
	(1.1)	(2.0)	(1.8)	(1.5)	(1.7)	(1.7)
ET (Environment tech.)	65,577	62,271	62,777	70,009	79,636	77,641
	(10.3)	(9.4)	(9.0)	(8.9)	(9.3)	(8.7)
CT (Culture tech.)	4,917	7,027	9,365	7,841	8,075	8,098
	(0.8)	(1.1)	(1.3)	(1.0)	(0.9)	(0.9)
Others	208,683	217,592	233,169	272,810	293,680	294,691
	(32.7)	(33.0)	(33.6)	(34.6)	(34.3)	(33.1)
Total	637,341	659,594	694,055	787,892	857,287	890,471
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

R&D Expenditure by Technology Classification

☑ R&D expenditure by technology classification of Korea is as follows:

- Electricity & Electronics of 26.0%, Machinery of 15.3%; and Information & Communication of 18.9%, taking up 60.2% of the total R&D expenditure.
- Public research institutes spends the largest amount of R&D expenditure in Machinery of 18.6%; the higher educations in Health science of 22.7%; and the business enterprises in Electricity & Electronics of 30.2%.

〈Table 8〉 R&D expenditure rate by sector of performance and technology classification, 2019 (Korea)

(Unit : %)

	Mathematics	Physics	Chemistry	Earth Science	Life Science	Agriculture, Fishery & food	Health Science
Public research ins.	0.3	6.0	2.7	3.2	4.7	5.9	5.5
Higher educations	1.1	2.2	3.6	2.5	7.7	5.0	22.7
Business enterprises	0.1	0.5	6.7	0.1	2.0	1.2	2.6
Total	0.2	1.2	5.9	0.6	2.8	2.1	4.6
	Machinery	Materials	Chemical Eng.	Electricity & Electronics	Information/ Communication	Energy/ Resources	Nuclear Power
Public research ins.	18.6	5.1	1.5	9.0	10.2	5.7	4.3
Higher educations	6.7	4.6	2.7	8.5	6.7	2.9	0.8
Business enterprises	15.7	5.0	3.0	30.2	21.4	1.7	0.5
Total	15.3	5.0	2.8	26.0	18.9	2.3	1.0
	Environment	Construction/Transportation	History/ Archeology	Philosophy/ Religion	Linguistics	Literature	Cultural/ Arts/Sports
Public research ins.	3.4	3.5	0.2	0.0	0.0	0.0	0.2
Higher educations	2.5	4.2	0.7	0.3	0.5	0.7	1.6
Business enterprises	0.8	6.2	0.0	0.0	0.0	0.0	0.9
Total	1.2	5.7	0.1	0.0	0.1	0.1	0.9
	Law	Politics/Public Administration	Economics/ Management	Society, Anthropology, Welfare, Woman	Human Ecology	Geographical/ Region/Tourism	Psychology
Public research ins.	0.2	1.2	2.5	0.6	0.1	0.4	0.0
Higher educations	0.4	0.8	2.5	1.5	0.5	0.6	0.2
Business enterprises	0.0	0.0	0.1	0.0	0.4	0.0	0.0
Total	0.1	0.2	0.5	0.2	0.4	0.1	0.0
	Education	Media/ Communication/ Library & information	Brain Sciences	Cognitive/ Emotion & Sensibility Sciences	S&T and Society	Total	
Public research ins.	2.2	0.0	0.5	0.1	2.1	100.0	
Higher educations	2.6	0.6	0.6	0.3	1.0	100.0	
Business enterprises	0.2	0.2	0.1	0.0	0.2	100.0	
Total	0.6	0.2	0.1	0.1	0.5	100.0	

R&D Expenditure by Socio-economics Objectives

☑ Based on socio-economics objectives, Korea's R&D expenditure by sector of performance in 2019 is as follows:

- The largest amount is devoted to Industrial production and technology of 60.4%, followed by Transport, telecommunication and other infrastructures of 11.0%, and Health of 7.4%, and Energy of 5.2%.
- Business enterprises spends a significant amount of R&D expenses of 70.0% in Industrial production and technology, while higher educations invests relatively higher share of their R&D expenditure of 27.1% in Health and 20.3% in Industrial production and technology. Public research institutes spends heavily on Industrial production and technology of 22.2% and Defence of 20.4%.

〈Table 9〉
R&D expenditure rate by sector of performance and socio-economics objectives, 2019 (Korea)

(Unit : %)

	Public research institutes	Higher educations	Business enterprises	Total
Exploration and Exploitation of the Earth	3.0	1.6	0.1	0.5
Environment	3.9	3.6	1.8	2.2
Exploration and Exploitation of Space	5.1	1.5	0.2	0.9
Transport, telecommunication and other infrastructures	6.7	9.1	11.8	11.0
Energy	8.3	6.6	4.6	5.2
Industrial production and technology	22.2	20.3	70.0	60.4
Health	9.1	27.1	5.2	7.4
Agriculture	6.8	5.1	1.6	2.5
Education	1.8	4.3	0.3	0.8
Culture, recreation, religion and mass media	0.5	3.5	1.1	1.2
Political and social systems, structures and processes	4.2	3.7	0.2	0.9
General advancement of knowledge	8.0	12.7	1.5	3.2
Defence	20.4	1.0	1.7	3.7
Total	100.0	100.0	100.0	100.0

R&D Expenditure by Field of R&D

☑ In 2019, Korea's R&D expenditure for science and technology accounts for 85.9448 trillion won, and for humanities and social sciences for 3.1023 trillion won.

- As for R&D investment in science and technology, engineering and technology takes up 64.3406 trillion won; natural sciences, 15.4460 trillion won; medical & health sciences, 4.3789 trillion won, and agriculture sciences, 1.7794 trillion won.
- Social sciences accounts for 1.8228 trillion won, and humanities for 1.2794 trillion won.
- Compared with the previous year, science and technology shows an increase of 3.1864 trillion won, or 3.9%; humanities and social sciences, 132.0 billion won, or 4.4%.

☑ The share of R&D investment in science and technology is the largest of 96.5%, while humanities and social sciences takes up 3.5%.

- Compared with the previous year, Science and technology, and Humanities and social sciences were similar to previous year.

〈Table 10〉
R&D expenditure by field of R&D (Korea)

(Unit : 0.1 billion won, %)

		2014	2015	2016	2017	2018	2019
Science and Technology	Natural Sciences	88,047	115,853	124,596	131,014	145,095	154,460
		(13.8)	(17.6)	(18.0)	(16.6)	(16.9)	(17.3)
	Engineering & Tech.	437,269	473,395	494,434	577,871	626,383	643,406
		(68.6)	(71.8)	(71.2)	(73.3)	(73.1)	(72.3)
	Medical & Health Sciences	75,281	32,126	34,229	36,700	39,610	43,789
		(11.8)	(4.9)	(4.9)	(4.7)	(4.6)	(4.9)
	Agricultural Sciences	14,048	13,893	13,318	14,368	16,496	17,794
		(2.2)	(2.1)	(1.9)	(1.8)	(1.9)	(2.0)
	Sub total	614,645	635,267	666,577	759,953	827,584	859,448
		(96.4)	(96.3)	(96.0)	(96.5)	(96.5)	(96.5)
Humanities and Social Sciences	Humanities	8,915	9,229	11,220	10,784	12,168	12,794
		(1.4)	(1.4)	(1.6)	(1.4)	(1.4)	(1.4)
	Social Sciences	13,781	15,098	16,259	17,155	17,535	18,228
		(2.2)	(2.3)	(2.3)	(2.2)	(2.0)	(2.0)
	Sub total	22,697	24,326	27,479	27,939	29,703	31,023
		(3.6)	(3.7)	(4.0)	(3.5)	(3.5)	(3.5)
Total		637,341	659,594	694,055	787,892	857,287	890,471
		(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

〈Table 11〉
R&D expenditure by sector of performance and field of R&D, 2019 (Korea)

(Unit : 0.1 billion won, %)

		Public research institutes		Higher educations		Business enterprises		Total	
		exp.	rate	exp.	rate	exp.	rate	exp.	rate
Science and Technology	Natural Sciences	14,557	(14.3)	10,703	(14.5)	129,200	(18.1)	154,460	(17.3)
	Engineering & Tech.	64,336	(63.3)	32,763	(44.4)	546,306	(76.4)	643,406	(72.3)
	Medical & Health Sciences	5,876	(5.8)	16,697	(22.6)	21,215	(3.0)	43,789	(4.9)
	Agricultural Sciences	6,947	(6.8)	4,464	(6.1)	6,383	(0.9)	17,794	(2.0)
	Sub total	91,717	(90.2)	64,627	(87.7)	703,104	(98.3)	859,448	(96.5)
Humanities and Social Sciences	Humanities	1,074	(1.1)	3,141	(4.3)	8,578	(1.2)	12,794	(1.4)
	Social Sciences	8,897	(8.7)	5,948	(8.1)	3,384	(0.5)	18,228	(2.0)
	Sub total	9,971	(9.8)	9,090	(12.3)	11,962	(1.7)	31,023	(3.5)
Total		101,688	(100.0)	73,716	(100.0)	715,067	(100.0)	890,471	(100.0)

R&D Expenditure by Region

☑ R&D expenditure of the Seoul metropolitan area is 62.2257 trillion won including Gyeonggi of 45.9348 trillion won, Seoul of 13.4449 trillion won, and Incheon of 2.8459 trillion won.

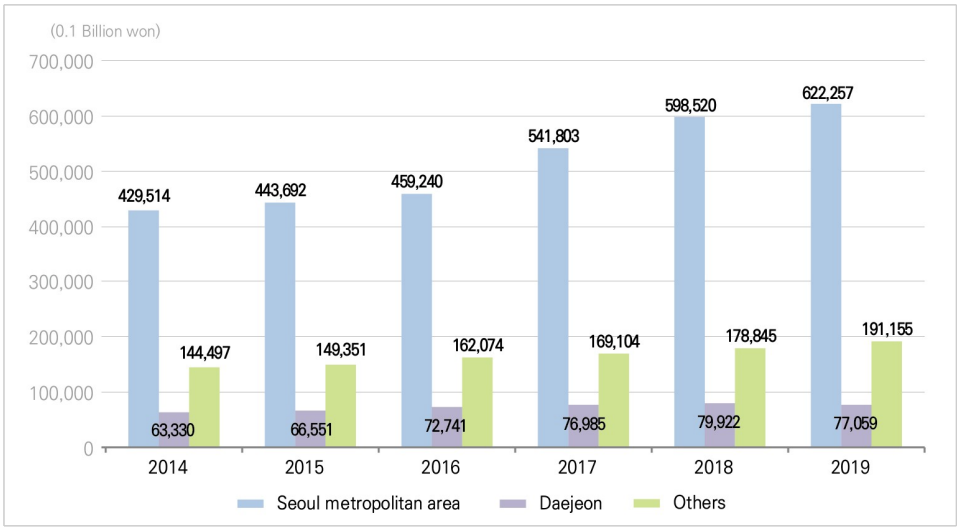
- Compared with the previous year, Gyeonggi and Chungnam have increased by 2.3195 trillion won, or 5.3% and 887.5 billion won, or 34.3% each but Daejeon has decreased by 286.3 billion won, or 3.6%.

〈Table 12〉
R&D expenditure by region (Korea)

(Unit : 0.1 billion won)

	2014	2015	2016	2017	2018	2019
Seoul	96,356	100,306	104,839	131,697	134,754	134,449
Busan	11,048	12,862	12,417	14,033	15,449	15,817
Daegu	9,705	11,040	11,958	12,380	13,258	13,360
Incheon	22,829	24,996	23,895	25,482	27,613	28,459
Gwangju	6,798	7,332	8,353	7,933	9,010	8,269
Daejeon	63,330	66,551	72,741	76,985	79,922	77,059
Ulsan	8,153	9,723	8,015	7,299	11,103	11,100
Sejong	3,925	4,887	4,685	4,837	5,171	5,941
Gyeonggi	310,330	318,390	330,506	384,625	436,153	459,348
Gangwon	3,705	4,142	3,921	4,503	4,818	5,172
Chungbuk	12,539	13,797	21,054	22,129	16,287	16,595
Chungnam	23,238	22,837	29,801	25,614	25,878	34,752
Jeonbuk	8,705	8,043	9,003	10,322	10,846	11,217
Jeonnam	7,485	5,739	5,198	5,491	6,608	7,238
Gyeongbuk	26,966	26,680	24,177	28,468	30,204	28,054
Gyeongnam	20,620	20,948	21,937	24,537	28,625	31,895
Jeju	1,609	1,320	1,555	1,560	1,590	1,744
Total	637,341	659,594	694,055	787,892	857,287	890,471

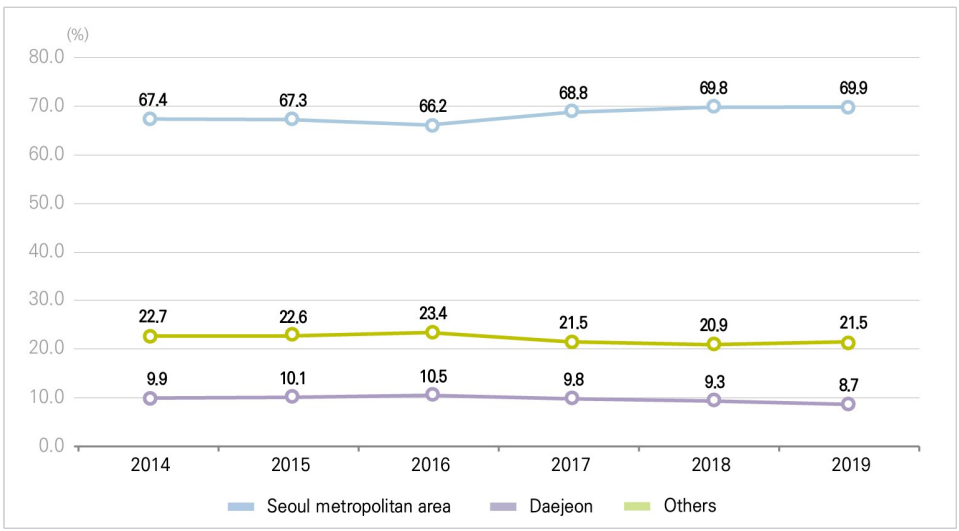
〈Figure 18〉
R&D expenditure in Seoul metropolitan area and Daejeon (Korea)



☑ R&D expenditure of the Seoul metropolitan area accounts for 69.9% and Daejeon accounts for 8.7% of the total R&D investments.

- The percentage of R&D expenditure has increased by 0.1%p, 0.6%p in the Seoul metropolitan area, other regions each, but it has decreased by 0.7%p in Daejeon.

〈Figure 19〉
R&D expenditure rate in Seoul metropolitan area and Daejeon (Korea)



The Flow and Composition of R&D Expenditure

〈Table 13〉
Flow of R&D expenditure by sector of performance, 2019 (Korea)

(Unit : 0.1 billion won, %)

Source \ Performance			Public research institutes			Higher educations		Business enterprises		Total
			Gov. Public Institute	Gov. supported Research institute	Other non-profit institute	National public univ.	Private univ.	Large corporations	Small and medium-sized businesses	
Gov., & other national sources	Gov.	Gov.	8,408	70,985	9,090	24,030	29,647	545	22,050	164,754
			(98.51)	(88.24)	(71.54)	(73.38)	(72.36)	(6.27)	(3.12)	(18.50)
		Gov-invested institute	30	6,121	222	1,545	2,350	32	9,128	19,428
			(0.35)	(7.61)	(1.75)	(4.72)	(5.74)	(0.36)	(1.29)	(2.18)
		National public univ.	12	22	8	1,582	93	0	78	1,796
			(0.14)	(0.03)	(0.06)	(4.83)	(0.23)	(0.00)	(0.01)	(0.20)
		Sub total	8,450	77,129	9,319	27,158	32,090	577	31,256	185,978
			(99.01)	(95.88)	(73.34)	(82.93)	(78.32)	(6.64)	(4.42)	(20.89)
	Other national sources	Private univ.	0	39	13	15	2,329	0	68	2,463
			(0.00)	(0.05)	(0.10)	(0.04)	(5.69)	(0.00)	(0.01)	(0.28)
		Non-profit corp.	2	400	908	307	675	0	221	2,513
			(0.02)	(0.50)	(7.15)	(0.94)	(1.65)	(0.00)	(0.03)	(0.28)
		Sub total	2	439	921	322	3,004	0	289	4,976
			(0.02)	(0.55)	(7.25)	(0.98)	(7.33)	(0.00)	(0.04)	(0.56)
	Total		8,452	77,567	10,240	27,479	35,094	577	31,545	190,955
			(99.03)	(96.42)	(80.59)	(83.92)	(85.66)	(6.64)	(4.47)	(21.44)
Business enterprise		Gov-invested institute	1	282	42	315	273	7,790	251	8,952
			(0.01)	(0.35)	(0.33)	(0.96)	(0.67)	(89.65)	(0.04)	(1.01)
		Private companies	81	2,281	1,928	4,775	5,199	313	661,685	676,263
			(0.95)	(2.83)	(15.18)	(14.58)	(12.69)	(3.61)	(93.67)	(75.94)
		Total	82	2,562	1,970	5,090	5,472	8,103	661,936	685,216
			(0.96)	(3.19)	(15.50)	(15.54)	(13.36)	(93.26)	(93.71)	(76.95)
Rest of the world			1	316	497	176	404	9	12,897	14,300
			(0.01)	(0.39)	(3.91)	(0.54)	(0.99)	(0.11)	(1.83)	(1.61)
Total			8,535	80,446	12,706	32,746	40,971	8,689	706,378	890,471
			(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

* Source of Funds :
Government = central government+local governments+national and public research institutes+national and public universities+government funded institutions
Other national sources = private universities+non-profit corporations
Business enterprise = government investment organizations+private companies
* Beneficiary of the funds :
Government public institute = National & public research institutes+N&P hospitals
Government supported research institute = central government funded+local government funded research institutes
Other non-profit organizations= private hospitals+others
National & public universities = N&P universities+their affiliated hospitals
Private universities = private universities+their affiliated hospitals
Large corporations = Large corporations+high potential enterprises
Small and medium-sized businesses = small and medium-sized businesses+venture businesses

2. R&D Personnel

Total Researchers

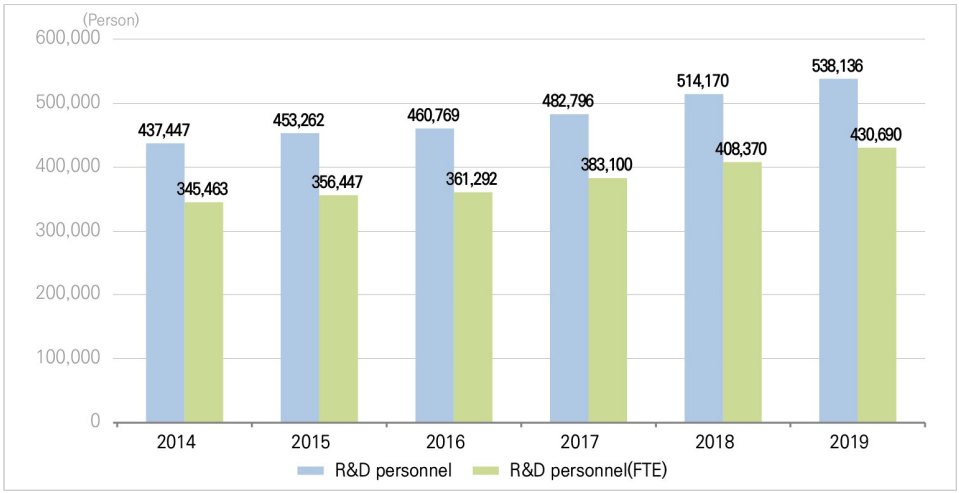
☑ Korean researchers totals 538,136 and its R&D personnel including research assistants totals 718,759.

- Researchers have increased by 23,966, or 4.7% and R&D personnel including research assistants by 27,699, or 4.0% from the previous year.

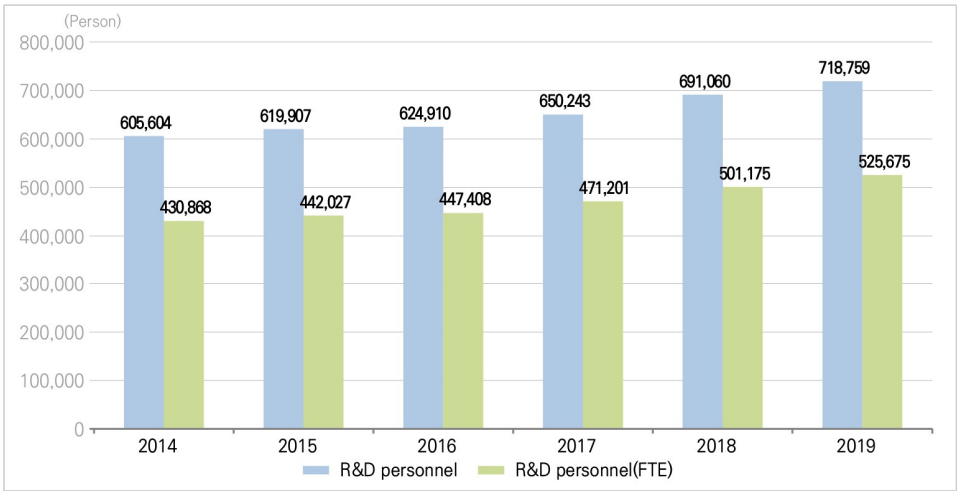
☑ Korean researchers(FTE) is 430,690, and its R&D personnel(FTE) is 525,675.

- Researchers(FTE) has increased by 22,320 or 5.5% and R&D personnel(FTE) including research assistants has increased by 24,500 or 4.9% from the previous year.

〈Figure 20〉 Researchers (Korea)



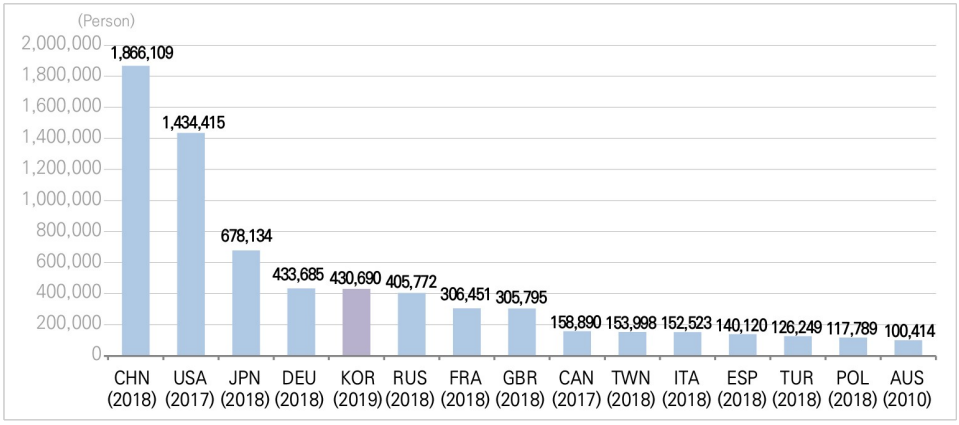
〈Figure 21〉 R&D personnel (Korea)



☑ Researchers(FTE) of Korea is the 5th largest in the world.

- China has the largest researchers(FTE) of 1,866,109 as of 2018 and the United States comes next with 1,434,415 as of 2017, followed by Japan with 678,134 as of 2018.

〈Figure 22〉
Researchers(FTE) by country



* Source : OECD, *Main Science and Technology Indicators 2020-1*, 2020

* CHN: China, USA: United States. JPN: Japan, DEU: Germany, KOR: Korea, RUS: Russian Federation, FRA: France, GBR : United Kingdom, CAN: Canada, TWN: Chinese Taipei, ITA: Italy, ESP: Spain, TUR: Turkey, POL: Poland, AUS: Australia

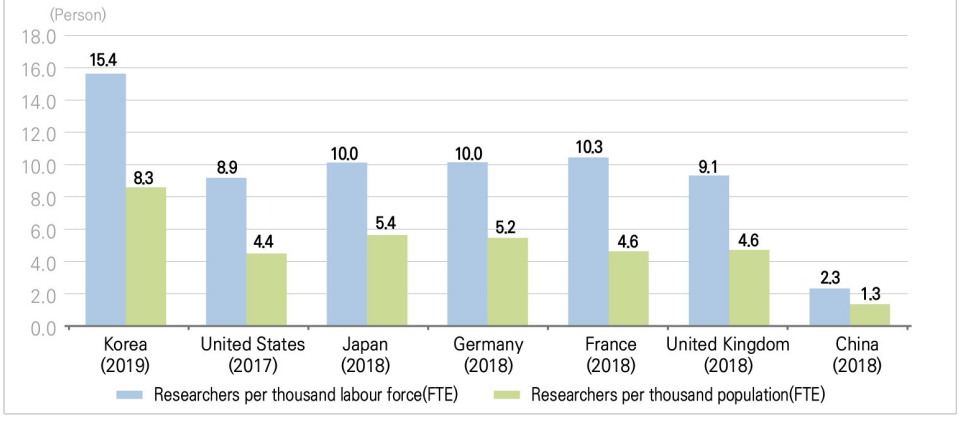
Researchers per Thousand Population /Labour Force

☑ Researchers(FTE) of Korea per 1,000 labour force in 2019 has risen by 0.7 to 15.4.

☑ Among the major countries, Korea has the largest researchers(FTE) per 1,000 labour force, followed by France of 10.3 in 2018, Germany of 10.0 in 2018, and Japan of 10.0 in 2018.

- Researchers(FTE) per 1,000 population has increased by 0.4 to 8.3.
- Researchers(FTE) per 1,000 population of Korea is the highest, followed by Japan of 5.4 in 2018, and by Germany of 5.2 in 2018.

〈Figure 23〉
Researchers(FTE) per thousand population/labour force (Major countries)



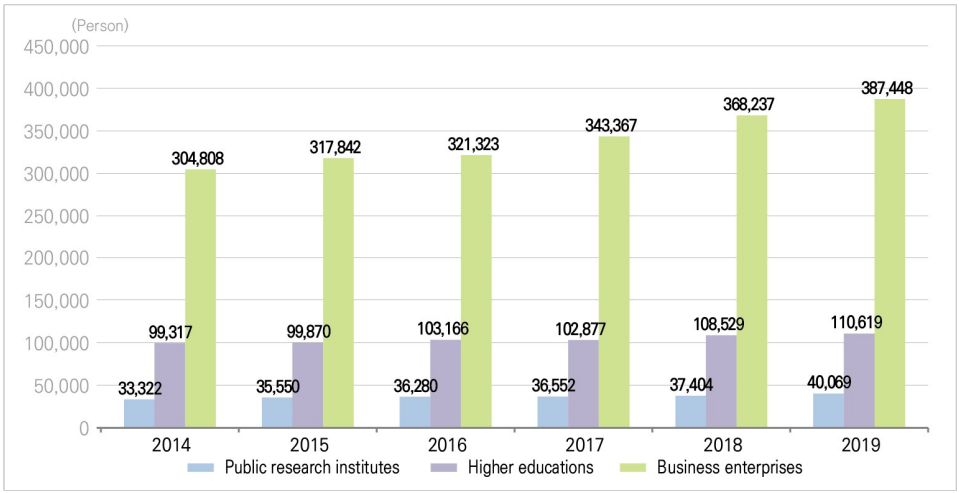
* Source : OECD, *Main Science and Technology Indicators 2020-1*, 2020

Researchers by Sector of Performance

☑ Researchers in business enterprises is 387,448; in public research institutes, 40,069; and in higher educations, 110,619.

- Compared with the previous year, researchers in business enterprises rose by 19,211, or 5.2%; in public research institutes by 2,665, or 7.1%; in higher educations by 2,090, or 1.9%.

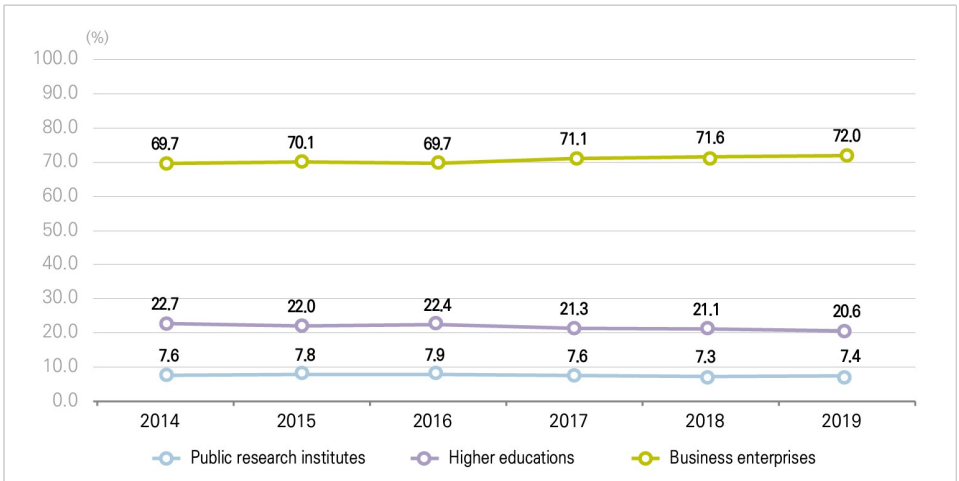
〈Figure 24〉 Researchers by sector of performance (Korea)



☑ As for the rate of researchers by sector of performance, business enterprises take up 72.0%, public research institutes 7.4%, and higher educations 20.6%.

- The rate for business enterprises and public research institutes have increased by 0.4%p and 0.2%p each, and higher educations have dropped by 0.6%p.

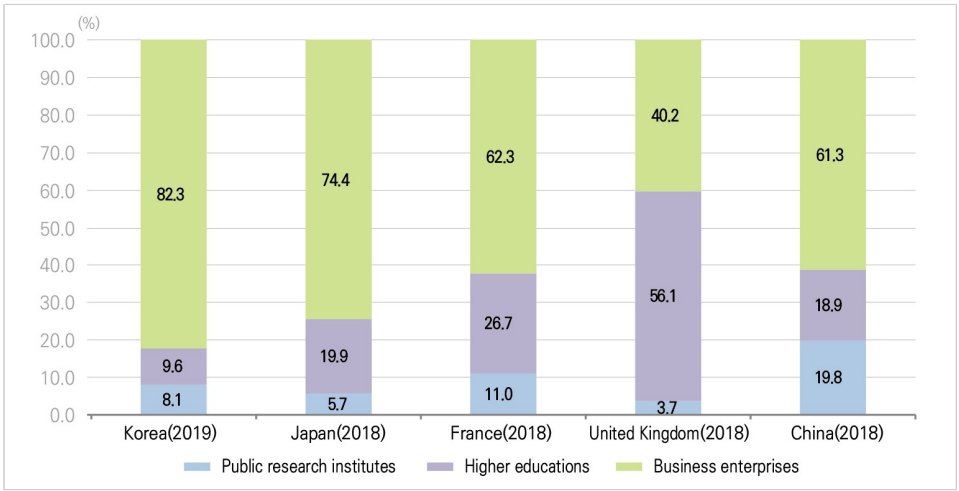
〈Figure 25〉 Researchers rate by sector of performance (Korea)



☑ The share of researchers(FTE) in business enterprises of 82.3% is relatively high among the major countries.

- Other nations with a high percentage of researchers in the business enterprises are Japan of 74.4% in 2018, China of 61.3% in 2018, France of 62.3% in 2018.
- Meanwhile, Korea' percentage of researchers in higher educations of 9.6% is lower than major countries such as United Kingdom of 56.1% in 2018, France of 26.7% in 2018 and Japan of 19.9% in 2018.

〈Figure 26〉
Researchers(FTE) rate by sector of performance (Major countries)



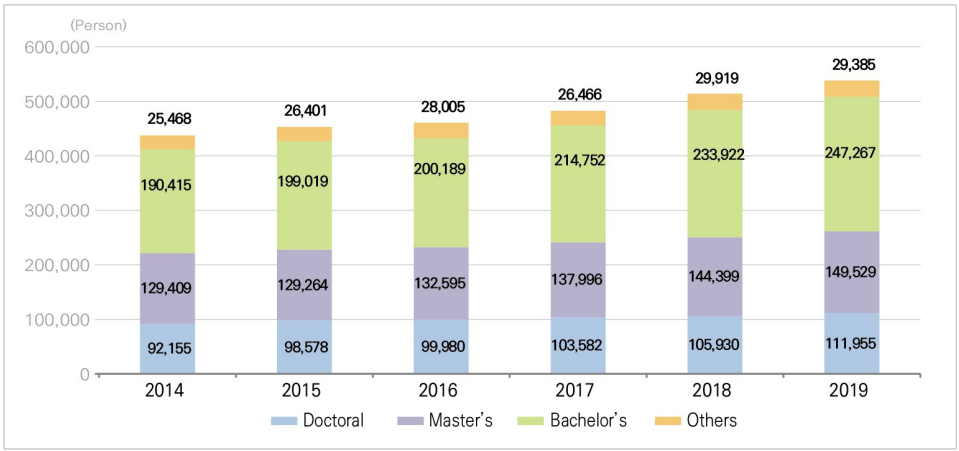
* Source : OECD, *R&D Statistics 2020*, 2020

Researchers by Degree

☑ As for researchers by degree, there are 111,955 researchers with doctoral degrees; 149,529 researchers with master's degrees; 247,267 researchers with bachelor's degrees; and 29,385 researchers with other degrees.

- Researchers with doctoral degrees has risen by 6,025, or 5.7%; with master's degree 5,130, or 3.6%; with bachelor's degree 13,345, or 5.7%, but that with other degrees has dropped 534, or 1.8%.

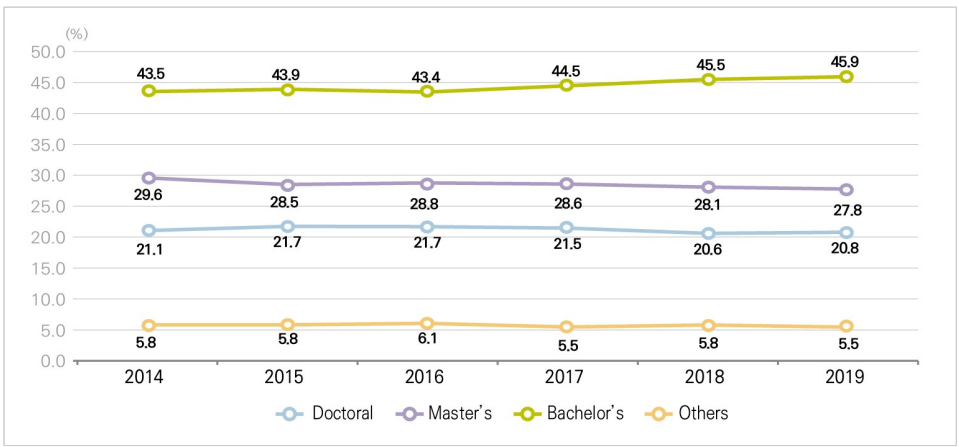
〈Figure 27〉
Researchers by degree (Korea)



☑ As for the rate of researchers by degree, doctoral degree takes up 20.8%, master's degree 27.8%, bachelor's degree 45.9%, and others 5.5%.

- The share of researchers with doctoral degrees and bachelor's degrees have risen by 0.2%p and 0.5%p, but that with master's degrees and other degrees has dropped by 0.3%p and 0.4%p.

〈Figure 28〉
Researchers rate by degree (Korea)



☑ 63,840, or 57.0% of the researchers with doctoral degrees are working in Higher educations.

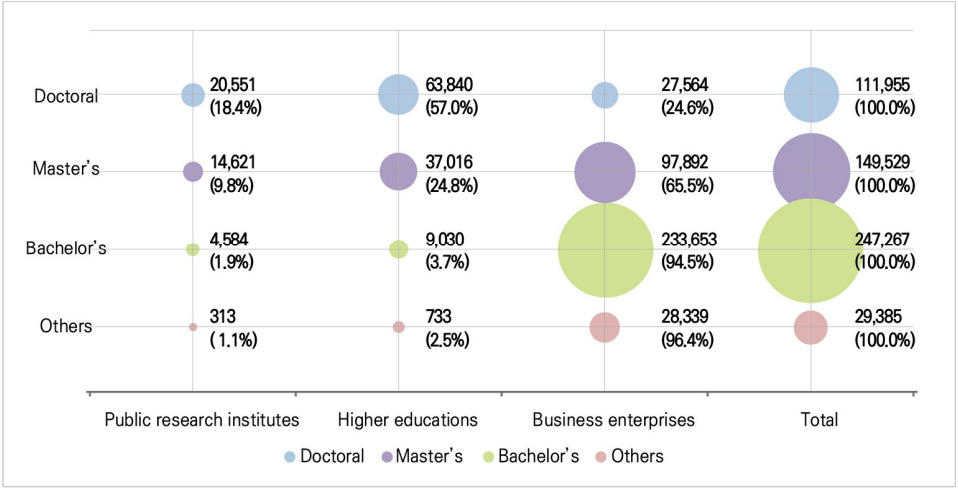
- Higher educations and public research institutes record the highest percentage of researchers with doctoral degrees, followed by master's degrees and bachelor's degrees, but business enterprises has the highest percentage of bachelor's degrees, followed by mater's and doctoral degrees except others.

※ Higher educations : doctoral(57.7%), master's(33.5%), bachelor's(8.2%), others(0.7%)

※ Public research institutes: doctoral(51.3%), master's(36.5%), bachelor's(11.4%), others(0.8%)

※ Business enterprises : doctoral(7.1%), master's(25.4%), bachelor's(60.2%), others(7.3%)

〈Figure 29〉 Distribution of researchers by sector of performance and degree, 2019 (Korea)



Researchers by Major Field of Study

☑ 480,365 of all researchers in Korea have majored in science and technology, and 58,989 of them in humanities and social sciences.

- As for science and technology fields, 351,218 in engineering & technology, 86,248 in natural sciences, 31,848 in medical & health sciences, and 11,051 in agricultural sciences.
- Compared with the previous year, natural sciences majors has increased by 13,364 or 18.3%; engineering & technology majors by 6,302 or 1.8%; medical and health sciences majors by 2,074 or 7.0%; agricultural sciences majors by 60 or 0.5%.
- Compared with the previous year, humanities majors has risen by 923 or 3.3%; social sciences majors by 2,461 or 8.9%.

☑ The rate of science and technology majors of all researchers is 89.1%, and that of humanities and social sciences is 10.9%

- As for science and technology fields, engineering & technology majors account for 65.1%; natural sciences majors, 16.0%; and medical & health sciences majors, 5.9%; agricultural sciences majors, 2.0%.
- As for humanities and social sciences fields, humanities majors account for 5.3% and social sciences majors, 5.6%.

〈Table 14〉
Researchers by major field of study (Korea)

(Unit : person, %)

		2014	2015	2016	2017	2018	2019
Science and Technology	Natural Sciences	54,772	57,976	56,710	67,736	72,884	86,248
		(12.5)	(12.8)	(12.3)	(14.0)	(14.2)	(16.0)
	Engineering & Technology	298,436	308,230	312,987	322,952	344,916	351,218
		(68.2)	(68.0)	(67.9)	(66.9)	(67.1)	(65.1)
	Medical & Health Sciences	23,522	24,066	26,347	27,911	29,774	31,848
		(5.4)	(5.3)	(5.7)	(5.8)	(5.8)	(5.9)
	Agricultural Sciences	10,662	11,045	11,378	10,423	10,991	11,051
		(2.4)	(2.4)	(2.5)	(2.2)	(2.1)	(2.0)
	Sub total	387,392	401,317	407,422	429,022	458,565	480,365
		(88.6)	(88.5)	(88.4)	(88.9)	(89.2)	(89.1)
Humanities and Social Sciences	Humanities	22,870	23,996	24,734	26,576	27,931	28,854
		(5.2)	(5.3)	(5.4)	(5.5)	(5.4)	(5.3)
	Social Sciences	27,185	27,949	28,613	27,198	27,674	30,135
		(6.2)	(6.2)	(6.2)	(5.6)	(5.4)	(5.6)
	Sub total	50,055	51,945	53,347	53,774	55,605	58,989
		(11.4)	(11.5)	(11.6)	(11.1)	(10.8)	(10.9)
Total		437,447	453,262	460,769	482,796	514,170	539,354
		(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

☑ The percentage of engineering & technology majors working in business enterprises is the highest at 74.9%, which is 290,238.

〈Table 15〉
Researchers by sector of performance and major field of study, 2019 (Korea)

(Unit : person, %)

		Public research institutes		Higher educations		Business enterprises		Total	
		Num.	rate	Num.	rate	Num.	rate	Num.	rate
Science and Technology	Natural Sciences	7,824	(19.5)	16,602	(15.0)	61,822	(16.0)	86,248	(16.0)
	Engineering & Technology	20,526	(51.2)	39,236	(35.5)	290,238	(74.9)	350,000	(65.0)
	Medical & Health Sciences	2,297	(5.7)	23,740	(21.5)	5,811	(1.5)	31,848	(5.9)
	Agricultural Sciences	2,790	(7.0)	4,527	(4.1)	3,734	(1.0)	11,051	(2.1)
	Sub total	33,437	(83.4)	84,105	(76.0)	361,605	(93.3)	479,147	(89.0)
Humanities and Social Sciences	Humanities	831	(2.1)	11,166	(10.1)	16,857	(4.4)	28,854	(5.4)
	Social Sciences	5,801	(14.5)	15,348	(13.9)	8,986	(2.3)	30,135	(5.6)
	Sub total	6,632	(16.6)	26,514	(24.0)	25,843	(6.7)	58,989	(11.0)
Total		40,069	(100.0)	110,619	(100.0)	387,448	(100.0)	538,136	(100.0)

Researchers by Gender

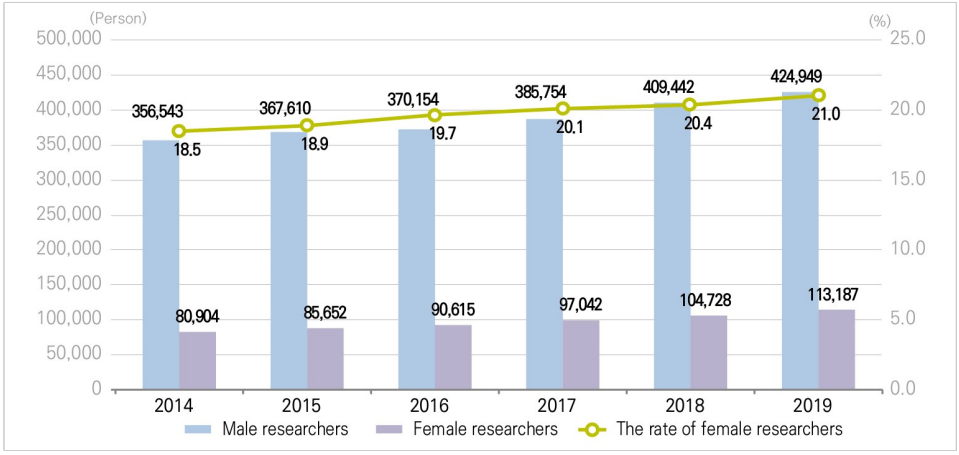
☑ Female researchers in Korea is 113,187 and male researchers is 424,949.

- Compared with the previous year, female researchers has increased by 8,459 or 8.1% and male researchers by 15,507 or 3.8%.

☑ The rate of female researchers in Korea stands at 21.0%.

- Compared with the previous year, female researchers has risen by 0.7%p, being on a constant increase.

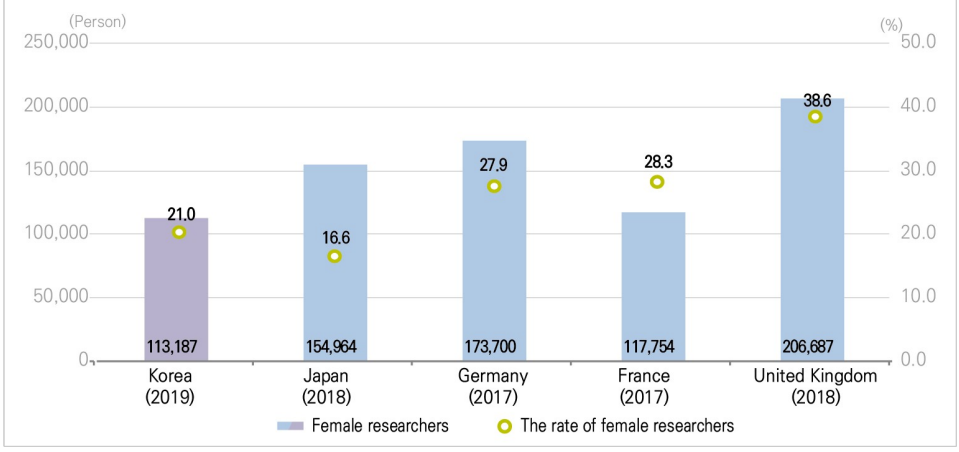
〈Figure 30〉
Researchers by gender (Korea)



☑ The rate of female researchers in Korea, which is 21.0%, is still lower than major countries except Japan of 16.6% as of 2018.

- United Kingdom records the highest among the surveyed, with 38.6% in 2018, Germany records 27.9% in 2017 and France 28.3% in 2017.

〈Figure 31〉
Female researchers (Major countries)



* Source : OECD, *Main Science and Technology Indicators 2020-1*, 2020

Researchers by Region

☑ 350,654 researchers are working in the Seoul metropolitan area including 195,972 in Gyeonggi, 132,997 in Seoul and 21,685 in Incheon.

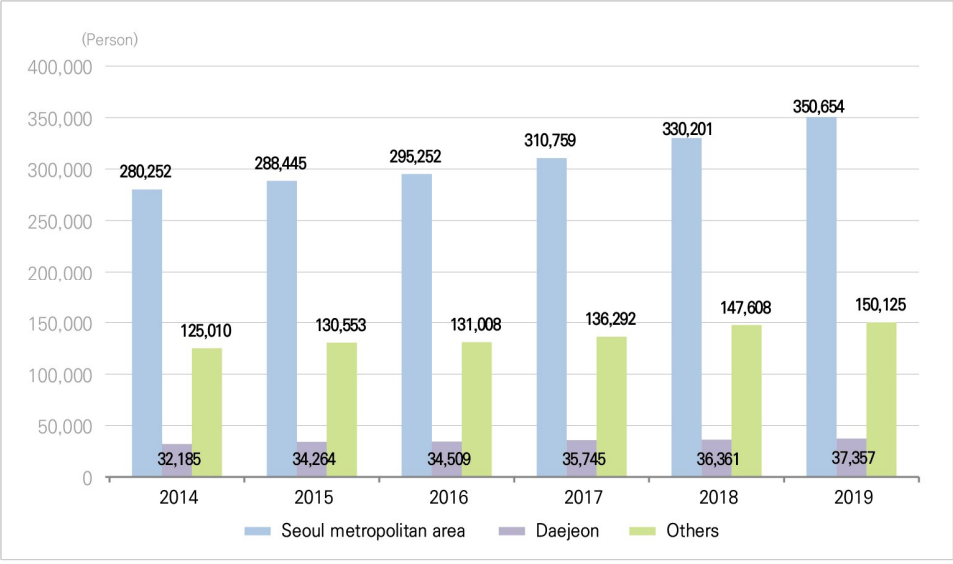
- Compared with the previous year, Gyeonggi has added 13,318 researchers, a 7.3% increase; Seoul, 5,647, a 4.4% increase; Incheon, 1,488, a 7.4% increase.

〈Table 16〉
Researchers by region (Korea)

(Unit : person)

	2014	2015	2016	2017	2018	2019
Seoul	107,474	105,714	110,080	118,541	127,350	132,997
Busan	13,632	15,544	14,683	14,371	16,356	16,507
Daegu	10,625	11,756	11,453	11,781	13,429	14,047
Incheon	15,907	17,613	18,435	19,635	20,197	21,685
Gwangju	7,885	8,254	8,485	7,722	9,472	9,471
Daejeon	32,185	34,264	34,509	35,745	36,361	37,357
Ulsan	6,678	6,987	7,372	7,807	8,422	8,025
Sejong	3,049	3,565	3,562	4,109	4,064	4,199
Gyeonggi	156,871	165,118	166,737	172,583	182,654	195,972
Gangwon	6,157	6,295	5,886	6,668	6,730	7,084
Chungbuk	11,153	11,329	11,505	12,324	13,405	13,318
Chungnam	16,472	17,572	17,362	17,139	17,823	18,384
Jeonbuk	8,549	8,732	9,172	9,126	9,653	9,207
Jeonnam	4,361	4,229	4,199	4,493	5,106	5,532
Gyeongbuk	17,330	18,002	17,873	19,335	19,412	19,535
Gyeongnam	17,579	16,740	17,722	19,584	21,908	22,807
Jeju	1,540	1,548	1,734	1,833	1,828	2,009
Total	437,447	453,262	460,769	482,796	514,170	538,136

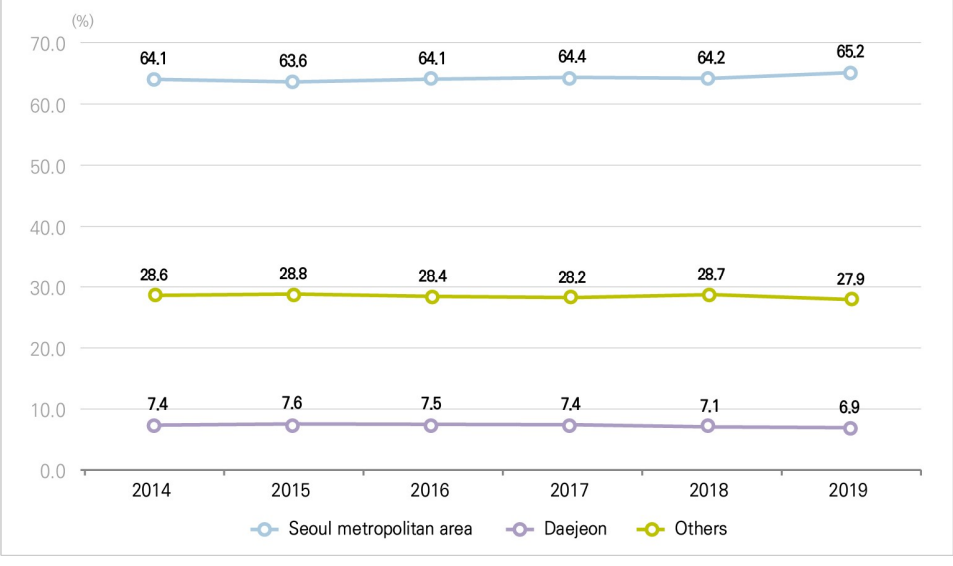
〈Figure 32〉
Researchers in Seoul metropolitan area and Daejeon (Korea)



☑ The rate of researchers working at the Seoul metropolitan area takes up 65.2% and that of Daejeon 6.9%.

- The rate of researchers at the Seoul metropolitan area has risen by 0.9%p, but that of Daejeon and others have dropped by 0.1%p, and 0.8%p from the previous year.

〈Figure 33〉
Researchers rate in Seoul metropolitan area and Daejeon (Korea)



3. R&D Activities of Business Enterprise Sector

R&D Expenditure to Sales

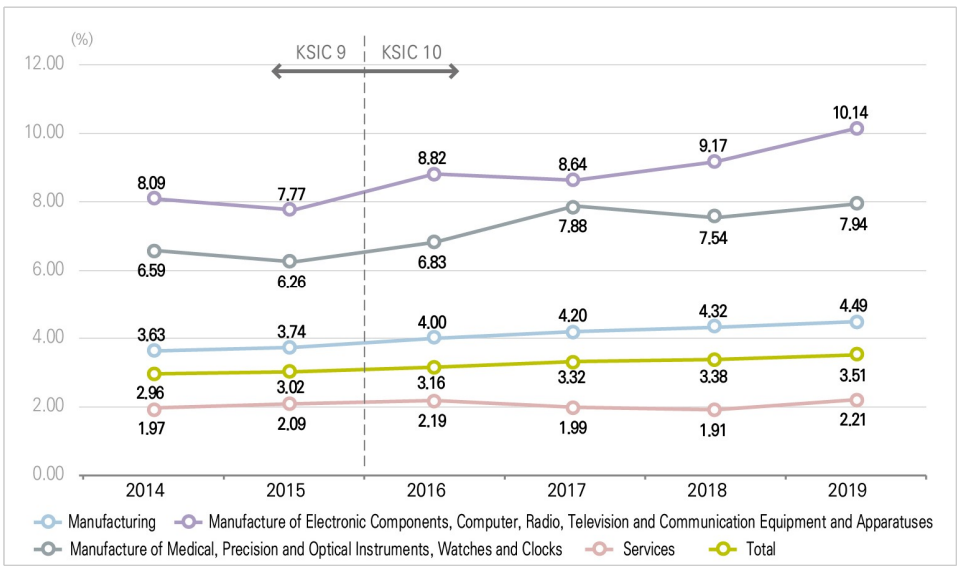
☑ In 2019, Korean companies' R&D expenditure rate to sales is 3.51%.

- That of the manufacturing industry is 4.49%, and that of the service industry is 2.21%.

☑ In the manufacturing industry, the highest R&D expenditure rate to sales is seen in the sectors of electronic components, computer, radio, television, and communication equipment and apparatuses, which is 10.14%.

- Medical, Precision and Optical Instruments, watches and clocks takes up 7.94%.

〈Figure 34〉 R&D expenditure rate to sales by major industries (Korea)



* 10th Korean Standard Industrial Classification(KSIC) has been applied since 2016

〈Table 17〉
R&D expenditure rate to sales status by industry, 2019 (Korea)

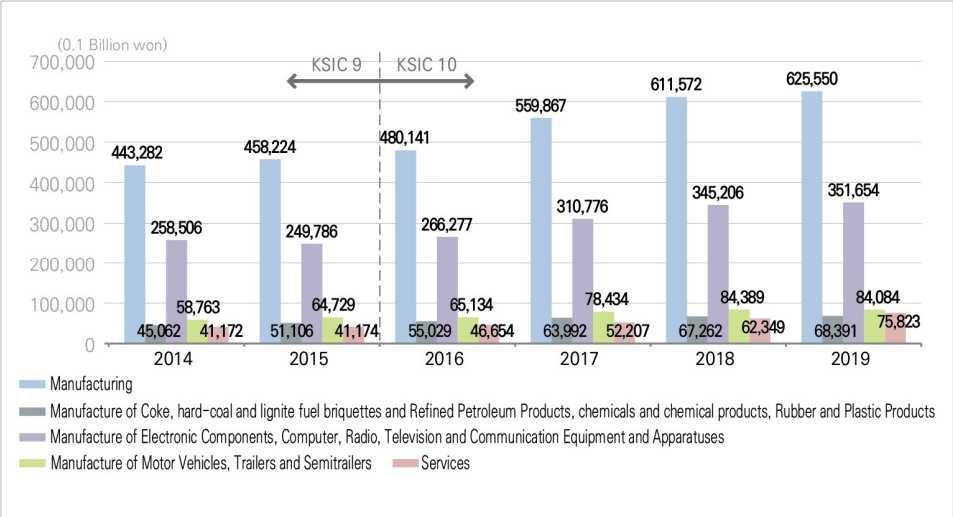
(Unit : %)

Industries*	2018	2019	Difference
Total	3.38	3.51	0.13
Agriculture, Forestry and Fishing	11.52	7.70	-3.82
Mining and Quarrying	2.08	0.59	-1.49
Manufacturing	4.32	4.49	0.17
Manufacture of food products; beverages and tobacco products	1.12	1.20	0.08
Manufacture of textiles, wearing apparel, leather and related products	1.31	1.28	-0.02
Manufacture of wood, paper, printing and reproduction	1.16	1.24	0.08
Manufacture of Coke, hard-coal and lignite fuel briquettes and Refined Petroleum Products, chemicals and chemical products, Rubber and Plastic Products	2.20	2.31	0.11
Manufacture of Coke, hard-coal and lignite fuel briquettes and Refined Petroleum Products	0.70	0.33	-0.37
Manufacture of chemicals and chemical products	2.84	3.17	0.33
Manufacture of chemicals and chemical products except pharmaceuticals, medicinal chemicals	2.30	2.58	0.28
Manufacture of Pharmaceuticals, Medicinal Chemicals and Botanical Products	6.04	6.17	0.14
Manufacture of Rubber and Plastic Products	2.52	2.53	0.01
Manufacture of Other Non-metallic Mineral Products	1.23	1.36	0.13
Manufacture of Basic Metal Products	0.71	0.70	-0.01
Manufacture of Fabricated Metal Products, Except Machinery and Furniture	2.31	2.54	0.24
Manufacture of Electronic Components, Computer, Radio, Television and Communication Equipment and Apparatuses	9.17	10.14	0.97
Semiconductor and Electronic components	5.96	6.74	0.78
Telecommunication and Broadcasting Apparatuses	10.54	12.37	1.83
Electronic Video and Audio Equipment	16.64	13.63	-3.01
Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	7.54	7.94	0.40
Manufacture of electrical equipment	3.52	3.56	0.04
Manufacture of Other Machinery and Equipment	3.58	3.82	0.23
Manufacture of Motor Vehicles, Trailers and Semitrailers	3.81	3.67	-0.14
Manufacture of Other Transport Equipment	2.12	2.10	-0.02
Manufacture of Furniture & Other manufacturing	2.18	2.13	-0.04
Maintenance and Repair Services of Industrial Machinery and Equipments	3.22	1.26	-1.96
Electricity, gas, steam and air conditioning supply	0.51	0.48	-0.03
Water supply, sewage, waste management, materials recovery	1.30	1.40	0.10
Construction	0.41	0.39	-0.02
Services	1.91	2.21	0.30
Professional, scientific and technical activities	4.91	6.58	1.67
Research and Development	28.30	37.34	9.05

R&D Expenditure by Industry

☑ Among the total R&D expenditure of the business enterprises in 2019, R&D investment of the manufacturing industry is 62.5550 trillion won, and that of the service industry is 7.5823 trillion won.

〈Figure 35〉 R&D expenditure by major industries (Korea)

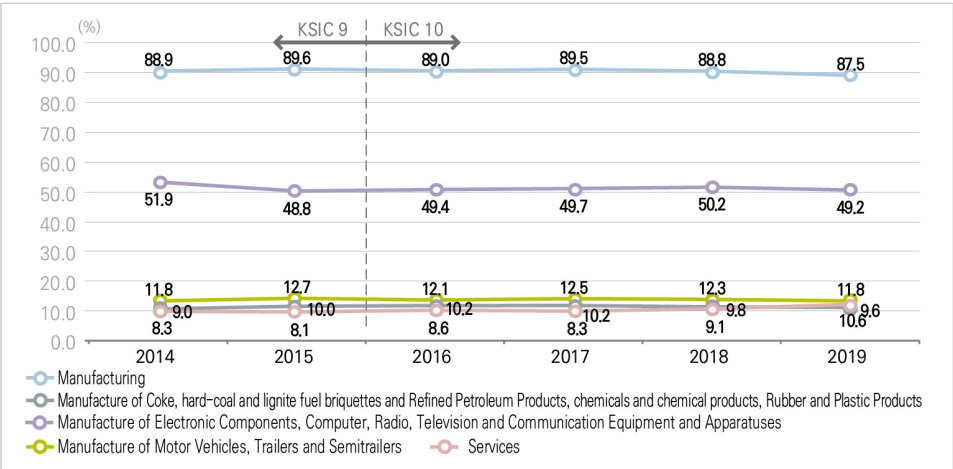


* 10th Korean Standard Industrial Classification(KSIC) has been applied since 2016

☑ The manufacturing industry takes up 87.5% out of the total R&D investment in the business enterprises and the service industry takes up 10.6%.

- This percentage of R&D investment by the sectors of electronic components, computer, radio, television, and communication equipment and apparatuses is 49.2%.

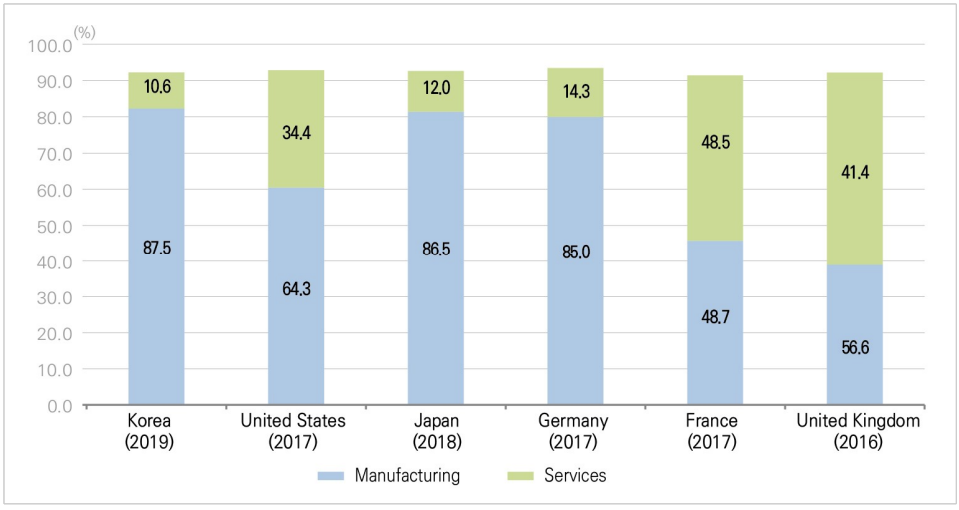
〈Figure 36〉 R&D expenditure rate by major industries (Korea)



* 10th Korean Standard Industrial Classification(KSIC) has been applied since 2016

☑ However, that of the service industry of Korea remains low at 10.6%, compared to major economies such as the United States of 34.4% in 2017, United Kingdom of 56.6% in 2016, and France of 48.5% in 2017.

〈Figure 37〉
R&D expenditure rate by major industries (Major countries)



* Source : OECD, *R&D Statistics 2020*, 2020

〈Table 18〉
R&D expenditure status by industry, 2019 (Korea)

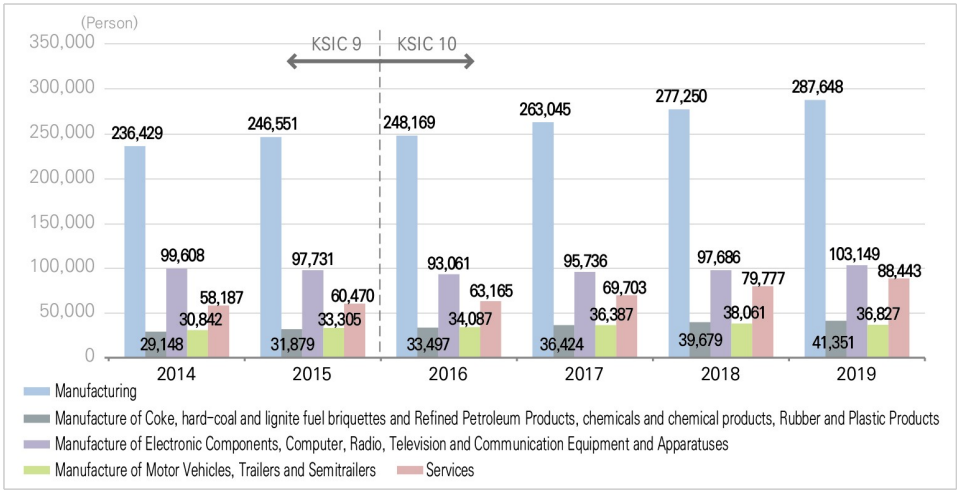
(Unit : 0.1 billion won)

Industries*	2018	2019	Difference
Total	688,344	715,067	26,722
Agriculture, Forestry and Fishing	835	615	-220
Mining and Quarrying	161	84	-77
Manufacturing	611,572	625,550	13,978
Manufacture of food products; beverages and tobacco products	8,052	9,154	1,102
Manufacture of textiles, wearing apparel, leather and related products	4,838	4,895	57
Manufacture of wood, paper, printing and reproduction	1,904	2,006	102
Manufacture of Coke, hard-coal and lignite fuel briquettes and Refined Petroleum Products, chemicals and chemical products, Rubber and Plastic Products	67,262	68,391	1,129
Manufacture of Coke, hard-coal and lignite fuel briquettes and Refined Petroleum Products	5,967	2,676	-3,291
Manufacture of chemicals and chemical products	51,375	55,503	4,128
Manufacture of chemicals and chemical products except pharmaceuticals, medicinal chemicals	35,574	37,800	2,225
Manufacture of Pharmaceuticals, Medicinal Chemicals and Botanical Products	15,800	17,703	1,903
Manufacture of Rubber and Plastic Products	9,920	10,212	292
Manufacture of Other Non-metallic Mineral Products	2,570	2,905	334
Manufacture of Basic Metal Products	7,454	7,330	-124
Manufacture of Fabricated Metal Products, Except Machinery and Furniture	7,086	8,300	1,214
Manufacture of Electronic Components, Computer, Radio, Television and Communication Equipment and Apparatuses	345,206	351,654	6,448
Semiconductor and Electronic components	90,112	92,244	2,132
Telecommunication and Broadcasting Apparatuses	193,378	209,294	15,916
Electronic Video and Audio Equipment	58,337	46,567	-11,770
Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	14,817	16,670	1,853
Manufacture of electrical equipment	20,864	21,548	685
Manufacture of Other Machinery and Equipment	36,565	37,582	1,016
Manufacture of Motor Vehicles, Trailers and Semitrailers	84,389	84,084	-305
Manufacture of Other Transport Equipment	7,889	8,557	669
Manufacture of Furniture & Other manufacturing	2,571	2,384	-187
Maintenance and Repair Services of Industrial Machinery and Equipments	105	90	-15
Electricity, gas, steam and air conditioning supply	6,119	5,904	-214
Water supply, sewage, waste management, materials recovery	465	512	47
Construction	6,845	6,578	-266
Services	62,349	75,823	13,475
Professional, scientific and technical activities	16,487	25,095	8,608
Research and Development	6,894	14,759	7,865

Researchers by Industry

☑ Researchers in the manufacturing industry is 287,648, and that of the service industry is 88,443.

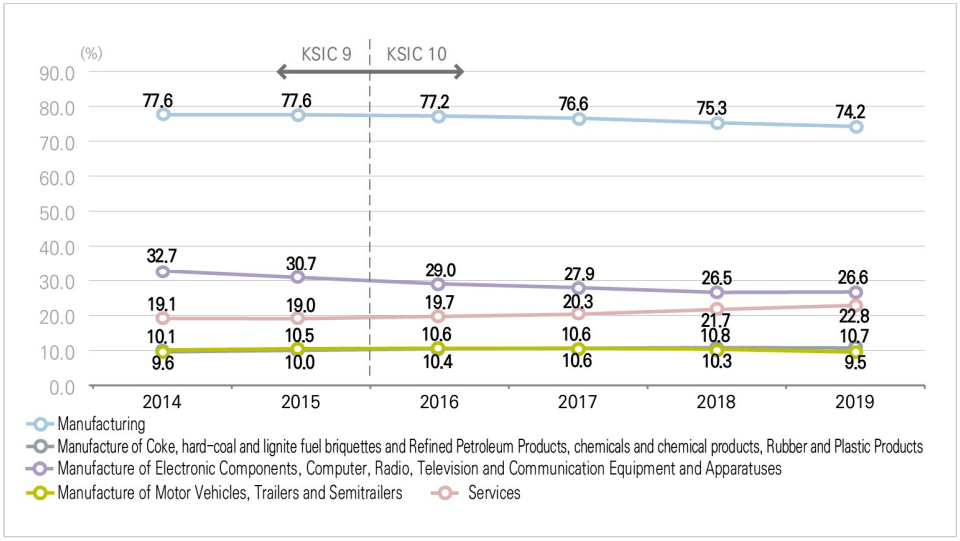
〈Figure 38〉
Researchers by major industries (Korea)



* 10th Korean Standard Industrial Classification(KSIC) has been applied since 2016

☑ Researchers in the manufacturing industry takes up 74.2%, and those in the service industry accounts for 22.8%.

〈Figure 39〉
Researchers rate by major industries (Korea)



* 10th Korean Standard Industrial Classification(KSIC) has been applied since 2016

〈Table 19〉
Researchers status by industry, 2019 (Korea)

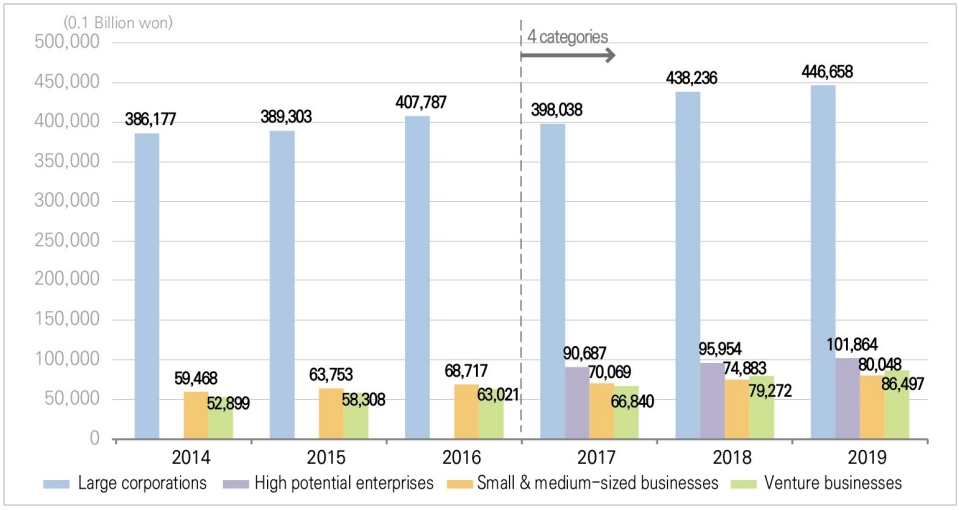
(Unit : Person)

Industries*	2018	2019	Difference
Total	368,237	387,448	19,211
Agriculture, Forestry and Fishing	332	412	80
Mining and Quarrying	51	57	6
Manufacturing	277,250	287,648	10,398
Manufacture of food products; beverages and tobacco products	7,853	8,381	528
Manufacture of textiles, wearing apparel, leather and related products	5,675	6,116	441
Manufacture of wood, paper, printing and reproduction	2,527	2,766	239
Manufacture of Coke, hard-coal and lignite fuel briquettes and Refined Petroleum Products, chemicals and chemical products, Rubber and Plastic Products	39,679	41,351	1,672
Manufacture of Coke, hard-coal and lignite fuel briquettes and Refined Petroleum Products	935	1,003	68
Manufacture of chemicals and chemical products	31,662	32,835	1,173
Manufacture of chemicals and chemical products except pharmaceuticals, medicinal chemicals	22,952	23,697	745
Manufacture of Pharmaceuticals, Medicinal Chemicals and Botanical Products	8,710	9,138	428
Manufacture of Rubber and Plastic Products	7,082	7,513	431
Manufacture of Other Non-metallic Mineral Products	2,437	2,531	94
Manufacture of Basic Metal Products	3,801	3,792	(9)
Manufacture of Fabricated Metal Products, Except Machinery and Furniture	8,287	8,876	589
Manufacture of Electronic Components, Computer, Radio, Television and Communication Equipment and Apparatuses	97,686	103,149	5,463
Semiconductor and Electronic components	28,547	29,214	667
Telecommunication and Broadcasting Apparatuses	50,047	54,353	4,306
Electronic Video and Audio Equipment	16,246	16,540	294
Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	13,890	14,433	543
Manufacture of electrical equipment	16,004	16,864	860
Manufacture of Other Machinery and Equipment	31,101	32,338	1,237
Manufacture of Motor Vehicles, Trailers and Semitrailers	38,061	36,827	(1,234)
Manufacture of Other Transport Equipment	6,727	6,683	(44)
Manufacture of Furniture & Other manufacturing	3,375	3,404	29
Maintenance and Repair Services of Industrial Machinery and Equipments	147	137	(10)
Electricity, gas, steam and air conditioning supply	1,301	1,341	40
Water supply, sewage, waste management, materials recovery	657	690	33
Construction	8,869	8,857	(12)
Services	79,777	88,443	8,666
Professional, scientific and technical activities	19,638	23,929	4,291
Research and Development	5,402	8,979	3,577

R&D Activity by Company Type

☑ R&D expenditure of Korean large corporations in 2019 is 44.6658 trillion won; high potential enterprises 10.1864 trillion won; small & medium-sized businesses 8.0048 trillion won; venture businesses 8.6497 trillion won.

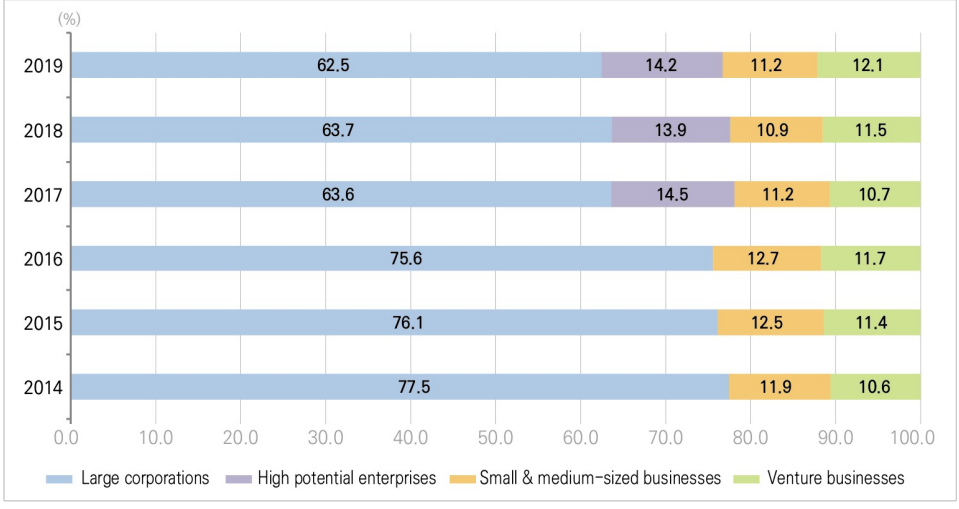
〈Figure 40〉
R&D expenditure by company type (Korea)



* Business enterprises are classified into four categories since 2017.

☑ Large corporations account for 62.5%, high potential enterprises, 14.2%, Small & medium-sized businesses, 11.2% and venture businesses, 12.1%.

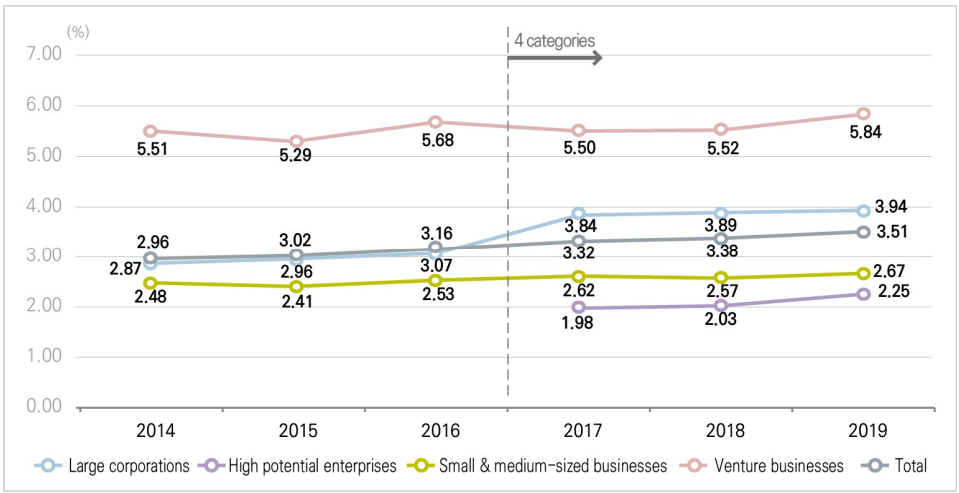
〈Figure 41〉
R&D expenditure rate by company type (Korea)



* Business enterprises are classified into four categories since 2017.

☑ R&D expenditure rate to sales of large corporations is 3.94%; that of high potential enterprises, 2.25%; that of small & medium-sized businesses, 2.67%; and that of venture businesses is 5.84%.

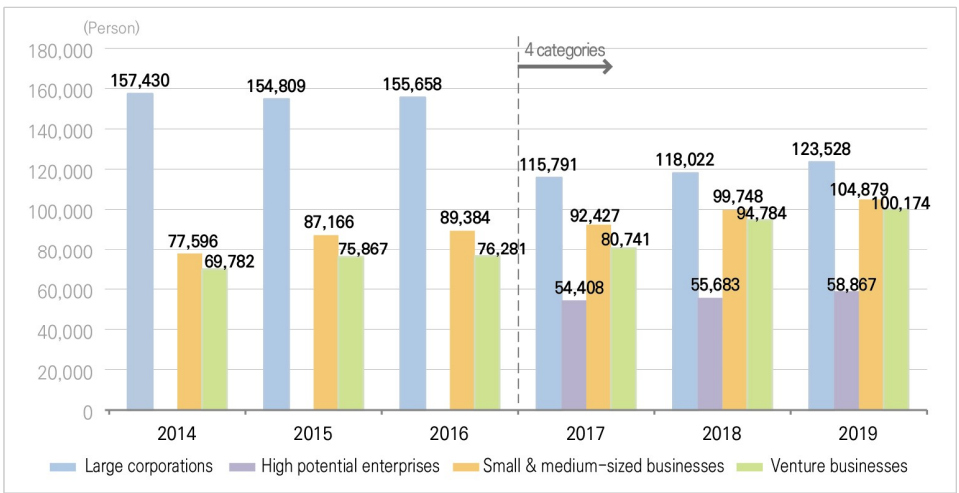
〈Figure 42〉
R&D expenditure rate to sales by company type (Korea)



* Business enterprises are classified into four categories since 2017.

☑ Researchers working at large corporations totals 123,528, and those at high potential enterprises, 58,867 and those at small & medium-sized businesses, 104,879 and those at venture businesses, 100,174.

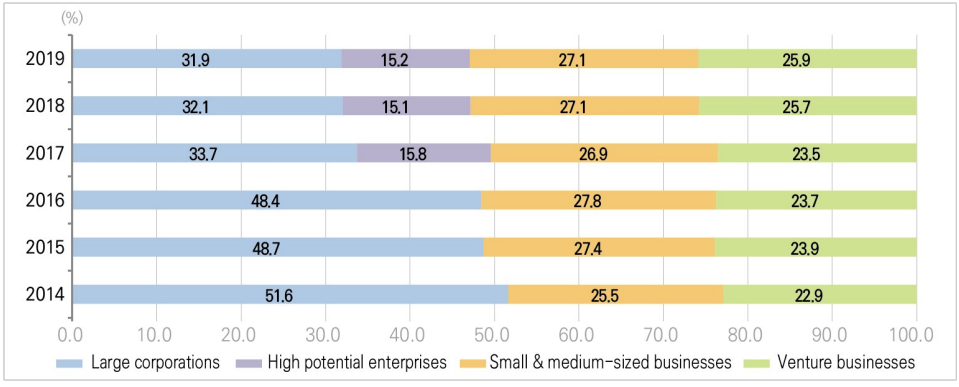
〈Figure 43〉
Researchers by company type (Korea)



* Business enterprises are classified into four categories since 2017.

☑ Researchers at large corporations takes up 31.9%, those at high potential enterprises 15.2%, those at small & medium-sized businesses 27.1%, and those at venture businesses 25.9%.

〈Figure 44〉
Researchers rate by company type (Korea)



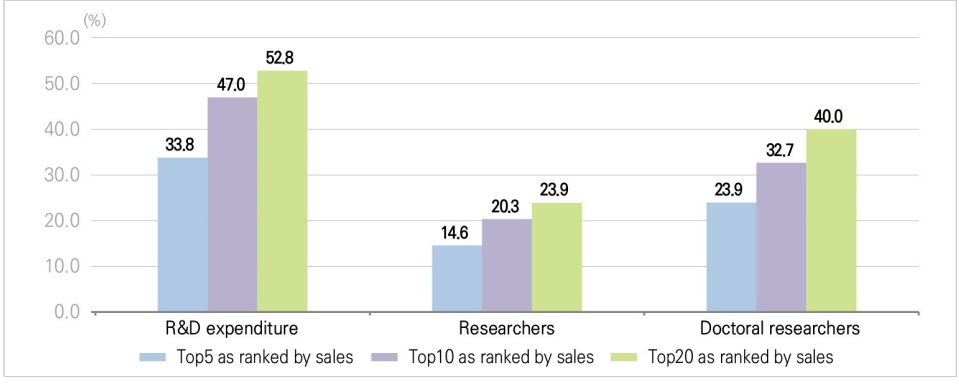
* Business enterprises are classified into four categories since 2017.

R&D Concentration of Business Enterprises

☑ R&D concentration of the nation's top companies with the highest sales has differed from according to level, but R&D expenditure, researchers and doctoral degree researchers have eased.

- Top 5 companies ranked by sales account for 33.8% of the total R&D expenditure of business enterprises, and employ 14.6% of the total researchers and 23.9% of doctoral researchers.
- Top 10 companies ranked by sales account for 47.0% of the total R&D expenditure of business enterprises, and employ 20.3% of the total researchers and 32.7% of doctoral researchers.
- Top 20 companies ranked by sales account for 52.8% of the total R&D expenditure of business enterprises, and employ 23.9% of the total researchers and 40.0% of doctoral researchers.

〈Figure 45〉
R&D concentration rate of the top sales companies, 2019 (Korea)



〈Table 20〉
R&D concentration rate of top sales companies (Korea)

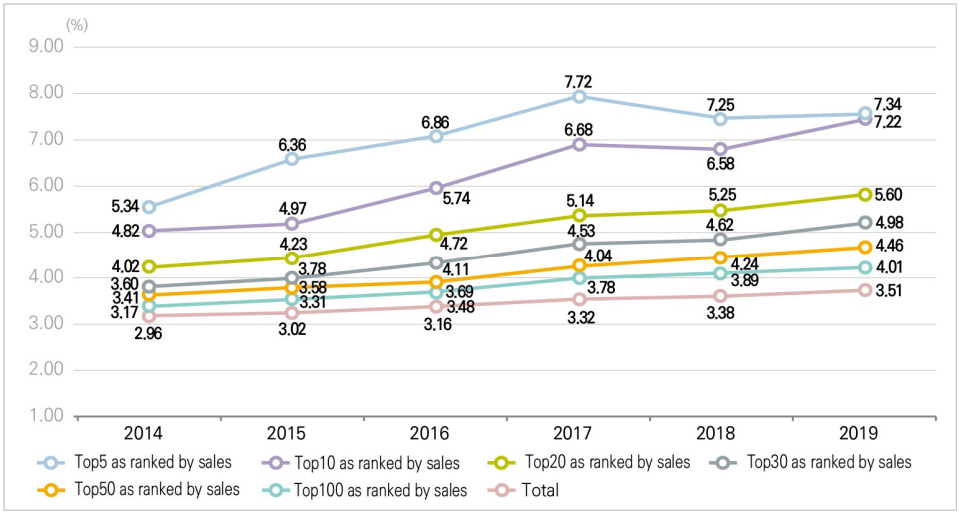
(unit : %)

		2014	2015	2016	2017	2018	2019
R&D expenditure	Top5	33.5	37.2	37.7	40.4	36.8	33.8
	Top10	44.1	41.7	44.3	50.2	47.4	47.0
	Top20	51.6	49.3	51.6	54.0	53.7	52.8
	Top30	53.9	51.5	53.4	55.5	54.5	54.0
	Top50	58.9	57.3	56.3	58.0	58.4	56.6
	Top100	63.4	61.9	62.3	63.7	63.1	60.7
Researchers	Top5	18.4	20.7	20.5	19.6	15.1	14.6
	Top10	24.2	23.0	23.0	23.2	20.2	20.3
	Top20	28.9	26.8	26.7	25.7	23.9	23.9
	Top30	30.4	28.1	28.0	27.3	24.4	24.6
	Top50	33.0	31.0	29.8	29.1	27.2	26.5
	Top100	36.5	34.9	34.4	33.1	30.5	29.7
Doctoral researchers	Top5	29.6	29.0	26.8	27.8	24.6	23.9
	Top10	36.3	34.7	33.0	34.5	33.2	32.7
	Top20	45.3	41.4	40.3	40.7	40.8	40.0
	Top30	48.2	43.4	42.4	42.5	42.5	42.3
	Top50	55.0	50.5	46.8	46.8	47.4	46.4
	Top100	59.8	55.2	54.2	53.4	52.4	51.1

☑ The survey results indicate that Korea's top sales companies are actively investing in R&D.

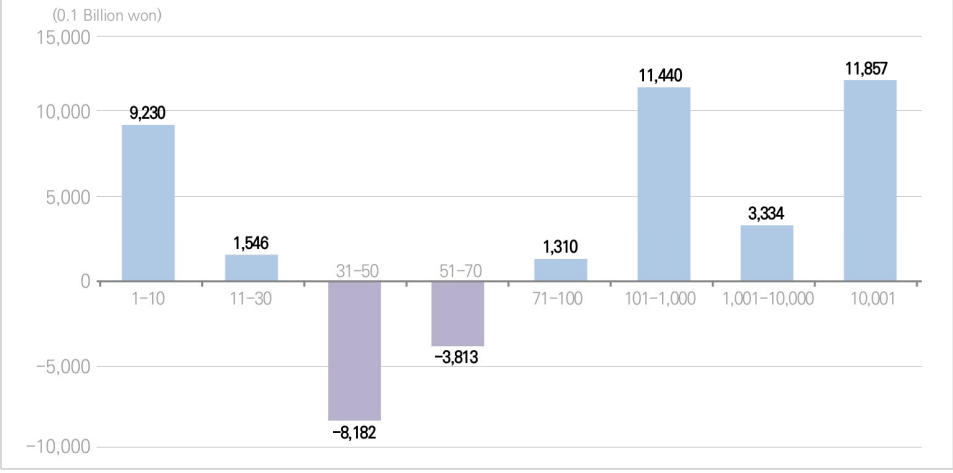
- The top 5 companies' 2019 R&D expenditure rate to sales of 7.34% is higher than the average R&D expenditure of the total business enterprises of 3.51% and has risen by 0.1%p from the previous year.

〈Figure 46〉
R&D expenditure rate to sales of the top sales companies (Korea)



☑ R&D expenditure of top 30 sales companies has risen, whereas R&D expenditure of companies with sales rank from 31st to 70th has decreased year on year.

〈Figure 47〉
R&D expenditure change of top companies ranked by sales (Korea)

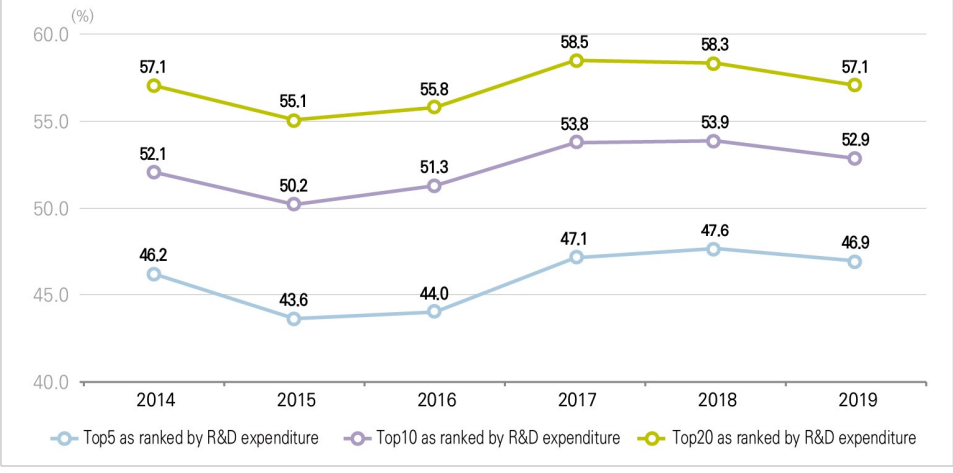


☑ Analysis of R&D concentration by item* shows that concentration of largest R&D spending companies is in a decreasing trend.

- Concentration rate of top 5 R&D expenditure companies is 46.9%; that of top 10 R&D expenditure companies, 52.9%; and that of top 20 R&D expenditure companies, 57.1%. Top 5, top 10, top 20 companies have dropped by 0.7%p, 1.0%p and 1.3%p respectively from the previous year.

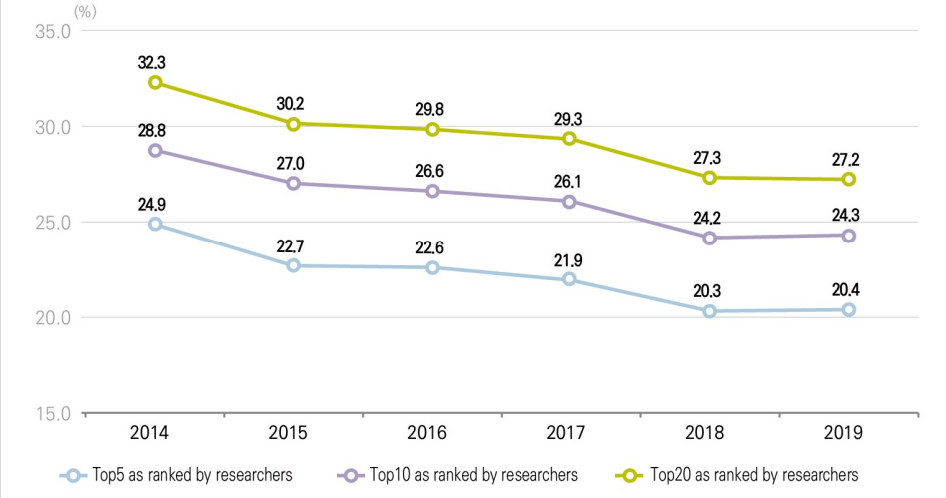
* R&D concentration by item, different from R&D concentration of the top sales companies, refers to R&D concentration rate of the largest spending companies in terms of R&D expenditure, researchers and doctoral researchers.

〈Figure 48〉
Concentration rate of the top R&D expenditure companies (Korea)



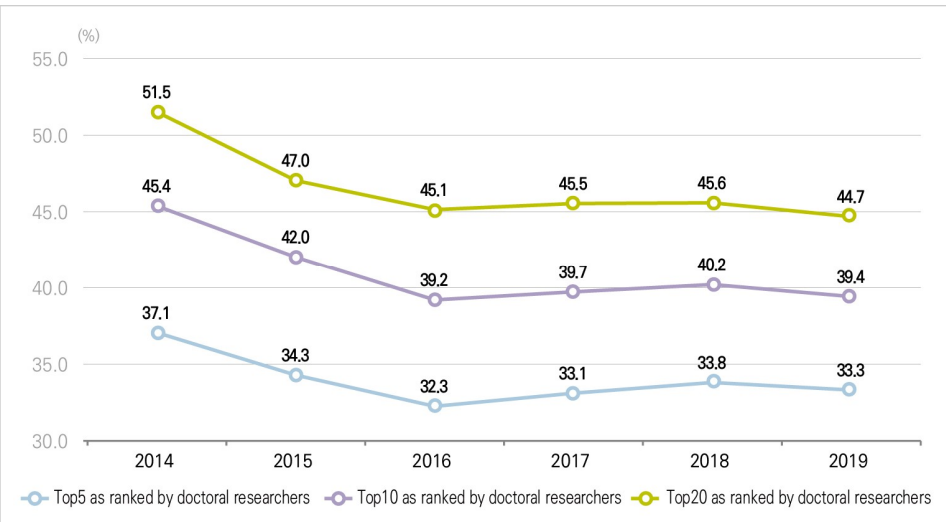
☑ In terms of researchers, concentration rate of the top 5 companies account for 20.4%; that of the top 10 companies 24.3%; and that of the top 20 companies 27.2%, which have increased 0.1%p, 0.1%p and decreased by 0.1%p respectively from the previous year.

〈Figure 49〉
Concentration rate of the top researchers companies (Korea)



☑ In terms of doctoral researchers, concentration rate of the top 5 companies account for 33.3%; that of the top 10 companies 39.4%; and that of the top 20 companies 44.7%, which have decreased by 0.5%p, 0.8%p, and 0.9%p respectively from the previous year.

〈Figure 50〉
Concentration rate of the top doctoral researchers companies (Korea)



R&D Expenditure by Type of Usage

☑ As for R&D expenditure by type of usage, Korean business enterprises have invested 34.1333 trillion won in developing new products; 15.2328 trillion won in upgrading existing products; 12.5719 trillion won in developing new processes; and 9.5687 trillion won in upgrading existing processes.

- Compared with the previous year, investment in new products has risen by 3.1919 trillion won or 10.3%; existing products by 318.5 billion won or 2.1%; existing processes by 639.0 billion won or 5.4%, but that in existing processes has dropped by 1.4772 trillion won or 13.4%.

☑ The rate of R&D expenditure in developing new products takes up 47.7%; that of upgrading existing products, 21.3%; that of developing new processes, 17.6%; and that of upgrading existing processes, 13.4%.

- R&D investment for new products and new processes have increased by 2.7%p and 0.3%p respectively, but existing product and existing processes have decreased by 0.4%p and 2.6%p respectively compared with the previous year.

〈Table 21〉
R&D expenditure by type of usage (Korea)

(Unit : 0.1 billion won, %)

	2014	2015	2016	2017	2018	2019
New product	213,582	217,218	224,521	284,281	309,414	341,333
	(42.8)	(42.5)	(41.6)	(45.4)	(45.0)	(47.7)
Existing product	112,773	115,674	127,139	137,291	149,143	152,328
	(22.6)	(22.6)	(23.6)	(21.9)	(21.7)	(21.3)
New process	97,709	101,983	101,112	106,065	119,329	125,719
	(19.6)	(19.9)	(18.7)	(17.0)	(17.3)	(17.6)
Existing process	74,480	76,488	86,753	97,999	110,459	95,687
	(14.9)	(15.0)	(16.1)	(15.7)	(16.0)	(13.4)
Total	498,545	511,364	539,525	625,634	688,344	715,067
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

III APPENDIX

Exchange Rates by Country

(Unit : national currency per US dollar)

	2014	2015	2016	2017	2018	2019
Australia	1.109	1.331	1.345	1.305	1.338	1.439
Austria	0.753	0.901	0.903	0.885	0.847	0.893
Belgium	0.753	0.901	0.903	0.885	0.847	0.893
Canada	1.105	1.279	1.326	1.298	1.296	1.327
Chile	570.348	654.124	676.958	648.834	641.277	702.897
Colombia	2,001.781	2,741.881	3,054.122	2,951.327	2,955.704	3,280.832
Czech Republic	20.758	24.599	24.440	23.376	21.730	22.932
Denmark	5.612	6.728	6.732	6.603	6.315	6.669
Estonia	0.753	0.901	0.903	0.885	0.847	0.893
Finland	0.753	0.901	0.903	0.885	0.847	0.893
France	0.753	0.901	0.903	0.885	0.847	0.893
Germany	0.753	0.901	0.903	0.885	0.847	0.893
Greece	0.753	0.901	0.903	0.885	0.847	0.893
Hungary	232.602	279.333	281.523	274.433	270.212	290.660
Iceland	116.767	131.919	120.812	106.840	108.300	122.607
Ireland	0.753	0.901	0.903	0.885	0.847	0.893
Israel	3.578	3.887	3.841	3.600	3.591	3.565
Italy	0.753	0.901	0.903	0.885	0.847	0.893
Japan	105.945	121.044	108.793	112.166	110.423	109.010
Korea	1,052.961	1,131.158	1,160.433	1,130.425	1,100.500	1,165.499
Latvia	0.753	0.901	0.903	0.885	0.847	0.893
Lithuania	0.753	0.901	0.903	0.885	0.847	0.893
Luxembourg	0.753	0.901	0.903	0.885	0.847	0.893
Mexico	13.292	15.848	18.664	18.927	19.244	19.264
Netherlands	0.753	0.901	0.903	0.885	0.847	0.893
New Zealand	1.205	1.434	1.437	1.407	1.445	1.518
Norway	6.302	8.064	8.400	8.272	8.133	8.800
Poland	3.155	3.770	3.943	3.779	3.612	3.839
Portugal	0.753	0.901	0.903	0.885	0.847	0.893
Slovak Republic	0.753	0.901	0.903	0.885	0.847	0.893
Slovenia	0.753	0.901	0.903	0.885	0.847	0.893
Spain	0.753	0.901	0.903	0.885	0.847	0.893
Sweden	6.861	8.435	8.562	8.549	8.693	9.458
Switzerland	0.916	0.962	0.985	0.985	0.978	0.994
Turkey	2.189	2.720	3.020	3.648	4.828	5.674
United Kingdom	0.608	0.655	0.741	0.777	0.750	0.783
United States	1.000	1.000	1.000	1.000	1.000	1.000
Argentina	8.075	9.233	14.758	16.563	28.095	48.148
China	6.143	6.227	6.644	6.759	6.616	6.908
Romania	3.349	4.006	4.059	4.052	3.942	4.238
Russian Federation	38.378	60.938	67.056	58.343	62.668	64.738
South Africa	10.853	12.759	14.710	13.324	13.234	14.448

* Source : OECD, *Main Science and Technology Indicators 2020-1*, 2020

Survey of Research and Development in Korea, 2019

Print & Edit January 2021

Ministry of Science and ICT(MSIT)
Tel : +82-44-202-6964
E-mail: jphong82@korea.kr
http://www.msit.go.kr

Korea Institute of S&T Evaluation and Planing(KISTEP)
Tel : +82-43-750-2468
E-mail : jaden@kistep.re.kr

http://www.kistep.re.kr

Survey of Research and Development in Korea, 2019

Key Figures of Korea R&D Activities

Ministry of Science and ICT

KISTEP Korea Institute of S&T Evaluation and Planning