

43

Value of shipments

trillion yen

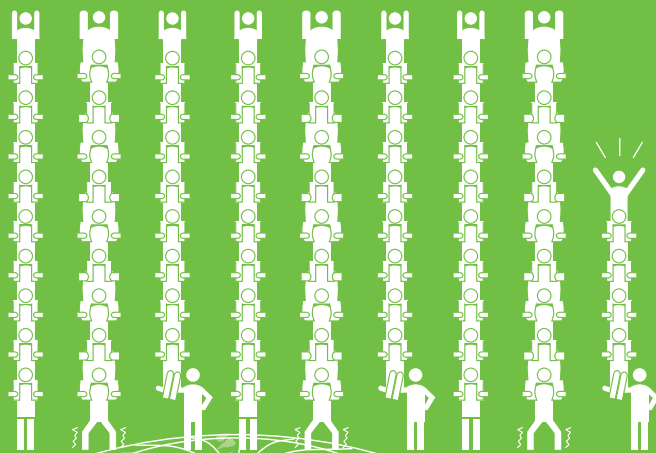
The chemical industry including plastic and rubber products ships goods approximately amounting to 43 trillion yen, the 2nd largest in manufacturing industry.

290.8 billion dollars
Japan's chemical industry ranks 3rd in global chemical shipments.



Chemical Industry of Japan 2016

Number of **860** thousand people employees



22.0%
Chemical industry

40.0%
Other manufacturing industries

24.2%
Transportation machinery

13.8%
Information and communication electronic equipment

R & D expenditures

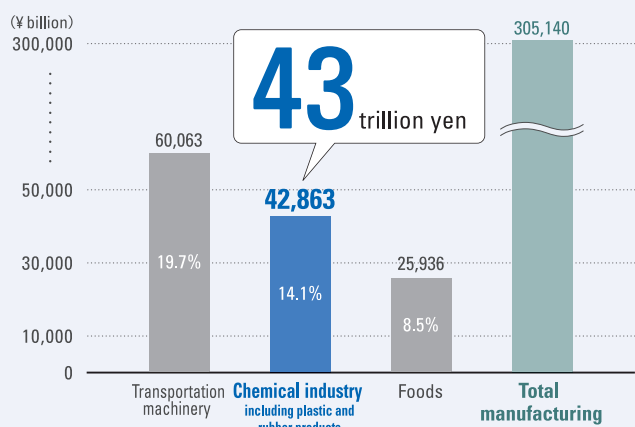
2.6

trillion yen

R&D expenditures of chemical industry including plastic and rubber products amounted to 2.6 trillion yen.

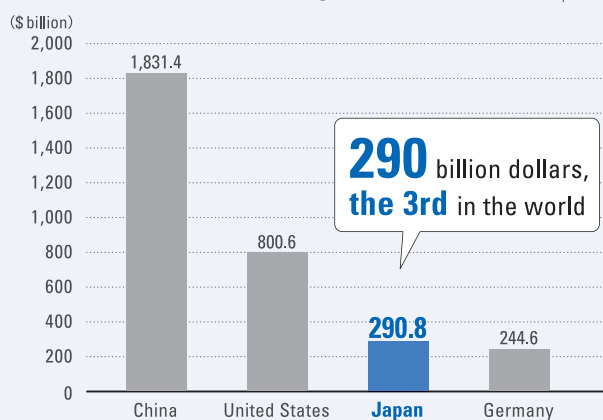
Japan's chemical industry viewed by figures and graphs

Value of shipments (2014) Source:METI [Census of Manufactures]



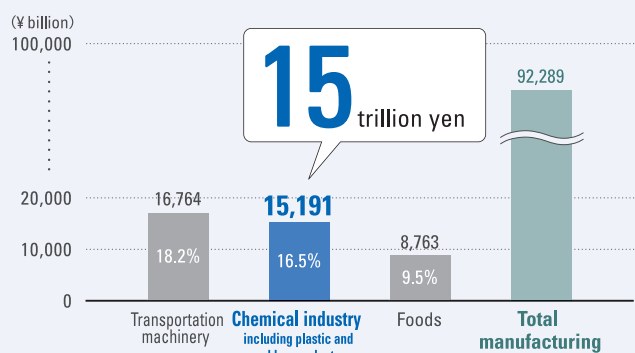
➔ page 3

Global chemical shipments (2014) Source:ACC [Guide to the Business of Chemistry 2015]



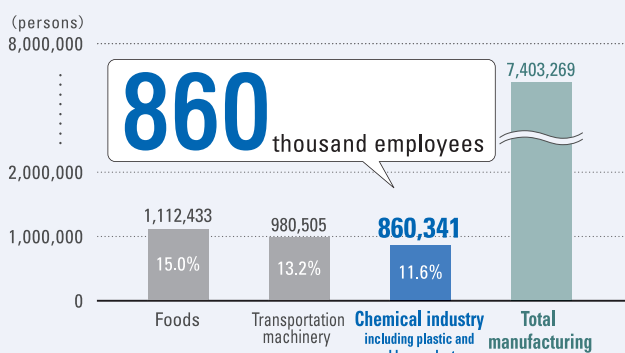
➔ page 15

Amount of value added (2014) Source:METI [Census of Manufactures]



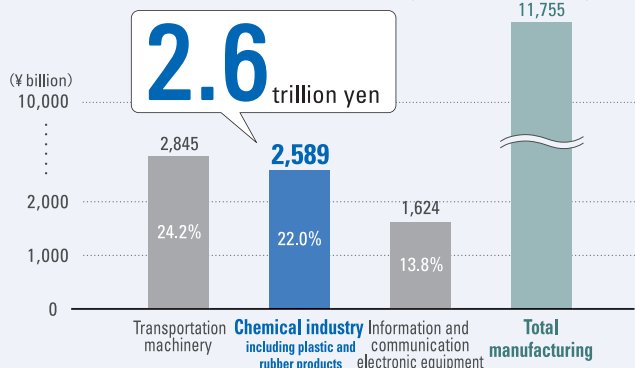
Note: Value added = Production amount – Cost for using raw materials – Domestic consumption tax – Depreciation cost, etc.

Number of employees (2014) Source:METI [Census of Manufactures]



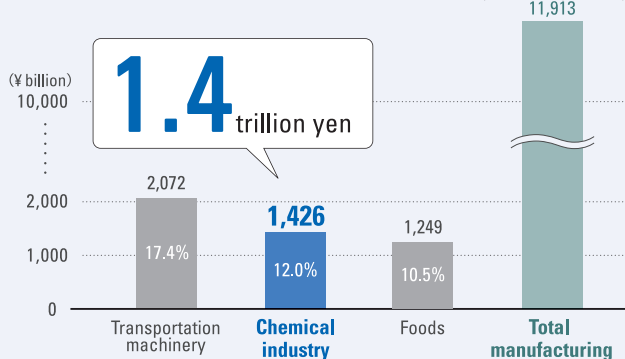
➔ page 9

R&D expenditures (FY2014) Source:MIC [Survey of Research and Development]



➔ page 11

Capital investment (FY2014) Source:MOF [Financial Statements Statistics of Corporations by Industry]



➔ page 14

Japan's chemical industry supports people's lives and other industries

Japan's chemical industry not only contributes to the improvement of the quality of daily life by supplying products and materials that make our lives affluent and pleasant but also supports other manufacturing industries of Japan. In addition, it also makes contribution to the resolution of such various issues as global warming, energy, natural resources, and food etc.

The total shipments and amount of value added of "chemical industry including plastic and rubber products" amounted to Yen 43 trillion and Yen 15 trillion, respectively, in 2014, ranking those as the second biggest industry that contributes to the Japanese economy following the transportation machinery. The number of employees is more than 860,000. Thus, the industry significantly supports the people's lives also in employment.

Although it may be difficult for people to understand overall chemical industry because it manufactures diverse products*, we introduce the industry with data and graphs in this "Chemical Industry of Japan".

* Since the chemical industry is vast, with a wide range and scope of work, content may vary depending on different classifications. Therefore, in this brochure, we have conformed to Japan Standard Industrial Classification (second classification: chemical industry). Detail of the content is described on Page 5. When the standard differs, we have provided footnotes.



CONTENTS

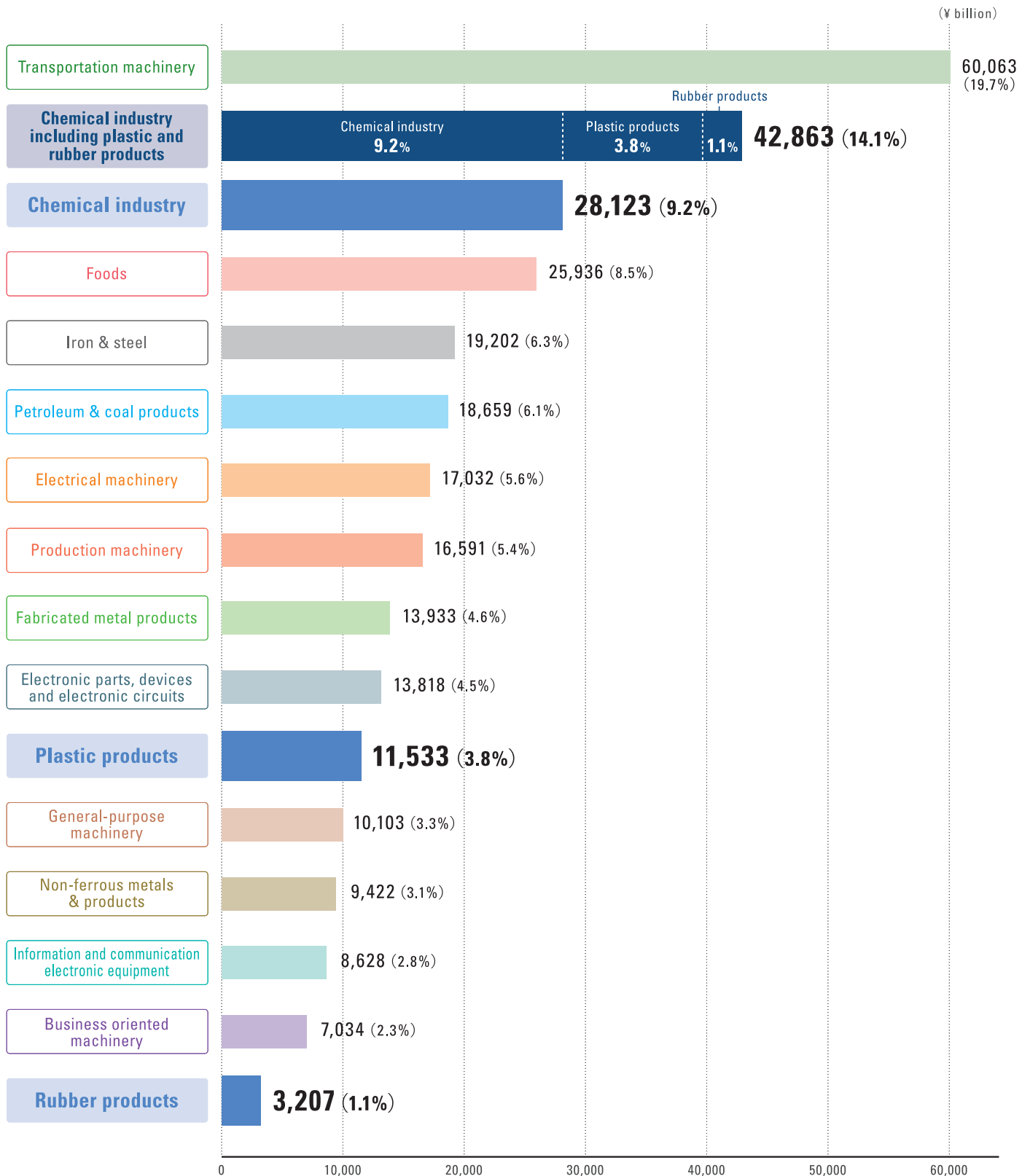
| | | | |
|--|----|---|----|
| Japan's chemical industry viewed by figures and graphs | 01 | 8. Amount of capital investment | 14 |
| Japan's chemical industry supports people's lives and other industries | 02 | 9. Shipments by country | 15 |
| 1. Shipments | 03 | 10. The world's 30 leading chemical companies | 16 |
| 2. Shipment by products/Major indices | 05 | 11. Trade balance | 17 |
| 3. Shipment, number of employed workers and number of facilities by prefecture | 07 | 12. Exports and imports of chemicals by region | 18 |
| 4. Number of employed workers | 09 | 13. Outward/inward direct investments | 19 |
| 5. Labor productivity/Working hours | 10 | 14. Ratio of overseas production/Sales of overseas subsidiary companies | 20 |
| 6. Research and development expenditures | 11 | Chemistry creates the future of the earth | 21 |
| 7. Operating profit margin | 13 | | |

1

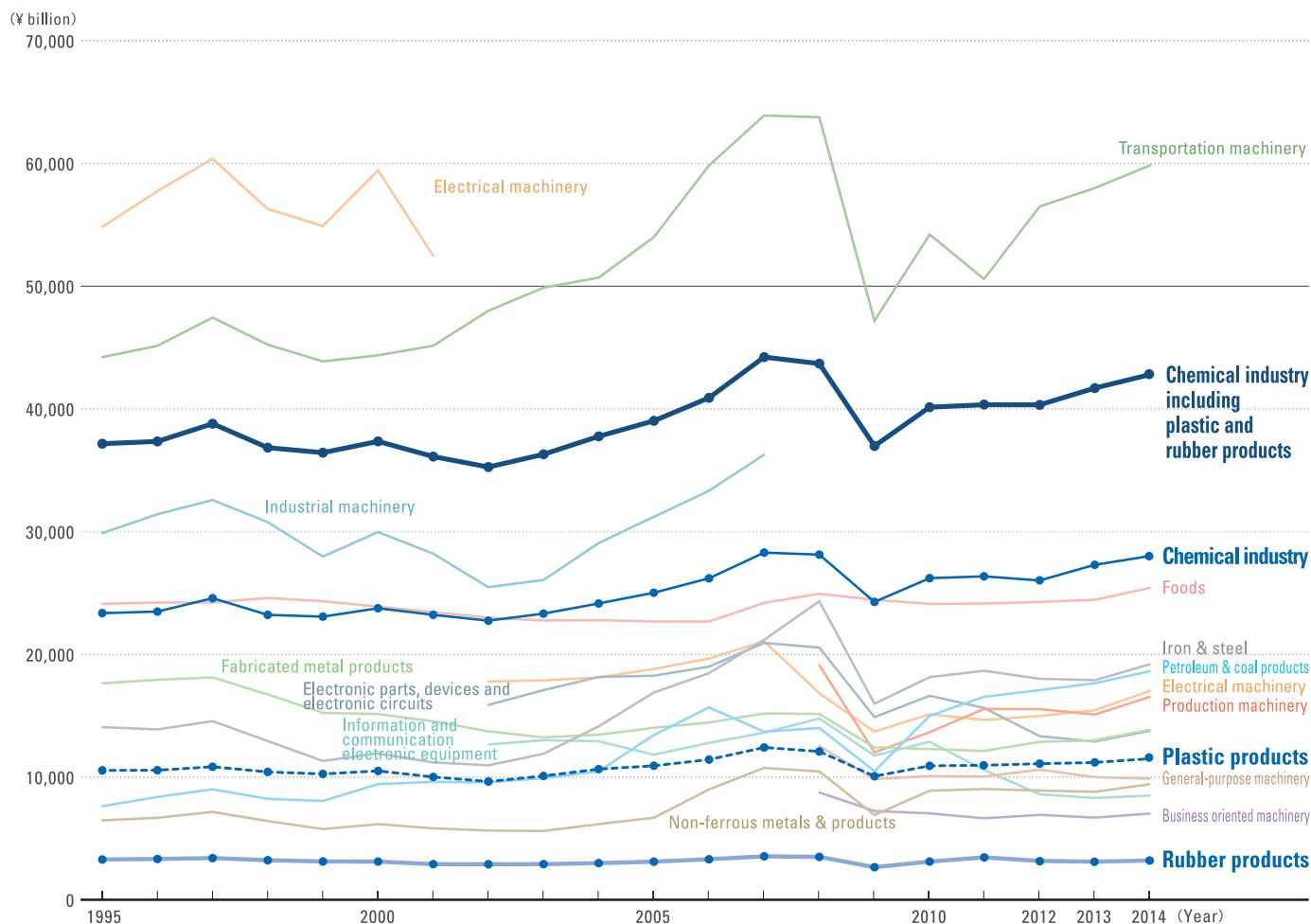
Shipments

Total shipment value of chemical industry ranks 2nd in manufacturing industries amounting to 43 trillion yen.

Value of shipments by manufacturing industry in 2014



Trend in shipment value (1995-2014)



(¥ billion)

| Industry | Year | Every 5th year | | | | Recent three years | | | |
|---|------|----------------|----------------|----------------|----------------|--------------------|----------------|----------------|---------------|
| | | 1995 | 2000 | 2005 | 2010 | 2012 | 2013 | 2014 | |
| Chemical industry | | 23,363 | 23,762 | 25,027 | 26,212 | 26,038 | 27,409 | 28,123 | 9.2% |
| Plastic products | | 10,530 | 10,486 | 10,906 | 10,903 | 11,106 | 11,237 | 11,533 | 3.8% |
| Rubber products | | 3,275 | 3,107 | 3,099 | 3,029 | 3,177 | 3,113 | 3,207 | 1.1% |
| Chemical industry including plastic and rubber products | | 37,168 | 37,356 | 39,032 | 40,144 | 40,321 | 41,759 | 42,863 | 14.1% |
| Foods | | 24,117 | 23,888 | 22,678 | 24,114 | 24,302 | 24,948 | 25,936 | 8.5% |
| Petroleum & coal products | | 7,635 | 9,434 | 13,429 | 14,992 | 17,077 | 17,676 | 18,659 | 6.1% |
| Iron & steel | | 14,073 | 11,927 | 16,896 | 18,146 | 18,012 | 17,905 | 19,202 | 6.3% |
| Non-ferrous metals & products | | 6,496 | 6,191 | 6,712 | 8,911 | 8,923 | 8,806 | 9,422 | 3.1% |
| Fabricated metal products | | 17,646 | 15,143 | 14,016 | 12,292 | 12,861 | 13,061 | 13,933 | 4.6% |
| Industrial machinery | | 29,884 | 29,972 | 31,211 | — | — | — | — | — |
| General-purpose machinery | | — | — | — | 10,100 | 10,624 | 10,231 | 10,103 | 3.3% |
| Production machinery | | — | — | — | 13,646 | 15,539 | 15,155 | 16,591 | 5.4% |
| Business oriented machinery | | — | — | — | 6,873 | 6,919 | 6,705 | 7,034 | 2.3% |
| Electrical machinery | | 54,831 | 59,449 | 18,812 | 15,120 | 14,983 | 15,458 | 17,032 | 5.6% |
| Information and communication electronic equipment | | — | — | 11,534 | 12,585 | 8,622 | 8,427 | 8,628 | 2.8% |
| Electronic parts, devices and electronic circuits | | — | — | 18,265 | 16,633 | 13,338 | 12,943 | 13,818 | 4.5% |
| Transportation machinery | | 44,215 | 44,367 | 54,000 | 54,214 | 56,486 | 58,203 | 60,063 | 19.7% |
| Others | | 69,965 | 62,752 | 48,760 | 41,338 | 40,722 | 40,815 | 41,857 | 13.7% |
| Total manufacturing | | 306,030 | 300,478 | 295,346 | 289,108 | 288,728 | 292,092 | 305,140 | 100.0% |

(Source) Ministry of Economy, Trade and Industry [Census of Manufactures]

(Note) 1. Electrical machinery was divided into electrical machinery, information and communication electronic equipment, and electronic parts and devices in 2002.

Industrial machinery was divided into general-purpose machinery, production machinery, and business oriented machinery in 2008.

2. Because "other revenues" have been added to the amount of total shipment since the survey conducted in 2007, the total shipment amount cannot be compared with that in 2006.

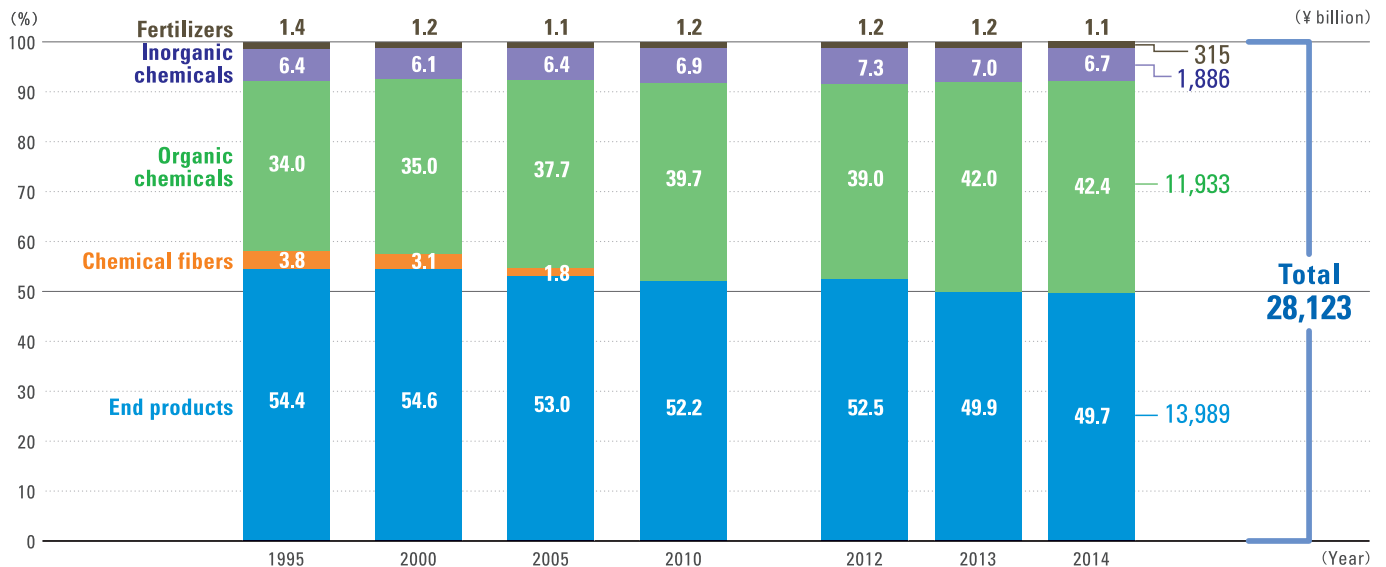
3. Electronic circuits have been added to electronic parts and devices since 2011.

2

Shipment by products/Major indices

Chemical products meet the needs of various fields.

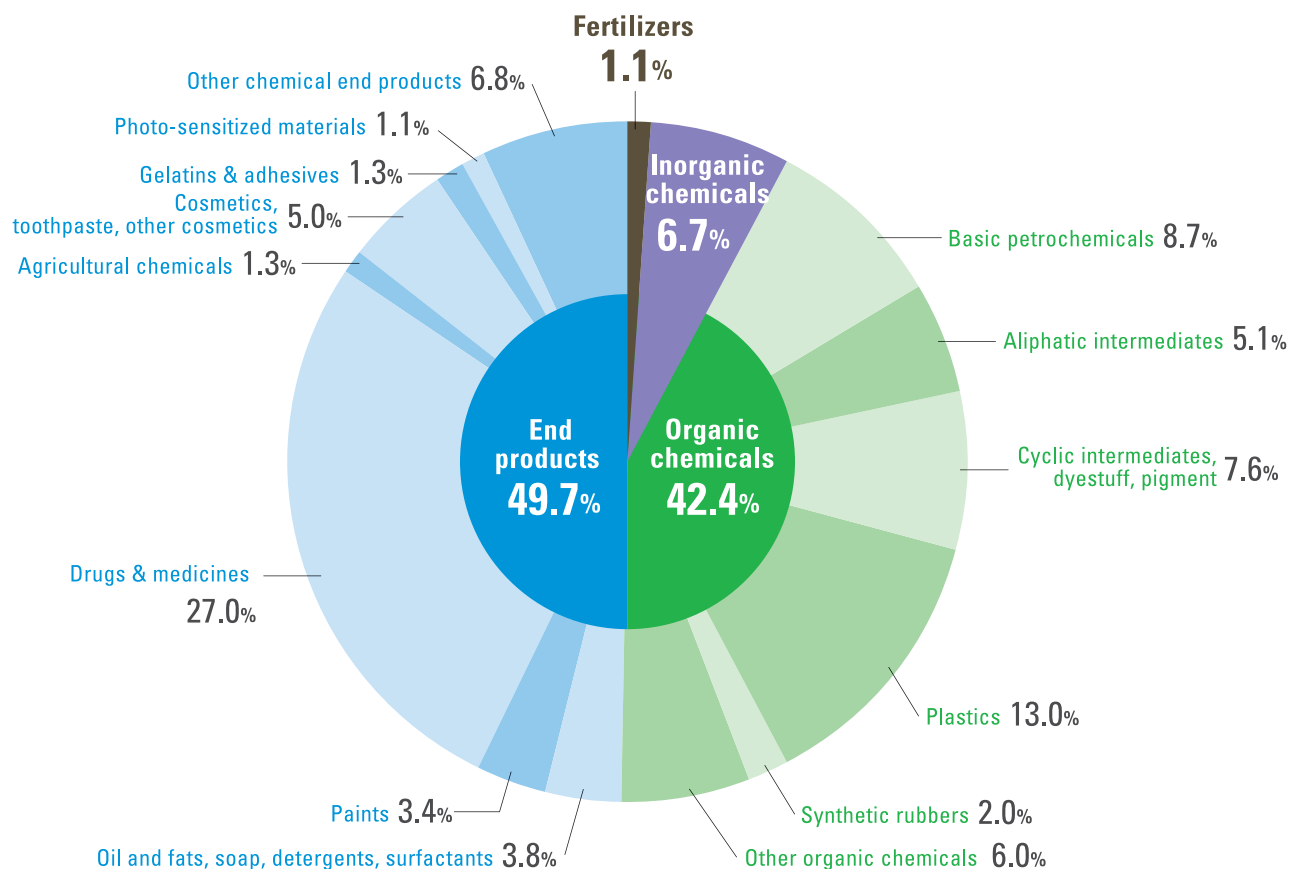
Trend of shipments composition in chemical industry (1995-2014)



| Industry | Year | Every 5th year | | | | Recent three years | | |
|---|------|----------------|------------|------------|------------|--------------------|------------|------------|
| | | 1995 | 2000 | 2005 | 2010 | 2012 | 2013 | 2014 |
| Fertilizers | | 1.4 | 1.2 | 1.1 | 1.2 | 1.2 | 1.2 | 1.1 |
| Inorganic chemicals | | 6.4 | 6.1 | 6.4 | 6.9 | 7.3 | 7.0 | 6.7 |
| Organic chemicals | | 34.0 | 35.0 | 37.7 | 39.7 | 39.0 | 42.0 | 42.4 |
| ▶ Basic petrochemicals | | 2.6 | 2.9 | 6.3 | 6.6 | 7.0 | 9.4 | 8.7 |
| ▶ Aliphatic intermediates | | 5.5 | 7.1 | 6.1 | 5.9 | 4.1 | 4.8 | 5.1 |
| ▶ Cyclic intermediates, dyestuff, pigment | | 6.9 | 6.1 | 7.6 | 6.8 | 7.5 | 7.5 | 7.6 |
| ▶ Plastics | | 14.0 | 13.6 | 11.0 | 13.2 | 12.7 | 12.7 | 13.0 |
| ▶ Synthetic rubbers | | 1.7 | 1.5 | 2.0 | 1.6 | 1.9 | 2.0 | 2.0 |
| ▶ Other organic chemicals | | 3.3 | 3.8 | 4.7 | 5.5 | 5.8 | 5.5 | 6.0 |
| Chemical fibers | | 3.8 | 3.1 | 1.8 | - | - | - | - |
| End products | | 54.4 | 54.6 | 53.0 | 52.2 | 52.5 | 49.9 | 49.7 |
| ▶ Oil and fats, soap, detergents, surfactants | | 4.0 | 3.5 | 4.1 | 4.2 | 3.8 | 3.9 | 3.8 |
| ▶ Paints | | 4.6 | 4.1 | 3.7 | 4.0 | 3.6 | 3.5 | 3.4 |
| ▶ Drugs & medicines | | 25.7 | 27.0 | 28.0 | 28.1 | 29.7 | 27.8 | 27.0 |
| ▶ Agricultural chemicals | | 1.6 | 1.4 | 1.1 | 1.0 | 1.1 | 1.1 | 1.3 |
| ▶ Cosmetics, toothpaste, other cosmetics | | 6.4 | 6.0 | 5.6 | 5.3 | 5.0 | 4.8 | 5.0 |
| ▶ Gelatins & adhesives | | 1.0 | 1.0 | 1.0 | 1.2 | 1.2 | 1.1 | 1.3 |
| ▶ Photo-sensitized materials | | 4.6 | 4.4 | 2.5 | 1.7 | 1.1 | 1.1 | 1.1 |
| ▶ Other chemical end products | | 6.6 | 7.2 | 7.0 | 6.8 | 7.1 | 6.5 | 6.8 |
| Chemical industry | | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Chemical industry | | 62.9 | 63.6 | 64.1 | 65.3 | 64.6 | 65.6 | 65.6 |
| Plastic products | | 28.3 | 28.1 | 27.9 | 27.2 | 27.5 | 26.9 | 26.9 |
| Rubber products | | 8.8 | 8.3 | 7.9 | 7.5 | 7.9 | 7.5 | 7.5 |
| Chemical industry in a broad sense (including plastic and rubber products) | | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

(Source) Ministry of Economy, Trade and Industry[Census of Manufactures]
 (Note) 1. Chemical fibers have been moved to textile industry since 2008.

Composition of chemical products shipped in 2014



Major chemical industry indices with breakdown by product in 2014

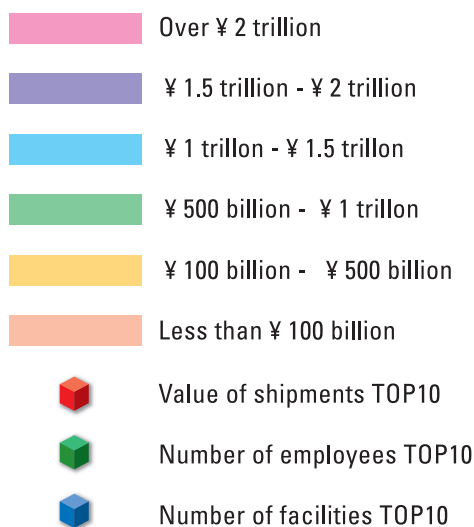
| Industry | Major indices, Composition | | | | | | | |
|---|----------------------------|------------|---------------------|------------|--------------------------------|------------|-----------------------------------|------------|
| | Number of facilities | % | Number of employees | % | Value of shipments (¥ billion) | % | Amount of value added (¥ billion) | % |
| Fertilizers | 161 | 3.4 | 4,526 | 1.3 | 315 | 1.1 | 73 | 0.7 |
| Inorganic chemicals | 805 | 17.2 | 31,760 | 9.2 | 1,886 | 6.7 | 612 | 6.3 |
| Organic chemicals | 751 | 16.1 | 91,789 | 26.7 | 11,933 | 42.4 | 2,661 | 27.2 |
| ▶ Basic petrochemicals | 11 | 0.2 | 5,221 | 1.5 | 2,444 | 8.7 | 290 | 3.0 |
| ▶ Aliphatic intermediates | 63 | 1.3 | 9,474 | 2.8 | 1,441 | 5.1 | 441 | 4.5 |
| ▶ Cyclic intermediates, dyestuff, pigment | 145 | 3.1 | 13,759 | 4.0 | 2,128 | 7.6 | 408 | 4.2 |
| ▶ Plastics | 232 | 5.0 | 32,632 | 9.5 | 3,655 | 13.0 | 923 | 9.4 |
| ▶ Synthetic rubbers | 16 | 0.3 | 6,264 | 1.8 | 565 | 2.0 | 137 | 1.4 |
| ▶ Other organic chemicals | 284 | 6.1 | 24,439 | 7.1 | 1,700 | 6.0 | 462 | 4.7 |
| End products | 2,952 | 63.2 | 215,341 | 62.7 | 13,989 | 49.7 | 6,439 | 65.8 |
| ▶ Oil and fats, soap, detergents, surfactants | 272 | 5.8 | 13,935 | 4.1 | 1,065 | 3.8 | 468 | 4.8 |
| ▶ Paints | 381 | 8.2 | 15,744 | 4.6 | 968 | 3.4 | 340 | 3.5 |
| ▶ Drugs & medicines | 781 | 16.7 | 95,732 | 27.9 | 7,598 | 27.0 | 3,854 | 39.4 |
| ▶ Agricultural chemicals | 71 | 1.5 | 4,911 | 1.4 | 367 | 1.3 | 148 | 1.5 |
| ▶ Cosmetics, toothpaste, other cosmetics | 456 | 9.8 | 32,948 | 9.6 | 1,409 | 5.0 | 778 | 8.0 |
| ▶ Gelatins & adhesives | 140 | 3.0 | 6,112 | 1.8 | 357 | 1.3 | 105 | 1.1 |
| ▶ Photo-sensitized materials | 50 | 1.1 | 8,153 | 2.4 | 299 | 1.1 | 125 | 1.3 |
| ▶ Other chemical end products | 801 | 17.2 | 37,806 | 11.0 | 1,925 | 6.8 | 621 | 6.3 |
| Chemical industry | 4,669 | 100 | 343,416 | 100 | 28,123 | 100 | 9,784 | 100 |
| Chemical industry | 4,669 | 23.2 | 343,416 | 39.9 | 28,123 | 65.6 | 9,784 | 64.4 |
| Plastic products | 12,936 | 64.3 | 405,938 | 47.2 | 11,533 | 26.9 | 4,081 | 26.9 |
| Rubber products | 2,525 | 12.5 | 110,987 | 12.9 | 3,207 | 7.5 | 1,326 | 8.7 |
| Chemical industry in a broad sense (including plastic and rubber products) | 20,130 | 100.0 | 860,341 | 100.0 | 42,863 | 100.0 | 15,191 | 100.0 |

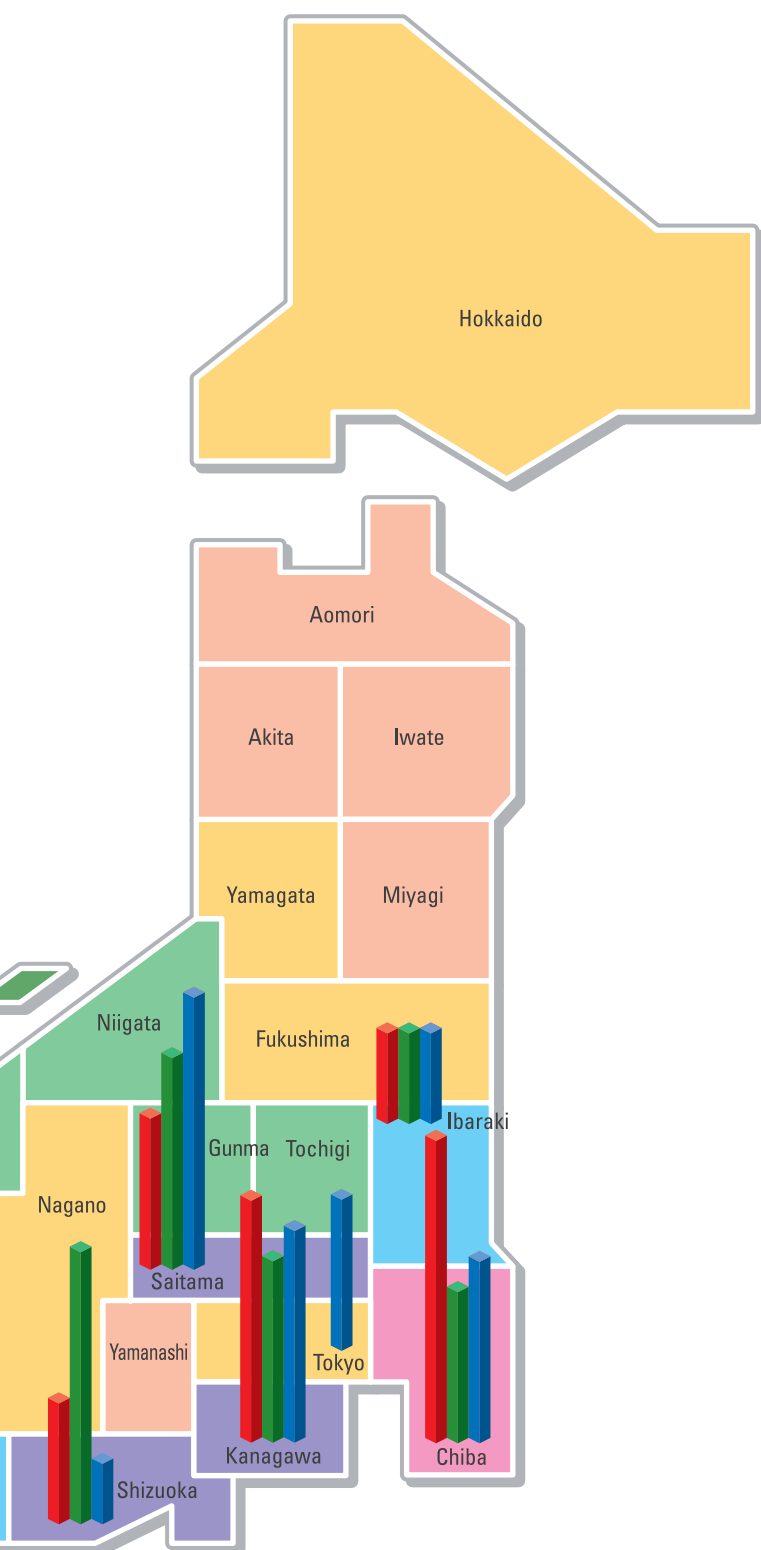
3

Shipment, number of employed workers and number of facilities by prefecture

Top 3 prefectures in shipments are Chiba, Osaka and Kanagawa.

Shipments of chemical products by prefecture in 2014





Shipment, number of employed workers and number of facilities by prefecture in 2014

| Prefecture | Value of shipments (¥100 million) | Change from 2013 | Number of employees | Number of facilities |
|--------------|--------------------------------------|---------------------|------------------------|-------------------------|
| 1 Chiba | 31,311 | 103.8% | 20,372 | 251 |
| 2 Osaka | 19,061 | 95.9% | 31,225 | 547 |
| 3 Kanagawa | 18,305 | 104.4% | 20,902 | 258 |
| 4 Hyogo | 17,740 | 111.9% | 21,435 | 297 |
| 5 Yamaguchi | 16,456 | 102.2% | 14,506 | 93 |
| 6 Saitama | 15,501 | 94.7% | 20,972 | 335 |
| 7 Shizuoka | 15,180 | 93.0% | 21,666 | 183 |
| 8 Ibaraki | 14,925 | 98.7% | 14,312 | 192 |
| 9 Mie | 13,648 | 105.2% | 13,696 | 113 |
| 10 Okayama | 12,995 | 103.4% | 11,131 | 114 |
| 11 Aichi | 12,084 | 109.4% | 12,975 | 217 |
| 12 Shiga | 8,442 | 108.6% | 7,004 | 107 |
| 13 Oita | 6,357 | 101.6% | 3,099 | 35 |
| 14 Niigata | 6,054 | 109.5% | 7,792 | 74 |
| 15 Toyama | 5,994 | 109.7% | 13,667 | 112 |
| 16 Tochigi | 5,914 | 103.0% | 5,222 | 77 |
| 17 Tokushima | 5,662 | 101.0% | 5,842 | 42 |
| 18 Gunma | 5,398 | 108.2% | 7,524 | 83 |
| 19 Fukuoka | 5,307 | 106.9% | 8,506 | 145 |
| 20 Fukushima | 4,421 | 101.9% | 7,721 | 102 |
| 21 Hiroshima | 4,169 | 111.0% | 5,509 | 89 |
| 22 Tokyo | 3,956 | 102.2% | 10,905 | 221 |
| 23 Ehime | 3,454 | 90.8% | 3,355 | 48 |
| 24 Wakayama | 3,413 | 105.6% | 4,960 | 72 |
| 25 Gifu | 2,817 | 93.9% | 5,831 | 89 |
| 26 Fukui | 2,640 | 91.2% | 4,000 | 59 |
| 27 Yamagata | 2,297 | 116.9% | 2,779 | 31 |
| 28 Kyoto | 1,920 | 103.0% | 5,126 | 104 |
| 29 Hokkaido | 1,907 | 102.0% | 3,273 | 94 |
| 30 Saga | 1,701 | 104.7% | 2,259 | 33 |
| 31 Kumamoto | 1,621 | 105.2% | 4,520 | 44 |
| 32 Miyazaki | 1,512 | 104.4% | 1,714 | 21 |
| 33 Kagawa | 1,506 | 96.6% | 3,364 | 42 |
| 34 Ishikawa | 1,491 | 118.0% | 1,685 | 24 |
| 35 Nagano | 1,344 | 104.5% | 2,144 | 43 |
| 36 Nara | 1,035 | 103.0% | 3,499 | 79 |
| 37 Miyagi | 895 | 102.1% | 1,896 | 44 |
| 38 Akita | 785 | 110.2% | 1,426 | 14 |
| 39 Iwate | 532 | 102.5% | 1,574 | 21 |
| 40 Yamanashi | 362 | 110.5% | 971 | 18 |
| 41 Aomori | 338 | 113.2% | 529 | 15 |
| 42 Kagoshima | 237 | 103.0% | 458 | 22 |
| 43 Okinawa | 122 | 97.4% | 689 | 30 |
| 44 Nagasaki | 90 | 105.9% | 372 | 14 |
| 45 Kochi | 75 | 117.6% | 244 | 12 |
| 46 Tottori | – | – | 33 | 2 |
| 47 Shimane | – | – | 732 | 7 |
| Total | 281,230 | 102.6% | 343,416 | 4,669 |

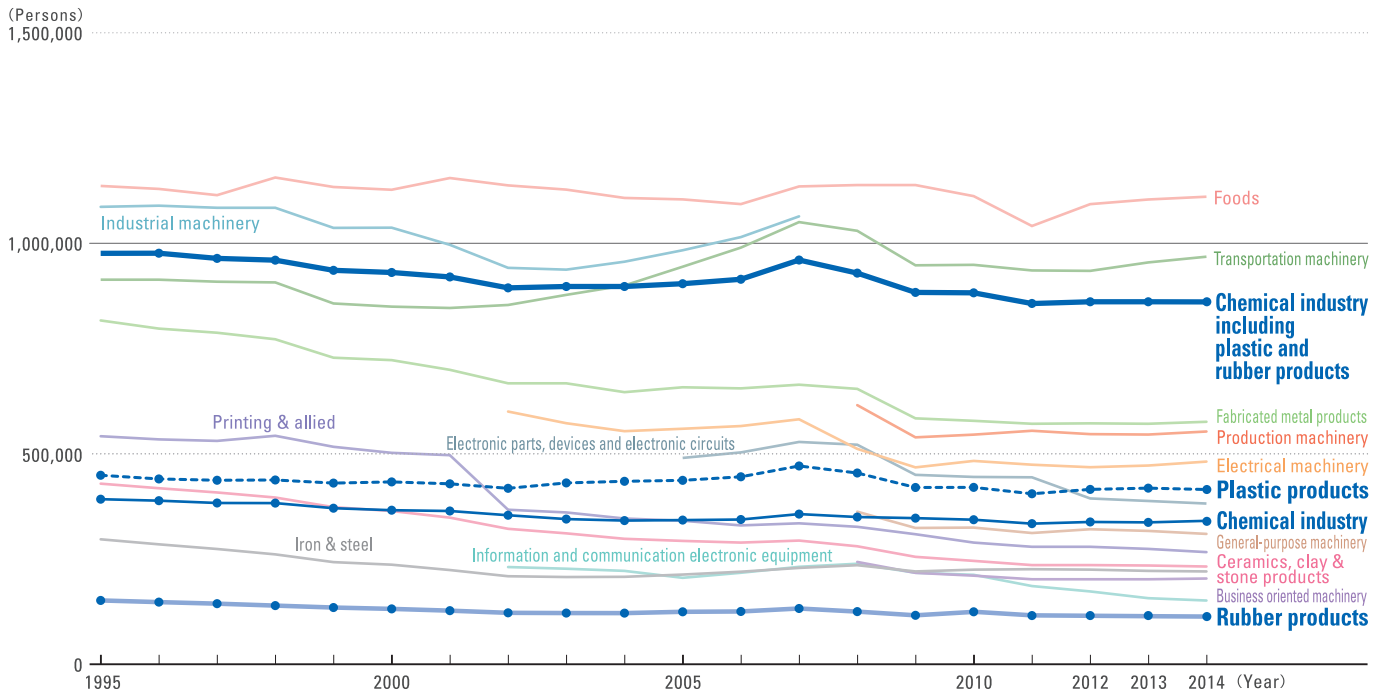
(Source) Ministry of Economy, Trade and Industry [Census of Manufactures]

4

Number of employed workers

Over 860,000 workers are employed making the industry to rank 3rd among manufacturing industries.

Changes in the number of employees by manufacturing industry (1995-2014)



| Industry | Year | Every 5th year | | | | Recent three years | | | |
|--|------|-------------------|------------------|------------------|------------------|--------------------|------------------|------------------|---------------|
| | | 1995 | 2000 | 2005 | 2010 | 2012 | 2013 | 2014 | persons |
| Chemical industry | | 392,109 | 365,953 | 342,481 | 344,968 | 338,327 | 339,708 | 343,416 | 4.6% |
| Plastic products | | 448,939 | 433,177 | 436,897 | 420,179 | 412,189 | 409,136 | 405,938 | 5.5% |
| Rubber products | | 151,601 | 131,532 | 124,613 | 117,176 | 111,743 | 111,826 | 110,987 | 1.5% |
| Chemical industry including plastic and rubber products | | 992,649 | 930,662 | 903,991 | 882,323 | 862,259 | 860,670 | 860,341 | 11.6% |
| Foods | | 1,136,236 | 1,127,177 | 1,104,292 | 1,122,817 | 1,092,789 | 1,105,813 | 1,112,433 | 15.0% |
| Printing & allied | | 541,688 | 502,184 | 340,890 | 299,038 | 281,104 | 276,620 | 268,880 | 3.6% |
| Ceramics, clay & stone products | | 429,023 | 363,997 | 293,013 | 250,001 | 241,997 | 240,177 | 237,733 | 3.2% |
| Iron & steel | | 296,824 | 236,525 | 213,056 | 219,983 | 219,044 | 216,280 | 214,988 | 2.9% |
| Fabricated metal products | | 816,694 | 722,425 | 657,942 | 578,559 | 572,631 | 571,976 | 576,707 | 7.8% |
| Industrial machinery | | 1,086,575 | 1,037,079 | 983,449 | — | — | — | — | — |
| General-purpose machinery | | — | — | — | 324,636 | 319,554 | 315,928 | 308,841 | 4.2% |
| Production machinery | | — | — | — | 543,070 | 544,213 | 543,449 | 550,642 | 7.4% |
| Business oriented machinery | | — | — | — | 211,834 | 202,708 | 202,652 | 204,404 | 2.8% |
| Electrical machinery | | 1,750,103 | 1,573,683 | 559,413 | 483,979 | 468,807 | 472,547 | 481,936 | 6.5% |
| Information and communication electronic equipment | | — | — | 205,331 | 212,466 | 173,516 | 157,425 | 151,851 | 2.1% |
| Electronic parts, devices and electronic circuits | | — | — | 490,140 | 452,169 | 394,488 | 388,209 | 382,110 | 5.2% |
| Transportation machinery | | 913,535 | 849,517 | 944,352 | 948,824 | 945,164 | 966,741 | 980,505 | 13.2% |
| Others | | 3,443,831 | 2,877,663 | 2,444,572 | 1,134,148 | 1,107,065 | 1,084,497 | 1,071,898 | 14.5% |
| Total manufacturing | | 10,320,583 | 9,183,833 | 8,156,992 | 7,663,847 | 7,425,339 | 7,402,984 | 7,403,269 | 100.0% |

(Source) Ministry of Economy, Trade and Industry [Census of Manufactures]

(Note) 1. Statistics of facilities with four or more employees.

2. Electrical machinery was divided into electrical machinery, information and communication electronic equipment, and electronic parts and devices in 2002.

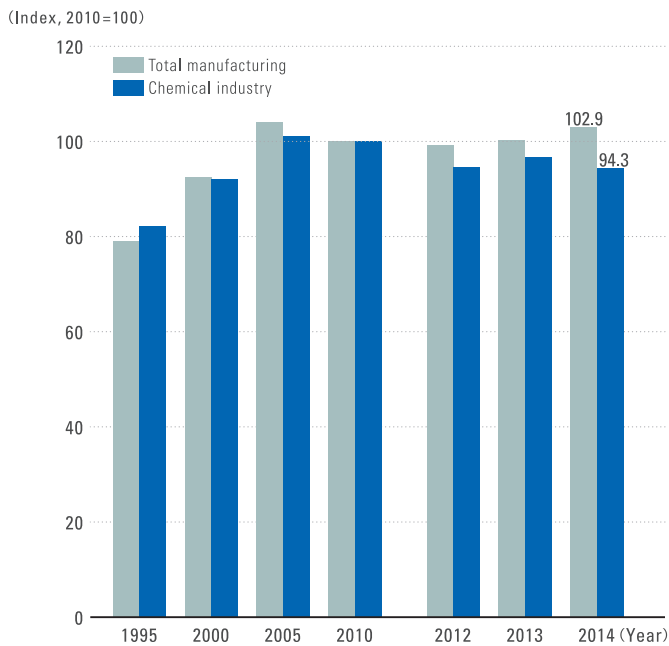
Industrial machinery was divided into general-purpose machinery, production machinery, and business oriented machinery in 2008.

3. Electronic circuits have been added to electronic parts and devices since 2011.

5

Labor productivity/Working hours

Index of physical labor productivity (1995-2014)



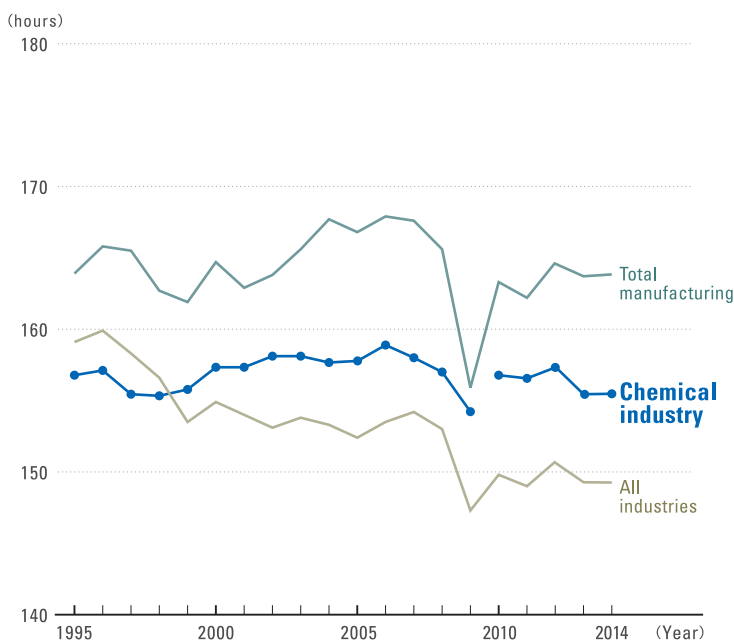
(Index, 2010=100)

| Industry | | Total manufacturing | | Chemical industry | |
|--------------------|------|---------------------|---------------|-------------------|---------------|
| | | Index | Increase rate | Index | Increase rate |
| Every 5th year | 1995 | 79.8 | 4.5% | 80.2 | 8.1% |
| | 2000 | 92.4 | 6.7% | 92 | 2.1% |
| | 2005 | 104.1 | 2.0% | 100.9 | ▲0.5% |
| | 2010 | 100 | 11.4% | 100 | 7.2% |
| Recent three years | 2012 | 99.0 | 0.7% | 94.6 | ▲3.0% |
| | 2013 | 100.3 | 1.3% | 96.8 | 2.3% |
| | 2014 | 102.9 | 2.6% | 94.3 | ▲2.6% |

(Source) Japan Productivity Center

(Note) 1. Since 2010, petrochemical and coal product manufactures have been included in the chemical industry.
2. The base year was changed to 2010, in 2013.

Working hours (monthly average of total net working hours) (1995-2014)



(hours)

| Industry | | All industries | Total manufacturing | Chemical industry |
|--------------------|------|----------------|---------------------|-------------------|
| Every 5th year | 1995 | 159.1 | 163.9 | 156.1 |
| | 2000 | 154.9 | 164.7 | 156.6 |
| | 2005 | 152.4 | 166.8 | 157.0 |
| | 2010 | 149.8 | 163.3 | 156.1 |
| Recent three years | 2012 | 150.7 | 164.6 | 156.6 |
| | 2013 | 149.3 | 163.7 | 154.9 |
| | 2014 | 149.0 | 164.6 | 155.2 |

(Source) Ministry of Health, Labour and Welfare [Monthly Labour Survey]

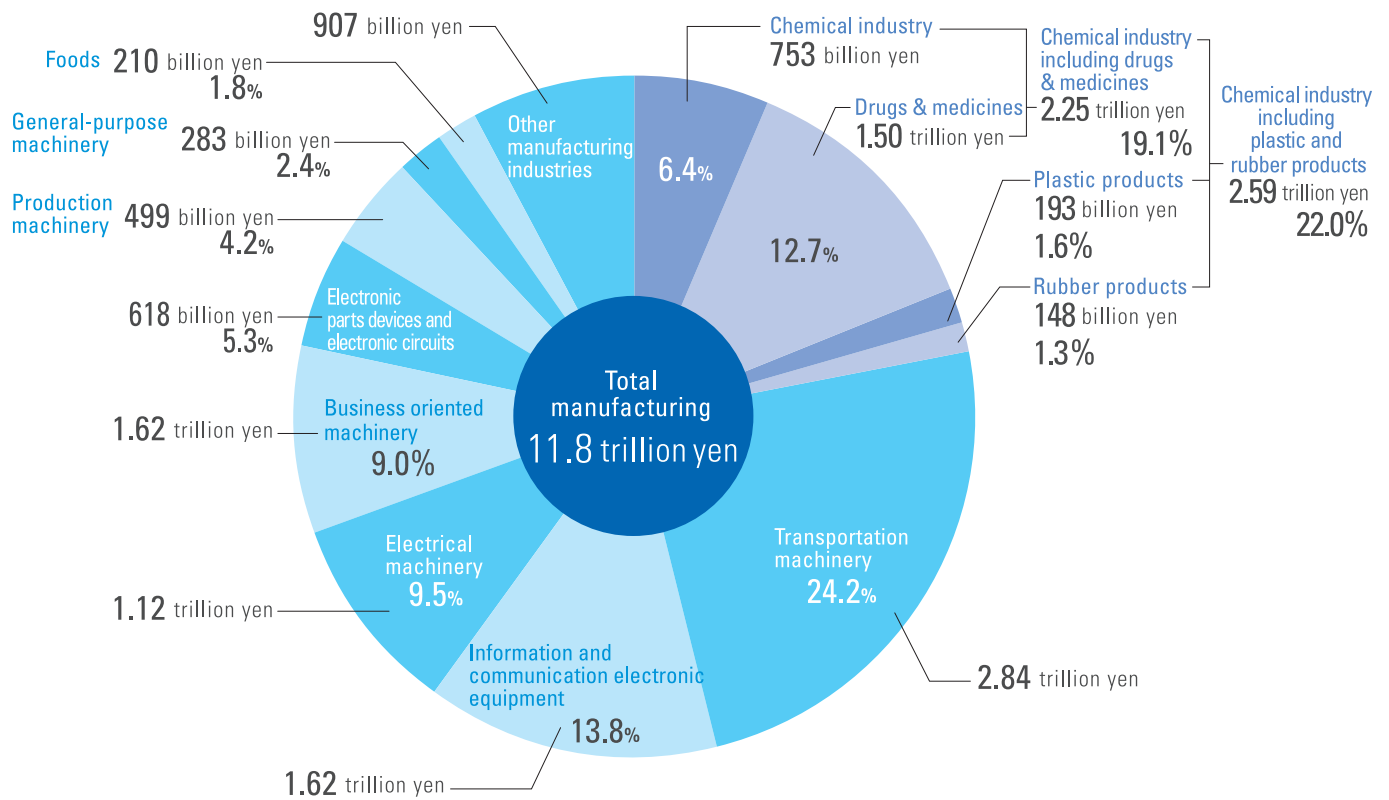
(Note) Since 2010, petrochemical and coal product manufactures have been included in the chemical industry.

6

Research and development expenditures

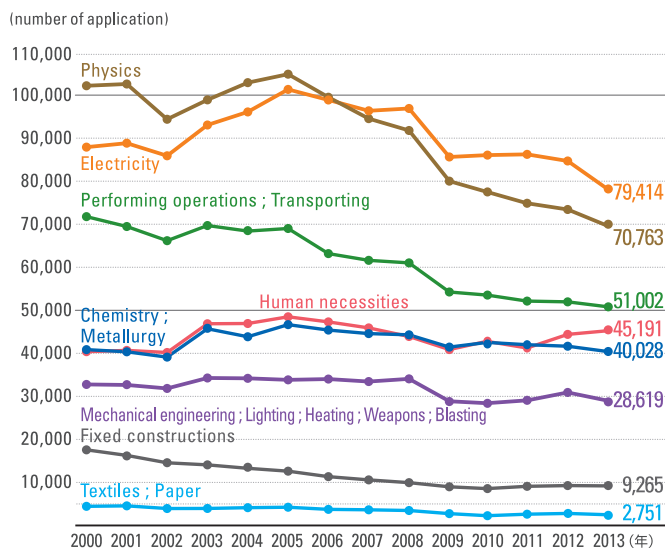
R&D expenditures of chemical industry amounted to 2.6 trillion yen.

Ratio of R&D expenditures by manufacturing industry in FY 2014



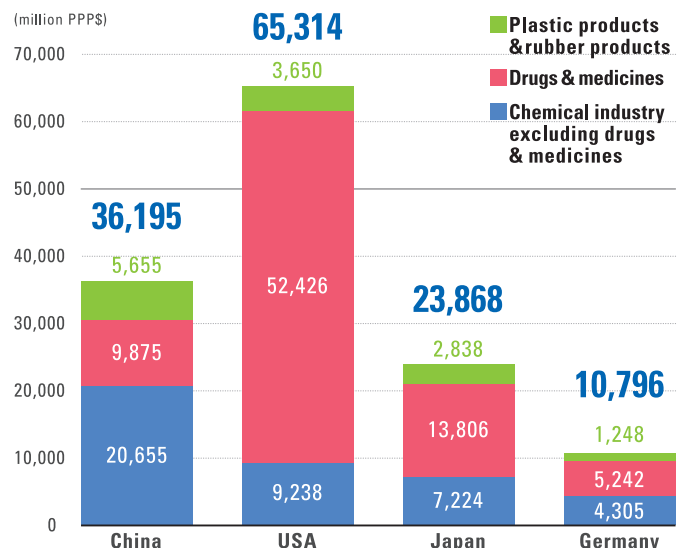
(Source) Ministry of Internal Affairs and Communications
[Survey of Research and Development]

Trend of number of applications for patents by classification (2000-2013)



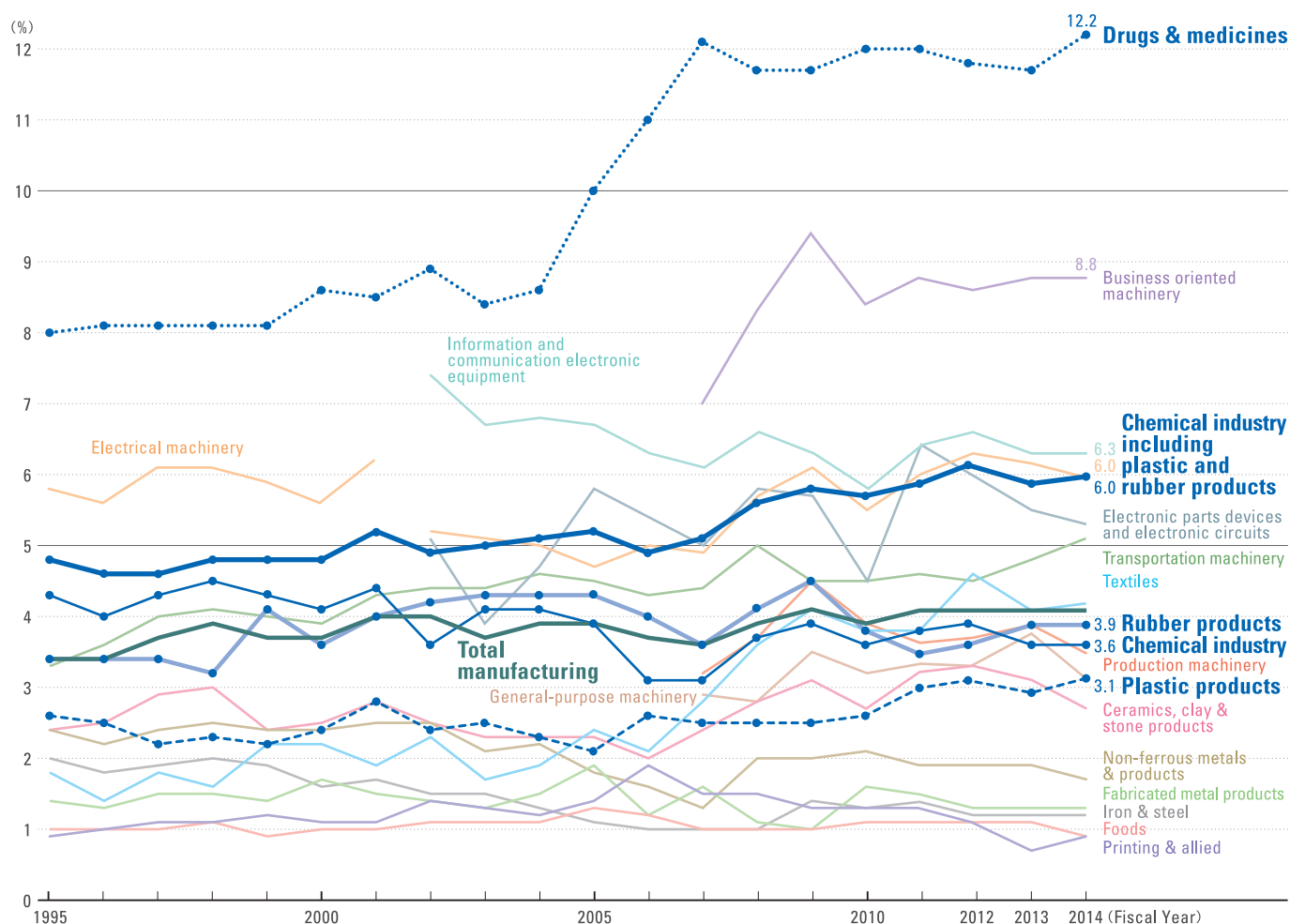
(Source) Japan Patent Office

R&D expenditures of chemical industry in the top four countries in shipment (2013)



(Source) OECD.Stat Extracts as of April 2016
(Note) PPP : Purchasing Power Parity

Ratio of R&D expenditures to sales by manufacturing industry (FY1995-FY2014)



| Industry | Fiscal year | Every 5th year | | | | Recent three years | | |
|---|-------------|----------------|------------|------------|------------|--------------------|------------|------------|
| | | 1995 | 2000 | 2005 | 2010 | 2012 | 2013 | 2014 |
| Chemical industry | | 4.3 | 4.1 | 3.9 | 3.6 | 3.9 | 3.6 | 3.6 |
| Drugs & medicines | | 8.0 | 8.6 | 10.0 | 12.0 | 11.8 | 11.7 | 12.2 |
| Chemical industry including drugs & medicines | | 5.3 | 5.4 | 5.9 | 6.4 | 6.8 | 6.6 | 6.8 |
| Plastic products | | 2.6 | 2.4 | 2.1 | 2.6 | 3.1 | 2.9 | 3.1 |
| Rubber products | | 3.4 | 3.6 | 4.3 | 3.8 | 3.7 | 3.9 | 3.9 |
| Chemical industry including plastic and rubber products | | 4.8 | 4.8 | 5.2 | 5.7 | 6.1 | 5.9 | 6.0 |
| Foods | | 1.0 | 1.0 | 1.3 | 1.1 | 1.1 | 1.1 | 0.9 |
| Textiles | | 1.8 | 2.2 | 2.4 | 3.8 | 4.6 | 4.1 | 4.2 |
| Printing & allied | | 0.9 | 1.1 | 1.4 | 1.3 | 1.1 | 0.7 | 0.9 |
| Ceramics, clay & stone products | | 2.4 | 2.5 | 2.3 | 2.7 | 3.3 | 3.1 | 2.7 |
| Iron & steel | | 2.0 | 1.6 | 1.1 | 1.3 | 1.2 | 1.2 | 1.2 |
| Non-ferrous metals & products | | 2.4 | 2.4 | 1.8 | 2.1 | 1.9 | 1.9 | 1.7 |
| Fabricated metal products | | 1.4 | 1.7 | 1.9 | 1.6 | 1.3 | 1.3 | 1.3 |
| General-purpose machinery | | — | — | — | 3.2 | 3.3 | 3.8 | 3.1 |
| Production machinery | | — | — | — | 3.9 | 3.8 | 3.9 | 3.5 |
| Business oriented machinery | | — | — | — | 8.4 | 8.6 | 8.8 | 8.8 |
| Electrical machinery | | 5.8 | 5.6 | 4.7 | 5.5 | 6.3 | 6.2 | 6.0 |
| Information and communication electronic equipment | | — | — | 6.7 | 5.8 | 6.6 | 6.3 | 6.3 |
| Electronic parts devices and electronic circuits | | — | — | 5.8 | 4.5 | 5.9 | 5.5 | 5.3 |
| Transportation machinery | | 3.3 | 3.9 | 4.5 | 4.5 | 4.5 | 4.8 | 5.1 |
| Total manufacturing | | 3.4 | 3.7 | 3.9 | 3.9 | 4.1 | 4.1 | 4.1 |

(Source) Ministry of Internal Affairs and Communications [Survey of Research and Development]

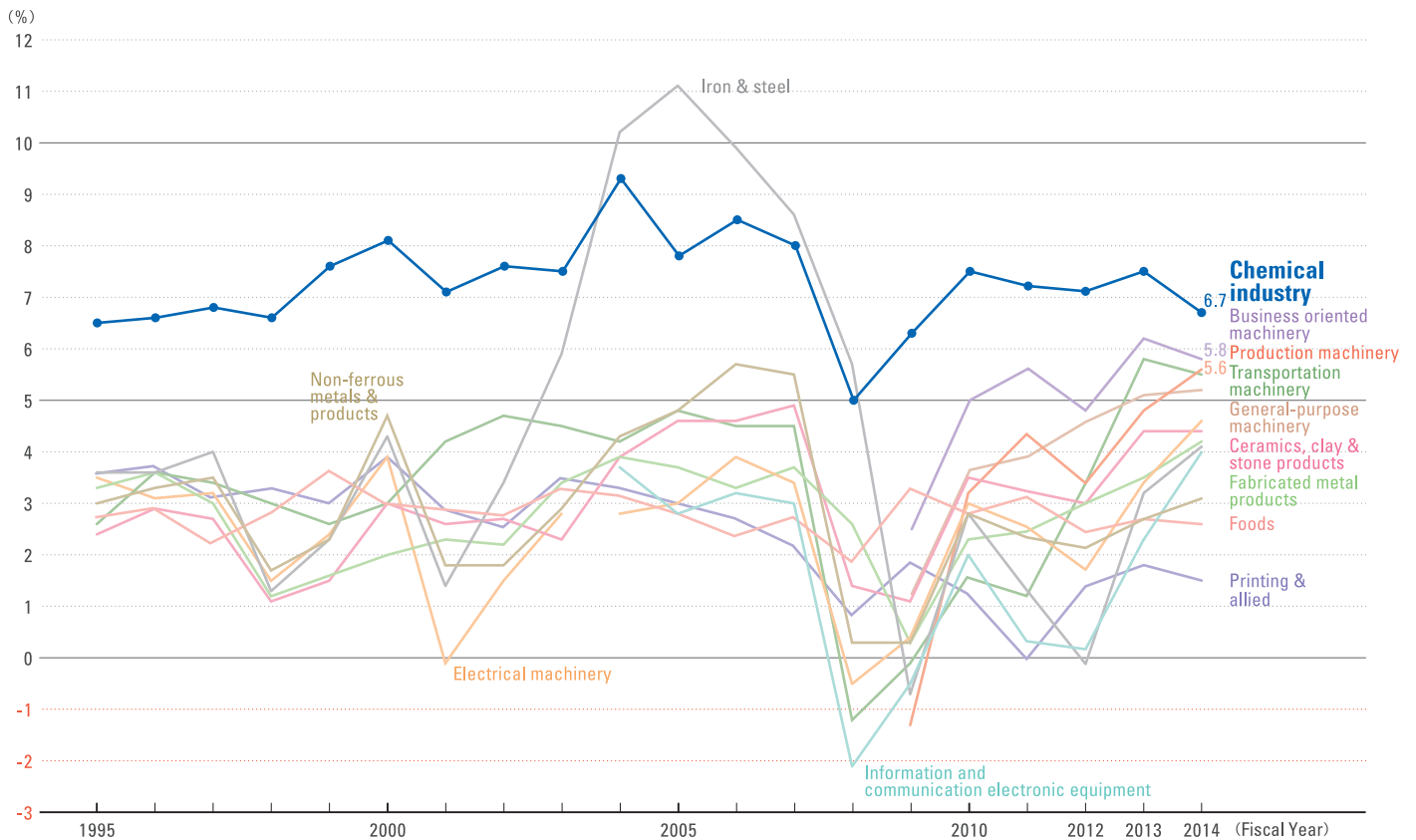
(Note) Drugs & medicines are excluded from the chemical industry.

7

Operating profit margin

Chemical industry is the No.1 in operating profit margin.

Trend of operating profit margin by manufacturing industry (FY1995-FY2014)



| Industry | Fiscal year | Every 5th year | | | | Recent three years | | |
|--|-------------|----------------|------|------|------|--------------------|------|------|
| | | 1995 | 2000 | 2005 | 2010 | 2012 | 2013 | 2014 |
| Chemical industry | | 6.5 | 8.1 | 7.8 | 7.5 | 7.1 | 7.5 | 6.7 |
| Foods | | 2.8 | 3.0 | 2.8 | 2.8 | 2.4 | 2.7 | 2.6 |
| Printing & allied | | 3.6 | 3.9 | 3.0 | 1.2 | 1.4 | 1.8 | 1.5 |
| Ceramics, clay & stone products | | 2.4 | 3.0 | 4.6 | 3.5 | 3.0 | 4.4 | 4.4 |
| Iron & steel | | 3.6 | 4.3 | 11.1 | 2.8 | -0.1 | 3.2 | 4.1 |
| Non-ferrous metals & products | | 3.0 | 4.7 | 4.8 | 2.8 | 2.2 | 2.7 | 3.1 |
| Fabricated metal products | | 3.3 | 2.0 | 3.7 | 2.3 | 3.0 | 3.5 | 4.2 |
| General-purpose machinery | | - | - | - | 3.5 | 4.6 | 5.1 | 5.2 |
| Production machinery | | 3.1 | 4.0 | 5.2 | 3.2 | 3.4 | 4.8 | 5.6 |
| Business oriented machinery | | 5.1 | 6.0 | 7.6 | 5.0 | 4.7 | 6.2 | 5.8 |
| Electrical machinery | | 3.5 | 3.9 | 3.0 | 3.0 | 1.8 | 3.4 | 4.6 |
| Information and communication electronic equipment | | - | - | 2.8 | 2.0 | 0.2 | 2.3 | 4.0 |
| Transportation machinery | | 2.6 | 3.0 | 4.8 | 1.6 | 3.4 | 5.8 | 5.5 |
| Total manufacturing | | 3.3 | 3.8 | 4.5 | 3.2 | 2.9 | 4.1 | 4.2 |

(Source) Ministry of Finance [Financial Statements Statistics of Corporations by Industry]

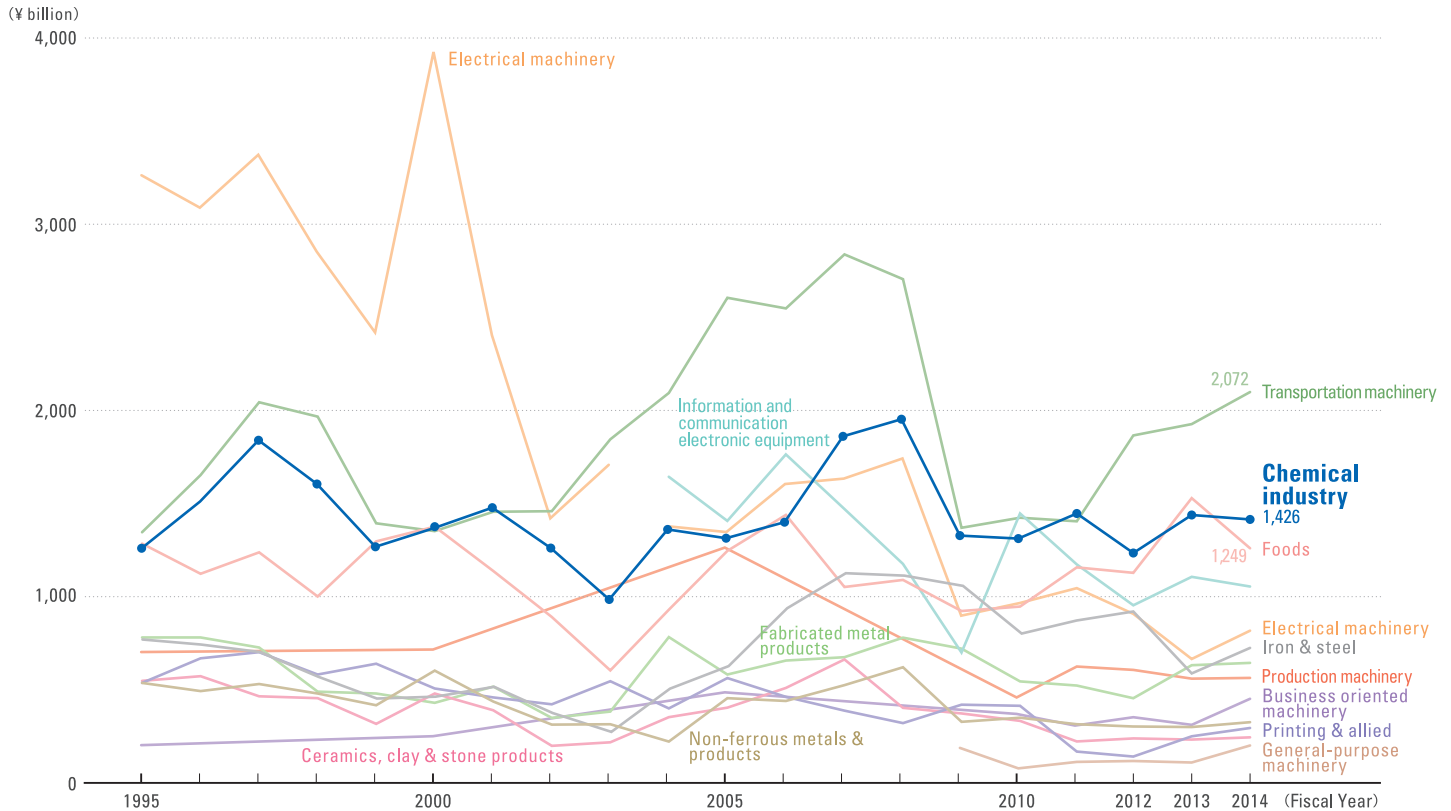
(Note) Rubber & plastic products are excluded from the chemical industry.

8

Amount of capital investment

Capital investment of chemical industry amounted to 1.4 trillion yen making it ranked 2nd in manufacturing industries.

Trend of capital investment by manufacturing industry (FY1995-FY2014)



| Industry | Fiscal year | Every 5th year | | | | Recent three years | | | % |
|--|-------------|----------------|---------------|---------------|---------------|--------------------|---------------|---------------|---------------|
| | | 1995 | 2000 | 2005 | 2010 | 2012 | 2013 | 2014 | |
| Chemical industry | | 1,260 | 1,368 | 1,314 | 1,312 | 1,236 | 1,450 | 1,426 | 12.0% |
| Foods | | 1,285 | 1,376 | 1,246 | 947 | 1,131 | 1,516 | 1,249 | 10.5% |
| Printing & allied | | 537 | 507 | 563 | 414 | 143 | 241 | 284 | 2.4% |
| Ceramics, clay & stone products | | 548 | 480 | 404 | 333 | 253 | 234 | 246 | 2.1% |
| Iron & steel | | 770 | 463 | 627 | 802 | 917 | 596 | 735 | 6.2% |
| Non-ferrous metals & products | | 537 | 603 | 455 | 350 | 312 | 300 | 326 | 2.7% |
| Fabricated metal products | | 781 | 430 | 582 | 545 | 451 | 607 | 619 | 5.2% |
| General-purpose machinery | | — | — | — | 78 | 122 | 109 | 200 | 1.7% |
| Production machinery | | 705 | 692 | 1,266 | 461 | 609 | 562 | 566 | 4.8% |
| Business oriented machinery | | 268 | 316 | 480 | 364 | 418 | 377 | 517 | 4.3% |
| Electrical machinery | | 3,265 | 3,927 | 1,347 | 966 | 906 | 661 | 812 | 6.8% |
| Information and communication electronic equipment | | — | — | 1,407 | 1,447 | 924 | 1,169 | 1,114 | 9.3% |
| Transportation machinery | | 1,346 | 1,352 | 2,605 | 1,424 | 1,878 | 1,902 | 2,072 | 17.4% |
| Others | | 2,545 | 1,724 | 2,049 | 1,828 | 1,666 | 1,434 | 1,747 | 14.7% |
| Total manufacturing | | 13,849 | 13,238 | 14,343 | 11,272 | 10,967 | 11,157 | 11,913 | 100.0% |

(Source) Ministry of Finance [Financial Statements Statistics of Corporations by Industry]

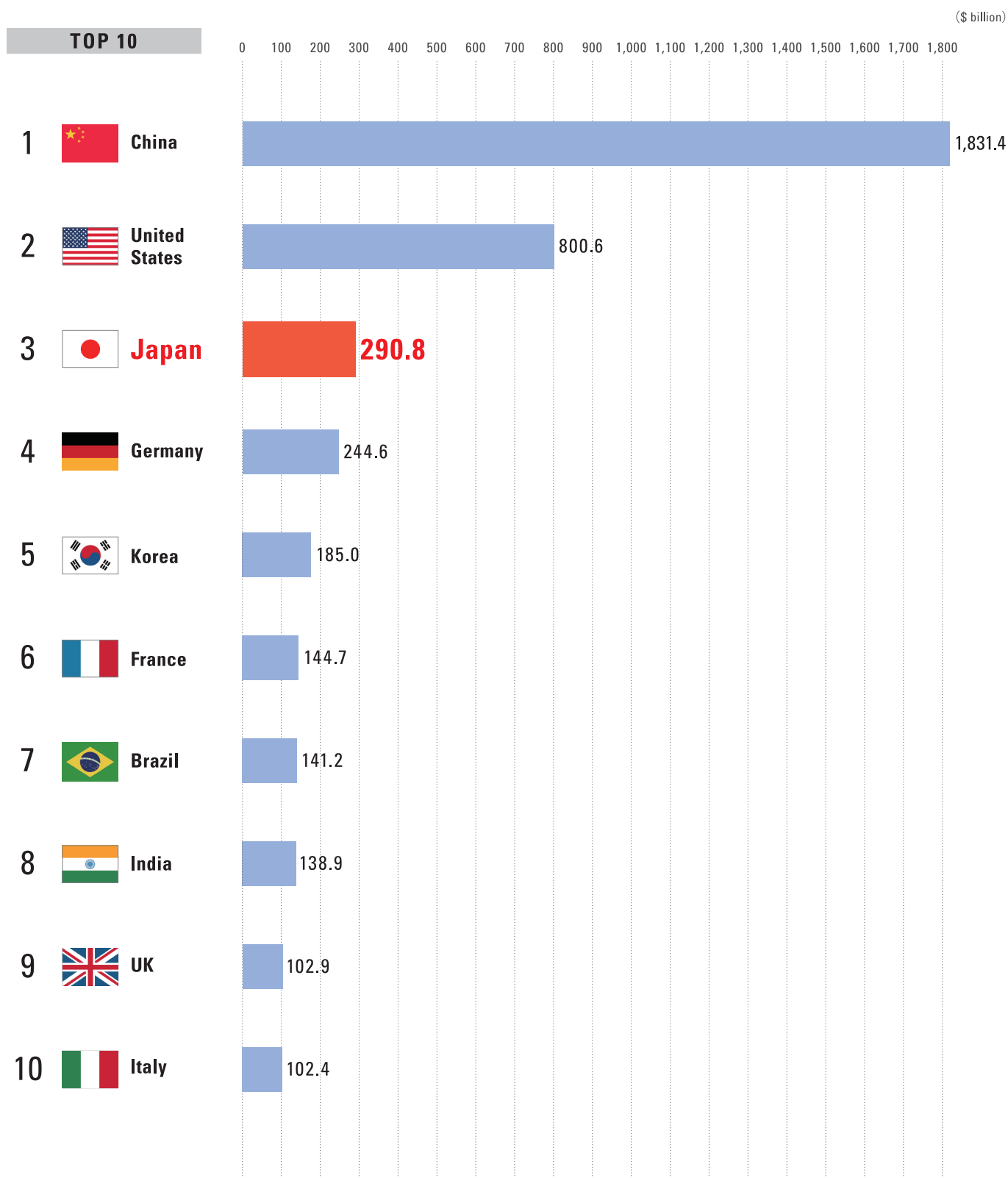
(Note) Rubber & plastic products are excluded from the chemical industry.

9

Shipments by country

Japan ranks 3rd in the world after China and the US.

Shipments of chemical products by country in 2014



(Source) American Chemistry Council(ACC) "Guide to the Business of Chemistry 2015"

10 The world's 30 leading chemical companies

Four Japanese companies are included among the world's leading chemical companies.

The world's 30 leading chemical companies in 2014

| Ranking | Company | Country | Chemical sales | | | Chemical operating profits | | |
|---------|----------------------------------|--------------|----------------------|-------------------------|--|----------------------------|-------------------------|-------------------------------|
| | | | 2014 (\$ million) | Change from 2013 (%) | Chemical sales as of total sales | 2014 (\$ million) | Change from 2013 (%) | Operating profit margin |
| 1 | BASF | Germany | 78,698 | 0.0% | 79.6 | 7,896 | 24.8% | 10.0% |
| 2 | Dow Chemical | U.S. | 58,167 | 1.9% | 100.0 | 5,950 | 26.2% | 10.2% |
| 3 | Sinopec | China | 57,953 | -4.6% | 12.8 | -351 | N.A. | N.A. |
| 4 | SABIC | Saudi Arabia | 43,341 | -0.6% | 86.4 | 12,033 | -6.0% | 27.8% |
| 5 | ExxonMobil | U.S. | 38,178 | -2.2% | 9.7 | 5,705 | 10.1% | 14.9% |
| 6 | Formosa Plastics | Taiwan | 37,059 | -2.2% | 60.4 | 1,592 | -36.8% | 4.3% |
| 7 | LyondellBasell Industries | Netherlands | 34,839 | 4.3% | 76.4 | N.A. | N.A. | N.A. |
| 8 | DuPont | U.S. | 29,945 | -3.5% | 86.2 | 6,184 | 18.2% | 20.7% |
| 9 | Ineos | Switzerland | 29,652 | 10.2% | 100.0 | 2,768 | 29.4% | 9.3% |
| 10 | Bayer | Germany | 28,120 | 5.4% | 50.1 | 4,717 | 6.8% | 16.8% |
| 11 | Mitsubishi Chemical | Japan | 26,342 | 6.9% | 76.2 | 870 | 85.8% | 3.3% |
| 12 | Shell | Netherlands | 24,607 | -41.8% | 5.8 | N.A. | N.A. | N.A. |
| 13 | LG Chem | South Korea | 21,456 | -2.4% | 100.0 | 1,656 | 0.0% | 7.7% |
| 14 | Braskem | Brazil | 19,578 | 12.4% | 100.0 | 1,475 | 17.4% | 7.5% |
| 15 | Air Liquide | France | 19,210 | 0.2% | 94.1 | 3,688 | 3.2% | 19.2% |
| 16 | AkzoNobel | Netherlands | 19,011 | -2.0% | 100.0 | 1,426 | 19.4% | 7.5% |
| 17 | Linde | Germany | 18,593 | 0.1% | 82.0 | 5,100 | -0.3% | 27.4% |
| 18 | Sumitomo Chemical | Japan | 17,833 | 6.6% | 79.3 | 1,041 | 64.0% | 5.8% |
| 19 | Mitsui Chemicals | Japan | 17,201 | -1.5% | 100.0 | 454 | 60.5% | 2.6% |
| 20 | Evonik Industries | Germany | 17,177 | 0.3% | 100.0 | 1,737 | 4.9% | 10.1% |
| 21 | Toray Industries | Japan | 17,006 | 10.6% | 89.4 | 1,231 | 15.8% | 7.2% |
| 22 | Reliance Industries | India | 15,870 | -6.9% | 25.8 | 1,359 | -1.3% | 8.6% |
| 23 | Yara | Norway | 15,141 | 12.1% | 100.0 | 2,217 | 21.0% | 14.6% |
| 24 | PPG Industries | U.S. | 14,250 | 8.0% | 92.8 | 2,156 | 15.5% | 15.1% |
| 25 | Solvay | Belgium | 14,134 | 2.5% | 100.0 | 1,445 | 22.4% | 10.2% |
| 26 | Lotte Chemical | South Korea | 14,121 | -9.6% | 100.0 | 333 | -28.0% | 2.4% |
| 27 | Chevron Phillips Chemical | U.S. | 13,416 | 2.0% | 100.0 | N.A. | N.A. | N.A. |
| 28 | DSM | Netherlands | 12,344 | -3.5% | 100.0 | 339 | -41.6% | 2.7% |
| 29 | Praxair | U.S. | 12,273 | 2.9% | 100.0 | 3,907 | 4.6% | 31.8% |
| 30 | SK Innovation | South Korea | 12,011 | 1.7% | 19.2 | 341 | -57.5% | 2.8% |

(Source) Chemical and Engineering News

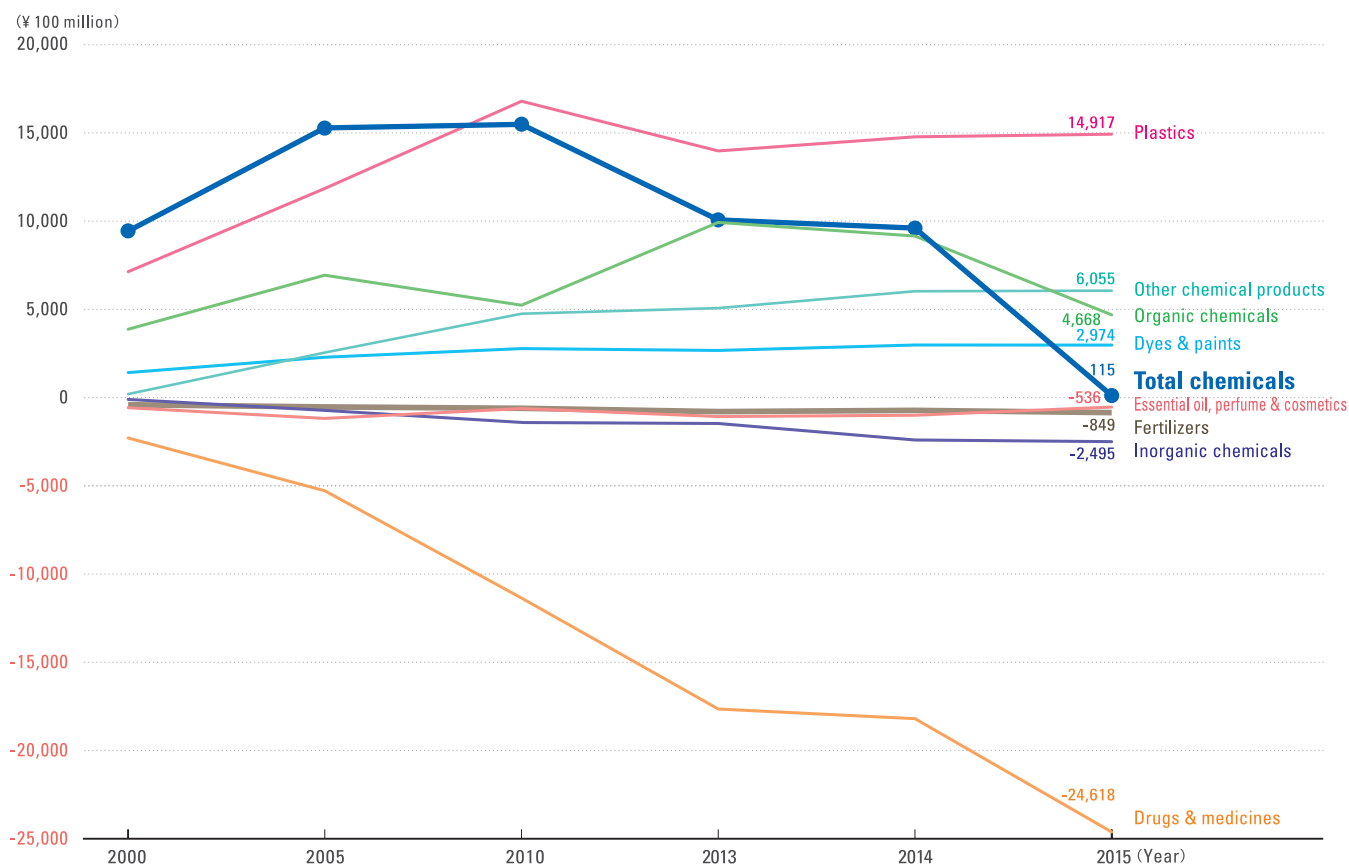
(Note) Drugs & medicines are excluded.

11

Trade balance

Trade surplus in 2015 amounts to 10 billion yen.

Trade balance of chemicals by product (2000-2015)



Exports and imports of chemicals (2000-2015)

(¥ 100 million)

| Exports | | | | | | Articles | Imports | | | | | |
|----------------|---------------|---------------|--------------------|---------------|---------------|------------------------------------|----------------|---------------|---------------|--------------------|---------------|---------------|
| Every 5th year | | | Recent three years | | | | Every 5th year | | | Recent three years | | |
| 2000 | 2005 | 2010 | 2013 | 2014 | 2015 | | 2000 | 2005 | 2010 | 2013 | 2014 | 2015 |
| 100 | 121 | 128 | 153 | 124 | 142 | Fertilizers | 570 | 783 | 745 | 955 | 929 | 990 |
| 2,221 | 3,109 | 3,772 | 3,646 | 3,839 | 4,034 | Inorganic chemicals | 2,287 | 3,935 | 5,237 | 5,142 | 6,258 | 6,529 |
| 11,927 | 18,832 | 18,728 | 25,204 | 24,396 | 21,166 | Organic chemicals | 7,993 | 11,843 | 13,496 | 15,205 | 15,490 | 16,499 |
| 10,575 | 17,157 | 23,360 | 22,593 | 24,129 | 24,441 | Plastics | 3,476 | 5,324 | 6,542 | 8,654 | 9,631 | 9,523 |
| 2,626 | 3,323 | 4,048 | 4,171 | 4,488 | 4,629 | Dyes & paints | 948 | 1,187 | 1,343 | 1,453 | 1,576 | 1,655 |
| 2,944 | 3,677 | 3,787 | 3,596 | 3,530 | 4,623 | Drugs & medicines | 5,149 | 9,060 | 15,226 | 21,382 | 22,140 | 29,241 |
| 1,292 | 1,820 | 2,479 | 2,682 | 3,005 | 3,676 | Essential oil, perfume & cosmetics | 1,944 | 2,909 | 3,087 | 3,853 | 3,987 | 4,213 |
| 6,361 | 10,442 | 12,950 | 13,027 | 14,665 | 14,883 | Other chemical products | 6,183 | 8,172 | 8,119 | 7,997 | 8,631 | 8,828 |
| 38,047 | 58,480 | 69,253 | 75,074 | 78,177 | 77,594 | Total chemicals | 28,550 | 43,212 | 53,794 | 64,642 | 68,642 | 77,479 |

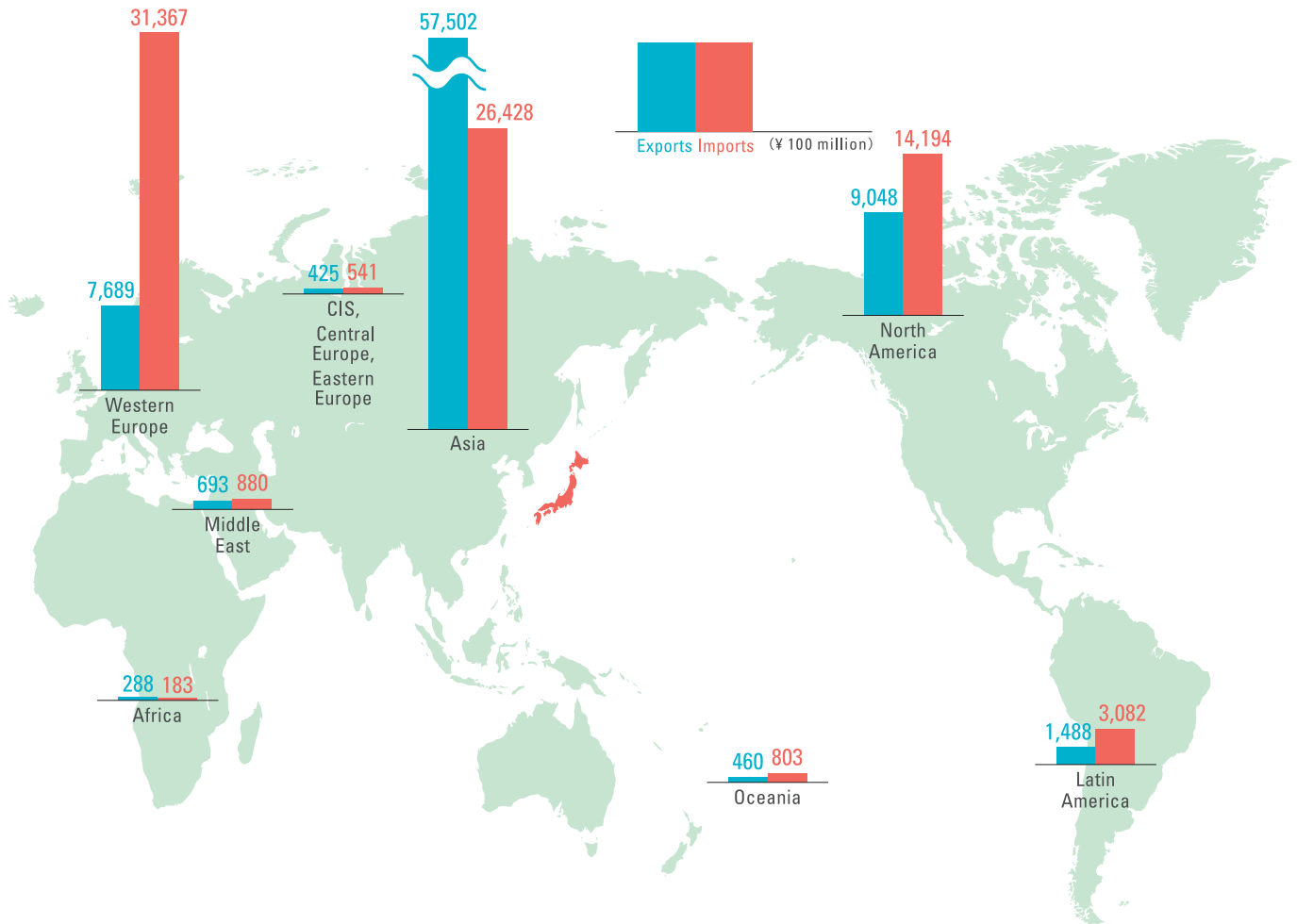
(Source) Ministry of Finance [Trade Statistics]

12

Exports and imports of chemicals by region

Exports to Asia have increased.

Exports and imports of chemicals by region in 2015



Exports and imports of chemicals by region (2000-2015)

(¥ 100 million)

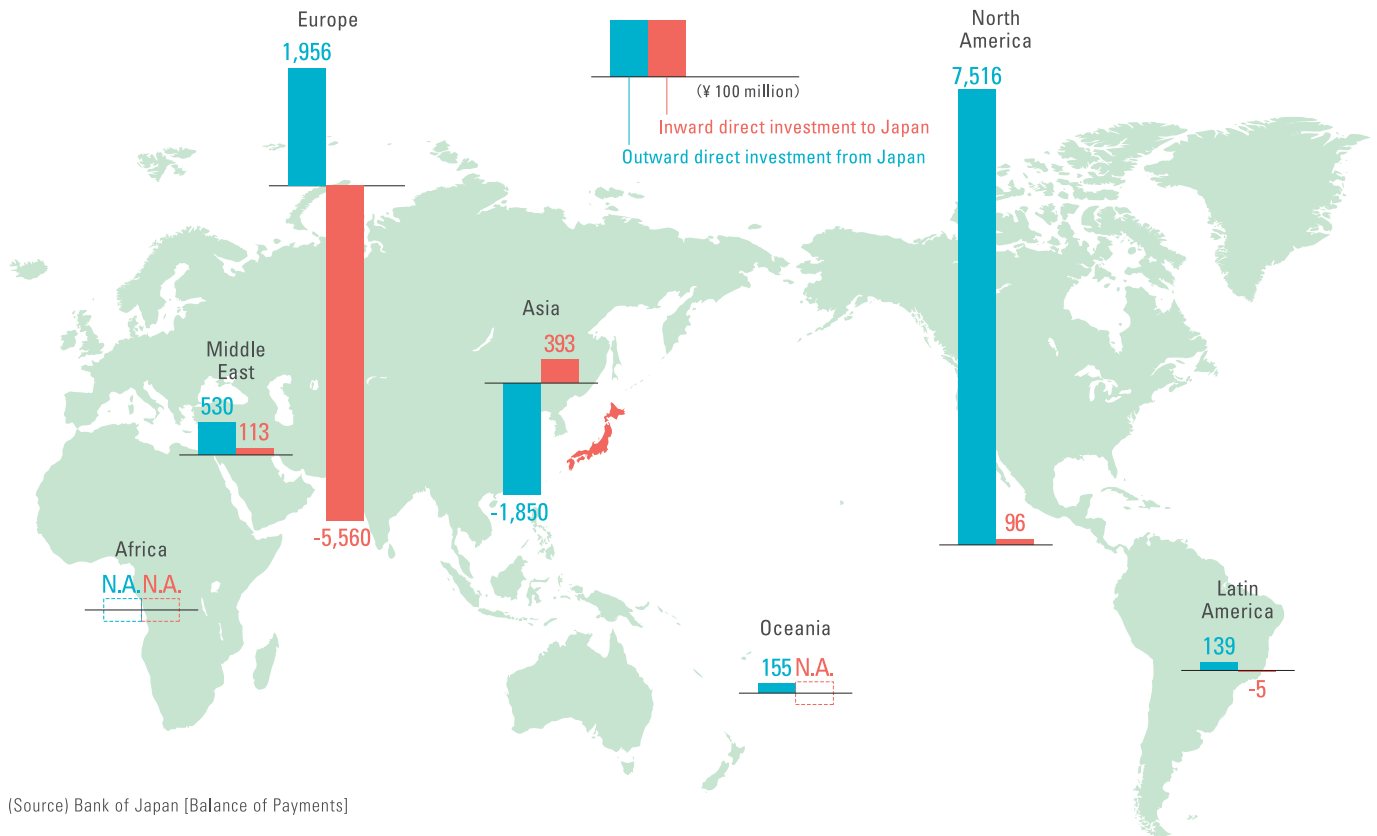
| Exports | | | | | | Region | Imports | | | | | |
|----------------|---------------|---------------|--------------------|---------------|---------------|-------------------------------------|----------------|---------------|---------------|--------------------|---------------|---------------|
| Every 5th year | | | Recent three years | | | | Every 5th year | | | Recent three years | | |
| 2000 | 2005 | 2010 | 2013 | 2014 | 2015 | | 2000 | 2005 | 2010 | 2013 | 2014 | 2015 |
| 22,742 | 40,150 | 51,799 | 56,702 | 58,563 | 57,502 | Asia | 6,414 | 12,974 | 17,474 | 22,714 | 25,249 | 26,428 |
| 224 | 364 | 580 | 578 | 617 | 693 | Middle East | 521 | 692 | 652 | 892 | 1,066 | 880 |
| 5,948 | 7,609 | 7,084 | 7,043 | 7,398 | 7,689 | Western Europe | 12,065 | 17,398 | 21,413 | 24,939 | 24,612 | 31,367 |
| 7,065 | 7,743 | 6,824 | 7,413 | 7,893 | 9,048 | North America | 8,198 | 9,364 | 11,190 | 12,026 | 13,438 | 14,194 |
| 1,402 | 1,629 | 1,819 | 2,275 | 2,613 | 1,488 | Latin America | 694 | 1,790 | 2,013 | 2,660 | 2,657 | 3,082 |
| 163 | 196 | 278 | 281 | 302 | 288 | Africa | 54 | 177 | 128 | 207 | 215 | 183 |
| 419 | 586 | 494 | 420 | 392 | 460 | Oceania | 457 | 520 | 595 | 815 | 925 | 803 |
| 84 | 204 | 374 | 363 | 399 | 425 | CIS, Central Europe, Eastern Europe | 147 | 298 | 330 | 388 | 480 | 541 |
| 38,047 | 58,480 | 69,253 | 75,074 | 78,177 | 77,594 | Total | 28,550 | 43,212 | 53,794 | 64,642 | 68,642 | 77,479 |

(Source) Ministry of Finance [Trade Statistics]

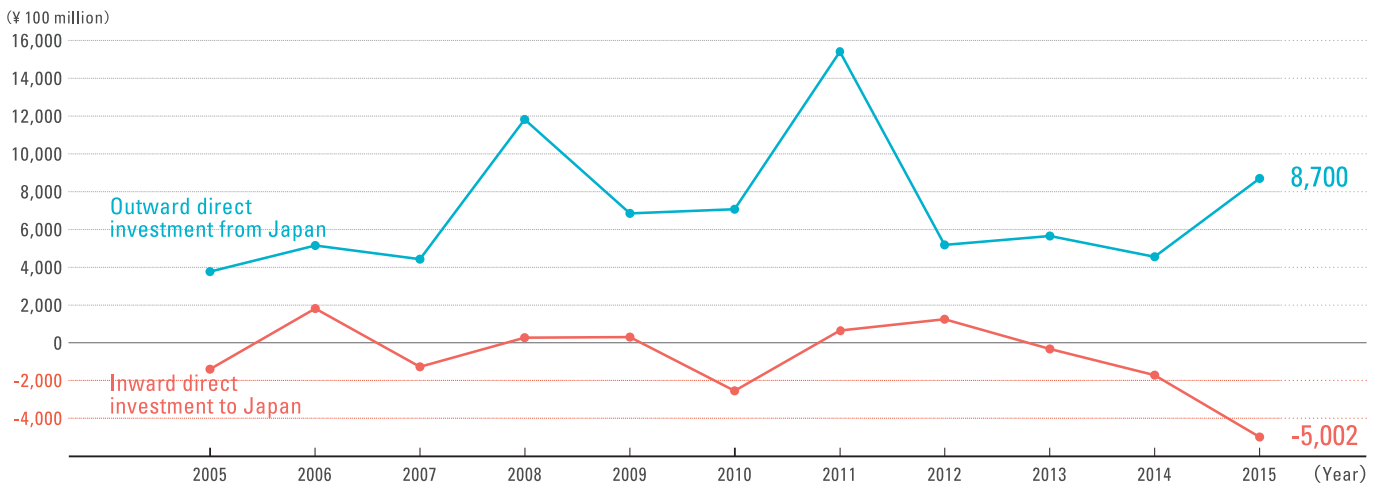
13

Outward/inward direct investments

Outward direct investment of Japanese chemical industry and inward direct investment to chemical industry in Japan in 2015



Actual outward direct investment of Japanese chemical industry and inward direct investment to chemical industry in Japan (2005-2015)



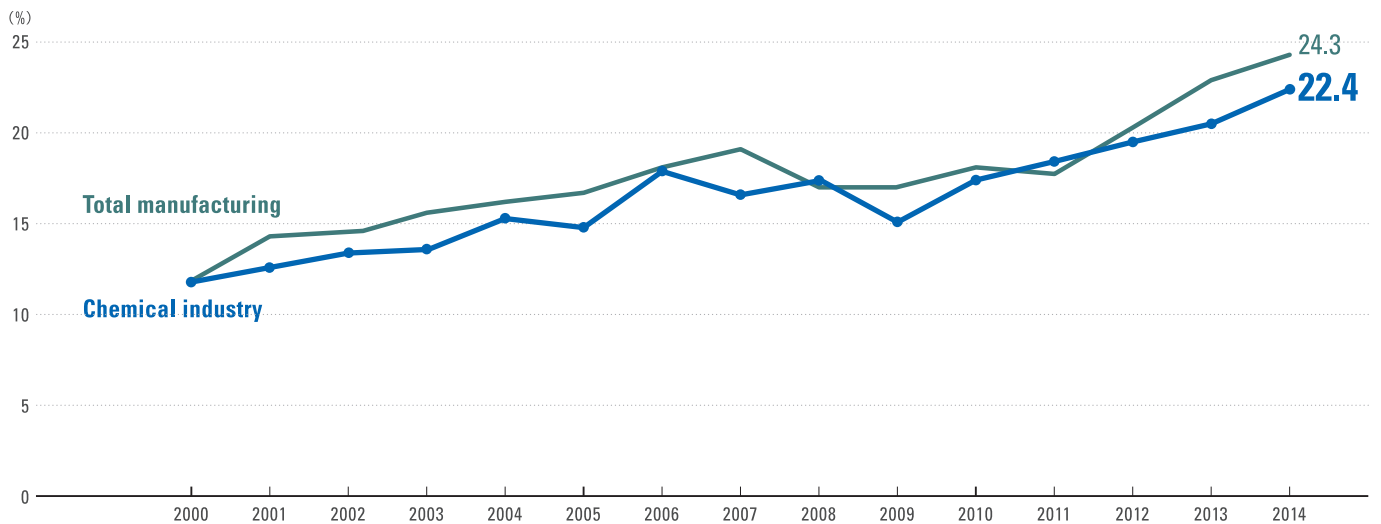
(Source) Bank of Japan [Balance of Payments statistics]

- (Note) 1. Outward direct investment from Japan is the investment that domestic companies perform for foreign countries, and Inward direct investment to Japan is the investment that overseas companies perform for Japan, and it shows minus in case of withdrawal and collection of the investment.
 2. Because Balance of Payments statistics have been based on the BPM6 since January 2014, sign of "outward direct investment" was changed from minus figures to plus figures retroactively to the past.
 3. Drugs & medicines are included in the chemical industry.

14

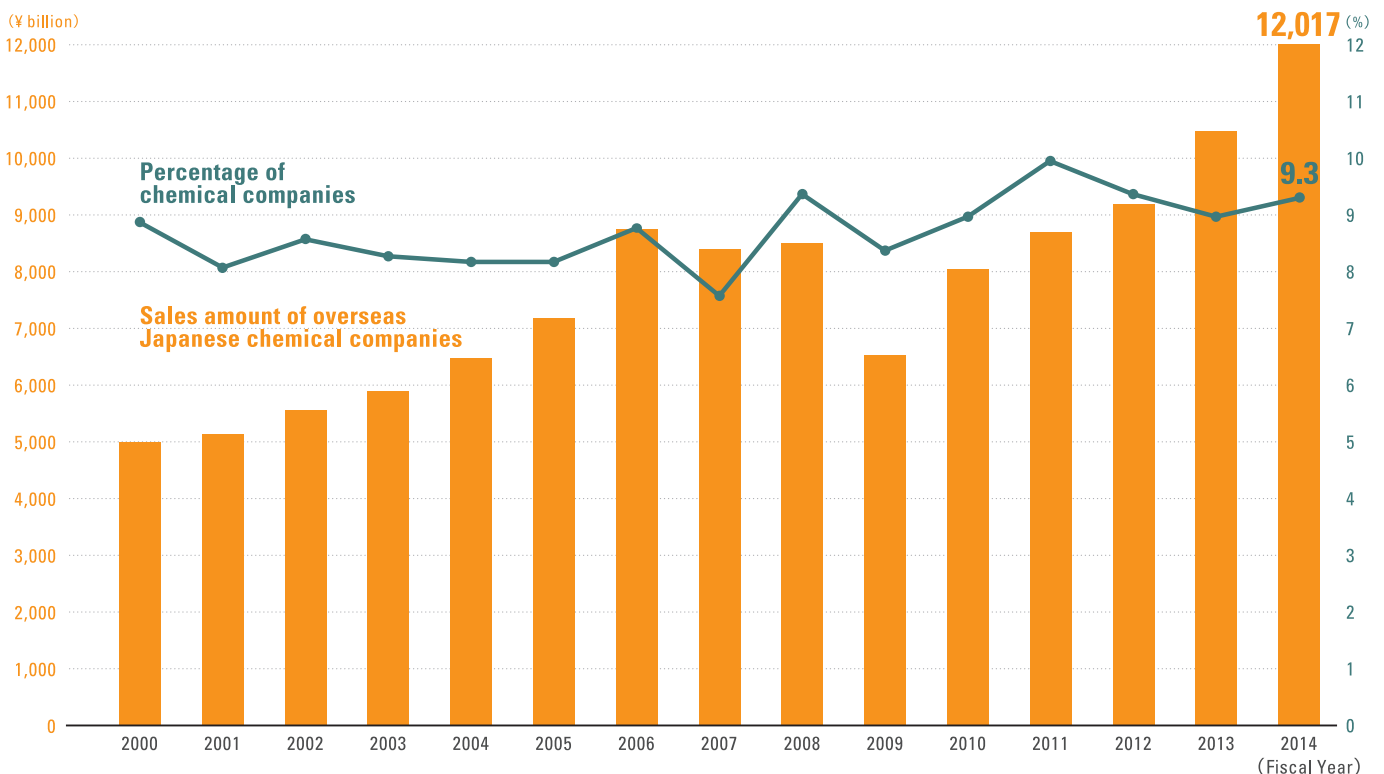
Ratio of overseas production/Sales of overseas subsidiary companies

Trend of overseas production of Japanese companies (FY2000-FY2014)



(Source) Ministry of Economy, Trade and Industry [Basic Survey of Overseas Business Activities]
 (Note) Chemical fiber products are excluded from the chemical industry.

Sales of Japanese chemical companies based overseas and its percentage of all overseas Japanese manufacturing companies' sales (FY2000-FY2014)



(Source) Ministry of Economy, Trade and Industry [Basic Survey of Overseas Business Activities]

Chemistry creates the future of the earth

Mission of the chemical industry for the future of the earth

Chemistry has made our lives affluent and pleasant by creating innovative substances and products/technologies which were not existing before such as plastic products and pharmaceuticals. Meanwhile, among the substances and products that chemistry creates, there are those which either consume much energy in the manufacturing process or affect human health and environment without proper risk management.

There is a limit in the natural resources of the earth. Therefore, the chemical industry which conducts its production activity by using the limited resources is responsible to realize “sustainable development” in which it makes the current and future living of the people in the world better through chemical products while it maintains and preserves the human health, environment and safety.

Japan's chemical industry addresses global climate change issue

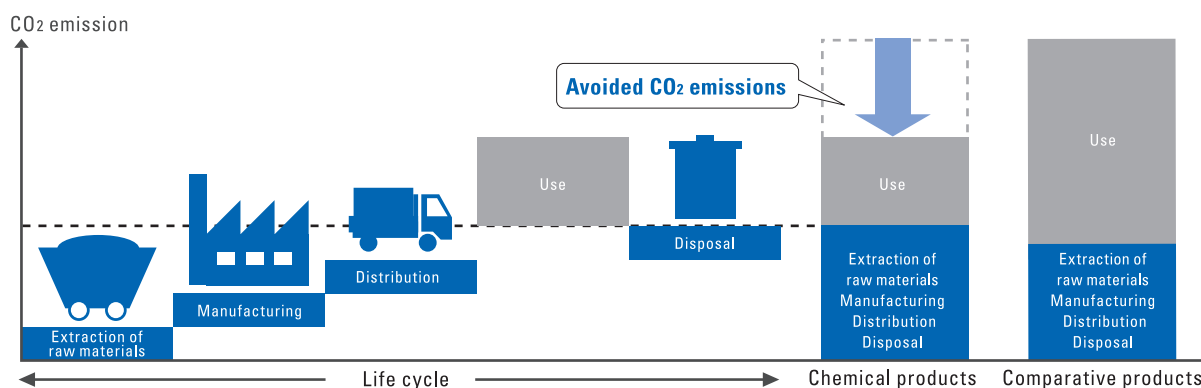
Chemical industry consumes energy in the process of manufacturing the products. The chemical industry in Japan, which relies on imports for most of resources and energy, has achieved the world's highest level of energy saving after the “oil shock” through various activities such as transformation of process methods and process development, and improvement in energy

efficiency of equipment and devices and operation methods. In addition, the industry has also contributed to the reduction of greenhouse gas (GHG) emissions through development, production and supply of highly energy-efficient chemical products in lifecycle such as thermal insulation materials and fuel efficient tires and LED bulbs.

As a core member of the ICCA, JCIA has been carrying out international promotion activity of the methodology for quantification by using carbon life cycle analysis (cLCA) to enhance the transparency and consistency in showing avoided GHG emissions enabled by chemical products.

The avoided CO₂ emissions calculated based on cLCA

Concept of Carbon Life Cycle Analysis (cLCA): Difference of CO₂ emission between chemical products and their comparable products based on the finished products



An initiative “Responsible Care®” which global chemical industry implements

Responsible Care® is a voluntary commitment by the global chemical industry to drive continuous improvement and achieve excellence in environmental, health and safety and security performance.

Responsible Care is an essential part of ICCA's contribution to the Strategic Approach to International Chemicals Management (SAICM). Through Responsible Care, global chemical manufacturers commit to

pursue an ethic of safe chemicals management and performance excellence worldwide. Our commitment helps to enhance public confidence and trust in the industry's dedication to safely manage chemicals throughout their lifecycle while ensuring that chemistry can continue to contribute to a healthier environment, improved living standards and a better quality of life for all.

First launched in Canada in 1985, Responsible Care is today practiced by 58 chemical associations in more than 60 countries around the globe. Responsible Care empowers companies to continue to strive for innovative ways to contribute to the vision of the World Summit on Sustainable Development that, by the year 2020, “All chemicals will be produced and used in ways that minimize risks for human health and the environment.”



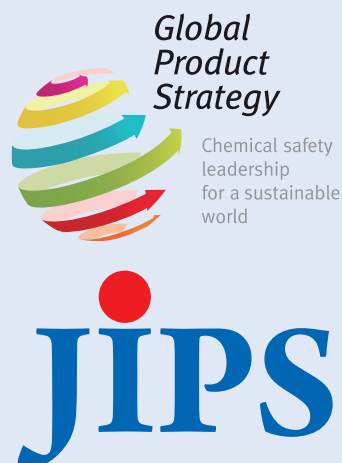
Chemical industry continues its efforts to minimize risk of chemicals

Among chemicals, there exist those which would cause adverse effects on human health and environment when improperly handled. Therefore, the chemical industry globally promotes an initiative to minimize the risk on “environment, health and safety” throughout an entire product's life cycle (supply chain) including development, production, distribution, use, final consumption

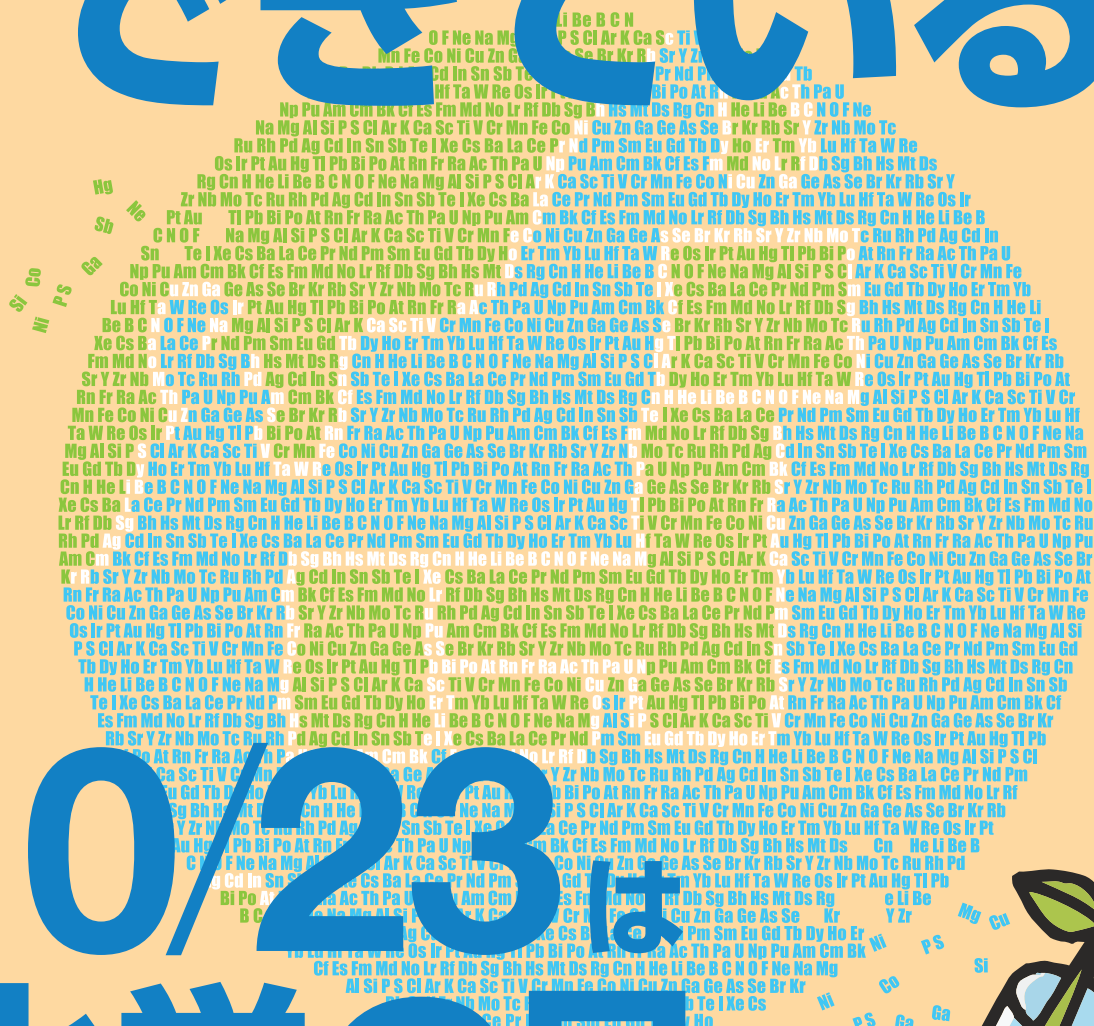
and disposal/recycling. ICCA is promoting “GPS (Global Product Strategy)”, under which each member company appropriately manages its chemicals based on risk by implementing risk assessment of their own chemicals (products) and widely discloses information such as risk management measures not only to supply chain but also to general society.

JIPS (Japan Initiative of Product Stewardship) activity is the domestic Japanese chemical industry's voluntary action based on risk assessment and management considering whole supply chain of chemical distribution. Japanese chemical industry has its own domestic situations such as the laws and regulations, needs of the society/customers and business customs. Therefore, the term “GPS/JIPS[※]” is used as GPS activities in Japan to take into account the domestic situations described above.

※ GPS/JIPS : Global Product Strategy/Japan Initiative of Product Stewardship



全ては化学で できている



10/23は 化学の日

化学とは物質の学問です。そして世の中に存在する物質はすべてとても小さなツブツブ（粒子）からできています。例えば、水はH₂Oという粒子（分子）の集まりで、その分子量は18です。この分子量にgをつけた量が1モルとなります。つまり、水18gは1モルとなります。また1モルの物質中には粒子が6.02×10²³個集まっており、これを「アボガド定数」とよびます。化学では物質をくっつけたり、離したりするので、モルという単位はとても便利な物質量として使われています。



ニッカちゃん



Japan Chemical Industry Association

Sumitomo Rokko Building, 1-4-1 Shinkawa, Chuo-ku, Tokyo 104-0033, Japan
Tel: +81-3-3297-2555 Fax: +81-3-3297-2615
URL <http://www.nikkakyo.org/>

