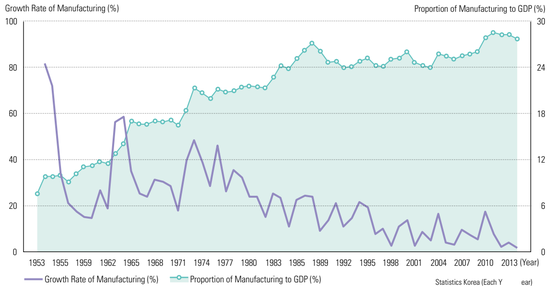
Manufacturing Industry

Korea's manufacturing industry has gone through tremendous continuous growth during the last fifty years, playing a pivotal role in the nation's economic development and contributing to the upgrade of the overall industrial foundation. Growth was particularly vigorous during President Park Chung-Hee's administration beginning in 1962, when the government adopted economic growth as a major national policy and promoted a series of five-year economic development plans as the central task of a government-led industrial development policy. The policy pursued a strategy of exporting products from light industries such as textiles, wigs, and shoes. Since the mid-1970s, government industry promotion has shifted to the heavy chemical industry. In the 1990s, there was a shift in investment emphasis to high-tech industries. Significant high-tech growth, including the development of semiconductors, computers, and information and communication technology, was accompanied by advanced technology training. Since the mid-2000s, stagnated growth in the manufacturing sector has brought a need for a different development strategy. This chapter will discuss the history of the last 40 years of the Korean manufacturing industry and its transformation since its early stages. Specifically, this chapter will introduce the current Korean major industries that have served as the foundation of national economic growth for years, the "Ppuri industry" (also known as the foundry industry) that supports the current Korean major industries, and the high value-added industries and new growth engine industries that will become future cornerstones of Korea's economy.

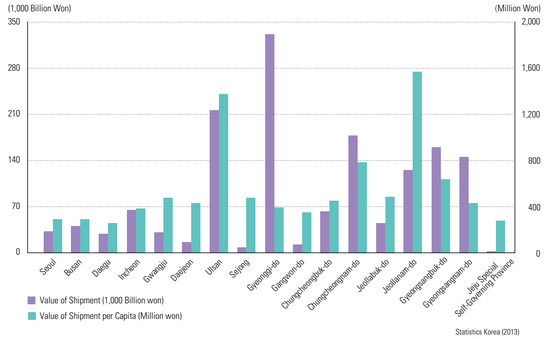
Analyzing Korea's manufacturing growth trend by comparing its proportion to its GDP reveals that manufacturing accounted for only 10% of the GDP before 1960. During the decade from 1961 to 1970, manufacturing grew from 11.8% to 17.2%, and manufacturing became an important component of the Korean economy. In the 1970s, manufacturing accounted for over 20% of the total GDP. In the 1980s, the growth rate for the decade was 24.3% and manufacturing became the major driving force of Korea's economic growth. Between the late 1980s and early 1990s, the manufacturing share of the GDP declined slightly from 27.2% (1988) to 23.9% (1992), after which it gradually rose again, remaining at around 27-28% into the 2010s. Although the real growth rate of the manufacturing industry was kept at a steadily high level (16.8% in the 1960s, 15.8% in the 1970s, and 12.2% in the 1980s), it declined to 6.5% in the 1990s and to 4% in the 2000s. In particular, with the 1997 financial crisis resulting from internal and external factors and the global financial crisis of 2008, manufacturing fell significantly, recording a negative rate of growth.

During the early industrialization stage in the 1960s, Seoul was the most important manufacturing center in the country. Since the 1980s, however, manufacturing has become suburbanized and decentralized outside of the Greater Seoul Metropolitan area. At the same time, foreign direct investments in China and Southeast Asia have accelerated as the wage increases have surpassed productivities and weakened cost-competitiveness. On the other hand, producer services such as design and advertising and the software industry have become more concentrated in Seoul. As a result, in 2013, Gyeonggi-do was responsible for 22.3% of all metropolitan and provincial manufacturing shipments, followed by Ulsan (14.5%), Chungcheongnam-do (11.8%), Gyeongsangbuk-do (10.7%), and Gyeongsangnam-do (9.7%), while Seoul's share was only 2.2% (11th in the nation).

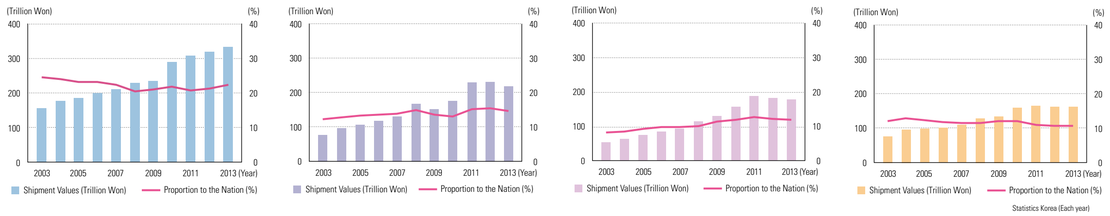
Manufacturing Industry's Growth Rate and Proportion to GDP (1953 – 2013)



Manufacturing Shipment Values

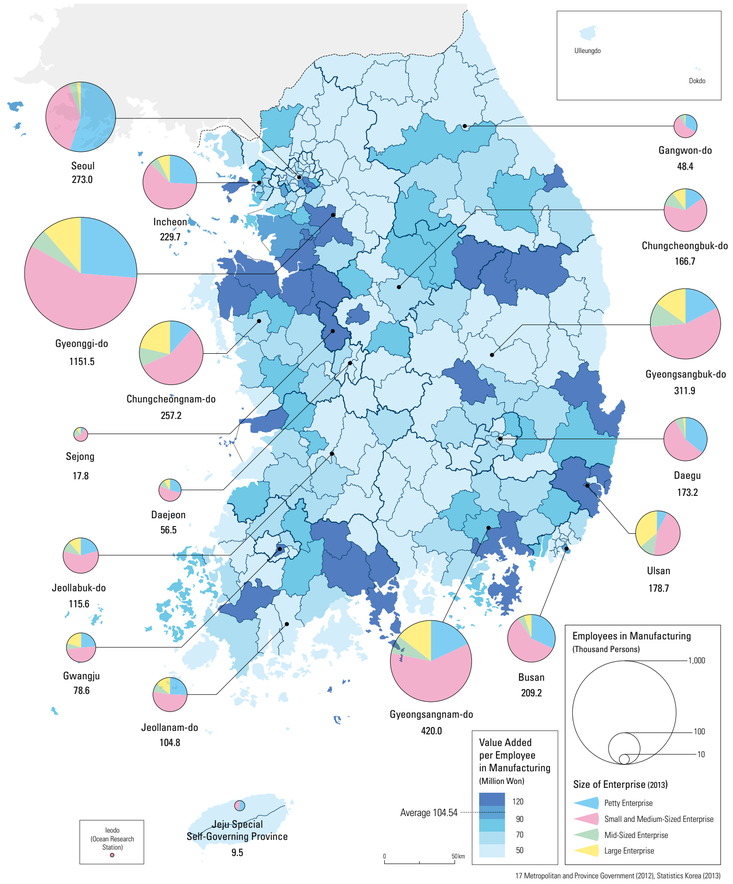


Manufacturing Shipment Values (2003 – 2013)

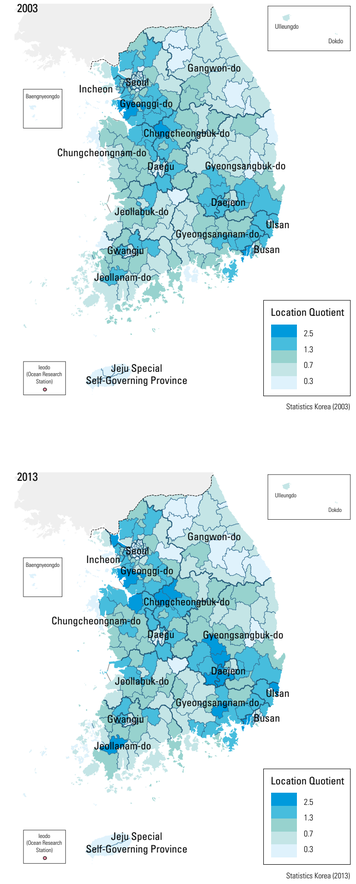


Manufacturing

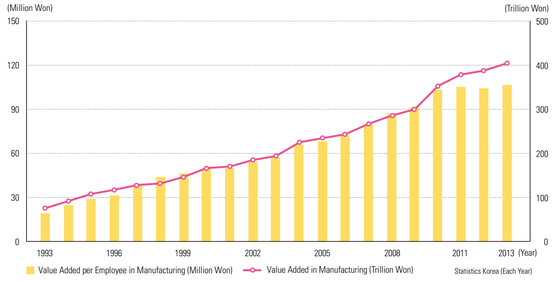
Employees in Manufacturing (2012)



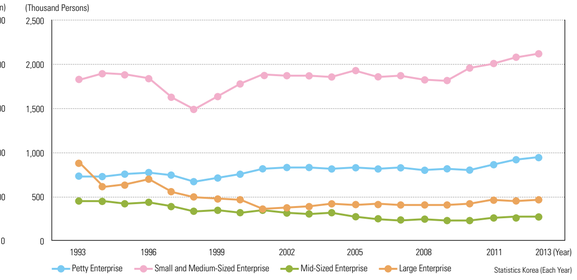
Location Quotient of Manufacturing



Changes in Value Added in Manufacturing (1993 – 2013)



Number of Employees in Manufacturing by Enterprise Size (1993 – 2013)

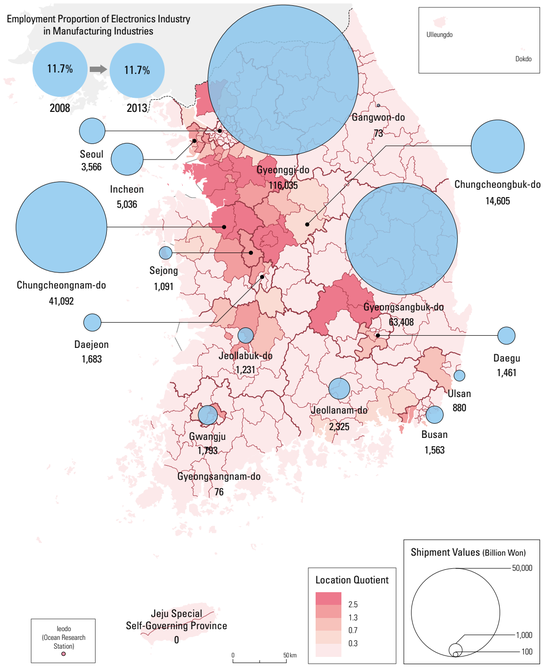


In 1993, Korea's gross value-added manufacturing was at 74.9 trillion KWN and its (per capita) value-added rate was at 19.29 million KWN. In 2013, these numbers increased to 404.6 trillion KWN and 106.41 KWN, respectively. Per capita value-added manufacturing by region for 2013 was as follows: Yeosu-si (KRW 5.0 billion), Namgu in Ulsan (KRW 4.6 billion), Gwangyang-si (KRW 3.5 billion), Seosan-si (KRW 3.2 billion) Yongin-si (KRW 2.7 billion), Dangjin-si (KRW 2.6 billion), and Asan-si (KRW 2.3 billion won). In 1993, manufacturing workers hired by different sizes of enterprises indicated that the large and mid-size enterprises hired 0.88 million workers (22.7%) and 0.45 million workers (11.7%), respectively. In 2013, both categories declined: 0.46 million workers (12.3 %) for large enterprises and 0.27 million workers (7.2%) for mid-size enterprises. On the other hand, small-to-medium enterprises (SMEs) and petty enterprises increased: in 1993, there were 1.82 million workers (47.0%) for SMEs and 0.72 million workers (18.6%) for petty enterprises, but in 2013 they increased to 2.11 million workers (55.7%) and 0.94 million workers (24.9%), respectively.

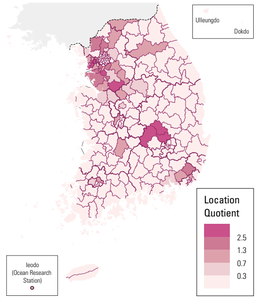
In addition, location quotients for 2003 ranked by descending order were: Gangseo-gu in Busan (2.9), Hwaseong-si (2.9), Jincheon-gun (2.5), Buk-gu in Ulsan (2.5), Yangju-si (2.5), Ulju-gun (2.4), and Chilgok-gun (2.4). In 2013, the geographic pattern changed: Gangseo-gu in Busan (3.8), Dong-gu in Ulsan (3.1), Jincheon-gun (3.0), Haman-si (3.0), Yeongam-gun (2.9), Asan-si (2.9), and Eumseong-gun (2.8).

Traditional and Advanced Industries

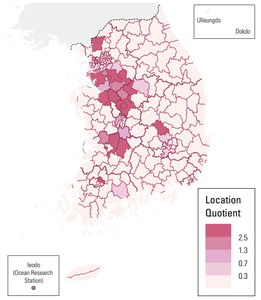
Electronics Industry (2013)



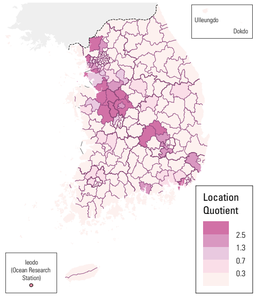
Household Electric Appliances Industry



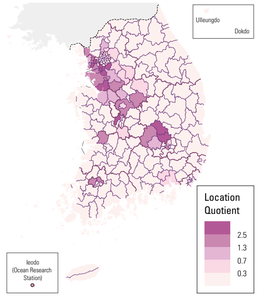
Semiconductor Industry



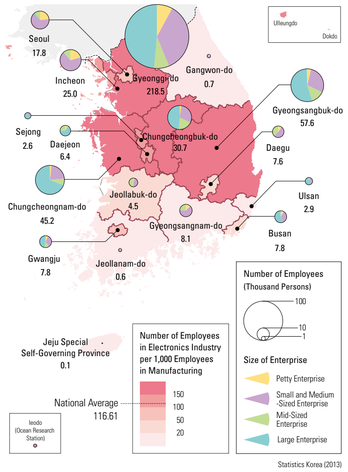
Electronic Components Industry



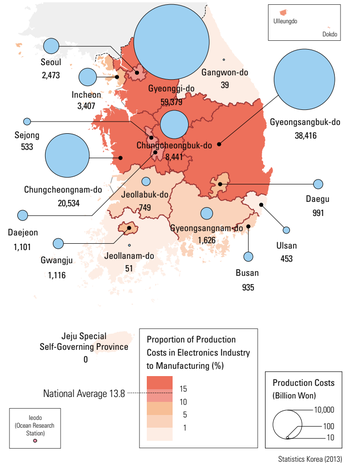
Computer and Telecommunication Industry



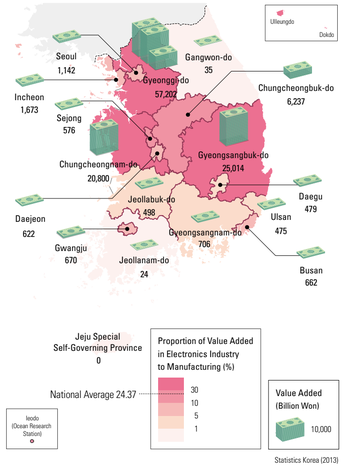
Electronics Industry by Enterprise Size



Production Costs in Electronics Industry



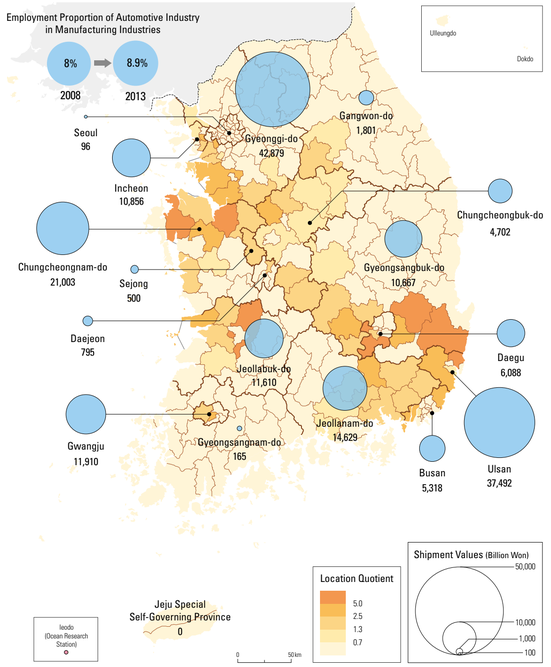
Value Added in Electronics Industry



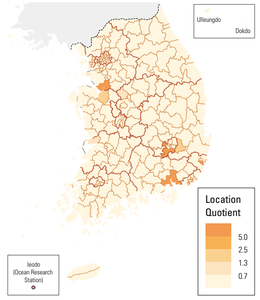
Current Korean major industries are the industries that have traditionally been the basic foundation of national economic development. Value-added manufacturing has great influence on production, export, and employment; it also provides great forward and backward linkages with other industries. Industrial growth will contribute greatly to national economic development and will be essential to the development of other economic sectors.

In the 1980s, the electrical and electronics industries, which centered on household electrical appliances as well as industrial products, were the driving force of the Korean economy. Major sectors were the household electronic appliance industry, semiconductor industry, computer and telecommunication industry, and electronic components industry. Location quotients for electronic industries indicated that the regional concentrations were clearly in Gyeonggi-do, Chungcheongnam-do, and Gyeongsangbuk-do. Value-added production costs, and firm sizes in Gyeonggi-do, in particular, were highest in the country. The distribution of specialized items or industries also appears to be different for each sub-section. The household appliances industry is regionally concentrated (in descending order) in Suwon-si, and Gimcheon-si, Gumi-si, while the semiconductor industry has shown a high concentration (in descending order) in Icheon-si, and Yongin-si, Hwaseong-si. The electronic components industry is concentrated (in descending order) in Paju-si, Asan-si, and Gumi-si. The computer and communication equipment industry is concentrated (in descending order) in Gumi-si, Pyeongtaek-si, and Chilgok-gun. Thus Gyeonggi-do and Gyeongsangbuk-do have prominent regional concentrations.

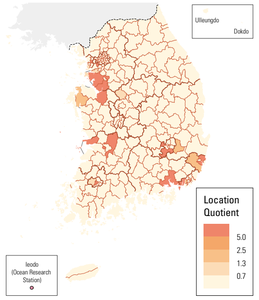
Automotive Industry (2013)



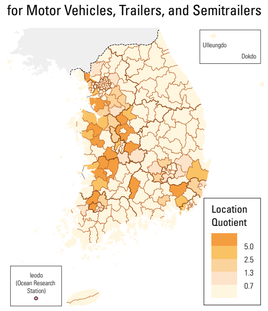
Manufacture of Engines for Motor Vehicles



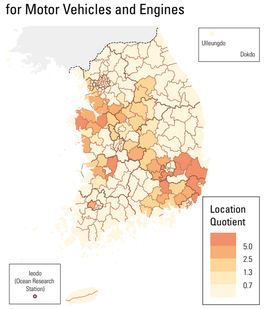
Manufacture of Motor Vehicles



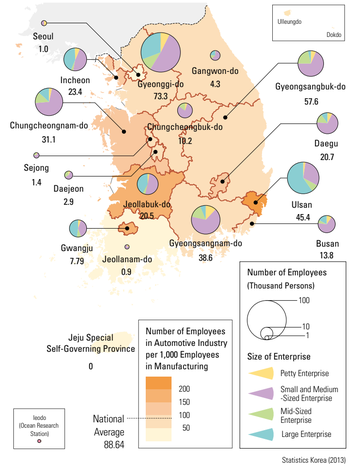
Manufacture of Bodies for Motor Vehicles, Trailers, and Semitrailers



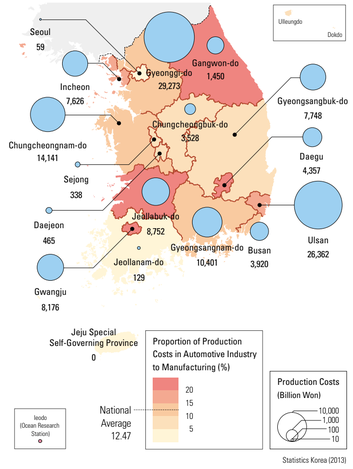
Manufacture of Parts and Accessories for Motor Vehicles and Engines



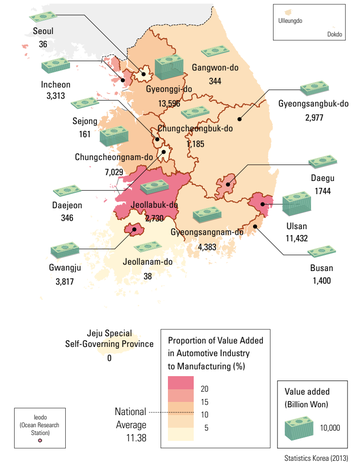
Automotive Industry by Enterprise Size



Production Costs in Automotive Industry

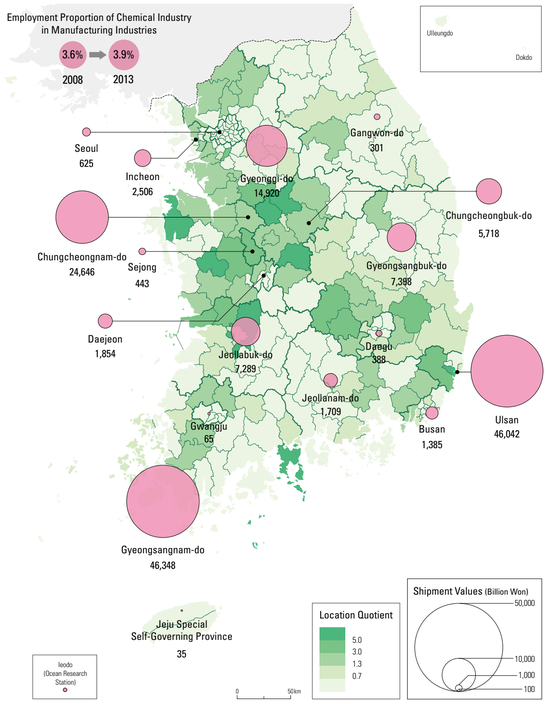


Value Added in Automotive Industry

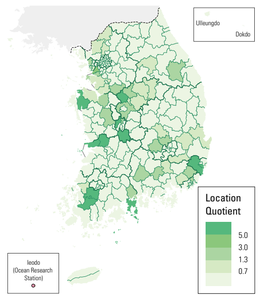


According to the 9th Korean Standard Industrial Classification, the automobile industry can be subdivided into manufacturers of motor vehicles, engines for motor vehicles, bodies for motor vehicles, trailers and semitrailers, and other parts and accessories for motor vehicles. The places with the highest location quotients for the automobile industry are (in descending order) Ulsan, Wanju-gun, Seosan-si, Dalseong-gun, Yeongcheon-si, and Asan-si, with prominent concentrations in Ulsan, Chungcheongnam-do, and Gyeongsangbuk-do. The locations with the highest number of manufacturing enterprises are (in descending order) Gyeonggi-do, Ulsan, Gyeongsangnam-do, and Chungcheongbuk-do. The locations with the highest production cost and value-added manufacturing rankings are (in descending order) Gyeonggi-do, Ulsan, Chungcheongnam-do, and Gyeongsangnam-do. In reviewing the subsections of the automobile industry, manufacturers of motor vehicles are concentrated (in descending order) in Bupyeong-gu in Incheon, Buk-gu in Ulsan, Hwaseong-si, Wanju-gun, Changwon-si, Gunsan-si, Asan-si, Seo-gu in Gwangju, and Gwangmyeong. The locations with the highest concentration of manufacturers of engines for motor vehicles are (in descending order) Changwon-si, Dalseong-gu in Daegu, Nam-gu in Ulsan, Pyeongtaek-si, Seoguipo-si in Jeju, and Asan-si. Manufacturers of motor vehicle and manufacturers of engines for motor vehicle are highly concentrated in the top five cities with a location quotient of 50 or above. A similar pattern can be found for manufacturers of engines for motor vehicles in the top five cities with a location quotient of 10 or above. For areas outside of these top five cities in each category, the location quotient was mostly less than 1.

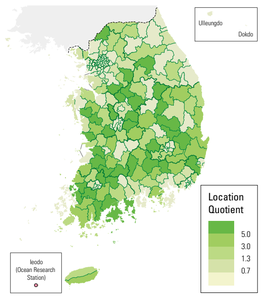
Chemical Industry (2013)



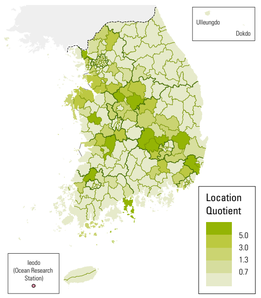
Manufacture of Basic Chemicals



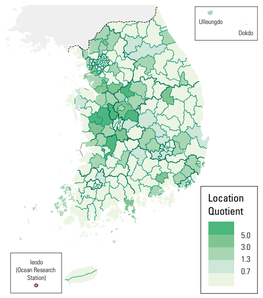
Manufacture of Fertilizers and Nitrogen Compounds



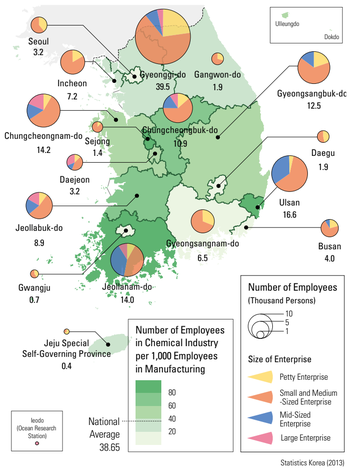
Manufacture of Synthetic Rubber and of Plastics in Primary Forms



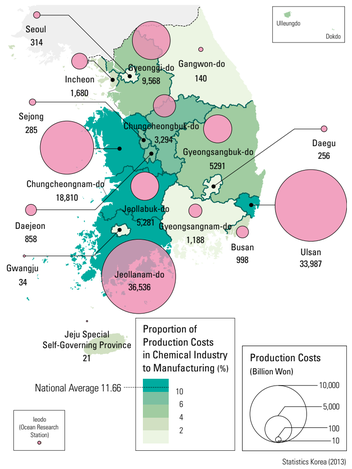
Manufacture of Other Chemical Products



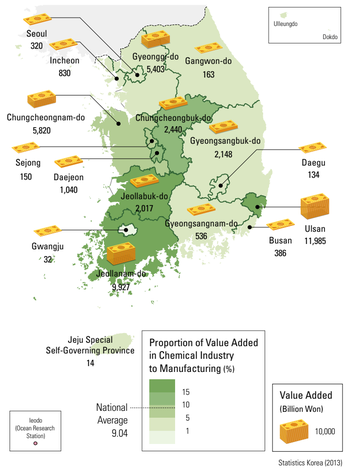
Chemical Industry by Enterprise Size



Production Costs in Chemical Industry

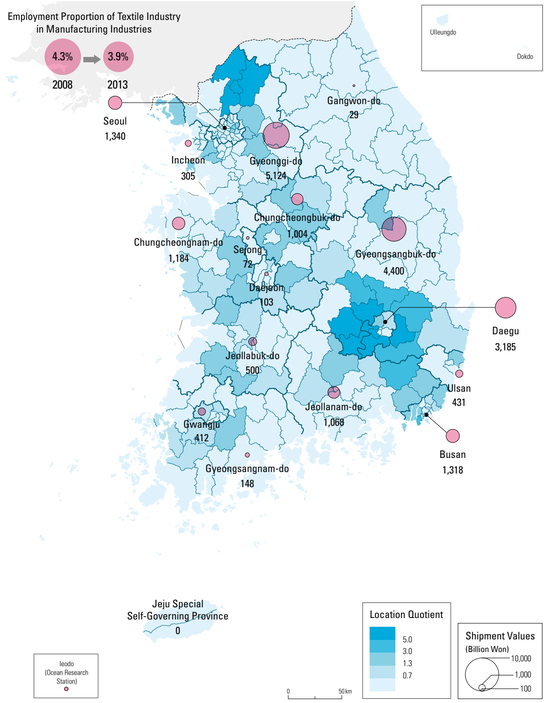


Value Added in Chemical Industry

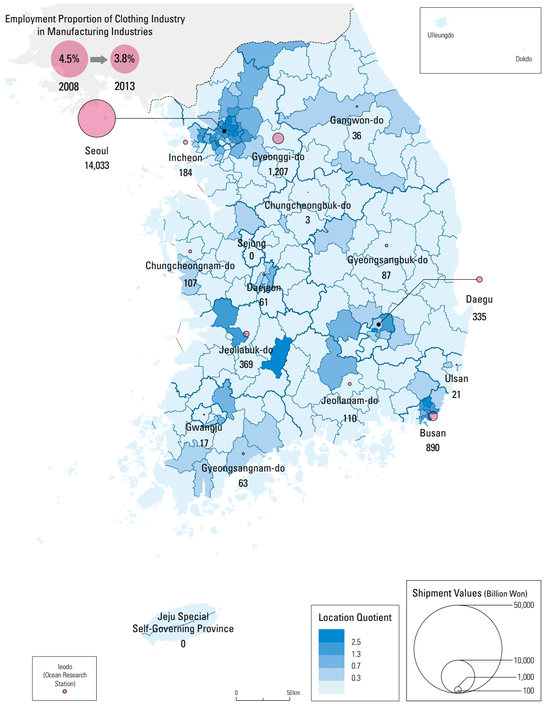


The chemical manufacturing industry is further divided into basic chemicals (a major component), fertilizers and nitrogen compounds, synthetic rubber and plastics in primary form, and other chemical products. Location quotients for chemical industries were the highest (in descending order) in Yeosu-si, Boeun-gun, Ulsan, Seosan-si, Cheongyang-gun, and Eumseong-gun, with clear concentrations in Chungcheongnam-do, Chungcheongbuk-do, and Ulsan. The largest businesses are found (in descending order) in Gyeonggi-do, Ulsan, Chungcheongnam-do, and Jeollanam-do. Production costs are highest (in descending order) in Jeollanam-do, Ulsan, Chungcheongnam-do, and Gyeonggi-do, and the highest concentrations of value-added chemical manufacturing are (in descending order) in Ulsan, Jeollanam-do, Chungcheongnam-do, and Gyeonggi-do. Analysis of the distribution of chemical industries by classification shows that basic chemicals plants are concentrated (in descending order) in Seosan, Yeosu, Nam-gu in Ulsan, Ulju-gun in Ulsan, and Gunsan-si. Manufacturers of fertilizers and nitrogen compounds are mostly concentrated (in descending order) in Seocheon-gun, Cheongyang-gun, Geosan-gun, Boeun-gun, and Gimje-si. For manufacturers of basic chemicals, the top 4 places had location quotients of over 10; for manufacturers of fertilizers and nitrogen compounds, the top 12 places had location quotients of above 10, indicating a greater regional concentration.

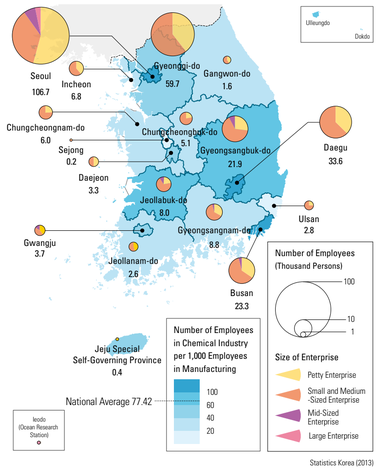
Textile Industry (2013)



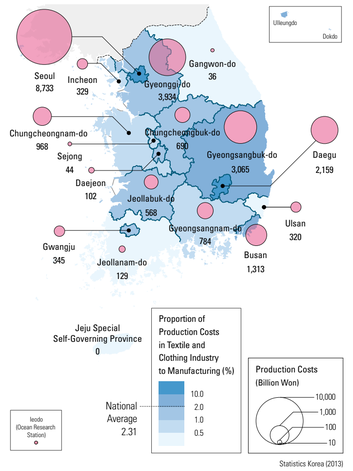
Clothing Industry (2013)



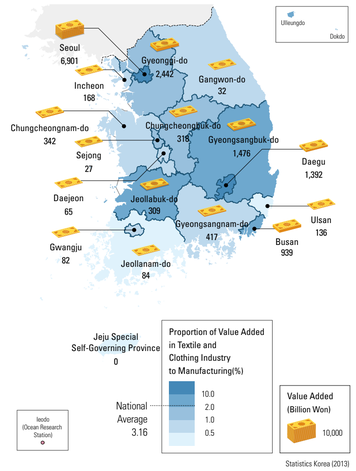
Textile and Clothing Industry by Enterprise Size



Production Costs in Textile and Clothing Industry

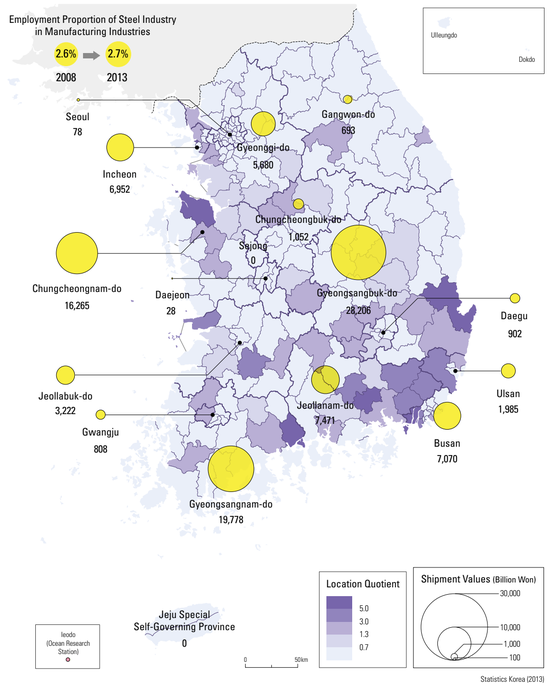


Value Added in Textile and Clothing Industry

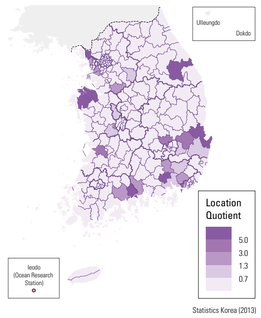


The textile/apparel industry can be further subdivided into the manufacture of textiles, clothing, clothing accessories, and fur articles. Location quotients for the textile industry are highest (in descending order) in Seo-gu in Daegu, Yangju-si, Pocheon-si, Seongju-gun, and Goryeong-gun, and centered around Daegu, Gyeongsangbuk-do, and Gyeonggi-do. Location quotients for the apparel industry are highest (in descending order) in Seoul, Daegu, Jangsu-gun, and Nam-gu and Dong-gu in Busan, and centered in Seoul, Busan, and Daegu. The largest enterprises for the manufacture of textiles/apparel are found (in descending order) in Seoul, Gyeonggi-do, Daegu, Busan, and Gyeongsangbuk-do. Both the production cost and the total value-added revenue were the highest (in descending order) in Seoul, Gyeonggi-do, Gyeongsangbuk-do, Daegu, and Busan. For the textile industry, the 5 locations with the highest concentrations have location quotients of over 10 and for the apparel industry, the top 5 locations are all concentrated in Seoul, with location quotients of over 5.

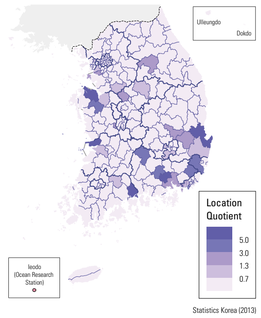
Steel Industry (2013)



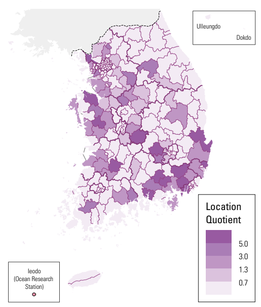
Manufacture of Basic Iron, Steel, and Ferro-Alloys



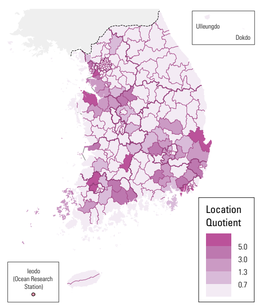
Manufacture of Rolled, Drawn, and Folded Products of Iron or Steel



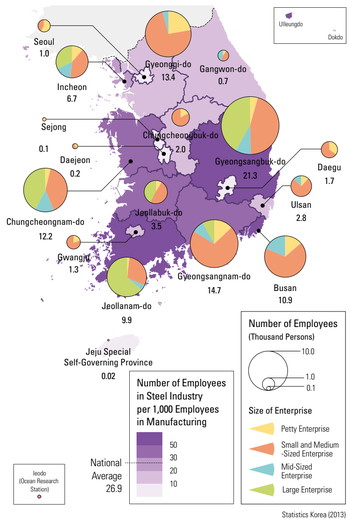
Manufacture of Pipes, Tubes, and Hollow Profiles of Iron or Steel



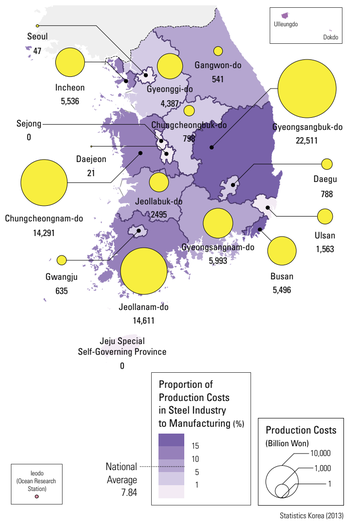
Manufacture of Other Basic Iron and Steel



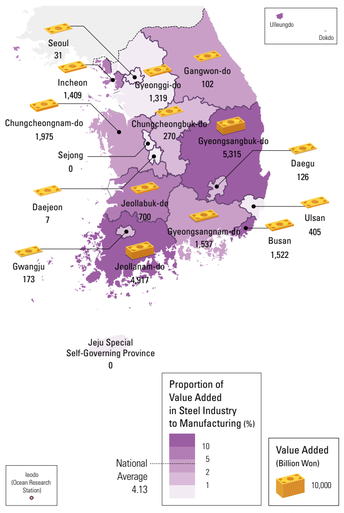
Steel Industry by Enterprise Size



Production Costs in Steel Industry



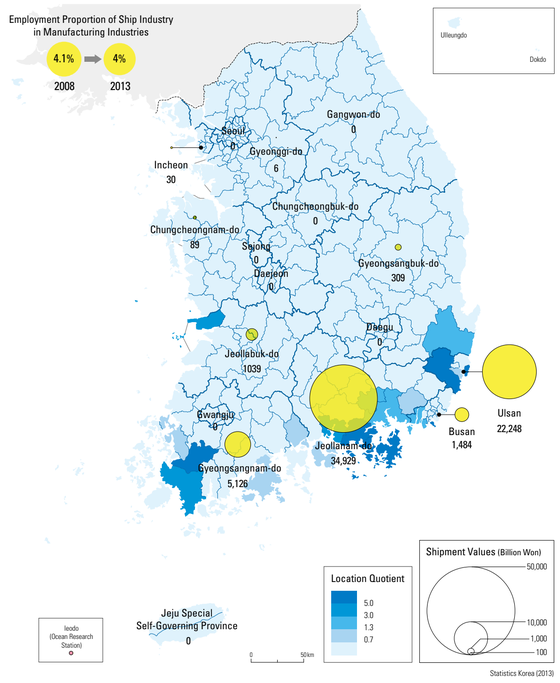
Value Added in Steel Industry



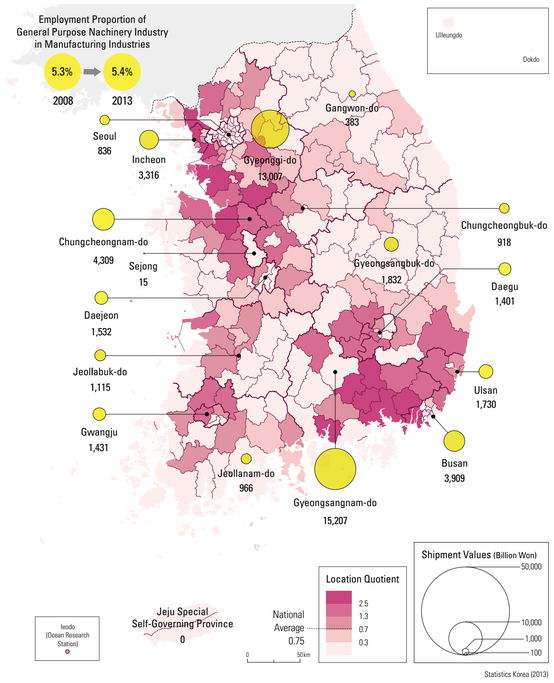
The location quotient for steel manufacturing is highest (in descending order) in Dangjin, Gwangyang-si, Dong-gu in Incheon, Pohang-si, and Gangseo-gu in Busan. The largest businesses are found (in descending order) in Gyeongsangbuk-do, Gyeongsangnam-do, and Gyeonggi-do. For production cost and value-added, the highest concentrations are (in descending order) in Gyeongsangbuk-do, Jeollanam-do, and Chungcheongnam-do.

For the steel industry by classification, the highest concentrations of manufacture of basic iron, steel, and ferro-alloys are (in descending order) in Gwangyang-si, Donghae-si, Dong-gu in Incheon, Dangjin-si, Haman-si, and Jeongseon-gun. The highest concentrations for the manufacture of rolled, drawn, and folded products of iron and steel are (in descending order) in Dangjin-si, Gwangyang-si, Dong-gu in Incheon, and Pohang-si. For the manufacture of basic iron, steel, and ferro-alloys, the top two areas have location quotients of over 50, and the other top 8 areas have location quotients of over 10; these quotients indicate extremely high concentrations. The top 4 areas for the manufacture of rolled, drawn, and folded products of iron and steel have location quotients of over 20, indicating a very strong regional concentration.

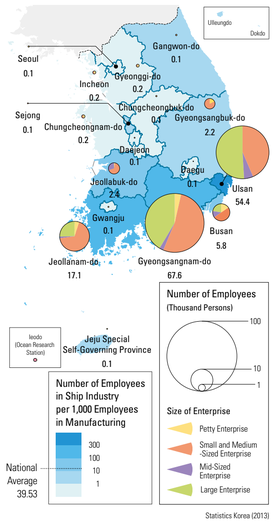
Ship Industry (2013)



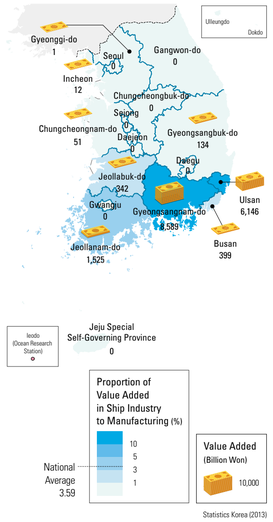
General Purpose Machinery Industry (2013)



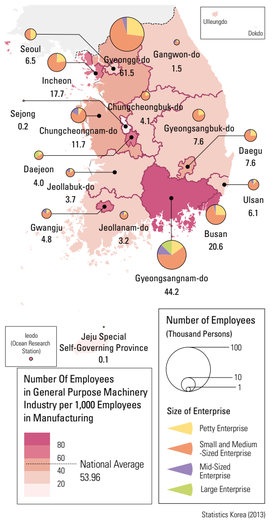
Ship Industry by Enterprise Size



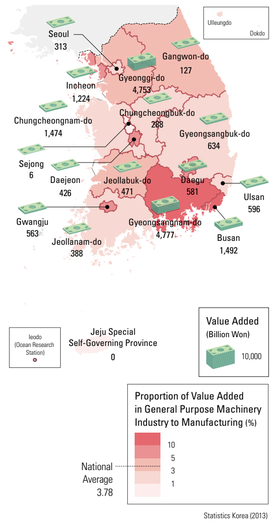
Value Added in Ship Industry



General Purpose Machinery Industry by Enterprise Size



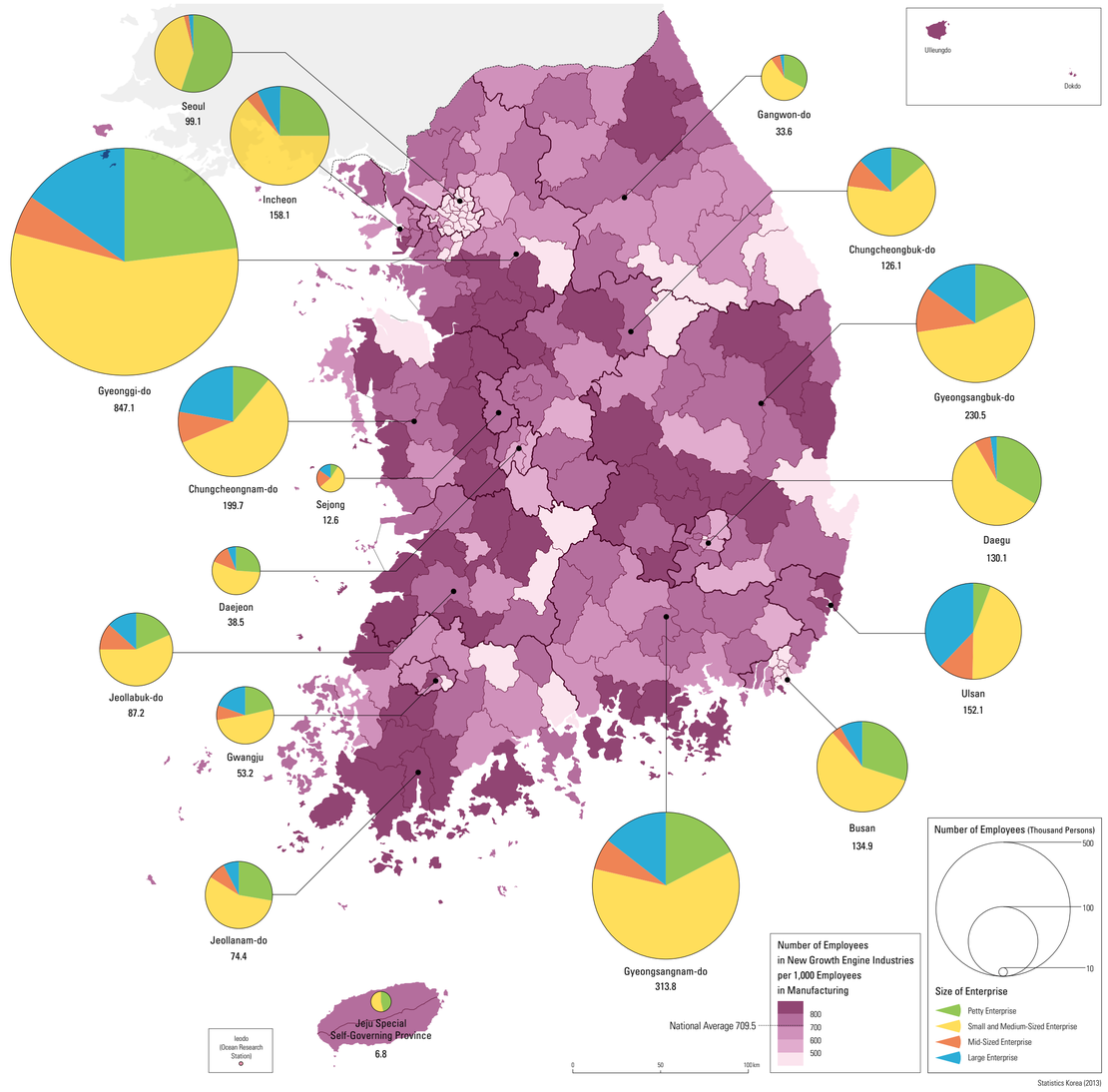
Value Added in General Purpose Machinery Industry



Location quotients for the shipbuilding industry are highest (in descending order) in Dong-gu in Ulsan, Yeongam-gun, Goeje-si, Goseong-gun, Tongyong-si, and Yongdo-gu in Busan; this list clearly reveals a regional concentration. The locations with the largest enterprises are (in descending order) Gyeongsangnam-do, Ulsan, Jeollanam-do, and Busan. Gyeongsangnam-do has the highest ranking for value-added manufacturing, followed by Ulsan, Jeollanam-do, and Busan. The top 2 shipbuilding areas have location quotients of over 50 and the top 5 areas have location quotients over 10, revealing a heavy regional concentration. Related to the shipbuilding industry are supportive manufacturing industries such as general purpose machinery industries including internal combustion piston engines and turbines, fluid power equipment, pumps and compressors (including taps), bearings, gears, driving-related components, industrial ovens, furnaces, and furnace burners.

New Growth Engine Industries

Employees in New Growth Engine Industries (2013)



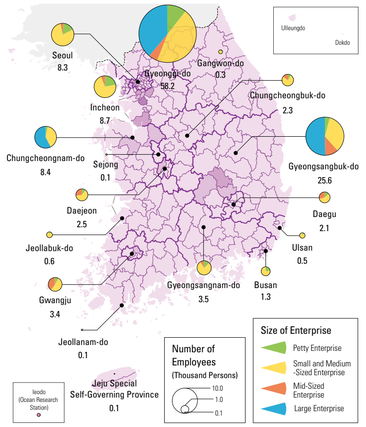
Statistics Korea (2013)

New growth engine industries are those that will continually bring high value-added industries through the evolution of existing industries in technological innovations, convergence, and services at a time when existing major Korean industries have matured to a level that is causing overall slow economic growth and deterioration of job creation potential. In 2009, according to the "Comprehensive Plan for New Growth Engine Industries," the government selected 17 new growth engine industries in three major growth fields, namely green technology, high technology convergence industry, and high value-added services. New growth engine industries that belong to manufacturing categories include the broadcasting and communications convergence industry, IT convergence system industry, robotic application industry, advanced materials and nano convergence industry, bio-pharmaceutical industry, medical appliances and instruments industry, and high value-added food industry.

As of 2013, there were 233,099 enterprises in new growth engine industries in Korea with 2.69 million employees, constituting 62.9% of the total manufacturing enterprises and 71.0% of the total employees, respectively. In terms of enterprise size, there were 88 large enterprises, 428 mid-size enterprises, 44,438 SMEs, and 188,145 petty enterprises, making up 0.0%, 0.2%, 19.1%, 80.7% of the total enterprises, respectively; these percentage distributions reveal a heavy concentration in small industries. Regional distribution of enterprises centered on Gyeonggi-do (29.8%), Seoul (10.1%), Gyeongsangnam-do (9.4%), Daegu (7.6%), Busan (7.2%), Gyeongsangbuk-do (7.1%), and Incheon (6.3%). Of the total new growth engine industries, 46.2% were located in the Greater Seoul Metropolitan Area.

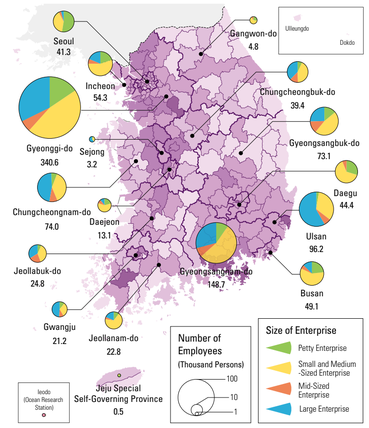
As of 2013, there were 4,621 enterprises employing 125,757 workers in the broadcasting and communications convergence industry, which made up 2.0% of total enterprises and 4.7% of total employees within the new growth engine industries. There were 7 large enterprises (0.2%), 20 mid-size enterprises (0.4%), 1,623, SMEs (35.1%), and 2,971 petty enterprises (64.3%). The regional distribution of enterprises indicated the highest concentration in Gyeonggi-do (46.9%), followed by Seoul (14.7%), Incheon (11.6%), and Gyeongsangbuk-do (10.0%). %). In particular, Suwon-si ranked highest (39.1%) in terms of the proportion of employment followed by Gumi-si (22.1%), Gangseo-gu in Seoul (14.0%), and Seongnam-si (13.4%).

Broadcasting and Communications Convergence Industry



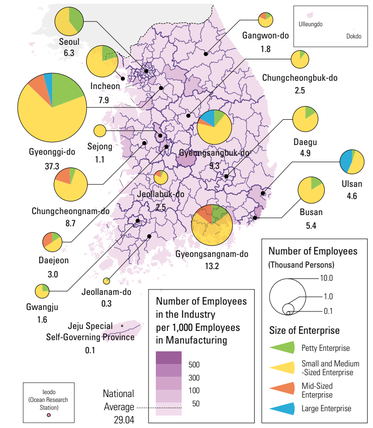
Statistics Korea (2013)

IT Convergence System Industry



Statistics Korea (2013)

Robot Application Industry



Statistics Korea (2013)

Advanced Materials and Nano Convergence Industry

Statistics Korea (2013)

Biopharmaceutical, Medical Appliances and Instruments Industry

Statistics Korea (2013)

High Value-Added Food Industry

Statistics Korea (2013)

The number of enterprises (58,653) and the number of employees (1,051,412) in the IT convergence industry accounted for 25.2% of enterprises and 39.0% of employees in the new growth engine industry. There were 64 large enterprises (0.1%), 164 mid-size enterprises (0.3%), 13,715 SMEs (23.4%), and 44,710 petty enterprises (76.2%). The regional distribution of enterprise concentration is as follows: Gyeonggi-do (31.7%), Seoul (14.2%), Gyeongsangnam-do (10.0%), Daegu (8.5%), Busan (7.8%), and Incheon (6.6%). In addition, the proportion of employees in the IT convergence system industry to the total manufacturing workers is highest in Dong-gu in Ulsan (88.6%), Geoje-si (83.8%), Yeongam-gun (80.4%), Tongyong-si (72.7%), Seogu in Gwangju (72.5%), and Yeongdo-gu in Busan (67.0%). The number of enterprises (6,674) and the employees (110,420) in the robotic application industry account for 2.9% of enterprises and 4.1% of employees in the new growth engine industry. There were 3 large enterprises (0.1%), 19 mid-size enterprises (0.3%), 1,998 SMEs (29.9%), and 4,654 petty enterprises (69.7%). The regional distribution of robotic application industries is highest in Gyeonggi-do (36.9%), followed by Seoul (13.3%), Gyeongsangnam-do (10.7%), and Incheon (9.0%).

In addition, the proportion of robotic applications industry employees is highest in Yeongdong-gun (20.2%), Yeonsu-gu in Incheon (11.0%), Gijang-gun in Busan (10.2%), and Wonju-si (9.4%), The number of enterprises (90,815) and employees (1,122,310) in this industry account for 39.0% of enterprises and 41.6% of employees in the new growth engine industry. There are 41 large enterprises (0.1%), 200 mid-size enterprises (0.2%), 17,993 SMEs (19.8%), and 72,581 petty enterprises (79.9%). Gyeonggi-do (32.7%) has the highest regional concentration, followed by Gyeongsangnam-do (10.6%), Daegu (9.3%), and Incheon (8.6%).

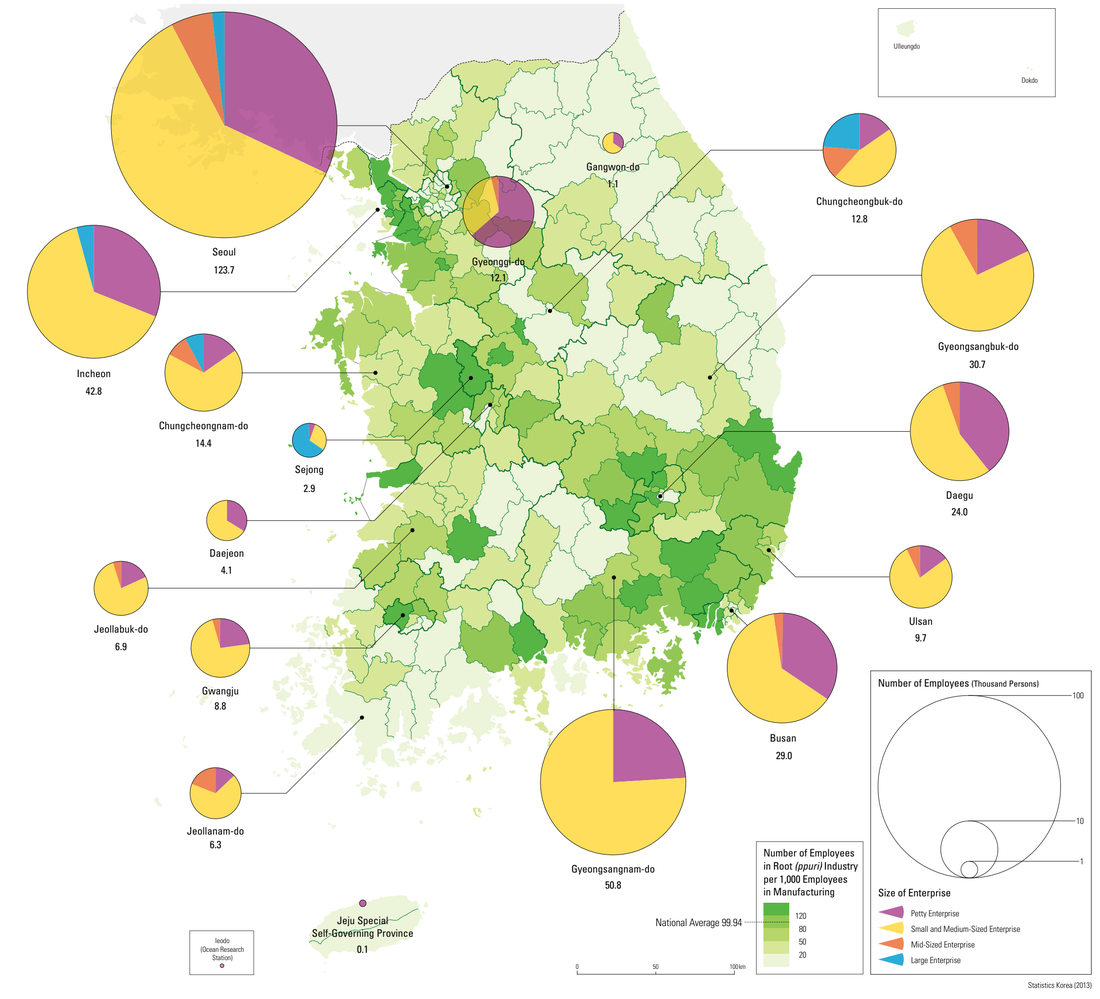
The proportion of employees in the advanced material and nanotechnology convergence industry to the total number of manufacturing workers is highest in Buk-gu in Ulsan (80.6%), followed by Seo-gu in Gwangju (78.2%), Seosan-si (72.9%), and Bonghwa-gun (56.9%).

The number of enterprises (13,574) and employees (171,809) for this industry account for 5.8% of enterprises and 6.4% of employees in the new growth engine industry. There were 5 large enterprises (0.0%), 33 mid-size enterprises (0.2%), 3,190 SMEs (23.5%), and 10,346 petty enterprises (76.2%). Gyeonggi-do (38.0%) has the highest regional concentration of enterprises, followed by Seoul (14.8%), Busan (6.1%), Daegu (5.1%), Gyeongsangnam-do (4.9%), and Gyeongsangbuk-do (4.7%). The proportion of bio-pharmaceutical medical device industry workers to the total number of manufacturing workers is highest in Yeonsu-gu in Incheon (29.3%), followed by Gongju-si (22.5%), Yeosu-si (19.3%), Hongcheon-gun (18.2%), Seosan-si (17.8%), Yuseong-gu in Daejeon (17.6%), and Hwasun-gun (16.0%).

The high value-added food industry utilizes state-of-the-art technology, such as biotechnology (BT), information technology (IT), and nanotechnology (NT), as well as other sectors such as culture and tourism connected to the food industry. The number of enterprises (92,857) and number of employees (889,419) account for 39.8% of enterprises and 33.0% of employees in the new growth engine industry. There are 25 large enterprises (0.0%), 135 mid-size enterprises (0.15%), 15,106 SMEs (16.3%), and 77,591 petty enterprises (83.6%). Gyeonggi-do has the highest concentration of high value-added enterprises (28.4%), followed by Seoul (8.7%), Gyeongsangbuk-do (8.5%), Gyeongsangnam-do (7.8%), Chungcheongnam-do (5.9%), and Jeollanam-do (5.9%). The proportion of high value-added food industry workers to the total number of manufacturing employees is highest in Wando-gun (86.4%), followed by Ulleung-gun (86.3%), Yeonggwang-gun (86.1%), Yeongyang-gun (85.3%), Jinan-gun (80.9%), Sokcho-si (79.8%), and Buan-gun (76.7%).

Root *(Ppuri)* Industry

Employees in Root *(Ppuri)* Industry (2013)

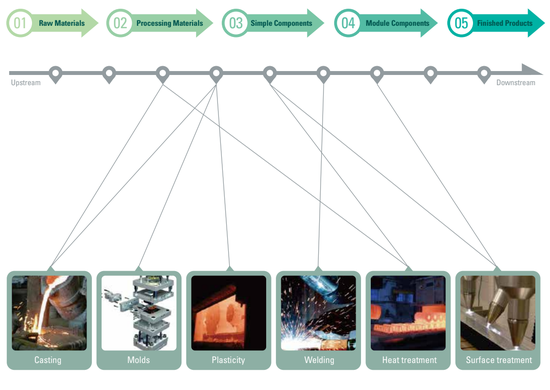


The *Ppuri* industry produces components from raw materials, produces final products from components, and improves the competitiveness of the quality of final products by utilizing process technologies for castings, molds, plasticity, welding, thermal processing, and surface treatment processes as a service to other manufacturing industries such as the automobile, shipbuilding, and IT industries. (*Ppuri* Industry Promotion Act, Article 2). The *Ppuri* industry is an emerging future growth engine in the Korean economy; it enhances the value of the products of the new growth engine industries under the latest inter-technology cooperation.

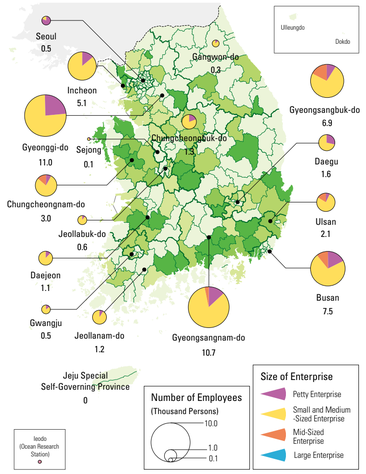
In 2013, the Korean *Ppuri* industry consisted of 40,723 *Ppuri* enterprises and manufacturers that applied the *Ppuri* technology in the finishing process. It accounted for 11.0% of all manufacturing enterprises and 380,000 employees, or 10.0% of all manufacturing employees. There were 6 large enterprises, 45 mid-size enterprises, 8,244 SMEs, and 32,428 petty enterprises, representing shares of 0.01%, 0.1%, 20.2% and 79.6%, respectively, reflecting a typical small industrial structure.

Gyeonggi-do has the highest regional concentration of *Ppuri* industries (34.3%), followed by Incheon (11.6%), Gyeongsangnam-do (10.7%), Busan (9.3%), Seoul (8.8%), Daegu (8.6%), and Gyeongsangbuk-do (5.2%). Of the total *Ppuri* industries, 54.6% are distributed in the Greater Seoul Metropolitan area. The proportion of *Ppuri* manufacturing employees compared to the total number of manufacturing workers is highest in Jeungpyeong-gun (32.8%), followed by Goryeong-gun (32.1%), Ansan-si (27.3%), Seo-gu in Incheon (24.2%), Buk-gu in Daegu (22.5%), Namdong-gu in Incheon (22.3%), Sasang-gu in Busan (21.6%), Siheung-si (20.9%), and Nam-gu in Incheon (20.5%).

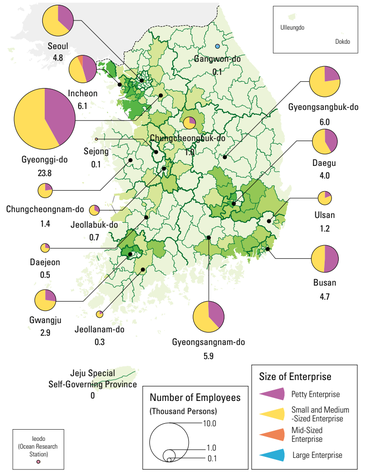
Network Systems of *Ppuri* Industry



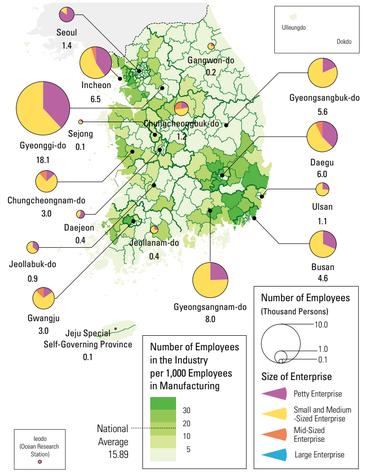
Casting Industry



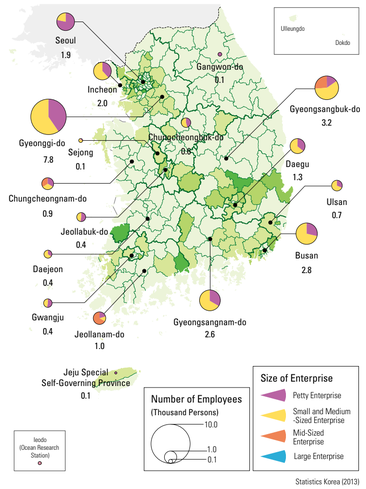
Molds Industry



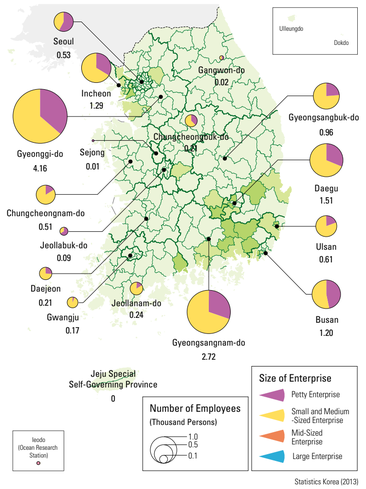
Plasticity Industry



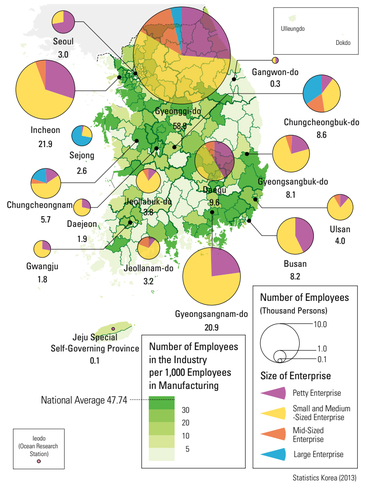
Welding Industry



Heat Treatment Industry



Surface Treatment Industry



The casting industry manufactures specifically-shaped molds from molten metal to create complex-shaped, solid metal products. The number of enterprises (3,416) and the number of employees (53,435) account for 8.4% of enterprises and 14.1% of workers in the Ppuri industry. There are 8 mid-size enterprises (0.2%), 1,253 SMEs (36.7%), and 2,155 petty enterprises (63.1%). Gyeonggi-do has the highest regional concentration of casting industries (25.6%), followed by Gyeongsangnam-do (16.5%), Busan (15.8%), Incheon (8.6%), and Gyeongsangbuk-do (8.4%).

The molding industry manufactures metal molds for mass production of products. The number of enterprises (9,496) and the number of employees (63,140) in the molding industry account for 23.3% of enterprises and 16.6% of employees in the Ppuri industry. There are one mid-size enterprise (0.0%), 1,446 SMEs (15.2%), and 8,049 petty enterprises (84.8%). Gyeonggi-do has the highest regional concentration of molding industries (39.6%), followed by Seoul (11.7%), Busan (10.0%), Incheon (9.3%), Gyeongsangnam-do (8.4%), and Daegu (7.0%).

The polymer industry processes raw materials into new forms of the material by applying an external force, causing permanent deformation. The number of enterprises (7,148) and the number of employees (60,422) in this industry account for 17.6% of enterprises and 15.9% of employees in the Ppuri industry. There are 5 mid-size enterprises (0.1%), 1,284 SMEs (18.0%), and 5,859 petty enterprises (82.0%). Gyeonggi-do has the highest regional concentration for this enterprise (33.6%), followed by Incheon (13.5%), Daegu (10.9%), Gyeongsangnam-do (9.9%), Seoul (7.5%), and Busan (7.4%).

The welding industry bonds materials using heat or pressure on metal and non-metal parts. The number of enterprises (3,720) and number of workers (26,101) account for 9.1% of enterprises and 6.9% of employees in the Ppuri industry. There are 4 mid-size enterprises (0.1%), 531 SMEs (14.3%), and 3,185 petty enterprises (85.6%). Gyeonggi-do has the highest regional concentration of businesses (29.2%), followed by Seoul (17.9%), Busan (8.3%), Gyeongsangnam-do (8%), Incheon (7.3%), and Gyeongsangbuk-do (5.7%).

The thermal processing industry improves material properties by controlling the metal structure through the application of repeated heating and cooling of metal components. The number of enterprises (1,619) and number of workers (14,416) in the thermal processing industry account for 4% of enterprises and 3.8% of workers in the Ppuri industry. There are 408 SMEs (25.2%) and 1,211 petty enterprises (74.8%). Gyeonggi-do has the highest regional concentration of businesses (31%), followed by Gyeongsangnam-do (16.7%), Busan (10.9%), Daegu (10.3%), Incheon (9.0%), and Seoul (7.5%).

The surface treatment industry refers to the surface coating of metallic or non-metallic materials using physical and/or chemical surface coating techniques to improve aesthetics, durability, and surface properties. The number of enterprises (15,324) and number of workers (162,497) in the surface treatment industry account for 37.6% of enterprises and 42.8% of employees in the Ppuri industry. There are 6 large enterprises (0.0%), 27 mid-size enterprises (0.2%), 3,322 SMEs (21.7%), and 11,969 petty enterprises (78.1%). Gyeonggi-do has the highest regional concentration of businesses (34.5%), followed by Incheon (14%), Gyeongsangnam-do (11.2%), Daegu (9.7%), Busan (8.3%), and Seoul (6.6%).