



Volume 105

2019

p-ISSN: 0209-3324

e-ISSN: 2450-1549

DOI: <https://doi.org/10.20858/sjsutst.2019.105.15>



Silesian
University
of Technology

Journal homepage: <http://sjsutst.polsl.pl>

Article citation information:

Mindur, M. The development of sea transport in South Korea between 2002-2017. *Scientific Journal of Silesian University of Technology. Series Transport*. 2019, **105**, 183-199.
ISSN: 0209-3324. DOI: <https://doi.org/10.20858/sjsutst.2019.105.15>.

Maciej MINDUR¹

THE DEVELOPMENT OF SEA TRANSPORT IN SOUTH KOREA BETWEEN 2002-2017

Summary. The transformation of South Korea from one of the poorest countries in the world in the 1950s to an industrial power and a member of OECD was exceptionally fast. The policy promoting the import of raw materials and the latest technologies enabled Korea to join the group of the most rapidly growing economies in the world in 2004. Such an imposing growth rate was the result of booming industrial production, trade expansion to Asian, American and European markets and a liberal economic policy. The Korean economy is the most foreign-trade dependent country of all OECD members, with sea transport playing a predominant role. This article analyses basic Korean macroeconomic indicators within 2002-2018, with particular emphasis on the GDP. It discusses sea transport figures, including the cargo handling capacity of Korean ports, as well as port and logistics operations and the throughput of Busan, the largest South Korean and one of the largest seaport in the world. Additionally, this article shows innovation and ecology focus in the port of Busan, and primary directions of the state policy in the field of environmentally friendly growth.

Keywords: South Korea, port of Busan, cargo handling, modern technology, ecology

¹ The Lublin University of Technology, Nadbystrzycka 38 D Str., 20-618 Lublin, Poland.
Email: mmindur@vp.pl

1. INTRODUCTION

Next to Taiwan, Singapore, Malaysia and Thailand, South Korea is considered as one of the newly industrialised countries. These countries have a relatively developed public sector, reduced income disparities and high labour productivity. All above-mentioned countries noted rapid economic growth due to their offensive export policy and specialisation in manufacturing of highly processed industrial goods, which require the latest technologies.

The transformation of South Korea from one of the poorest countries in the world in the 1950s to an industrial power and a member of OECD was exceptionally fast (South Korea is a member of various international organisations, such as UN, G-20, Association of Southeast Asian Nations and World Trade Organization). The policy promoting the import of raw materials and the latest technologies enabled Korea to join the group of the most rapidly growing economies in the world in 2004. Such an imposing growth rate was the result of booming industrial production, trade expansion to the Asian, American and European markets and a liberal economic policy². In 2018, South Korea was the seventh largest exporter and 11th largest economy in the world³.

The Korean shipbuilding industry, competing with that of China and Japan, significantly contributes to the growth of the South Korean economy. In the 1970s and 1980s, South Korea became the lead producer of ships, including supertankers and oil rigs⁴. The country has maintained this status until today.

Such a fast economic growth needs to be matched with large capacity handling seaports. Busan, the largest South Korean transshipment port of south-east Asia and the fifth busiest container port in the world⁵, boasts of its outstanding results in this area.

2. SOUTH KOREAN ECONOMY

The development strategy of South Korea, a country that inherited industry, infrastructure and bureaucracy from Japan after the Japanese occupation, followed the footsteps of the same country. Therefore, after economic difficulties, the country started a phase of rapid economic growth as late as 1963⁶. Still, in the 1960s, the GDP per capita in South Korea was comparable to that of poorer countries in Africa and Asia. However, it grew from 6% of the OECD average in 1970 to 89% in 2017⁷.

In 2002–2008, the GDP was stable (with 4.65% average growth), whereas the lowest level was noted in 2009 (0.7%) as a result of a drop in export due to the global economic crisis. Nevertheless, due to direct stimulation measures implemented by the Korean government and strong domestic consumption, which compensated major reduction of exports, the Korean economy avoided recession contrary to the majority of industrialised economies, and the country noted positive economic growth in two consecutive years into the crisis. In 2010, the GDP growth was 6.5%, until 2018 when the economic growth slightly slowed down (with average annual growth of 3%). Initially, it was the result of shrinking

² Logistics. Science-research-development (ed. M. Mindura), ITE-PIB Warsaw - Radom, 2017, p. 619.

³ OECD Better Policies for Better Lives; <http://www.oecd.org/economy/korea-economic-snapshot/>

⁴ Ship Technology; <https://www.ship-technology.com/projects/hyundai-heavy-industries-ulsan-korea/>

⁵ World Shipping Council; <http://www.worldshipping.org/about-the-industry/global-trade/top-50-world-container-ports>

⁶ M. Mindur, *Transport in the age of globalization*, Warsaw- Radom, 2010, pp. 56-57.

⁷ OECD Better Policies for Better Lives; <http://www.oecd.org/economy/korea-economic-snapshot/>

domestic consumption and investment, and recently also the result of the downturn in exports, the economic slowdown in China and US customs policy towards Chinese goods (Tab. 1)⁸. In the period concerned, the unemployment rate was low and stable (from 3.1 to 3.8%).

Tab. 1

Basic macroeconomic figures in Republic of Korea in 2002-2018 (annual change in %)

Item	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
GDP	7,4	2,9	4,9	3,9	5,2	5,5	2,8	0,7	6,5	3,7	2,3	2,9	3,3	2,8	2,9	3,1	2,7
Private consumption	8,9	-0,5	0,3	4,4	4,6	7,2	6,0	2,7	7,0	6,7	4,2	2,9	2,8	3,1	2,5	2,6	2,8
Total investment	6,9	4,8	2,9	2,0	3,6	5,0	-0,9	0,3	5,5	0,8	-0,5	3,3	3,4	5,1	5,6	8,6	1,6
Unemployment rate	3,3	3,6	3,7	3,7	3,5	3,2	3,2	3,6	3,7	3,4	3,2	3,1	3,5	3,6	3,7	3,2	3,8
Government gross debt (% GDP) (surplus/deficit)	3,5	1,6	0,1	0,9	1,1	2,2	1,4	-1,5	1,3	1,4	1,3	1,0	0,6	0,0	1,0	1,4	1,7
Current account balance	0,8	1,8	3,9	1,4	0,4	0,9	0,2	3,7	2,6	1,4	4,0	5,9	5,9	7,6	6,9	4,9	4,7
Export	13,0	13,9	20,6	7,8	12,1	12,7	7,5	-0,3	12,7	15,1	5,1	4,3	2,0	-0,1	2,6	1,9	5,5

Source: The World Bank

Of all OECD countries, the Korean economy is the most dependent on foreign trade, which accounts for over 80% of its GDP, whereas goods and services exported from South Korea account for 43.1% of the total Korean production. The most important trade partner for South Korea is China. In 2018, China's import of Korean goods (chiefly electronic components) was 26.8% of the Korean exports. An equally important trade partner was the United States (12.1%), Vietnam (8%), Hong Kong (7.6%) and Japan (5.1%). As regards the continental distribution of Korean exports, Asia accounts for two thirds (67%) in terms of the value, North America 14.9%, and Europe 11.4% (including Germany 1.5%)⁹. The most valuable outbound shipments include electronic chips, refined oil products (oils), cars and spare parts and accessories.

⁸ The World Bank; <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=KR>

⁹ The World Factbook; <https://www.cia.gov/library/publications/the-world-factbook/geos/ks.html>

Tab. 2

Main exports from South Korea

Item	Value, in bn USD	% of total export
Electrical machinery, equipment	184,6	30,5
Machines including computers	77,7	12,8
Vehicles	61,2	10,1
Mineral fuels including oil	48,2	8,0
Plastics, plastics articles	34,9	5,8
Optical, technical and medical apparatus	27,8	4,6
Organic chemicals	25,4	4,2
Iran, steel	24,8	4,1
Ships, boats	20,3	3,4
Articles of iron or steel	10,5	1,7

Source: <http://www.worldstopexports.com/south-koreas-top-10-exports/>

The strengths of the Korean economy include its competitive factors. GDP spending on research and development (R&D) has been growing as well as the manufacturing of hi-tech products, which are the main export goods. Globally recognised Korean companies include Samsung, Hyundai, LG and Kia Motors.

3. SOUTH KOREAN SEA TRANSPORT

Sea transport plays an important role in South Korean trade, especially as it has a land border with North Korea only. Across its territorial waters, South Korea borders Japan in the east and south and China in the west. Since the country is separated from the Asian mainland, Korean ports are tremendously important in export and import¹⁰.

South Korea has a large number of various shipping companies. At the same time, the prolonged stagnation on the container transport market and heavy competition translated into a crisis for South Korean shipping companies. In 2017, Hanjin Shipping, the seventh largest container transport company in the world, went bankrupt. Therefore, the Korea Shipping Partnership, a coalition of 14 South Korean container transport companies, was formed to strengthen the domestic sea shipping sector and regain trust among previous foreign trade partners. The alliance was aimed at enhancing the competitiveness of the domestic container-shipping sector, among others, by opening new shipping lines, cooperation in developing the fleet, provision of joint services at international terminals and consultations on the reduction of operating costs.

In the 1970s and 1980s, South Korea had become the leading global manufacturer of ships, including supertankers and oil rigs. The main shipbuilding company in Korea is Hyundai, which in the middle of 1970s built the Ulsan Shipyard. Today, the shipyard operates ten dry docks with nine Goliath cranes. This enables the production of virtually any type and size of ship. Until 2018, the shipyard built over 2119 ships for 324 ship owners from 52

¹⁰ <https://www.searoutes.com/country-ports/South-Korea>

countries¹¹. In 2017, Daewoo Shipbuilding secured a contract worth 4.8 bn USD for 15 ice class arctic tankers to transport LNG from the Russian Jamal LNG Terminal. The government of South Korea developed a program worth 1.9 bn USD to support shipbuilding companies in winning more projects, in particular for LNG carriers¹². The 2018 order by Hyundai Merchant Marine provides for 20 mega-container vessels (twelve of 23 thou. TEU and eight of 14 thou. TEU) to be built by Daewoo Shipbuilding & Marine Engineering, Hyundai Heavy Industries and Samsung Heavy Industries. Moreover, Korean shipyards stand much chance to win one of the largest contracts ever for about 60 LNG carriers for Qatar¹³.

The said bankruptcy of Hanjin Shipping, which dramatically reduced sales figures in the Korean shipping sector, forced the government to focus on strengthening the shipbuilding industry. Specific steps include a three-year plan of building 200 ships by Hyundai Merchant Marine, included 140 bulk carriers and 60 container carriers¹⁴. Moreover, the government undertook to adjust ships to stringent environmental regulations adopted by the International Maritime Organization (IMO) pertaining to the reduction of sulfur oxides (SO_x) emission from ships. Beginning from 2020, the global sulfur cap is going to be 0.5% m/m.

In 2017, the Republic of Korea had 1907 ships, including 89 container carriers, 394 general cargo vessels, 201 tankers and 1123 other ships¹⁵.

In 2017, the total cargo handling capacity of Korean ports was 1164 m tons, which accounted for 1.6 times increase from 737 m tons in 2007 and 2.4 times compared to 2002. When compared with 2016, cargo handling increased by 23.653 m tons (2.1%). The total capacity of vessels under the national flag was 45.729 m. Compared with the previous year, the capacity increase by 1134 m tons (2.5%) as regards tonnage, by 965 thou. tons (1.9%) in DWT and nearly 106 thou. TEU (44.9%)¹⁶.

Tab. 3

Cargo handling by ports and ships registered under the Korean flag

Year	Cargo handling capacity, in thou. tons	Ships under the national flag		
		Tonnage (tons)	DWT (tons)	Containers (TEU)
2002	486 889	15 295 015	-	-
2007	737 456	24 139 666	-	-
2010	928 524	31 285 948	-	-
2012	1 017 190	40 128 889	-	-
2013	1 024 977	43 709 221	-	-
2014	1 109 669	46 196 572	50 378 310	471 976
2015	1 139 693	46 498 120	50 962 232	516 606
2016 (A)	1 140 799	44 595 009	50 482 148	235 003

¹¹ Ship Technology; <https://www.ship-technology.com/projects/hyundai-heavy-industries-ulsan-korea/>

¹² Lee K.: South Korea's Infrastructure Vision, Reconnecting Asia 2018; <https://reconnectingasia.csis.org/analysis/entries/south-koreas-infrastructure-vision/>

¹³ The Wall Street Journal, Korea's Mega-Merger of Shipyards Set to Dominate Global Shipbuilding; <https://www.wsj.com/articles/koreas-mega-merger-of-shipyards-set-to-dominate-global-shipbuilding-11549475888>

¹⁴ PortalMorski.pl: South Korea orders 200 ships, <https://www.portalmorski.pl/stocznie-statki/38944-korea-poludniowa-zamawia-200-statkow>

¹⁵ http://www.indexmundi.com/south_korea/merchant_marine.html

¹⁶ Explore Korea through Statistics 2018, p. 72

2017 (B)	1 164 452	45 728 557	51 446 672	340 514
Change (B-A)	23 653	1 133 548	964 524	105 511
Rate (%)	2,1	2,5	1,9	44,9

Source: Explore Korea through Statistics 2018, p. 72.

Six Korean major ports are located on the coast, including the largest port of Busan. Other large ports include Gunsan (Kunsan), Gwangyang, Incheon, Masan, Mokpo and Ulsan.

In total, in 2017, South Korean ports handled 1.57 bn tons of cargo. Compared to the previous year, it counted for an increase of 4.1%. The largest increase was noted in the transport of vehicles (14.4%), lignite (11.6%) and machinery (8.3%), whereas in the handling of sand and steel, the sector noted a decrease of 35.9 and 12.8%, respectively. At the same time, container handling increased by 1.7% to 1.09 bn tons, whereas the container transport increased by 5.4% to 27.42 bn TEU.

In 2017, ports of Busan, Gwangyang and Incheon noted an increase in cargo handling by 10.5, 3.1 and 2.4%, respectively, chiefly due to the growing export of vehicles and import of coal and machinery. The contribution of those ports to the total container traffic in Korean ports is shown in Fig. 1. In 2017, the Port of Busan handled 400.5 m tons of cargo, Gwangyang 291.83 m tons, and the port of Ulsan 202.36 m tons. Increased demand for microchips and petrochemical products translated into the increase in export to China by 9%, and to the United States by 6.7%¹⁷.

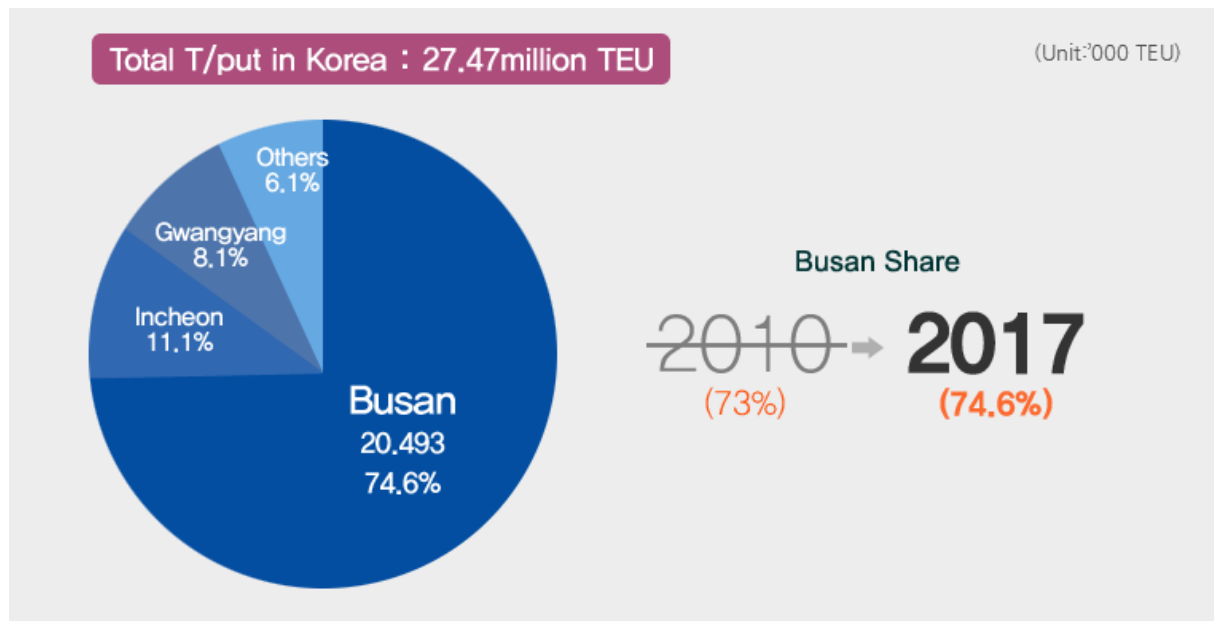


Fig. 1. Container handling in ports of Busan, Gwangyang and Incheon in 2017

Source: <http://www.busanpa.com/eng/Contents.do?mCode=MN0042>

¹⁷ Safety 4Sea; <https://safety4sea.com/south-korean-ports-see-4-1-volume-increase-in-2017/>

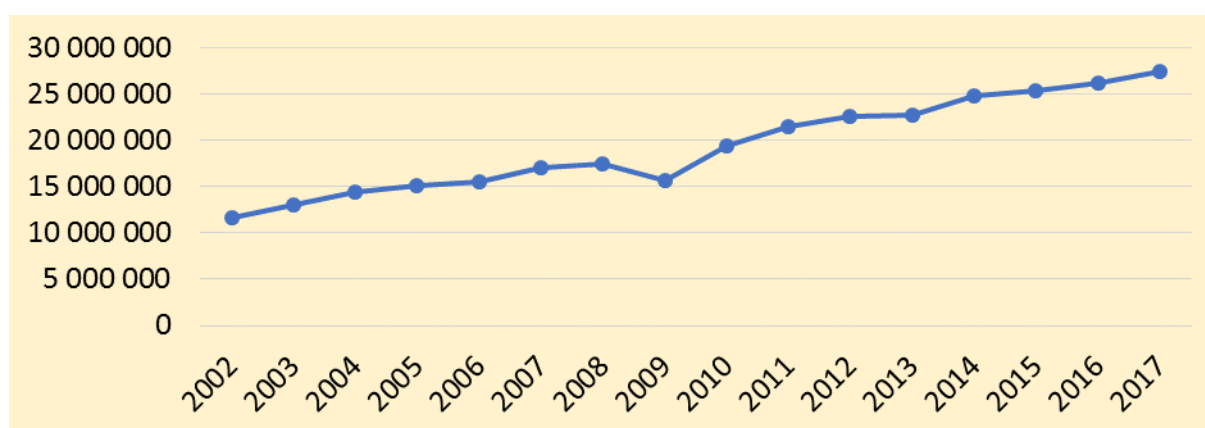


Fig. 2. Container traffic in the ports of the Republic of Korea in 2002–2017 (million TEU)

Source:

https://data.worldbank.org/indicator/IS.SHP.GOOD.TU?end=2017&locations=KR&name_desc=true&start=2000&view=chart

4. PORT AND LOGISTICS ACTIVITY IN THE PORT OF BUSAN

The largest Korean port of Busan is situated at the estuary of the Nakdong River. In 2016, it was the largest cargo port in South-East Asia and the fifth busiest container port in the world¹⁸, and in 2017, it was the sixth largest port regarding container handling (Tab. 4). The length of the coastline of the port is 26.8 km. Thus, enabling the mooring of 169 ships at the same time, including passenger and oil terminals, and handles 91 m tons annually¹⁹.

Tab. 4

Containers handled in ten busiest ports in the world in 2016

Position	Port	2016	2017	Increase, in %
1	Shanghai	37 133	40 300	8,5
2	Singapore	30 904	33 666	8,9
3	Shenzhen	23 997	26 000	7,3
4	Ningbo	21 560	25 970	20,4
6/5	Hong Kong	19 579	20 750	4,8
5/6	Busan	19 456	20 473	5,2

Source: <https://english.busan.go.kr/bsport>

¹⁸ World Shipping Council; <http://www.worldshipping.org/about-the-industry/global-trade/top-50-world-container-ports>

¹⁹ <http://www.ship-technology.com/projects/portofbusan/>

The port of Busan consists of four modern sections: North Port, South Port, Gamcheon Port and Dadaepo Port. It also includes five container terminals and three passenger terminals. The port infrastructure is complemented by well-equipped logistics centres.

The North Port handles both passengers and cargo, and its capacity is extended by the Gamcheon Port (ship technology). In the South Port is located the Busan Cooperative Fish Market, the largest fish processing hub in Korea, dealing with 30% of the total sea catch. It operates processing plants and cold storage facilities necessary to support fish product retail. Located in the west is the Dadaepo Port, which previously handled ships scheduled for maintenance and passenger vessels, and supports coastal fishing. Although the port meets all requirements of an environmentally friendly port, it will be transformed into an ecological port in the future.

The Jaseongdae container terminal occupies an area of 624 km². It is operated by Hutchison Korea Terminals Co. The terminal berth of 1447 m can receive four ships of up DWT 50 thou. at once. The annual cargo handling capacity of the terminal is 1.7 m TEU.

UAM, another container terminal, occupies 182 km² and the length of its berth is 500 m. It can handle one ship of DWT 20 thou. and two ships of 5 thou. tons. The annual cargo handling capacity of the terminal is 300 thou. TEU.

Yet another container terminal Gamman of 727 km² is operated by four companies, namely, Global Enterprises, Hanjin Shipping, Korea Express and Hutchison Korea Terminal Ltd. The terminal is furnished with modern container handling equipment. The length of the berth is 1400 m and it is sufficient for mooring four vessels of up to DWT 50 thou. The annual cargo handling capacity of the terminal is 1.56 m TEU.

Opened in June 1991, the Sinseondae container terminal of 1170 km² is equipped with advanced loading and unloading systems, including large speed container cranes capable of handling Post-Panamax container carriers. The operator for the terminal is CJ Korea Express Busan Container Terminal Co. Ltd. Some of the facilities include a berth of 1500 m capable of receiving five ships of up to DWT 50 thou. The annual cargo handling capacity of the terminal is 2 m TEU.

Singamman, a container terminal established in April 2002, is operated by Dongbu Busan Container Terminal Co. Ltd. Its berth of 826 m enables handling of two vessels of DWT 50 thou. and one of DWT 5 thou. It occupies an area of 294 km² and has an annual cargo handling capacity of 780 thou. TEU.

Since August 2012, the Busan Port International Ship Chandling Center has been operating in the port of Busan. A complex of five-level buildings of over 33 thou. m² house, most modern warehouses and offices. The centre supports airports, seaports and rail hubs providing comprehensive administration, logistics and port services necessary to promote efficient shipments.

In 1997, to improve the attractiveness of port services and guarantee speedy and efficient cargo handling, the decision to develop a new technologically advanced mega-port of Busan New Port (BPA) was made. The first stage of the port development was implemented by 2006, and its completion is scheduled for 2020.

The deep-sea Busan New Port (draft in excess of 17 m) is situated west of the old port on the Island of Gaduk. It is furnished with modern technological equipment and infrastructure, including innovative automated systems (for example, latest berth-side cranes, UAVs, automated gantry cranes, real-time monitoring systems) capable of handling vessels of 19

thou. TEU. The current 23 berthing facilities for container carriers (target is 45) are suitable for handling 10 m TEU annually²⁰.

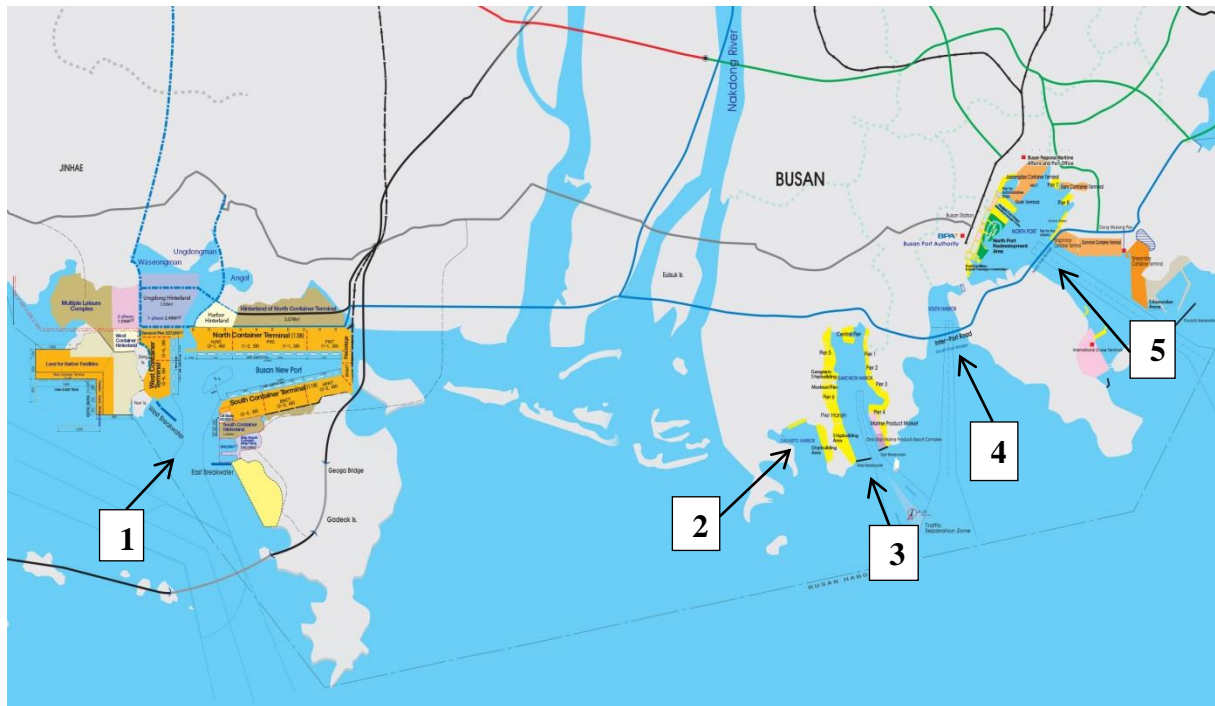


Fig. 3. Ports of Busan (left: 1 – Busan New Port, 2 – Dadaepo Port, 3 – Gamcheon Port, 4 – South Port, 5 – North Port)

Source: <http://www.busanpa.com/eng/Contents.do?mCode=MN0031>

Tab. 5

Current status and particulars of container terminals in the port of Busan

	Jaseongdae	Shinseondae	Gamman	Shingamman	Uam
Total area (thou. m ²)	624	1170	727	294	182
CY area (1000m ²)	335	804	384	153	156
Berth length (m)	1447	1500	1400	826	500
Capacity (DWT)	50,000 × 4 10,000 × 1	50,000 × 5	50,000 × 4	50,000 × 25,000 × 1	20,000 × 15,000 × 2
Capacity (1000 TEU)	1722	2236	1600	819	300

²⁰ Busan Port Authority; <http://www.busanpa.com/eng/Contents.do?mCode=MN0031>

	Jaseongdae	Shinseondae	Gamman	Shingamman	Uam
Draft (m)	15	15 ~ 16	15	15	11
In operation since	1978/9	1991/6	1998/4	2002/4	1996/9
Operator	Korea Huchson Terminal Co., Ltd.	KBCT	BICT, BGCT	Dongbu Busan Co., Ltd.	-
Busan New Port					
	Jetty 1	Jetty 2	Jetty 3	Jetty 4	Jetty 5
Total area (thou. m ²)	840	1210	688	553	785
CY area (1000m ²)	282	525	346	213	154
Berth (m)	1200	2000	1100	1150	1400
Ship handling in DWT	50,000 × 3	50,000 × 6	50,000 × 6 200,000 × 2	50,000 × 2 20,000 × 2	50,000 × 4
Capacity (thou. TEU)	2091	3677	2310	1936	2440
Draft (m)	16	16 ~ 17	18	16 ~ 17	17
In operation since	2010/3	2006/1	2009/2	2010/2	2012/1
Operator	PNIT	PNC	Hanjin New Port Company Terminal (HJNC)	Hyundai Pusan New-Port Terminal, Ltd.	BNCT Inc.

Source: <https://english.busan.go.kr/bsport>

In the Busan New Port – Distripark (Fig. 4), an integrated logistics complex still under construction, companies will be able to provide logistics, distribution and shipping services to international businesses, as well as companies based in the Free Economic Zone of Busan-Jinhae. Distripark has been designated as a free trade zone where foreign logistics businesses can enjoy affordable rent and tax exemptions. The total logistics operation area of 8.5 km² is

expected to support processing, storage, sorting, labelling, testing, packaging and warehousing of goods shortly before their delivery to customers, as well as disassembly/assembly services for automotive components and door-to-door service. Distripark has access to all modes of transport, including seaports, airports, rail and road. The completion of the project is scheduled for 2030²¹.

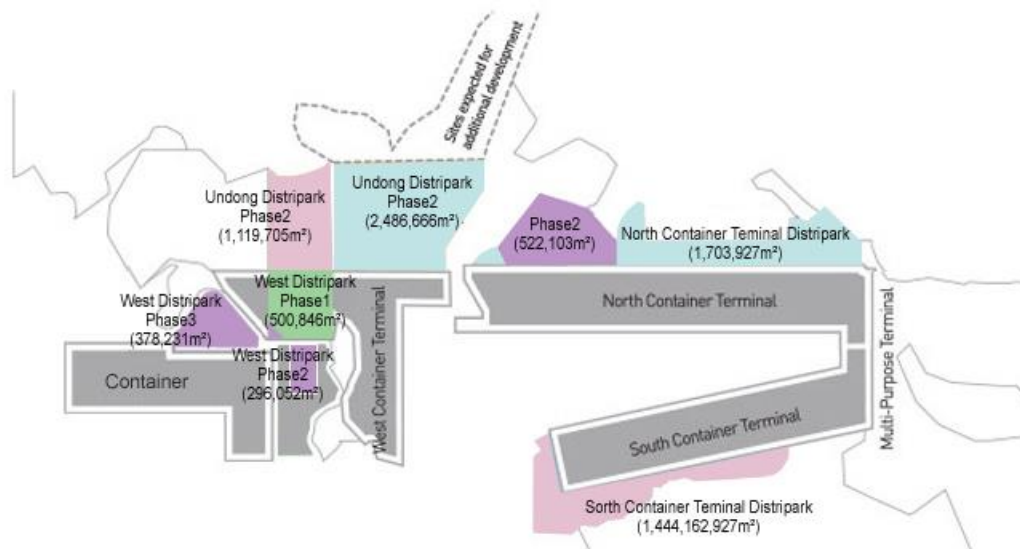


Fig. 4. Distripark Plan

Source: <http://www.busanpa.com/eng/Contents.do?mCode=MN0068>

The Busan New Port uses the latest technologies and facilities. For example, at jetty 5, due to the vertical automation project and latest operating equipment, stevedoring equipment in each section can operate independently which translates into high productivity. The number of trucks entering the port is limited to reduce congestion and risk of accidents, as well as the CO₂ emission. The jetty 5 operation system is shown in Fig. 5. The figure includes 1) loading/unloading of containers to/from a ship using a container crane, 2) transfer of cargo to the berth – a frame bridge vehicle transports containers from the ship side (inner wall) to the container yard at the waterfront, 3) port services – container yard operation is fully automated, including an automatic gantry crane and transport of containers from the container bay to the seaside (automatic loading section) or the ground side (external truck operation), 4) crossing the gate – when a truck approaches the gate, the RFID system checks its ID data. At the same time, the monitoring system at the gate identifies the container. When the container passes the gate, the system designates a working area and directs the driver to the relevant section.

BPA also plans to facilitate the flow of cargo between the old and new ports (a distance of 25 km) and it is now implementing an inter-terminal transfer (ITT) platform to optimise truck operation between the two facilities, as well as to reduce overall cost²². Since the measures are a part of a long-term strategy, BPA is going to consider subsidising certain costs incurred by shipping companies.

²¹ http://www.investkorea.org/busan_en/project/project.do?mode=view&articleNo=202208

²² Port Technology; https://www.porttechnology.org/news/busan_in_massive_10bn_expansion_plan

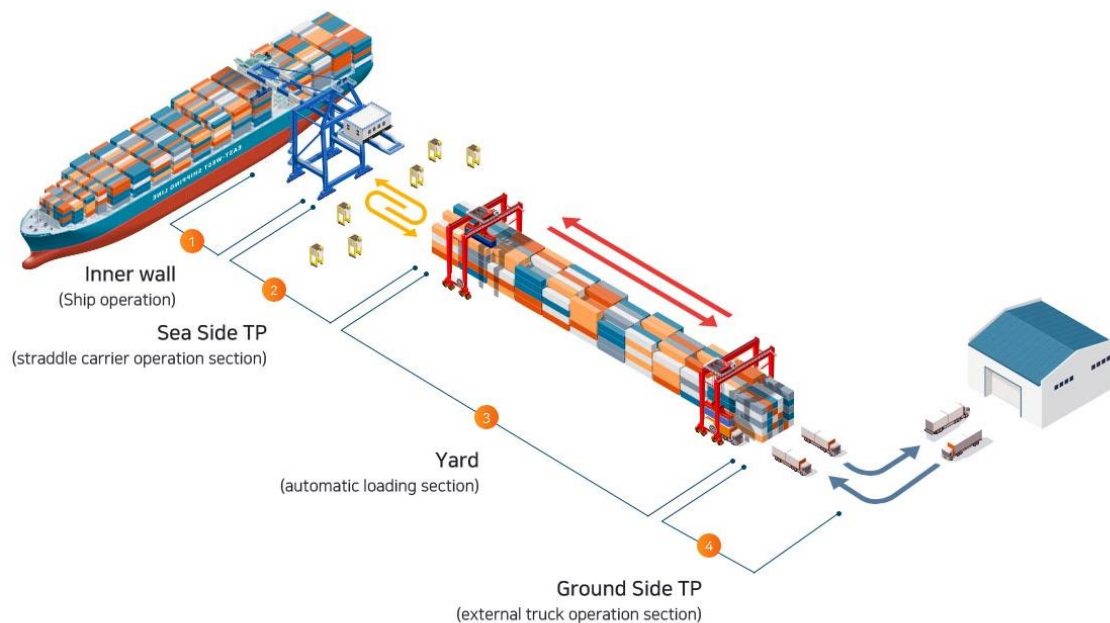


Fig. 5. Cargo handling at jetty 5 in Busan New Port

Source: <https://www.intergis.co.kr/eng/CMS/Contents/Contents.do?mCode=MN061>

5. CAPACITY OF BUSAN SEAPORT

The port of Busan handles nearly 40% of the total cargo volume transported by sea, 80% containers and 42% domestic fish catch and fish products. The port handles 130 ships per day. The number of containers handled in the port has been gradually growing. In 2017, the port handled 20.5 m TEU, which accounted for 42% increase compared with 2005 and 5% compared with 2016.

In 2017, the port of Busan handled 5,022,321 TEU in import, 5,143,952 TEU in export and 10,225,417 TEU in transshipment (T/S). The total 2017 container handling in the port was 20,493,475 TEU (Table 6).

Tab. 6

Containers throughput in the port of Busan in import, export and T/S in 2004-2017 (in TEU)

Year	Total traffic	Inbound	Outbound	T/S	Coastal
2017	20 493 475	5,022,321	5,143,952	10,225,417	81 785
2016	19 456 291	4,801,127	4,819,339	9,835,826	0
2015	19,486,725	4,713,229	4,650,168	10,105,318	10
2014	18 683 283	4,596,287	4,657,639	9,429,355	3
2013	17,686,099	4,424,105	4,509,339	8,748,453	4,202

Year	Total traffic	Inbound	Outbound	T/S	Coastal
2012	17,040,567	4,381,636	4,426,418	8,142,052	90 461
2011	16,184,706	4,402,736	4,305,315	7,352,539	124,116
2010	14,194,334	3,913,611	3,922,723	6,276,458	81,542
2009	11 980 325	3 266 708	3 302 018	5,372,485	39.114
2008	13 452 786	3,853,127	3,784,946	5,807,848	6 865
2007	13 261 484	3,752,747	3,691,003	5,811,167	6567
2006	12 038 786	3,429,141	3,374,042	5,207,731	27 772
2005	11 843 151	3,309,202	3,270,036	5,178,798	85115
2004	11 491 968	3,286,361	3,308,609	4,791,942	105 056

Source: <http://www.busanpa.com/eng/Contents.do?mCode=MN0042>

6. INNOVATION AND ENVIRONMENTAL APPROACH IN PORT OF BUSAN

The ever increasing sizes of vessels and growing volumes of cargo in ports necessitated innovation. In order to preserve competitiveness, new technologies are introduced globally, such as combined data exchange platforms, cloud services and mobile devices²³. Furthermore, the port of Busan is modernising its infrastructure in line with the latest trends to catch up with global leaders, in particular, Chinese ports that dominate in the region.

In 2019, the port plans to introduce the IoT platform together with KL-NET²⁴. KL-Net supports electronic data exchange (EDI) in logistics, integration of systems, IT advisory and logistics solutions for the maritime industry in South Korea²⁵. The system supports, among others, electronic exchange of the entry/leave declaration, cargo declaration, as well as reservation, bill of lading, transport and shipment. After the introduction of the system, IoT sensors in containers will enable real-time information exchange, including location, ambient temperature and humidity of cargo.

The port of Busan uses the Tandem-40' system that enables the simultaneous handling of two 40' or four 20' containers. Modern quayside cranes can load up to 8 levels of containers on a ship (11 pcs) and 10 levels (1 pcs) in the case of standard containers. It is also possible to stack 24 rows (width of container stacking). The tandem system can handle from 35 to 40 containers, whereas regular cranes handle from 25 to 30 containers²⁶. Cargo handling is supported by 38 unmanned automatic electric cranes (ATC) in the Hyundai Busan Newport Terminal.

²³ <https://bcg.com/publications/2018/to-get-smart-ports-go-digital.aspx>

²⁴ <http://koreabizwire.com/busan-port-incorporates-iot-to-boost-competitiveness/77548>

²⁵ <https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=9637232>

²⁶ https://www.hpnt.co.kr/homepage/eng/webpage/ter_equ.jsp

The Port of Busan is interested in using the blockchain technology²⁷ that helps to reduce cost related to paper freight documentation and customs payments. Such a decentralised and distributed database of transactions is accessible over the internet and can be used for recording individual transactions, payments and accounting records. The blockchain technology does not require the operation of central computers and does not have a centralised data storage. At the same time, the coding based on encryption algorithms makes it resistant to cyberattacks. The blockchain technology is already used to protect data of containers, tracing and tracking of cargo in Antwerp and Rotterdam²⁸.

In line with the Framework Act on Low Carbon, Green Growth, adopted by the Korean government in 2010, the port of Busan promotes “green management of port operations”²⁹. Diesel engines in a number of machines and equipment have been replaced with electric ones which significantly reduced the emission of greenhouse gases. With the aim of improving energy efficiency, roofs of warehouses and gates are furnished with PV panels, and office facilities in the New Port of Busan also use geothermal and solar energy. Moreover, ships of higher Environmental Ship Index³⁰ may enjoy exemptions or reduced rates of port fees.

In 2018, the Port of Busan entered into a cooperation contract with Korea Gas Corporation (KOGAS) to develop a bunkering system in the port. Both companies undertook to develop a feasibility study for the LNG bunkering method to supply LNG to ships entering the port of Busan. Under the project, the parties are going to examine LNG bunkering systems and various business issues, and in 2019, a floating LNG bunkering terminal would be built. A gradual shift to LNG propulsion in the national fleet is expected to significantly reduce the emission of solid particles from ships. According to the governmental agency, the emission from ships of total sulfur oxides and solid particles account for 73 and 51%³¹, respectively, in the city of Busan

7. SUMMARY

The multiple-year government intervention and investment in modern technologies made South Korea one of the most developed economies in the region. The government focuses on the development of the industry and speedy implementation of new technologies in existing and new facilities to expedite economic growth, boost production of goods, especially those to be exported to foreign markets, and develop competitive advantages. Not without significance was the financial aid for the South Korean economy granted by the United States (in 1946–1978, the United States offered about 60 bn USD in grants and loans). Yet another important factor was the financial crisis of 1997, triggered by the bankruptcy of six out of the thirty largest industrial conglomerates (*chaebol*). Then, the Korean government received a loan of 58 bn USD from the International Monetary Fund. The loan was granted with conditions that Korea tightens its fiscal and monetary policy and engage in far-reaching

²⁷ <https://medium.com/@nakanishi.g1106/south-korean-blockchain-week-in-busan-lucid-crypto-and-module-token-f605f2d5de8c>

²⁸ <https://bcg.com/publications/2018/to-get-smart-ports-go-digital.aspx>

²⁹ https://www.hpnt.co.kr/homepage/eng/webpage/ter_pos.jsp

³⁰ GreenPort, Environmental Stewardship at Busan; <https://www.greenport.com/news101/asia/environmental-stewardship-at-busan>

³¹ GreenPort, Port of Busan Bunkering Agreement; <https://www.greenport.com/news101/lng/port-of-busan-bunkering-agreement>

market reforms in sectors of finance and corporations, as well as the labour market policy. Additionally, South Korea agreed to open its economy to foreign goods and investors³².

The South Korean maritime policy has been shaped by three major factors, namely, the geopolitical situation, shortage of natural resources and the socio-economic program. The latter led to the creation of new jobs in the 1980s, the establishment of the pension system and improvement of the living standard. Therefore, the role of Korean ports in the national economy is particularly important, since they account for 99% of inbound and outbound goods³³.

The concentrated activity enhanced the position of the port of Busan and turned it to one of the most important logistics centres in South-East Asia. One of its advantages is the strategic location on the crossroads from North-East China, Japan and Russia, within the main transport corridor to Europe and America. The port of Busan enjoys excellent natural conditions, such as sheltering by nearby mountains and islands, considerably limited ebbs and three main sea routes in the vicinity.

According to the mid-term and long-term strategic plans of the Port of Busan, the quality of port services should improve to reach 30 m TEU by 2025. The modernisation and extension of the port, implementation of modern cargo handling technologies and the building of a broad logistics network to establish a mega-hub is to attract global companies and enhance the creation of new jobs. Activities planned are accompanied by incentives to establish one's business in the port, such as tax and customs exemptions and business consulting³⁴.

Korea is at the forefront of green growth initiatives. The 2009-2050 National Strategy for Green Growth and the five-year plan (2009-2013) established a comprehensive state policy framework in Korea, promoting environmentally friendly growth both short and long-term. In the longer-term perspective, the National **Strategy for Green Growth is designed to** promote new initiatives to improve the status of the natural environment and living standards for citizens, as well as active participation in international climate change programs.

References

1. BCG. To Get Smart, Ports Go Digital. Available at: <https://bcg.com/publications/2018/to-get-smart-ports-go-digital.aspx>.
2. Bloomberg. Available at: <https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=9637232>.
3. Buková Bibiána, Eva Brumerčíková, Pavlína Kolářová. 2015. "A study of a logistics transport chain in the transport of selected commodity from eastern Europe to China". *Naše More* 62(4): 256-263.
4. Busan Port. Available at: <https://www.busanpa.com/eng/Contents.do?mCode=MN0031>.
5. Busan Port Logistics. Available at: <https://english.busan.go.kr/bsport>.
6. Busan Port Authority. Available at: <http://www.busanpa.com/eng/>.
7. Busan Regional Office of Oceans and Fisheries. Available at: <http://portbusan.go.kr/eng/contents/intr010101.jsp>.

³² EveryCRSReport.com, South Korea-U.S. Economic Relations; https://www.everycrsreport.com/reports/RL30566.html#_Toc228343868

³³ Busan Regional Office of Oceans and Fisheries; <http://portbusan.go.kr/eng/contents/intr010101.jsp>

³⁴ <http://www.busanpa.com/eng/Contents.do?mCode=MN0008>

8. Dynamic BUSAN. Available at: https://www.investkorea.org/busan_en/project/project.do?mode=view&articleNo=202208.
9. EveryCRSRReport.com, South Korea-U.S. Economic Relations. Available at: https://www.everycrsreport.com/reports/RL30566.html#_Toc228343868.
10. Explore Korea through Statistics 2018.
11. GreenPort, Environmental Stewardship at Busan. Available at: <https://www.greenport.com/news101/asia/environmental-stewardship-at-busan>.
12. GreenPort, Port of Busan Bunkering Agreement. Available at: <https://www.greenport.com/news101/Ing/port-of-busan-bunkering-agreement>.
13. Indexmundi. Available at: http://www.indexmundi.com/south_korea/merchant_marine.html.
14. INTERGIS. Available at: <https://www.intergis.co.kr/eng/CMS/Contents/Contents.do?mCode=MN061>.
15. Knoema. Available at: <https://knoema.com/atlas/Republic-of-Korea/Current-account-balance-as-a-share-of-GDP>.
16. Lee K. South Korea's Infrastructure Vision, Reconnecting Asia. 2018. Available at: <https://reconnectingasia.csis.org/analysis/entries/south-koreas-infrastructure-vision/>.
17. List of ports in South Korea. Available at: <https://www.searoutes.com/country-ports/South-Korea>.
18. Medium. South Korean Blockchain Week in Busan -Lucid Crypto and Module Token. Available at: <https://medium.com/@nakanishi.g1106/south-korean-blockchain-week-in-busan-lucid-crypto-and-module-token-f605f2d5de8c>.
19. Mindur L. (Ed.). 2014. *Technologie transportowe*. [In Polish: *Transport technologies*]. Radom: ITE-PIB.
20. Mindur M. (Ed.). 2017. *Logistyka. Nauka-badania-rozwoj* [In Polish: *Logistics. Science-research-development*]. Radom: ITE-PIB.
21. Mindur M. 2010. *Transport w erze globalizacji*. [In Polish: *Transport in the age of globalization*]. Radom: ITE-PIB.
22. Obed Ndikom, Nwokedi Theophilus C., Sodiq Olusegun Buhari. 2017. "An appraisal of demurrage policies and charges of maritime operators in nigerian seaport terminals: the shipping industry and economic implications". *Naše More* 64(3): 90-99.
23. OECD Better Policies for Better Lives. Available at: <http://www.oecd.org/economy/korea-economic-snapshot/>.
24. Port Technology. Available at: https://www.porttechnology.org/news/busan_in_massive_10bn_expansion_plan.
25. PortalMorski.pl: South Korea orders 200 ships. Available at: <https://www.portalmorski.pl/stocznie-statki/38944-korea-poludniowa-zamawia-200-statkow>.
26. PSA HPNT. Available at: https://www.hpnt.co.kr/homepage/eng/webpage/ter_equ.jsp.
27. Safety 4Sea. Available at: <https://safety4sea.com/south-korean-ports-see-4-1-volume-increase-in-2017/>.
28. Ship Technology. Available at: <https://www.ship-technology.com/projects/hyundai-heavy-industries-ulsan-korea/>.
29. Ship Technology. Available at: <https://www.ship-technology.com/projects/portofbusan/>.
30. The World Bank. Container port traffic. Available at: https://data.worldbank.org/indicator/IS.SHP.GOOD.TU?end=2017&locations=KR&name_desc=true&start=2000&view=chart.

31. The Korea Bizwire. Available at: <http://koreabizwire.com/busan-port-incorporates-iot-to-boost-competitiveness/77548>.
32. The Wall Street Journal, Korea's Mega-Merger of Shipyards Set to Dominate Global Shipbuilding. Available at: <https://www.wsj.com/articles/koreas-mega-merger-of-shipyards-set-to-dominate-global-shipbuilding-11549475888>.
33. The World Bank. Available at: <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=KR>.
34. The World Factbook. Available at: <https://www.cia.gov/library/publications/the-world-factbook/geos/ks.html>.
35. World Shipping Council. Available at: <http://www.worldshipping.org/about-the-industry/global-trade/top-50-world-container-ports>.
36. World's Top Exports. Available at: <http://www.worldstopexports.com/south-koreas-top-10-exports/>.

Received 14.09.2019; accepted in revised form 09.11.2019



Scientific Journal of Silesian University of Technology. Series Transport is licensed under a Creative Commons Attribution 4.0 International License