

Industry R&D Trends for 2016



Ihwan Kim, Executive Deputy Chairman,
Korea Industrial Technology Association

Foreword

The world economy is expected to continue slow growth in 2016, with decreased world trade owing to slowed growth of the Chinese market, and financial crises looming for emerging markets due to the raising of interest rates by the United States. Whereas Korean economy is maintaining gradual growth as a result of improved domestic consumption, forecasts are not bright due to reduced exports as a result of the global economic slowdown.

Even amid these difficulties, Korean businesses continue to excel. Samsung Electronics has overtaken GE and is ranked 7th place in "Best Global Brands 2015" announced by a brand consultant, Interbrand, managing to keep its place in the top 10 for the fourth consecutive year. The Hyundai Motor Corporation rose to 39th place, up one place from 40th in 2014 joining the top-30 level for the first time, while Kia Motors also cemented its position as a global brand with 74th place. In 'CES 2016,' the world's largest electronics show held in the United States, key Korean businesses swept up the top prizes for innovation.

However, there are obstacles that our businesses need to overcome in order to become the true world best. While Korea was ranked 26th, the same as in 2014, in the national competitiveness evaluation announced by the World Economic Forum (WEF), in terms of corporate innovation, the country

came in 19th in 2015, down 2 steps from 17th in 2014. The average rate of return for Korean businesses ranked in the Fortune 500, at 4.52%, was lower than the 7.44% recorded by major American businesses, and the 5.49% for Chinese businesses. This figure falls short of the average of 5.37% for the Fortune 500. In the 500 top businesses of the world, announced by the Financial Times (FT) of the U.K. based on enterprise value, only 4 Korean businesses were included in 2015. This was the lowest figure since 2001. On the other hand, the United States and China advanced by leaps and bounds, placing 205 and 37 businesses in the top 500, up from 197 and 0, respectively, from just 10 years ago.

With global competition escalating, in order for more Korean competitive global businesses to emerge, the securing of peerless technological prowess and quality is necessary. In order to continue to enhance the efficiency of corporate management through innovation, a prerequisite is more R&D activities.

Results of research into R&D activities and technology trade in 2014

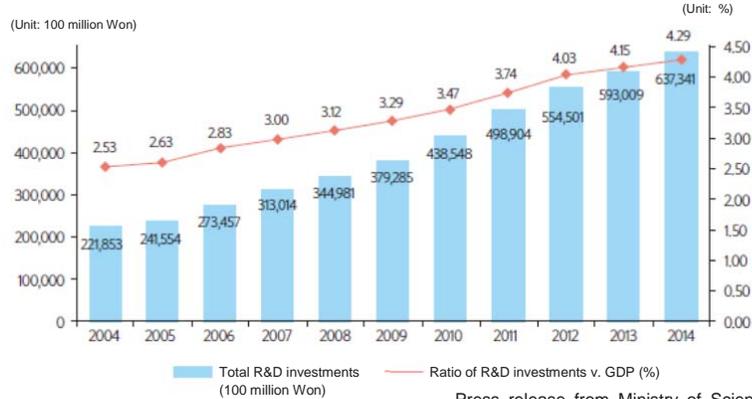
In 2014, total R&D expenditures for the country were 63,734.1 billion Won (around 60.5 billion USD), 7.5% up from the previous year. Also, R&D expenditures as a percentage of GDP in 2014 was found to be 4.29%, the highest in the world, 0.14% up from the previous year (Fig. 1).

R&D investments by corporations accounted for 78.2% of total Korean R&D investments, at 49,854.5 billion Won, followed by 8,112.7 billion Won by public research institutes (12.7%) and 5,767 billion Won (9.0%) by universities. The proportion of corporate R&D investments relative to total Korean R&D investments is higher than 76.6% for China (2013), 76.1% for Japan (2013) and 70.6% for the United States (2013). (Fig. 2).

Among corporate R&D investments, large corporations, investing 38,617.7 billion Won (77.5%), far outweighed small and medium corporations at 5,946.8 billion Won (11.9%), and 5,289.9 billion Won by venture corporations (10.6%). The proportion of corporate R&D investments accounted for by investments from large corporations has been rising steadily from 70.9% in 2009, and it appears that the tendency of R&D investments to be led by large corporations will continue for the mean time.

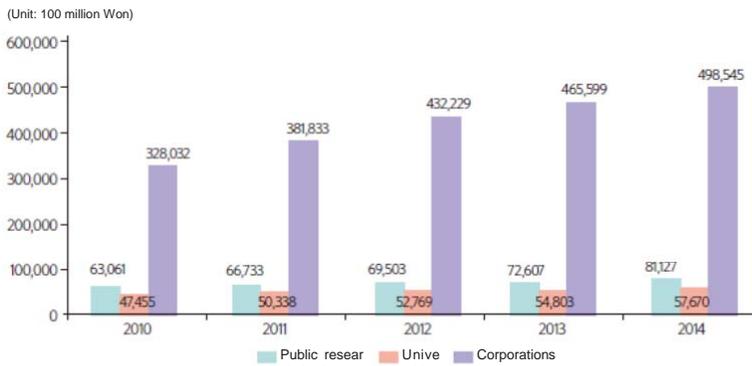
Among corporate R&D investments, manufacturing sector accounts for 88.9% of the total with 44,328.2 billion Won which is 374.2 billion Won up from the previous year, higher than Japan of 88.7%, Germany of 86.1%, and the United States of 65.8%. Meanwhile, service

Fig. 1 R&D investments and proportion of R&D investments relative to GDP



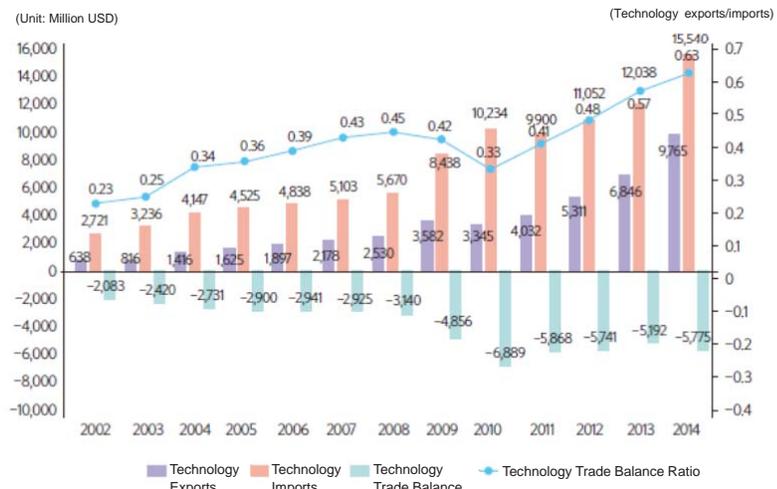
Press release from Ministry of Science, ICT and Future Planning (October 2015)

Fig. 2 R&D investments by investor



Press release from Ministry of Science, ICT and Future Planning (October 2015)

Fig. 3 Technology trade by year



Annual Technology Trade Statistics from Ministry of Science, ICT and Future Planning

sector R&D investments, at 4,117.2 billion Won, or 8.3% of the total R&D investments, were lower than the United States of 28.6% (2012), the United Kingdom of 58.1% (2012), Japan of 10.0% (2013), and Germany of 13.1% (2012).

Table 1 Technology trade by industry (2014)

(Units : Million USD, %)

Category	Technology Exports			Technology Imports			Size of technology trade		Technology Balance of Payments	
	Amount	Change from previous year	Ratio	Amount	Change from previous year	Ratio	Amount	Ratio	Amount	Ratio
Electric and electronics	4,095	27.9	41.9	8,463	37.2	54.5	12,558	49.6	-4,369	0.48
Information communications	2,815	275.4	28.8	2,141	131.1	13.8	4,956	19.6	673	1.31
Mechanical	1,499	-25.2	15.3	2,034	28.6	13.1	3,533	14.0	-536	0.74
Chemical	322	-43.7	3.3	727	19.4	4.7	1,049	4.1	-405	0.44
Textiles	251	2569.8	2.6	380	1328.5	2.4	631	2.5	-129	0.66
Materials	21	-78.1	0.2	346	307.0	2.2	367	1.5	-325	0.06
Agricultural and fisheries	183	2533.0	1.9	312	2223.8	2.0	496	2.0	-129	0.59
Construction	46	-39.4	0.5	257	-145.0	1.7	303	1.2	-210	0.18
Others	533	309.5	5.5	879	139.5	5.7	1,412	5.6	-346	0.61
Total	9,765	42.6	100.0	15,540	51.1	100.0	25,305	100.0	-5,775	0.63

Annual Technology Trade Statistics from Ministry of Science, ICT and Future Planning

One aspect of returns from R&D investment is technology trade. According to 2014 technology trade statistics, Korean technology trade recorded 25.35 billion USD, 6.421 billion USD up from 2013. Technology exports, at 9.765 billion USD, rose 42.6% from the previous year, whereas technology imports, at 15.54 billion USD, increased by 29.1% from the previous year. The ratio of technology balance of payments, found by dividing technology exports by technology imports, has continued to improve since 2010, when it recorded 0.33, and reached 0.57 in 2013, and 0.63 in 2014 (Fig. 3).

Examining technology exports by sector, electric and electronics technology exports, at 4.095 billion USD (41.9%), accounted for the highest proportion, followed by information communications at 2.815 billion USD (28.8%), and mechanical technology exports at 1.499 billion USD (15.3%). Technology imports were found to be concentrated in the electric and electronics sector, at 8.463 billion USD (54.5%), the information communications sector at 2.141 billion USD (13.8%), and mechanical technology, at 2.034 billion USD (13.1%) (Table 1). Key importers of Korean technology were China, the United States, Vietnam, and Singapore, in the same order, and key exporters of technology to Korea were the United States, Japan, and Sweden. Korean technology trade was found to be concentrated in trade with certain countries, with 30.2% of exports accounted for by China and 47.5% of imports accounted for by technology from the United States.

2016 forecast for corporate R&D investment

Corporate R&D investment by Korean companies is expected to stagnate in 2016, without major increases. KOITA recently surveyed 500 sample businesses to compute the KOITA RSIs¹, which are indices reflecting R&D sentiment. Investment RSI was shown to be 102.4, while manpower RSI was 103.6. It is therefore forecast that increases in R&D investment and hiring of R&D personnel will be negligible in 2016 (Table 2).

While the investment and manpower RSIs of large and small/medium corporations are expected to decrease compared to 2015 levels, the investment and manpower RSIs of intermediate-size businesses were forecast to increase compared to 2015 levels, albeit slightly.

Organized by industry, aside from a slight increase in the investment RSIs of the automotive and information communication sectors, the investment RSIs for all industry sectors were found to have decreased from 2015 levels. It is therefore expected that R&D activities will subside compared to 2015 across all industries. In the mechanical sector, severely negative investment sentiment among businesses in the shipbuilding and heavy industries sectors is expected to lead to reduced R&D investments.

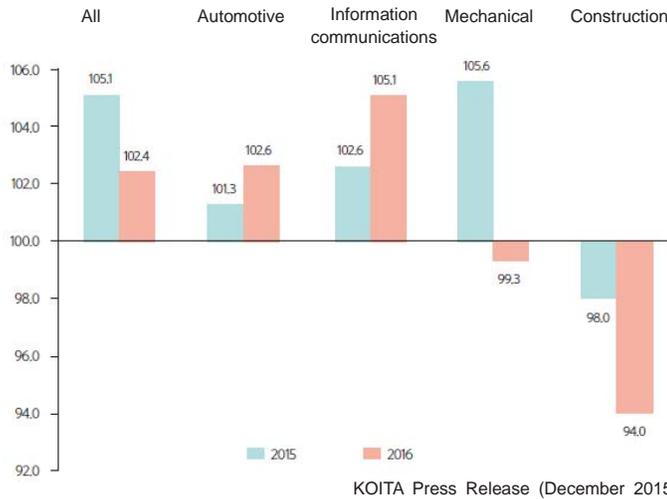
¹ KOITA RSI(KOITA R&D Sentiment Index): Indices indicating the investment outlook for R&D in the following year. An RSI higher than 100 indicates improvements over the current year. An RSI lower than 100 indicates a negative outlook, while 100 means R&D investment sentiment is identical to the current year (0≤RSI≤200)

Table 2 RSI according to business type

Category	Total		Large corporations		Intermediate corporations		Small and medium businesses	
	2015	2016	2015	2016	2015	2016	2015	2016
Investment RSI	105.1	102.4	109.0	103.2	102.7	103.3	105.2	102.1
Manpower RSI	105.6	103.6	110.0	102.1	103.8	104.4	105.4	103.6

KOITA Press Release (December 2015)

Fig. 4 Investment RSI by industry



KOITA Press Release (December 2015)

The investment RSI for the construction sector, under 100 for the second year, indicate that the trend toward reduced R&D investments in the sector will continue (Fig. 4).

Government R&D Policy

With unfavorable corporate R&D investment sentiment, a change in the government's R&D policy paradigm is called for. In light of the current situation, wherein the R&D expenditures as a percentage of GDP is the highest in the world at 4.29% but investments fail to produce results such as enhancements in R&D productivity, the government has reached the conclusion that increases in R&D investments are not backed up by strategy, and has announced an R&D innovation plan in June 2015. The innovation plan called for a restructuring of government R&D support, centering on small/medium and intermediate-sized businesses, and reinforcing the

role of the government as R&D control tower. R&D-related budgets were appropriated in a different manner, departing from a focus on quantitative expansion to an emphasis on R&D innovation and efficiency. The 2016 government budget as approved by the National Assembly reflects the government's R&D policy. R&D-related budgets for 2016, at 19.1 trillion Won, increased 1.1% over the previous year, while the proportion of total

expenditures accounted for by R&D, at 4.9%, dropped 0.1% from the previous year (Table 3).

Conclusion

Corporate research institutes continued to increase in number in 2015 as well, due to the relaxing of accreditation requirements and the spreading of an atmosphere favorable to technology innovator startups. The CEOs of small businesses less than 3 years old have been allowed to be registered as researchers (March 2015), while the qualification requirements for researchers in the research institutes of small and medium businesses have been relaxed, leading to an increase in R&D institutes among small and medium businesses. As of the end of December 2015, there are currently 35,288 corporate R&D centers, 3,121 or 9.7% up from 32,167 in 2014.

Table 3 R&D budget relative to total budget in 2016

Category	2015 budget	2016 budget	Relative to previous year
All	375.4 trillion Won	386.4 trillion Won	11 trillion Won (2.9%) increase
R&D (Ratio to total budget)	18.9 trillion Won (5.0%)	19.1 trillion Won (4.9%)	0.2 trillion Won (1.1%) increase

Press release from Ministry of Science, ICT and Future Planning (December 2015)

While R&D centers annexed to large corporations decreased in number from 1,421 in 2014 to 1,266, the number of R&D centers attached to small and medium businesses increased by 10.6%, from 30,746 to 34,022.

In order to enhance the technology competitiveness of corporations, the government has enforced various support policies in 2015. The SOS1379 Support Center was expanded and re-opened in July, to complete a one-stop technical support system for small and medium businesses. There were also efforts to create an innovative R&D ecosystem through collaboration between large corporations and government-funded research institutes. KOITA and the National Research Council of Science & Technology signed an MOU to support exchanges and cooperation between government-funded research institutes and corporations. November saw the first fruits of cooperation between the two bodies. The CTOs of 24 major corporations and representatives of government-funded research institutes met at the Korea Institute of Science and Technology to discuss technological cooperation in earnest.

18 Creative Economy Innovation Centers were founded throughout the country, and acted as the focal point for entrepreneurship.

There were also accelerated efforts to relax regulations. A fundamental review was performed on all certification regulations (203), of which 36 similar or redundant regulations were repealed, and 77 regulations unnecessarily burdening small and medium corporations with expenses or procedure were revised.

There were also radical changes in the award and certification systems to promote industrial technology. 2015 saw a total of 415 New Excellent Technology (NET) applications, of which 296 or 71.3% were accounted for by small and medium businesses, up from 70.9% in the previous year. The ratio of small and medium business applications accepted also increased, from 50.5% in 2014 to 60.9% in 2015.

2015 saw increased support for products employing NETs. Purchases of at least 10% were mandated for public procurement by public institutions, opening sales channels for

new technology products developed by small and medium businesses.

Interest and participation by small and medium businesses in NETs are expected to increase further in 2016. The NET system, now in its 23rd year, is expected to reach a major milestone in Korean new technology certification, with some 1,000 new technologies forecast to be certified in the first half of 2016.

The IR52 Jang Young-Shil award also meets its 25th anniversary in 2016. 1,300 businesses have been recipients of the award so far, and 13 of the awarded products were listed among the 70 Representative Science and Technology Achievements for the 70th Anniversary of Korean Independence.

Despite enthusiastic government support and active efforts by businesses, the worsening of the economic situation abroad is leading to the gradual atrophy of corporate attitudes toward R&D. Some analyses have pointed out that Korean products are no longer competitive against Japanese corporations in terms of price, and that China has caught up to Korea in terms of technology.

Given such a situation, the frame of 'accelerated short term growth' is no longer valid for us. It is now time for a sustainable and future-oriented growth strategy. This will require a massive transition from quantitative expansion to qualitative progress. With the continued increase in the number of corporate R&D centers, we have somewhat achieved quantitative growth in R&D investments. In addition to the fostering of businesses centering on their technological innovation potential, policies must be put in place to provide support for new industries, and to improve R&D efficiency and production efficiency. This calls for increased technology cooperation among large and small/medium businesses, increased research cooperation among industry, academia and research institutes, efficient research manpower policies, and broad changes to support systems.

2016 needs to be a year wherein the constitution of industrial technology is improved, and the foundations are laid for our next steps into the future. **Technology and**

Management