

# 2015 Outlook for Industrial R&D Investment

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## □ Preface

The world economy is projected to continue its overall slow-growth trend in 2015 despite the recovery of the U.S., as it showed a poorer performance in the first half of 2014 than expected. Moreover, the global economy is facing greater uncertainty, as shown by economic forecasting agencies that have steadily cut their projections in the face of the recent oil price slump and currency fluctuation.

Nonetheless, the Korean economy has had a strong showing. Especially notable is that, according to "2014 Export and Import Assessment and 2015 Economic Outlook" report, recently released by the Korea International Trade Association, Korea was ranked 7th in global exports and achieved trade volume of \$1 trillion for the fourth year in succession.

However, Korea is facing a number of challenges. The World Economic Forum's Global Competitiveness Report 2014 put the country in 26th place, one place lower than the previous year, indicating a weakened national competitive edge, and the OECD revised its economic growth projection for Korea downward by 0.4 percentage points from 4.2 percent in May 2014 to 3.8 percent in November, all of which demonstrate worsening economic conditions. Fortunately, however, in the "Innovation Union Scoreboard" published in March 2014, the European Commission reported that Korea held the top ranking in international research and performance in innovation, surpassing the U.S. and the U.K.

As global companies continue to invest in R&D and innovation in spite of increasing global economic uncertainty, now is the time for Korea to make every effort on the basis of its own innovative competency to discover corporate growth engines for the future.

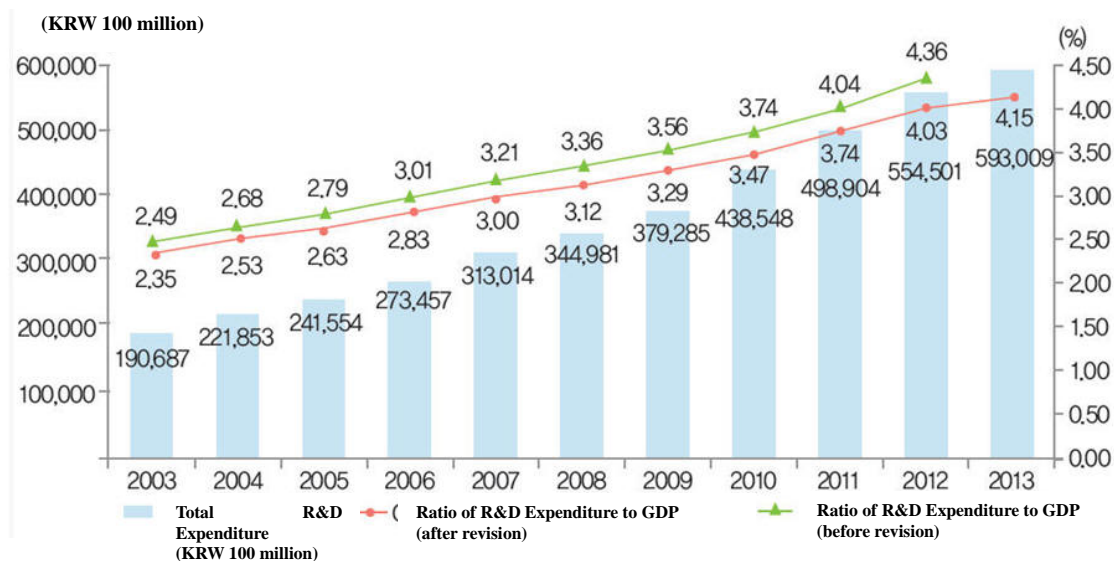
## □ Findings on R&D Activities and Technology Trade in 2013

The "Findings on R&D Activities in 2013" report by the Ministry of Science, ICT and Future Planning announced at the end of November 2014 that Korea spent a total of \$54.16 billion in R&D, an increase by \$3.52 billion (6.9% points) year on year, placing sixth in the world. The ratio of R&D expenditure to GDP was 4.15 percent<sup>1</sup>, the world's highest level.

<Figure 1> R&D Spending and the Ratio of R&D Spending to GDP

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<sup>1</sup> The ratios of R&D spending to GDP differ before and after the Bank of Korea's revision of National Account Statistics (NAS) in March 2014, which affected the calculation method of GDP (R&D investment was included in GDP in accordance with the UN's recommendation).



Source: Ministry of Science, ICT and Future Planning, Press Release (December 2014)

By investing entity, businesses invested \$42.53 billion (78.5%) in R&D, with public research institutions contributing \$6.63 billion and universities \$5.01 billion. The spending of businesses increased by \$3.05 billion (7.7% points) from the previous year, indicating that enterprises are leading R&D investment.

Corporate R&D spending is divided into \$32.68 billion by major companies and \$9.85 billion by small and medium-sized enterprises (SMEs) and venture businesses, which means that major firms accounted for 76.8 percent of total investment. Meanwhile, SMEs spent \$5.36 billion (12.6%) and venture businesses \$4.49 billion (10.6%). These findings show that R&D expenditure growth has fallen for SMEs as well as large companies since 2011 and the spending of venture businesses decreased in 2013 by 7.9 percent year on year.

<Table 1> R&D Spending by Corporate Size

(\$ billion, %)

Category	2011		2012		2013	
	R&D Expenditure	Increase/Decrease Rate	R&D Expenditure	Increase/Decrease Rate	R&D Expenditure	Increase/Decrease Rate
Major Companies	25.8	17.1	29.29	13.1	32.68	11.6
SMEs and Venture Businesses	8.98	14.5	10.19	13.4	9.85	-3.3
SME	4.77	7.6	5.31	11.4	5.36	0.9
Venture	4.22	23.5	4.88	15.6	4.49	-7.9

Source: Ministry of Science, ICT and Future Planning, Press Release (December 2014)

In addition, there is a continuing polarization in corporate R&D spending. The top five R&D investing firms spent 39.7 percent of the total in 2011, but the figure rose to 45.2

percent in 2013, a 5.5 percentage point increase in two years. The top 20 firms invested 51.2 percent of total R&D spending in 2011, while the top 10 companies 50.6 percent in 2013, which demonstrates that R&D investment is increasingly concentrated among those at the top of the list.

<Table 2> R&D Expenditure of Top Ranking Firms

(\$ billion, %)

Category	2011		2012		2013	
	R&D Expenditure	Ratio	R&D Expenditure	Ratio	R&D Expenditure	Ratio
Top 5	13.84	39.7	16.17	41.0	19.21	45.2
Top 10	15.77	45.2	18.28	46.3	21.50	50.6
Top 20	17.86	51.2	20.73	52.5	23.59	55.5
Top 100	22.83	65.5	25.71	65.1	28.67	67.4

Note: "Ratio" means a ratio of the spending to the total R&D investment.

Source: Ministry of Science, ICT and Future Planning, Press Release (December 2014)

On the other hand, corporate R&D expenditure by use shows that investment in product development slightly decreased, whereas spending on process development and improvement continued to increase.

<Table 3> Corporate R&D Expenditure by Use

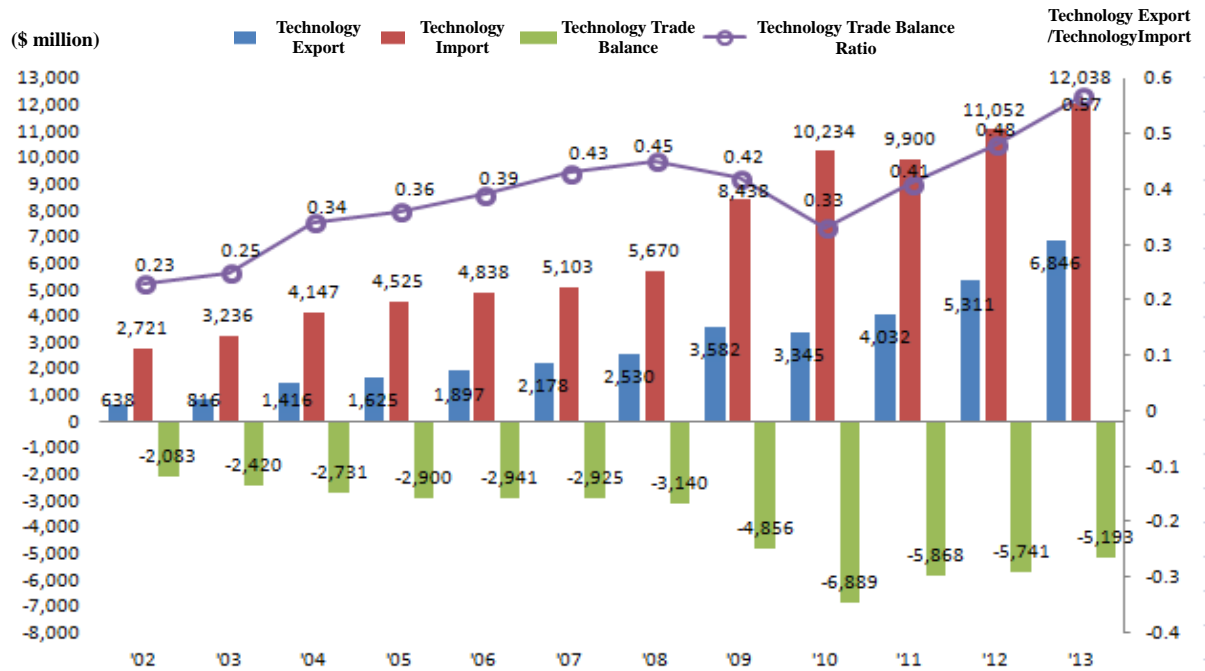
(\$ billion, %)

Category	2011		2012		2013	
	R&D Expenditure	Ratio	R&D Expenditure	Ratio	R&D Expenditure	Ratio
Development of new products	15.80	45.3	17.52	44.4	18.64	43.8
Improvement of existing products	8.19	23.5	9.18	23.2	9.38	22.0
Development of new processes	6.38	18.3	7.36	18.6	8.52	20.0
Improvement of existing processes	4.50	12.9	5.43	13.7	5.98	14.1
Total	34.88	100.0	39.48	100.0	42.53	100.0

Source: Ministry of Science, ICT and Future Planning, Press Release (December 2014)

Meanwhile, the "2013 Statistics Report on the Technology Trade" found that Korea's technology trade volume stood at \$11.88 billion, a 15.4 percent increase compared with 2012. Technology exports amounted to \$6.85 billion, a 28.9% increase year on year, and technology imports \$12.04 billion, an 8.9% increase from the previous year, allowing for a greatly improved technology trade balance ratio of 0.57, compared with 0.48 in 2012.

<Figure 2> Korea's Technology Trade (2002-2013)



Note: As overseas research, development service, construction/engineering and other technological services began to be considered part of technology trade from 2009, the surge of technology import had a great impact on the trade balance ratio.

By industry, electrics and electronics exported technology of \$3.2 billion (46.8%), machinery \$2 billion (29.3%) and telecommunications \$0.75 billion (11.0%). Electrics and electronics imported \$7.27 billion (60.4%), machinery \$1.46 billion (12.1%) and telecommunications \$1.16 billion (9.6%). In particular, electrics and electronics saw the largest trade deficit (78.4%), as much as \$4.07 billion, though the figure fell from \$4.47 billion in the previous year. By country, Korea's technology was exported mainly to China, France and the U.S., while the country imported technology from the U.S., Japan and Germany. Especially, exports to China accounted for 49.9 percent of the total, whereas the imports heavily depended on the U.S.

By business scale, major companies exported technology of \$5.9 billion (86.1%) and SMEs \$0.84 billion (12.3%), suggesting that major companies saw a huge increase. Large companies and SMEs both imported more technology, though the latter experienced a greater increase.

<Table 4> Technology Trade by Corporate Size (2013)

(\$ million, %)

Category	Technology Export			Technology Import			Technology Trade Balance		
	Amount	Year-on-year Increase /Decrease Rate	Proportion	Amount	Year-on-year Increase /Decrease Rate	Proportion	Amount	Year-on-year Increase /Decrease Rate	Proportion
Major firms	5,897.5	48.1	86.1	10,818.7	6.7	89.9	-4,921.2	-20.1	94.8

SMEs	840.3	-34.6	12.3	1,181.5	32.9	9.8	-341.2	-186.3	6.6
Non-profit and others	107.9	138.6	1.6	38.2	59.0	0.3	69.7	228.7	-1.3
Total	6,845.7	28.9	100.0	12,038.4	8.9	100.0	-5,192.7	-9.6	100.0

Source: Ministry of Science, ICT and Future Planning, Press Release (December 2014)

#### □ Outlook for Corporate R&D Investment in 2015

According to "2015 Business Environment Survey" of the nation's top 600 companies in terms of sales recently conducted by the Federation of Korean Industries (FKI), 80 percent of those surveyed said that they plan to make similar or smaller investments than in the previous year. In the "2015 Economic Outlook" released by the Korea Federation of SMEs, 48.2 percent of respondents picked the shrinking of consumer and investor sentiment as the main factor adversely affecting the domestic economy in 2015.

With a view to calculating corporate R&D statistics, the Korea Industrial Technology Association (KOITA) has used its own statistical index, called the R&D Sentiment Index (RSI) since 2013.<sup>2</sup> According to the RSI survey for 2015, investment RSI and employment RSI were found to be 105.1 and 105.6, respectively, showing a sharp decrease when compared to 114.3 and 113.0 in 2014. The survey forecasted that corporate R&D investment and research personnel employment in 2015 would increase from a year earlier, but the scale of the increase would drop significantly.<sup>3</sup>

<Table 5> 2015 RSI by Corporate Size

Category	Total		Large Corporation		Middle-Standing Enterprise		SME	
	2014	2015	2014	2015	2014	2015	2014	2015
Investment RSI	114.3	105.1	118.5	109.0	117.5	102.7	113.4	105.2
Employment RSI	113.0	105.6	117.7	110.0	113.1	103.8	112.5	105.4

Note: Middle-standing enterprises refer to those not belonging to the category of SME, yet recording less than KRW 1 trillion in sales.

Source: KOITA, 2015 R&D Outlook Survey, December 12, 2014 (Press Release)

Regardless of corporate size, whether large corporations, middle-standing enterprises, or SMEs, the investment RSI and employment RSI are predicted to decline compared to the

<sup>2</sup> RSI is scored on a five-point scale by category with additional weighting and then is divided by the total number of respondents ( $0 \leq \text{RSI} \leq 200$ ). RSI (R&D investment or research personnel employment) over 100, less than 100, and equal to 100 indicate improvement, deterioration, and no change, respectively, compared to the year of the survey. KOITA has released its outlook for R&D investment and research personnel employment of industrial sectors by calculating RSI on a yearly basis.

<sup>3</sup> The latest survey targeted at a sample of 500 out of 32,401 companies with research centers and R&D departments that responded to "2014 R&D Activities Survey." The 500 sample companies were classified into three company types (large corporations, middle-standing enterprises and SMEs) and into nine industrial sectors (construction, machinery, textile chemistry, materials, automobile, electrics and electronics, telecommunications, service and others). The survey was conducted for 12 days from November 3, 2014 via fax or e-mail in the form of questionnaires, and its confidence level is 95 percent and a margin of error is  $\pm 5.0$  percent.

previous year. In particular, as the investment RSI and employment RSI of middle-standing enterprises stood at 102.7 and 103.8, their scale of increase in R&D investment is expected to be relatively smaller than big corporations and SMEs. This result indicates that middle-standing enterprises have more negative forecasts for the business environments in 2015 than big corporations and SMEs.

<Table 6> RSI Trends by Industry (2014 & 2015)

Category	Investment RSI		Employment RSI	
	2014	2015	2014	2015
Construction	98.4	98.0	96.2	97.0
Machinery	115.9	105.6	117.2	104.9
Others	119.0	113.6	109.8	106.8
Service	107.1	106.2	106.4	106.9
Textile chemistry	117.8	109.2	119.0	107.5
Materials	114.4	104.2	111.2	106.3
Automobile	126.1	101.3	124.6	103.9
Electrics and electronics	115.5	104.5	114.0	106.1
Telecommunications	117.3	102.6	118.1	109.6
Total	114.3	105.1	113.0	105.6

Source: KOITA, 2015 R&D Outlook Survey, December 12, 2014 (Press Release)

By key industrial sector, as the investment RSI of all industries fell compared to last year, R&D investment for this year is expected to shrink by relative standards. Particularly, the investment RSI of the automobile industry and the telecommunications industry greatly dropped from 126.1 and 117.3 in 2014 to 101.3 and 102.6 in 2015. Moreover, the investment RSI of the construction industry fell below 100 two years in a row, indicating a continuing downward trend in R&D investment.

#### □ Government's R&D Investment Plan for 2015

When the Korean government unveiled the "Three-year Plan for Economic Innovation" in March 2014, it stressed the roles of R&D for realizing a "dynamic, innovative economy" by expanding the ratio of investment in national R&D to 5 percent of the country's GDP by 2017 and by raising the share of its R&D support to middle-standing enterprises and SMEs to the 18 percent level by 2016.

The government's R&D budget for 2015 rose by \$1.00 billion (6.2 percent) year-on-year to \$17.26 billion, which accounts for 5.03 percent of its total budget for 2015.

<Table 7> R&D Budget for 2015

Category	2014 Budget	2015 Budget	Year-on-Year
Total	324.98 billion	342.88 billion	17.90 billion (5.5%) increase
R&D (Ratio of R&D to total budget)	16.26 billion (5.00%)	17.26 Billion (5.03%)	1.00 billion (6.2%) increase

Source: Ministry of Strategy and Finance, Press Release (December 2014),

Key issues in the government's R&D investment plan for 2015 are as follows:

First, the government plans to increase its investment in the fields of future growth engines with an aim of generating new business opportunities following mobile phones and semiconductors and establishing the foundation for sustainable growth by creating new markets and industries for the creative economy. Notably, it will strengthen its investment in improving the technical prowess in new ICT and SW industries such as big data, cloud, Internet of Things (IoT) and 3D printing, while creating new energy industries by developing various technologies, including electricity demand-side management and energy management systems.

Second, in an effort to enhance technical capabilities to help middle-standing enterprises and SMEs grow and take off, as well as to reinforce R&D support to foster small but powerful global companies, the government plans to gradually increase the percentage of its investment in middle-standing enterprises and SMEs (from 16.7 percent in 2014, to 17.5 percent in 2015 and to 18.0 percent in 2016). Particularly, it will provide a variety of support targeting middle-standing enterprises and SMEs to nurture them as leaders for creative economy, such as "World Class 300 Project" aimed at fostering small but powerful companies.

Third, by promoting the technology transfer of R&D achievements delivered by public research institutions and facilitating convergence research among government-funded research institutions, the government will enhance the commercialization of R&D achievements and encourage more companies to use technology intermediaries. Further, it plans to introduce the convergence research center program aimed at jointly carrying out convergence research and expand its investment (from two pilot research centers in 2014 to around 10 research centers).

Fourth, the government will strive to improve the efficiency of projects, including stricter reexamination of the eligibility on projects launched before the introduction of preliminary feasibility study, and eliminate waste in R&D investment by reflecting performance evaluation, evaluation results on government-funded research institutions and other factors into its budget.

#### **Conclusion – Active Corporate R&D Investment is Needed**

Thanks to continuous corporate investment efforts and the government's policy support, the number of corporate research institutions in Korea surpassed 30,000 in May 2014 and that of SME research institutions also exceeded 30,000 in October. Research institutions operated by SMEs were rarely found when the reporting system for corporate research institutions was introduced in October 1981, but their number surged to 30,000 within 33 years after the introduction of the system.

Companies currently contribute 78.5 percent of total national R&D expenditure and 68.7 percent of total national research professionals and their expansion of R&D investment led corporate research institutions to achieve quantitative growth. Such growth, as the main driver of Korea's economic growth and industrial development, formed the basis for companies to develop new technologies and products, thereby helping the nation's economy grow into the seventh-largest exporter in the world.

However, amid growing uncertainty in the global economy in recent years, Korean firms were found to show lukewarm attitudes towards R&D investment for 2015. Contraction of corporate R&D investment, which takes up a large portion of national R&D investment and job creation, is undoubtedly not at all desirable for the country's pursuit of securing

growth engines. In order for industrial sectors to overcome economic hardships and continue their efforts on R&D investment, among other things, it is needed to reform regulations and to come up with demand-oriented and differentiated supportive measures that reflect the characteristics of widely varying demands in companies.

In 2015, KOITA will make every effort to continuously strengthen competitiveness in industrial technology by identifying policy demands from a variety of industrial sectors and making suggestions, helping corporate research institutions sharpen their competitive edge, improving R&D capabilities through expanded technical exchange and cooperation and developing demand-oriented policies and expanding participation.