물류학박사 학위논문

An Empirical Analysis on Key Factors Affecting the Introduction of Foldable Containers on Russian Transportation Market

러시아 운송 시장에서 접이식 컨테이너 도입에 영향을 미치는 핵심 요인에 대한 실증 분석

지도교수 신창훈

2019년 02월

한국해양대학교 대학원

물류시스템학과

DEN MARIIA

물류학박사 학위논문

An Empirical Analysis on Key Factors Affecting the Introduction of Foldable Containers on Russian Transportation Market

러시아 운송 시장에서 접이식 컨테이너 도입에 영향을 미치는 핵심 요인에 대한 실증 분석

지도교수 신창훈

2019년 02월

한국해양대학교 대학원

물류시스템학과

DEN MARIIA

본 논문을 DEN MARIIA의 물류학박사 학위논문으로 인준함

위원장 : 김율성 인

위 원 : 김시현 인

위 원 : 신재영 인

위 원 : 강정식 인

위 원 : 신창훈 인

2018 년 12 월

한국해양대학교 대학원

Contents

List of Tables

List of Figures

An Empirical Analysis on Key Factors Affecting the Introduction of Foldable Containers on Russian Transportation Market

DEN MARIIA

Department of Logistics
Graduate School of Korea Maritime and Ocean University

Abstract

The total container turnover of Russian seaports in 2017 amounted to 4.62 million TEUs, however, empty containers occupied 40% of the export traffic. In the same year, Russian railways transported about 4 million TEUs, but 32.6% of them were empty. Such significant amount of empty traffic causes problems for Russian transportation sector. It is notable that many recent studies reveal that foldable containers may be an effective and innovative solution to the empty container traffic problem. Furthermore, Moon et al. (2013) noted that foldable containers could become cheaper and their use is going to be more beneficial in case of an extensive adoption of container-folding technologies. Konings (2005) found that foldable containers might lead to substantial net benefits in the total chain of container transport, if they were used more extensively in the transportation chain.

Russia has a great potential role in the global transportation system, primarily due to its geographical location. Today, the world transportation system's development tends toward global integration. In order to become a major participant, Russia must not rely on its successful geographical location only, because without proper technical innovations this advantage is not going to be enough. Thus, it would be very unwise for Russian container transportation executives to overlook such promising technology as foldable containers.

In this paper, we studied the opportunities for foldable container technology

application in Russian transportation industry; the factors that may promote or hamper the application process were analyzed as well. To inquire the professional opinion on the empty container traffic issue and important aspects of containerized shipments, the survey were conducted for subsequent Factor Analysis and ANOVA. The final goal of the survey was to determine the market's interest in foldable containers. In addition, in order to contribute to the knowledge of foldable containers potential gains, the Cost-Benefit analysis along with the Sensitivity Analysis of Busan-Vostochny-Moscow route (maritime/continental concept) were conducted. Further, on the port-to-port concept, the estimates were adopted from the 2005-2017 data for Busan - Vladivostok/Vostochny container route.

1. Introduction

1.1 Background and objectives

In 2017, the total container turnover of Russian seaports amounted to 4.62 million TEUs, the share of outbound containers was 41.7%, inbound - 42.1%. Thus, the shares of exports and imports were almost the same. However, empty containers occupied 40% of export traffic and 4% of import traffic. It is also worth noting that in 2013, before the Russian financial crisis of 2014-2015, when the total container turnover was 5.35 million TEUs, empty containers accounted for 67% of export traffic. Table 1 presents the volumes of empty containers that passed through Russian Seaports in 2008-2017 by route type.

Table 1 The container throughput in Russian seaports, million TEUs.

Year	TOTAL			Export			Import		
	Laden	Empty	%empty	Laden	Empty	%empty	Laden	Empty	%empty
2008	2.488	1.287	**34%**	0.544	1.149	**68%**	1.688	0.014	**1%**
2009	1.791	0.729	**29%**	0.492	0.568	**54%**	1.043	0.017	**2%**
2010	2.443	1.147	**32%**	0.580	0.950	**62%**	1.595	0.035	**2%**
2011	3.038	1.602	**35%**	0.701	1.359	**66%**	2.028	0.042	**2%**
2012	3.343	1.726	**34%**	0.767	1.433	**65%**	2.267	0.033	**1%**
2013	3.503	1.849	**35%**	0.769	1.536	**67%**	2.318	0.032	**1%**
2014	3.617	1.670	**32%**	0.925	1.385	**60%**	2.273	0.017	**1%**
2015	2.912	1.038	**26%**	0.933	0.717	**43%**	1.570	0.070	**4%**
2016	3.047	0.943	**24%**	1.048	0.592	**36%**	1.567	0.103	**6%**
2017	3.517	1.103	**24%**	1.169	0.751	**39%**	1.872	0.078	**4%**

Year	Transit			Cabotage		
	Laden	Empty	%empty	Laden	Empty	%empty
2008	0.008	0.002	**20%**	0.248	0.122	**33%**
2009	0.009	0.001	**10%**	0.247	0.143	**37%**
2010	0.005	0.005	**50%**	0.264	0.156	**37%**
2011	0.020	0.010	**33%**	0.289	0.191	**40%**
2012	0.042	0.027	**39%**	0.268	0.232	**46%**
2013	0.058	0.036	**38%**	0.357	0.246	**41%**
2014	0.065	0.036	**36%**	0.354	0.232	**40%**
2015	0.051	0.019	**27%**	0.357	0.233	**39%**
2016	0.049	0.001	**2%**	0.393	0.247	**39%**
2017	0.063	0.004	**6%**	0.414	0.270	**39%**

Source: Association of Sea Commercial Ports (ASOP)

Over the past 10 years, the share of empty export sea containers remained high. The peak values of empty share were observed in high export years (2011, 2012, and 2013).

In 2016, global empty incidence accounted for 24.6% (source: Drewry Maritime Research "Container Forecaster & Annual Review 2017/18"). In European ports empty containers amounted to 18% of the export traffic and 19% of the import traffic. Specifically: in Dutch ports empty containers amounted to 22% of export traffic and 20% of import traffic, in German ports - 10% and 18%, respectively (source: Eurostat).

Empty containers amounted to 22% of export traffic and 33% of import traffic in South Korean ports (source: Busan port statistics). In Hong Kong empty containers amounted to 14.1% of total loaded containers and 14.5% of total discharged containers (source: port of Hong Kong statistical tables, Container Throughput by Main Cargo Handling Location).

Therefore, we can conclude that there is a high level of imbalance between empty export and import traffic values in Russian ports.

In 2017, almost 4 million TEUs were transported by Russian railway network, but 32.6% of them were empty. Transportation of empty containers amounted to 49.7% of all domestic traffic, export containers - 12.9%, import containers - 23.5%. In 2013, the share of empty containers in total container traffic was 32%, however, empty export traffic accounted for 29.6%, import traffic for 17.8%.

Table 2 presents the volumes of empty containers that passed through Russian railways in 2008-2017 by route type.

In 2016, empty container rail traffic in Germany amounted to 24% of domestic traffic, 16% of export traffic, 24% of import traffic and 14% of transit traffic. In Netherlands empty containers accounted for 19% of domestic traffic, 14% of export traffic, 13% of import traffic and 43% of transit traffic; in Italy - 20% of domestic traffic, 17% of export traffic, 8% of import traffic; in UK - 34% of domestic traffic, 25% of export traffic, 25% of import traffic (source: Eurostat).

Significant empty traffic values cause a number of problems for Russian transportation industry. First, transportation of empty containers does not bring any profit to carriers and they usually compensate it by doubling the prices for their services.

Table 2 The container traffic on the Russian Railways network, million TEUs.

Year	TOTAL			Domestic		
	Laden	Empty	%empty	Laden	Empty	%empty
2008	1,604	0,849	35%	0,595	0,532	47%
2009	1,207	0,715	37%	0,498	0,517	51%
2010	1,504	0,802	35%	0,595	0,522	47%
2011	1,779	0,888	33%	0,700	0,56	44%
2012	1,952	0,991	34%	0,738	0,611	45%
2013	2,105	0,992	32%	0,788	0,586	43%
2014	2,186	1,029	32%	0,861	0,638	43%
2015	1,925	1,034	35%	0,780	0,718	48%
2016	2,139	1,122	34%	0,843	0,835	50%
2017	2,634	1,265	32%	0,907	0,899	50%

Year	Export			Import			Transit		
	Laden	Empty	%empty	Laden	Empty	%empty	Laden	Empty	%empty
2008	0,413	0,183	31%	0,479	0,097	17%	0,117	0,037	24%
2009	0,411	0,058	12%	0,208	0,111	35%	0,090	0,029	24%
2010	0,449	0,123	22%	0,348	0,117	25%	0,112	0,041	27%
2011	0,512	0,182	26%	0,448	0,098	18%	0,118	0,049	29%
2012	0,562	0,187	25%	0,490	0,127	21%	0,162	0,066	29%
2013	0,588	0,216	27%	0,563	0,122	18%	0,166	0,069	29%
2014	0,654	0,194	23%	0,488	0,129	21%	0,184	0,067	27%
2015	0,635	0,106	14%	0,350	0,153	30%	0,160	0,057	26%
2016	0,712	0,088	11%	0,375	0,15	29%	0,208	0,05	19%
2017	0,844	0,124	13%	0,544	0,164	23%	0,349	0,068	16%

Source: Transcontainer Annual Report

Second, empty containers require space, and not only at container terminals, but also on ships and trains, eventually this factor limits the useful bandwidth of maritime and railway transportation lines.

Empty container handling requires time for loading and unloading operations, additional fuel costs and increased emissions arise. Empty containers often require relocation.

The abovementioned problems are not limited to Russian transportation market only. According to the American Boston Consulting Group (BCG), the world shipping companies spend up to 8% of their total operating costs on relocating empty containers, which is approximately $ 15-20 billion per year. Karmelic et al. (2012) identified this problem as a chronic problem affecting containerization at the global level.

Modern scientific studies emphasize that foldable containers may serve as a key to solving the old problem. A foldable container is a shipping container that can be folded (collapsed) when empty; after folding (collapsing), several (usually four or more) folded (collapsed) containers can be stacked into one interconnected bundle. This bundle has the size of a single conventional container and is handled in the same way.

Currently, there are several different folding technologies on the market (some further descriptions of them are presented in Chapter 3 of this study).

Figure 1 shows the "4FOLD" folding container, presented by Holland Container Innovations (HCI).

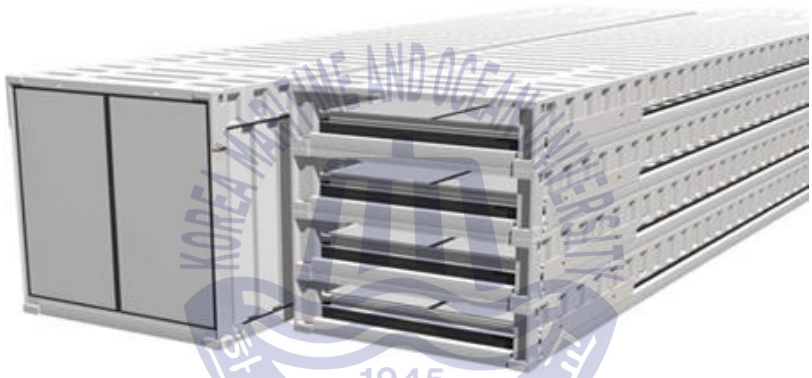


Fig. 1 A stack of four folded "4FOLD" containers and a conventional container
Source: Shintani et al. (2010)

According to Holland Container Innovations, foldable containers give the following advantages:

- collapsibility radically reduces the volume of empty containers being shipped;
- more laden containers (or other cargo) can be loaded on a vessel;
- reduction of repositioning and handling operations and corresponding costs;
- reduction of vessel loading/unloading time;
- reduction of port congestion;
- container terminals and yards suffer less from space shortage;
- lower fuel consumption and lower CO2 emission levels.

According to Ministry of Land, Infrastructure and Transport of the Republic of

Korea (MOLIT, 2017) foldable containers are 20% more economically efficient than standard containers in domestic logistic operations. Folding technologies are expected to reduce worldwide transportation costs by approximately 6 trillion won annually and by 300 billion won annualy for Korean market specifically.

Moon et al (2013) in their research states that foldable containers, if adopted extensively, may become cheaper and their usage will be more beneficial. Zhang et al (2018) discuss that introducing foldable containers on a minor scale cannot lead to a significant decrease in total cost - the larger the amount of foldable containers in use - the more economically effective they become. Konings (2005) has found that foldable containers may lead to substantial net benefits in the total chain of container transport, if they are used more extensively in the transportation chain.

Russia is an important link of international transportation system, which is primarily due to its geographical location. Modern transportation industry tends towards global integration. In order to become a major participant, Russia must not rely on its successful geographical location only, because without proper technical innovations this advantage is not going to be enough. Thus, it would be very unwise for Russian container transportation executives to overlook such promising technology as foldable containers.

Russia is a country with high level of logistics costs, which significantly reduces the efficiency of its production and trade, adversely affecting the competitiveness of its companies and the country as a whole. Logistics costs reach up to 19% of the GDP, for reference, in China it is 18%, in Brazil and India - 11~13%, in USA - 8.5%, in Italy - 9.7%, in Japan and Germany - 8.5% and 8.8%, respectively (RZD-Partner, 21.03.2016).

However, several Russian logistic operators have already started implementing foldable technologies. For example, in April 2017, the MCS logistics operator started to use foldable containers. This company is specialized in export, import and transit from China, South Korea, and Japan to Russia. MCS deployed foldable containers on the Shanghai - Vladivostok - Moscow route. Since no cargo goes from Vladivostok to Shanghai, the operator folds and stacks foldable containers and ships them to Shanghai. The company does not have its own fleet, so foldable containers greatly decrease transportation costs. Also in May 2017, the Tetris Container Terminal in Moscow area became an officially certified folding facility

(approved by the HCI Company - developer of “4FOLD” containers). The “4FOLD” containers are mainly used in Vladivostok direction.

The transport system of Russia includes 87 000 kilometers of railways, more than 904 000 kilometers of paved roads, 115 000 kilometers of navigable rivers and many sea routes. Russian transportation industry specifics are largely determined by historical and traditional background. The major share of long-distance cargo shipping is carried out by railroads, short- distance cargo shipping is performed by automobiles.

Moreover, the transport network of the European part of Russia is more developed and has a high traffic density. The transport infrastructure of Siberia and Russian Far East is relatively underdeveloped (Fig..2). The Trans-Siberian Railway (TSR) is the main road connecting the European part, the Urals, Siberia and the Far East.

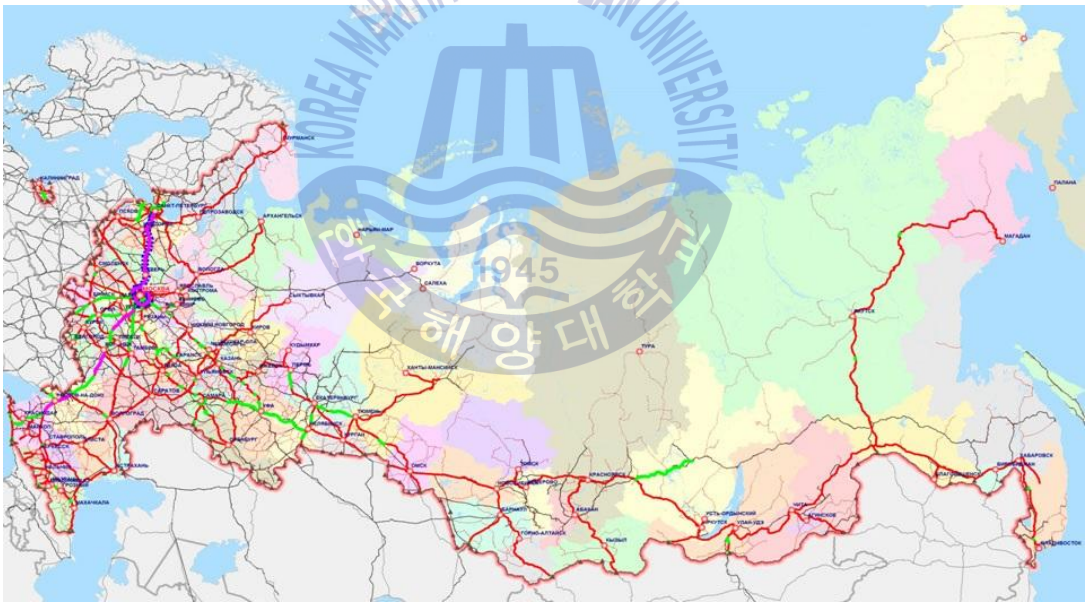


Fig. 2 Russian transport infrastructure

In 2017, 77% of all dry cargo that arrived in Russian ports for export departure was brought by rail, 17% - by road, 2% - by inland water transport, and 3% by sea. Among the outbound transit dry cargo: 94% arrived by rail, 5% by road, and 1% by sea.

Besides, among dry cargo, imported in Russia via seaports: 22% was carried away by rail, 75% by road, and 2% by sea. Among the inbound transit dry cargo: 94% was carried away by rail, 6% by road, and 1% by sea (Association of Sea Trade Ports (ASOP)).

The traditional scheme of imported goods delivery from Europe and South-East Asia to Russia involves their transportation to Moscow or St. Petersburg with the subsequent distribution throughout the country. International trade with China, Japan, South Korea, as well as with Southeast Asia and Australia is carried out mostly through the Far Eastern ports of Russia - Vladivostok and Nakhodka.

The remoteness of Far Eastern ports from more developed Western regions of the country, as well as the transit advantages of the Trans-Siberian Railway (as opposed to the sea route from Asia to Europe (Gydok, 2006.)), promotes wide distribution of intermodal cargo shipping using maritime and land transport lines.

For the purposes of this paper, we examined the opportunities for application of foldable containers technology in Russian transportation industry; the factors that can promote or hamper the application progress were discussed as well; professional opinion was investigated, and possible benefits were calculated for a particular case.

The first objective was to ascertain the specifics of Russian participation in international trade, and study the latest trends, which affect empty container traffic as well as any circumstances, contributing or precluding the implementation of folding technologies. The assignment was organized into two stages: analysis of the current trends in Russian foreign trade and transportation, with the emphasis on empty container traffic issues, and analysis of the distinctive features of Russian transportation industry with folding technology application perspectives. The goal of this part was to see the dynamic processes, which determine the key trends.

The second objective was to inquire and study the industry experts' professional point of view on the issues of empty containers in Russia, define the most important aspects of containerized shipments and determine the current Russian market's interest in foldable technologies. We performed a questionnaire survey with subsequent Factor Analysis and ANOVA, in order to identify the factors that determine the industry professionals' vision of the current state

of the transportation sector.

The third objective was to conduct the cost-benefit analysis, in order to contribute to the knowledge of foldable technology potential economic gains. This step was undertaken to quantify foldable containers impact at the chain level on Busan - Vostochny - Moscow route example (maritime/continental concept). Further, for the port-to-port concept, the estimates were adopted using 2005-2017 statistical data for Busan - Vladivostok/Vostochny route.

1.2 Literature review

Recently, there has been a significant growth of interest in foldable container technologies among the specialists, who research the issues of empty containers repositioning and empty traffic cost management.

Konings (2005) analyzed the opportunities for commercial application of foldable containers. The results showed that use of foldable containers could lead to substantial net benefits in the total chain of container transport.

Shintani et al. (2010) discussed the possibility of container fleet management costs reduction in repositioning empty containers through the use of foldable containers. The results showed that foldable containers can contribute to substantial cost savings in empty container repositioning between the seaport and its hinterland. However, the cost-saving effect of foldable containers depends on surplus and shortage situations in the hinterland.

Shintani et al. (2012) studied the potential role of foldable containers in lowering the costs of container fleet management in shipping line networks. The results showed that foldable containers could generate substantial cost savings, especially when there was a strong imbalance in the trade. However, the exploitation costs of a foldable container played a major role in determining the feasibility of these savings.

Moon et al. (2013) compared the repositioning costs of foldable containers to those of standard containers. The results showed that there were some conditions, when it was advisable to replace standard containers with foldable ones. Thus, the foldable containers production cost decrease along with an increase in transportation costs played a key role in foldable containers implementation.

Myung and Moon (2014) considered a multi-port and multi-period container-planning problem of shipping companies that use both standard and foldable containers. The results demonstrated that minimum cost flow of the network is equivalent to the optimal solution of problem of finding the nonnegative integer variables that minimize the total cost function.

Goh and Lee (2016) investigated the commercial viability of foldable containers from a carrier's perspective. The results show that foldable containers are compelling and savings of more than 50% are viable, even after taking into

account higher purchase and maintenance costs, and lower expected lifespan of foldable containers.

Ou et al. (2017) investigated the potential cost savings of using foldable containers and a fuzzy controller in a supply chain system. The results showed that applying the fuzzy control mechanism significantly improves the system to obtain more cost saving by reducing the supplier's oversupplying and maintain the production throughput. The use of foldable containers can lead to substantial net benefits in the total chain of container transport.

Zhang et al. (2017) proposed a repositioning model for empty containers in the intermodal transportation network of Belt and Road Initiative by considering both standard and foldable containers. The results demonstrated that the total cost in the network is not linearly decreasing with the ratio of empty foldable containers. When the share of foldable containers is relatively small, they are not beneficial, as the economics of scale is not reached.

Wang et al. (2017) studied the problem of ship type choice considering the empty container repositioning and foldable containers, in order to minimize the total costs that occur in a given planning horizon for the shipping route. The results demonstrated that under the current cost setting, it was not cost-effective for shipping lines to use foldable containers, as the long-term leasing cost was high. However, if container leasing companies charge a moderate price for a long-term leasing, shipping lines may devote more efforts to cutting down folding/unfolding costs, which may lead to a profitable result.

Shin et al. (2017) discussed the conditions required for successful commercial application of foldable containers on a domestic container route. The findings showed that the benefits were large enough to cover the losses. Seasonal patterns and mixing percentages of foldable and standard containers on the route may also produce cost-effective solutions. The benefits depend, to a large degree, on empty container shares.

The authors, more than once, noted the circumstances preventing the wide distribution of folding containers. It was pointed out that, foldable containers cannot be widely used because of their high production cost and vulnerability to damage (Moon et al., 2013), high exploitation costs (Shintani et al., 2012), additional time expenditures for folding/unfolding operations (Zhang et al.,

2017), short lifespan (Goh and Lee, 2016), high long-term leasing cost (Wang et al., 2017) etc.

At the same time, most authors pointed out the scenarios under which it was possible to neglect these negative effects: design improvements and rapid rise of oil prices (Moon et al., 2013), the claims related greenhouse emission and potential of mixed container fleets (Shintani et al., 2012), potential reduction of the handling time (Zhang et al., 2017), potential postponing the capital investments in storage yards and gantry cranes (due to reduced empty moves) (Goh and Lee, 2016).

Eventually, technologies will be improved, and the interest of market participants will encourage manufacturers and leasing companies to lower prices. There are also possible scenarios when implementation benefits significantly exceed the additional costs that can arise.

However, each county's market has its own specifics. Therefore, it is of interest to consider the features of Russian container market with its specifics and drawbacks.

The methods and samples of the abovementioned studies are summarized in Table 3.

Table 3 The relevant studies

Studies	Sample	Method
Konings(2005)	four logistic concepts (port-to-port, maritime worldwide, maritime/continental worldwide, door-to-door worldwide)	Cost-benefit analysis
Shintani et al. (2010)	land-based leg of maritime container transport chains transportation between the port of Rotterdam and the hinterland region that covers the eastern part of Netherlands and the western part of Germany	Integer programming models
Shintani et al. (2012)	transporting containers between seaports10 Asian ports and 4 North American	Integer programming model
Moon et al. (2013)	ocean transportation by vessels three ports - East Asia, US, and Europe	Mathematical models Heuristic algorithms Numerical experiments Sensitivity analysis
Myung and Moon(2014)	transportation from port to port	Network flow algorithm
Goh and Lee	use of containers by an Asian container	Cost-benefit analysis

(2016)	shipping line simple round-trip network with a single shipper and a single consignee	Sensitivity analysis
Ou et al. (2017)	transportation between a supplier and a factory by trucks	Mathematical model of a closed-loop supply chain Fuzzy control method
Zhang et al. (2017)	repositioning from the inland of the original area, such as China, to otherareas of B&R Initiative related countries and regions, such as European Union and Southeast Asia	Mixed integer linear programming model Artificial Bee Colony algorithm
Wang et al. (2017)	shipping route Shanghai - Ningbo - Busan - Los Angeles - Oakland additionally, Asia - North America trade route, North Europe - North America trade route, and Australia -Far East trade route	Network flow model Sensitivity analysis
Shin et al. (2017)	8-foot collapsible containers on the Jeju Island - Mokpo container route in South Korea	Cost-effective analysis Sensitivity analysis

Source: Author's own processing

The Factor Analysis was used in the following researches related to the fields of maritime studies and logistics.

Lee and Kim (2006) investigated the port performance related to distriparks. The study was carried out by applying correlation analysis, factor analysis, and multiple regression analysis.

Saeed (2009) analyzed foreign shipping lines' criteria for selected container terminals at two ports in Pakistan. The empirical study was conducted by distributing questionnaires to shipping agents, the factor analysis was used to determine whether the attributes could be partitioned into fewer, meaningful factors and One-Way ANOVA was performed to determine significant opinion differences among the respondents.

Lu et al. (2011) empirically evaluated container terminal service attributes from shipping lines and shipping agencies' perspective. For their study Internal-Consistency Reliability, Factor Analysis, Cluster Analysis, Importance-Satisfaction Analysis, and ANOVA were applied.

Lu et al. (2016) conducted a confirmatory factor analysis to identify crucial sustainability assessment criteria at ports.

Yang and Wong (2016) applied the theory of strategic groups to segment

environmental management practices orientation, and assess the performance outcomes of different environmental strategy oriented groups in container shipping sector in Taiwan. For study, the four environmental management dimensions were identified based on factor analysis.

Intihar et al. (2017) examines the impact of macroeconomic indicators on the accuracy of container throughput. For this purpose, a dynamic factor analysis and ARIMAX were used.

Pang and Lu (2018) evaluated factor analysis to summarize a large number of motivation, job satisfaction and organizational performance attributes to identify the crucial factors in the context of container shipping companies.

The Factor Analysis was also used in other field researches. Akintoye (2000) gained the understanding of the factors influencing contractors' cost estimating practice using the factor analysis and analysis of variance. Anushan et al. (2016) identified the factors that contribute and curtail people from online shopping and verified whether the behaviors of rural people and urban people vary using descriptive research design, Factor Analysis, and ANOVA.

Additionally, the European Commission DG Mobility and Transport (2015) analyzed the current trends of EU Short Sea Shipping sector, identified the main factors affecting the growth of the sector. The inputs were obtained through desk research, interviews and sending online surveys to stakeholders.

1.3. Methodology

Descriptive research: Based on the statistical data collected from Russian economy indicators in 2005 - 2017, we identified the factors, which determined empty container throughputs in Russian seaports and on railways.

Questionnaire: Data collection was based on a questionnaire survey from 71 employees from container terminals, transportation and logistics companies, container operators, port operators, and container shipping lines. The respondents provided scores that reflected the importance of 19 factors affecting container market and provided 12 observations of the current trends in Russian container industry affecting the empty containers traffic. Subsequently, an exploratory Factor Analysis was conducted and ANOVA tested to determine respondent opinion differences according to company's annual turnover, work experience, employee's rank, working location, and interest in foldable technology.

Case study: The 2005-2017 collected data included: container turnover of the Far East basin ports (Vladivostok/Vostochny), container turnover between the port of Busan and ports of the Russian Far East. The Cost-Benefit analysis presented the Busan - Vostochny - Moscow maritime/continental route and Busan - Vladivostok/Vostochny port-to-port route as the framework for analysis. Sensitivity Analysis was performed across container lifespan, cost, sea freight rates, folding/unfolding charges, and empty traffic levels.

The contribution of this paper is as follows: (1) provision of knowledge about the prospective beneficial effects of foldable containers considering the specifics of Russian transportation industry, since the existing literature has not yet elaborated on this matter, and (2) providing the specific information, formulating economic and innovation suggestions for concerned industry professionals.

2. Factors that influence empty container traffic in Russia

In order to understand all the issues of foldable container technology implementation, we must analyze several factors, which determine attractiveness and expediency of container innovations for Russian market. The factors can be divided into two groups. The first group consists of the factors that affect empty containers quantity. The second group consists of the factors that influence practical application of foldable containers.

2.1 Economy

2.1.1. Russian foreign trade

In order to understand the container market, it is important to identify the trends, which govern Russian foreign trade policy.

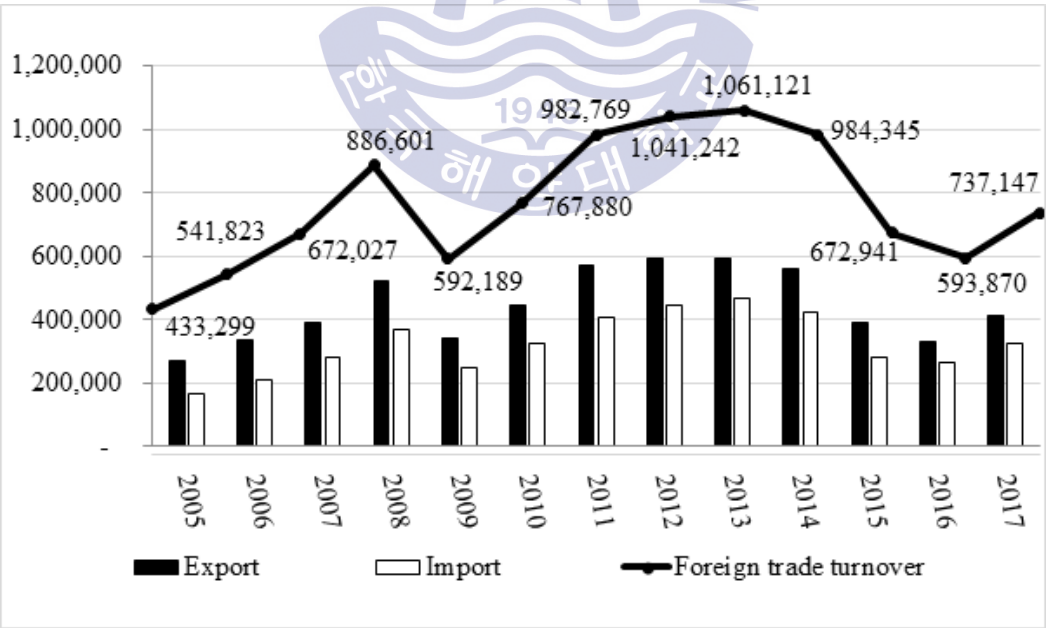


Fig. 3 Russian Export and Import dynamics, 2005-2017

Note) Units: million USD (Current US$)
Source: Federal State Statistics Service (Last Updated: 07/25/2018)

In 2005-2008, there was a significant growth of Russian trade turnover – export and import values increased almost twice in that period. The most intensive increase of trade volumes was observed during the periods of Russian economic growth. Exports increased mainly due to the growth in world prices for the main goods exported by Russia; imports growth was supported by production sector and households' increase of effective demand (Obolensky, 2012).

Global financial crisis of 2007-2008 resulted in a significant decline of Russian economy in 2009. The specific decline factors were world trade recession, global demand decrease, and petroleum (main Russian export commodity class) price collapse. As a result, export profits declined greatly. Import volumes also decreased due to collapsed consumer and investment demand, and a general recession of Russian economy.

Exchange rate of foreign currencies to Russian ruble is highly dependent on petroleum prices. Among other Russian industries, oil and gas industry generates the largest share of foreign currency earnings for the federal budget. Thus, the budget of the Russian Federation is overly dependent on global petroleum prices, which also makes Russian currency exchange rate extremely volatile (Dvorets and Shevelev, 2015).

Russian economy managed to recover export and import growth rates after the crisis, but after 2011 growth rates decreased significantly. From 2011 to 2013 increase rate was only 7.97%.

However, in 2014-2016, foreign trade levels suffered a significant decrease. Export and import values reached the five-year minimum it that period. Political crises and mutual economic sanctions greatly affected relations between Russia and its trade partners, reducing trade and transportation volumes.

Numerous restrictive measures were imposed on Russia by EU, USA, Australia, Albania, Israel, Iceland, Liechtenstein, Moldova, Norway, New Zealand, Ukraine, Switzerland, Montenegro, and Japan. The main types of sanctions – an entry ban for individuals and economic activity ban for commercial entities (these restrictions apply to the country, which introduces sanctions). The list of anti-Russian sanctions has been expanding since 2014.

Russia responded by administering counter-sanctions. The food embargo was introduced on August 6, 2014 – it prohibited import of several categories of

agricultural and manufactured food products from countries that imposed anti-Russian sanctions. This mainly affected EU countries, since many European manufacturers had previously carried out large-scale deliveries of agricultural and food products to Russia.

The imposed sanctions had both direct and indirect effects on Russian economy:

◆ Sanctions seriously affected the long-term GDP growth.

According to ACRA (2018), the sanctions affected 20-21% of Russian GDP. Most of the restrictions were imposed against large state-owned banks (54% of the total banking sector assets), oil and gas companies (95% of the total industry revenues), and almost all military-industrial complex companies.

◆ Sanctions destabilized Russian economy.

Deterioration of Russian investment climate caused a recession in the economy, which was further aggravated by falling petroleum prices. Foreign investors began to withdraw their capital from Russian assets - this led to the depreciation of ruble.

◆ The depreciation of the national currency caused a sharp solvency decline for both enterprises and population.

Demand for imported goods fell significantly because of their extreme, sometimes multifold, increase in prices. Additionally, Russian counter-sanctions against western countries caused an economic kickback, which increased import prices even further.

◆ The sanctions caused temporary disruptions in supply chains, since it took time to find new manufacturers and product suppliers.

As a result, banned European goods were replaced with substitutes from Egypt, Pakistan, Brazil and South Africa. In addition, more goods started coming from Asia.

◆ Due to the sanctions, Russian aluminum exports declined.

Aluminum domestic sales growth rates are not high enough to compensate the losses from overseas export ban.

It must be noted that Russian aluminum is traditionally exported in 20-foot containers, and each of them can hold up to 26 tons of metal (Vedomosti, 17.04.2018).

In 2017, Russian foreign trade turnover had finally started to increase (by

24.13%).

Therefore, we can state that the following elements served as the main driving force of Russian foreign trade during 2005-2017 period:

- World prices for the main Russian export goods;
- Political risks and mutual sanctions;
- Russian ruble's exchange rate;
- Commodity structure of foreign trade.

Russian container shipping industry is very sensitive to macroeconomic volatility and reacts promptly to any changes in the economy. Thus, let us consider driving factors in detail, and review the current trends.

2.1.2. Import and export trends

IMPORT OF LADEN CONTAINERS

The dynamics of Russian container market greatly depends on import volumes (Fig.4). The sharp increase of Russian trade turnover was followed by significant growth of Russian container market - 2 million TEUs in 2005 against 3.7 million TEUs in 2008.

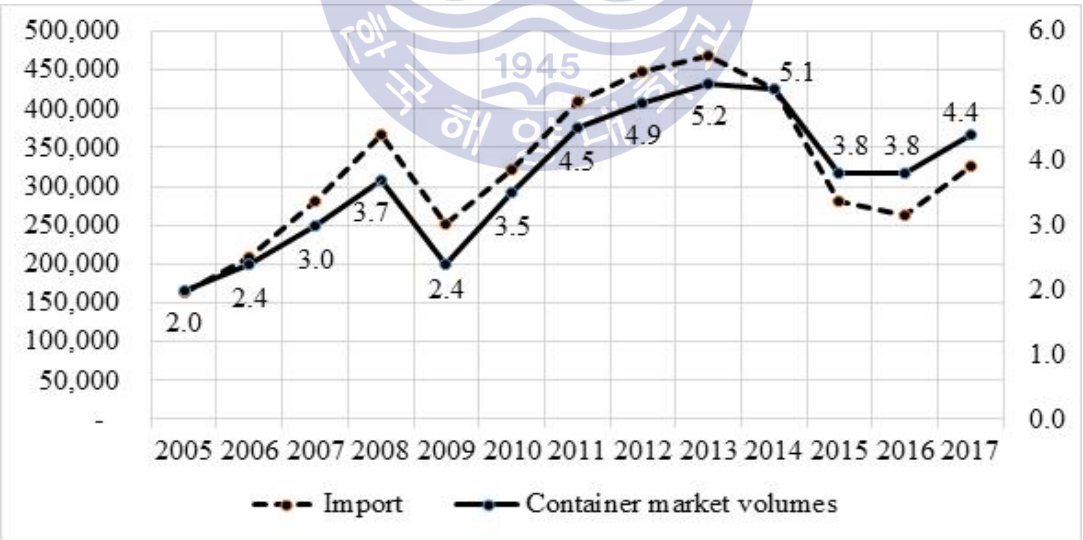


Fig. 4 The dynamics of Russian container market and import volumes in 2005-2017

Note) Units: million USD (Current US$); million TEUs

Source: Federal State Statistics Service (Last Updated: 07/25/2018)
Globalports Annual Report

Import collapse in 2009 directly correlated to container volumes decrease (down to 2.4 million TEU). In 2010-2014, the growing recovery trend can be observed (up to 5.1 million TEU in 2014). Then there was a dramatic decrease of 2015-2016 (down to 3.8 million TEU) and the following upturn in 2017 (up to 4.4 million TEU).

In this connection, we are particularly interested in empty to laden ratio of exported and imported containers, presented in annual dynamics (Table 4).

Table 4 The laden/empty ration of imported and exported containers in Russian seaports in 2008-2017, million TEUs.

Years	Import			Export		
	Total	Laden	Empty	Total	Laden	Empty
2008	1.702	1.688	0.014	1.693	0.545	1.149
2009	1.059	1.042	0.017	1.063	0.495	0.568
2010	1.637	1.601	0.035	1.531	0.580	0.950
2011	2.068	2.026	0.042	2.055	0.696	1.359
2012	2.253	2.219	0.033	2.201	0.768	1.433
2013	2.352	2.320	0.032	2.301	0.765	1.536
2014	2.290	2.272	0.017	2.306	0.921	1.385
2015	1.635	1.565	0.070	1.650	0.933	0.717
2016	1.666	1.563	0.103	1.638	1.046	0.592
2017	1.947	1.869	0.078	1.926	1.175	0.751

Source: Association of Sea Ports (ASOP)

Considering all other factors remain equal, we can observe that major share of the import containers are laden, and major share of export containers remain empty.

In the commodity structure of imports, the main share (47.2% in 2016; 44.4% in 2010) was occupied by machinery and equipment (mechanical equipment, electrical equipment, optical instruments, etc.). The second largest import category (18.6% in 2016; 16.1% in 2010) are chemical products (soap, cosmetics, fertilizers, etc.). Other import commodity groups in 2016 were: food - 13.7% (15.9% in 2010); metals - 6.5% (8.3% in 2010); mineral products - 1.8% (2.3% in 2010); lumber products - 1.9% (2.6% in 2010). The data shows (that there were no significant changes in the commodity group shares in 2010-2016.

Table 5 The import dynamics of Russian seaports.

Years	Total imported cargo, millions of tons	Total imported cargo in containers, millions of tons	Containerization of import, %
2008	42.1	19.5	46.28%
2009	27.4	12.9	47.02%
2010	39.4	18.4	46.86%
2011	44.6	22.7	50.93%
2012	47.5	24.6	51.75%
2013	46.0	25.7	55.89%
2014	43.4	25.4	58.55%
2015	33.3	18.4	55.33%
2016	31.7	18.6	58.71%
2017	36.1	21.5	59.57%

Source: ASOP

In Russian export commodity structure, the largest share traditionally belongs to petroleum goods. Fuel and energy products dominated export commodity structure in 2010-2016, 68.5% in 2010, and 59.2% in 2016. The recent decline happened due to decreasing value of exports, caused by falling global hydrocarbons prices; however, export grew in quantities instead. In particular, natural gas, coal, and crude oil extraction volumes were increased.

The second largest export commodity group is metals and metal products. The share of exported rolled steel products, semi-finished iron products, and non-alloy steel in 2016 was 13.2% (12.7% in 2010).

The share of machinery and equipment in 2016 was 8.6% (5.4% in 2010), chemical products - 7.3% (6.2% in 2010), food - 6% (2.2% in 2010).

Upon conducting the foreign trade commodity structure review, we can get a picture of of Russian maritime traffic containerization. The containerization of import was about 60% in 2017 (Table 5). In contrast, containerization level of export was small - about 3% in 2017 (Table 6). Thus, we can conclude that empty container traffic volumes in Russia depend heavily on containerized import values - the more laden containers are imported in Russia the more must be returned abroad in an empty state and vice versa. Containerization of Russian export is so insignificant it cannot substantially affect empty traffic volumes.

Table 6 The export dynamics of Russian seaports.

	Total exported cargo, millions of tons	Total exported cargo in containers, millions of tons	Containerization of export, %
2008	343.9	8.6	2.51%
2009	385.0	8.3	2.15%
2010	404.2	10.0	2.47%
2011	409.7	11.9	2.90%
2012	447.7	12.7	2.85%
2013	460.8	13.0	2.81%
2014	491.7	15.6	3.16%
2015	538.9	15.6	2.89%
2016	567.2	17.2	3.03%
2017	605.8	19.4	3.21%

Source: ASOP

EXPORT OF LADEN CONTAINERS

In 2014, the exchange rate of Russian ruble changed dramatically - from 32.7 rubles per dollar in January to 67.8 rubles per dollar in December. However, in that situation Russian exporters benefited greatly, and the competitiveness of Russian goods on world markets also increased. Thus, the decrease in total container turnover of Russian ports was accompanied by the increase in export cargo volumes (Table 4). Besides, the containerization of export in 2014-2017 was increasing as opposed to the previous years (Table 6).

One of the latest trends of Russian container market is using containers for bulk cargo shipment, such cargoes include steel products, mineral fertilizers, forest products, and even coal, ore, and grain.

In 2014, export of laden containers in Russian ports grew by 20% as opposed to the previous year - up to 921 thousand TEU; in 2015 export continued to grow and amounted to 933 thousand TEU (+1%); in 2016 - 1.046 million TEU (+12%) and in 2017 - 1.175 million TEU (+12%). Today about 60% of export containers are shipped laden, whereas 5 years ago the share was about 25-30%.

The same containerization increase trend was observed in Russian railway transportation dynamics (Fig.5).

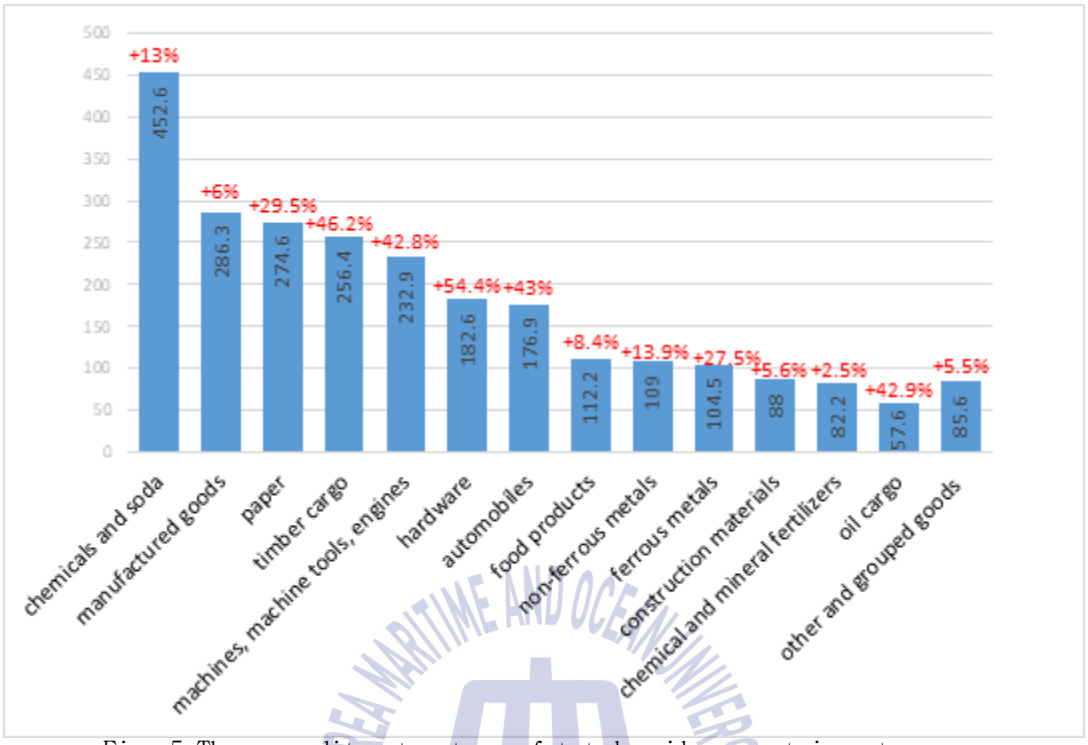


Fig. 5 The commodity structure of total railway container turnover in 2017, in thousands of TEUs

Source: RZD-Partner, 02.2018.

Thus, we can conclude that export containerization increase leads to a decrease of empty export containers quantities.

EMPTY IMPORT CONTAINERS GROWTH SUPPORTS EXPORTS

The decrease in import container traffic was accompanied by a shortage of empty containers for export cargo. Consequently, the situation with empty export containers only got worse. Shipping line operators were even considering the possibility of reducing the demurrage-free time to stimulate the return of empty containers after import.

However, a sudden trend occurred - an increase in the volume of imported empty containers (Table 4). In 2015, the import of empty containers in Russian ports grew up to 70 000 TEU or by 305% as opposite to the previous year. In 2016, import continued to grow and amounted to 103 000 TEU (+46%). As a result, in

2016, Russian ports handled 1.7 times more empty import containers than in 2015 and 7 times more than in 2014. The throughput of empty containers in Russian ports exceeded 7% of the total throughput of imported containers. This fact actually greatly contributed to the positive dynamics of Russian export in 2016, which otherwise would be negative.

However, in 2017 general import volumes increased, which led to a decrease in empty import container volumes down to 78 000 TEU (-25%).

The abovementioned facts led us to a conclusion that an increase of containerized export levels leads to an increase of empty import container volumes.

CHANGE IN THE EXPORT COMMODITY STRUCTURE

As it was already mentioned, the "non-containerized" cargo was predominant in the commodity structure of Russian exports over the last years. Moreover, export containerization growth is not unlimited.

According to the Russian Export Center state organisation, in the first half of 2017 the share of non-raw goods in total export reached 53.7%, non-raw non-energy goods - 34.1%. The main contribution to the increase was made by fuel (75% of the total growth), metal products (45%), food (16%), and chemical products (15%) (RZD-Partner, 01.09.2017).

The main commodity groups of Russian non-raw non-energy exports traditionally are:

- Metals and metallic products (intermediate products, flat-rolled iron and plain steel, crude aluminum);
- Machines, equipment and vehicles (turbojet engines, fuel elements and components of nuclear power equipment);
- Chemicals (mineral and organic fertilizers);
- Food products and agricultural goods (wheat and meslin).

These goods contributed to 80.9% of Russian total non-raw non-energy export volumes in 2017.

For the development of export containerization in Russia, administrative

measures were undertaken to increase the competitiveness of consumer and technological products, since such products are usually transported in containers. The government approved the list of priority goods, export of which will be stimulated and supported by federal authorities. (RZD-Partner, 01.09.2017).

For example, the recently launched Vorsino-Chengdu-Vorsino railway route. The train consists of forty-one 40-foot containers; the line goes to China via the border posts of Naushki (Russia) and Zamyn Uud (Mongolia). Travel time is no more than 14 days, with the departure taking place twice a month. The cargo consists mostly of confectionery products (like cookies and waffles) (SeaNews, 14.09.2017). The other Chinese destination is Dalian Port and Shilong Station in Guangzhou Province. Food products, metals, plastics and plastic products, synthetic detergents, and automobiles are sent in containers from Vorsino terminal to the port of Dalian. (SeaNews, 05.05.2017). The volumes of railway shipments from Vorsino to China are still small, although Russian experts forecast an increasing demand from Russian shippers and Chinese consignees.

When analyzing the state of Russian industry, one of the most important indicators, which must be taken into consideration, is the Industrial Confidence Index. It is a qualitative indicator, which allows, in accordance with managers' answers about predicted output, finished products stocks and demand for their production, to evaluate companies' commercial activities and give economic forecast. The Industrial Confidence Index of Russian processed goods manufacturers is presented in Figure 6. The last time when index value reached zero, was in 2013.

Russian industry is plagued by fundamental issues, which create serious obstacles for the development of non-raw export. A constant lack of high-tech and high-quality machinery and inability to maintain the existing equipment prevents Russian manufacturers from being fully competitive (Belov and Vasilevski 2018). Extremely low share of investments in fixed assets, due to lengthy rate of return periods, caused by long production cycles, high loan debts, and tax burdens (Gagarinskiy, 2015). All the aforementioned problems are further aggravated by insufficient research and development funding and lack of qualified personnel.

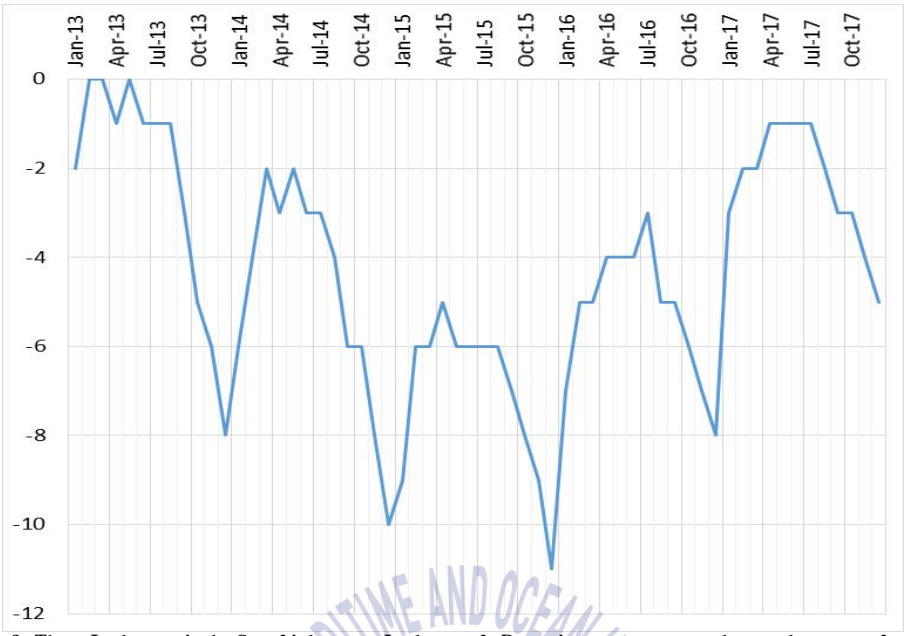


Fig. 6 The Industrial Confidence Index of Russian processed goods manufacturers in 2013-2017.

Source: Federal State Statistics Service

The data in Table 7 show that in 2012-2017 there were no significant changes in the share of non-raw goods. Therefore, despite all the government efforts and special programs, the share of non-raw goods in Russian foreign trade commodity structure is just slightly bigger than 50%, and railway-transported share is even smaller than that.

Considering all the abovementioned, we can conclude that the increase of containerized processed goods leads to reduction of empty export container volumes.

Nevertheless, processed goods share can be increased only in a long-run, and significant changes will only be noticeable after overcoming numerous obstacles.

Table 7 Russian exports commodity structure in 2012-2017

	2012	2013	2014	2015	2016	2017
Non-raw goods	48%	48%	51%	55%	55%	55%
Raw goods	52%	52%	49%	45%	45%	45%

Source: Russian export center

2.2. Distinctive features of Russian regional structure

The Russian Federation consists of 85 federal subjects. All of them are grouped into eight Federal districts - Central, South, Northwest, Far East, Siberia, Ural, Volga, and North Caucasus (Fig.7).

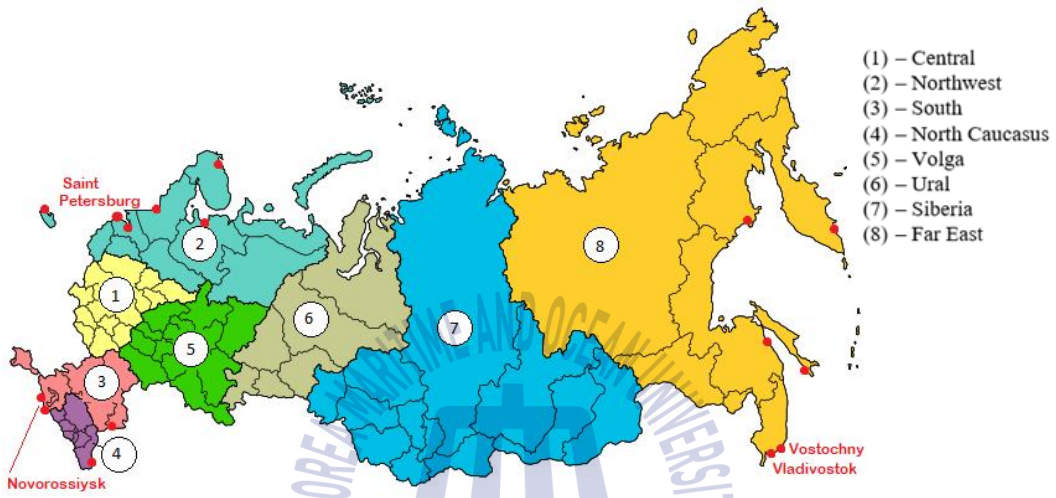


Fig. 7 The Federal districts of Russian Federation

Federal districts differ in number of included subjects, population, territory, level of industrial and agricultural production (Table 8).

Table 8 Socioeconomic indicators of Russian Federal districts (2017)

Federal districts		Territory (km2)	Population	Population density (population /km2)	Nominal GDP (bln rubles)	Local products shipped by railway (thousands of tons,% share)	
1	Central	650,205	39,209,600	60	24,135	201,734	15%
2	Northwest	1,686,972	13,899,300	8	7,804	150,075	11%
3	South	447,821	16,428,500	37	4,896	98,623	7%
4	North Caucasus	170,439	9,775,800	57	1,798	12,801	1%
5	Volga	1,036,975	29,636,500	29	10,376	197,270	14%
6	Ural	1,818,497	12,345,800	7	9,355	179,729	13%
7	Siberia	5,144,953	19,326,200	4	7,134	475,546	34%
8	Far East	6,169,329	6,182,700	1	3,757	62,337	5%

Source: Federal State Statistics Service

Transport infrastructure development also differs from region to region. The most modern, diversified, and dense transport network lies in the European part of the country. On the contrary, in Siberia and Far East the transport infrastructure is old and poorly developed. In addition, local climatic and natural conditions determine seasonal fluctuations and production structure, as well as regional demand.

Russian territory is stretched for 9 000 kilometers from west to east, and uneven distribution of natural resources and regional differences influence domestic freight turnover and container turnover as well (Nasonov, 2013).

The Ural, Siberia, Volga, and Far East Federal districts contributed the largest share of mining production values in 2016 – 38%, 15%, 14%, and 14%, respectively. The Central, Volga, Northwest and Ural Federal Districts gave a major share of total Russian processing industry output in 2016 – 35%, 20%, 13%, and 12%, respectively. The Central, Volga, South and Siberia Federal Districts were the leaders in agricultural production in 2016 – 25%, 23%, 18%, and 12%, respectively (Fig.8).

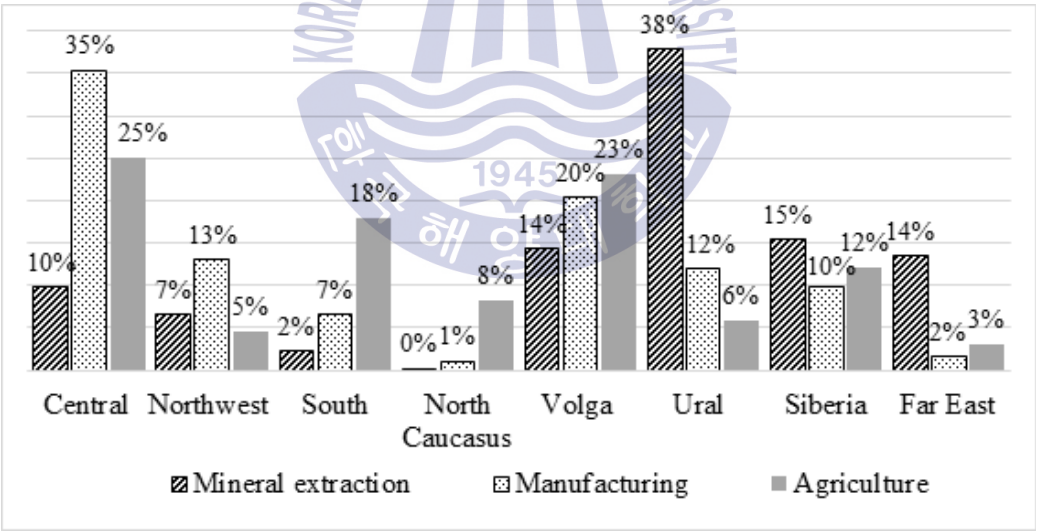


Fig. 8 The shares of Federal districts in production volumes by industry type in 2016

Source: Federal State Statistics Service

Such regional disparities determine the large share of empty containers in domestic rail transportation. (Table 9).

Table 9 Empty container transportation by Russian railways by route direction

	TOTAL	Domestic	Transit	Export	Import
2008	0.84890	0.53200	0.03660	0.18290	0.09740
2009	0.71460	0.51700	0.02870	0.05760	0.11130
2010	0.80210	0.52160	0.04080	0.12300	0.11670
2011	0.88820	0.55950	0.04880	0.18210	0.09780
2012	0.99130	0.61140	0.06550	0.18740	0.12720
2013	0.99220	0.58620	0.06870	0.21630	0.12170
2014	1.02910	0.63830	0.06740	0.19440	0.12920
2015	1.03360	0.71770	0.05700	0.10590	0.15300
2016	1.12230	0.83520	0.04960	0.08750	0.14960
2017	1.26542	0.89860	0.06821	0.12400	0.16390

Source: Transcontainer Annual Report

2.2.1. Industrial growth

After the Western economic sanctions and Russian counter-sanctions were mutually imposed, Russian government set course for a large-scale import substitution. The country began to reduce its dependency on foreign goods through stimulating local production of industrial products. The government defined the key economy sectors, in which maximum level of import substitution must be achieved: agriculture, mechanical engineering, and information and communications technology.

In 2013-2016, all sectors of Russian economy demonstrated positive dynamics. The volumes of domestically produced goods in manufacturing industry grew by 33%, in extractive industry by 20%, and in agriculture by 49% (Fig.9).

Such positive dynamics contributed to the development of domestic freight traffic. For example, the following new shipping lines were started in 2015: regular container service on Moscow – Yakutia route, increased amount of container trains from Vladivostok to Moscow, St. Petersburg – Artyom (Vladivostok) container railway route (PrimaMedia, 12.03.2015, PrimaMedia, 06.07.2015, YakutiaMedia, 19.05.2015).

However, there was a number of constraints. In terms of regional structure, most industries had a high level of uneven development.

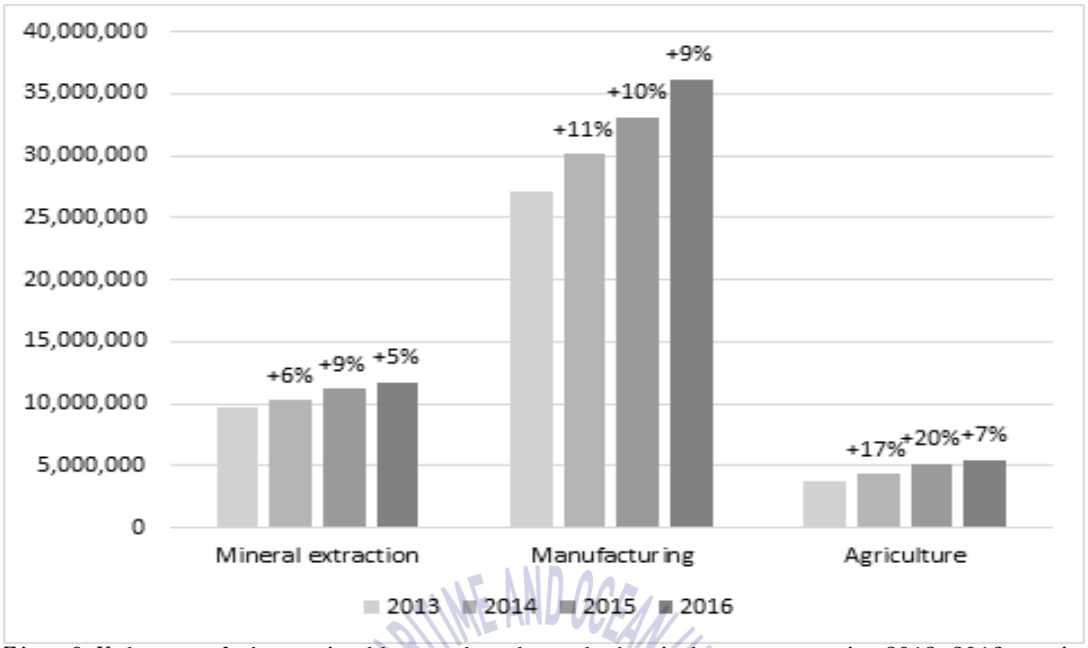


Fig. 9 Volumes of domestically produced goods by industry type in 2013-2016, in millions of rubles.

Source: Federal State Statistics Service

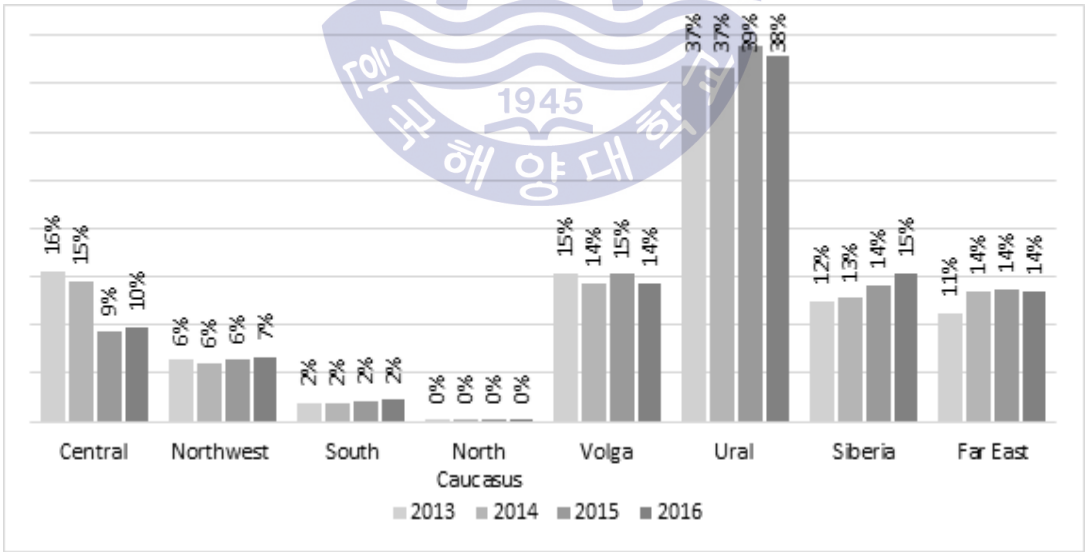


Fig. 10 The share of Federal districts in the total volume of domestically produced mineral goods

Source: Federal State Statistics Service

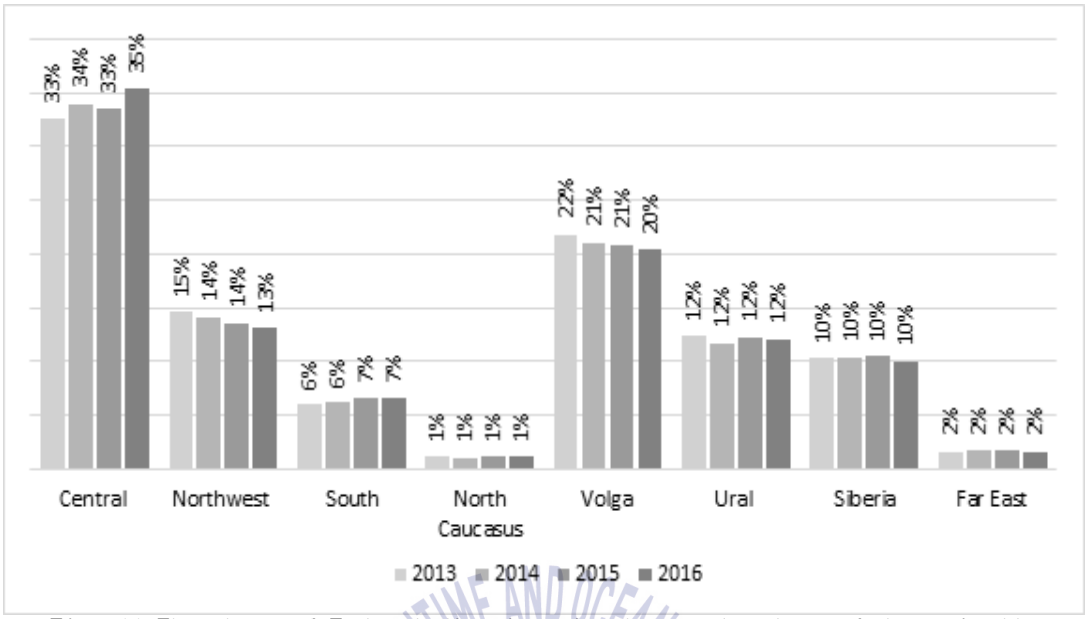


Fig. 11 The share of Federal districts in the total volume of domestically produced manufacturing products

Source: Federal State Statistics Service

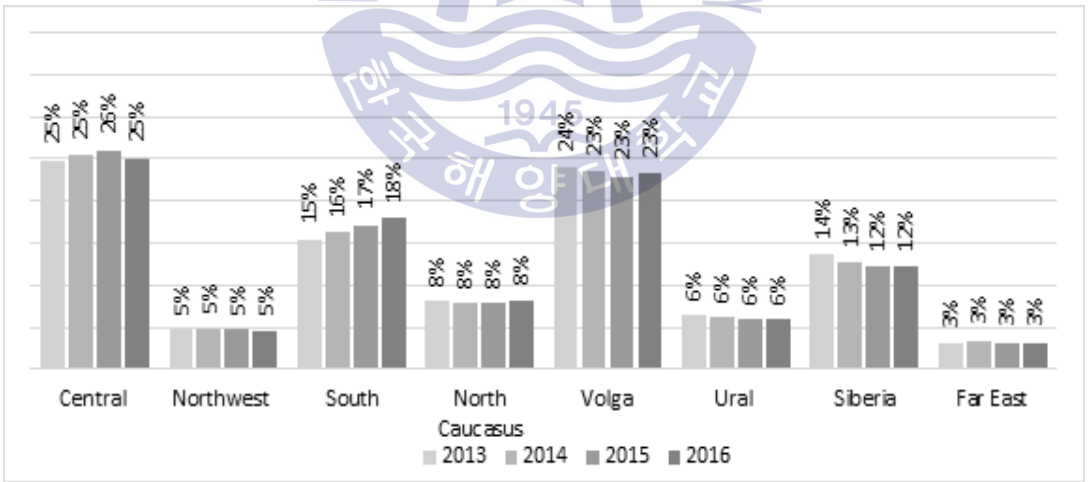


Fig. 12 The share of Federal districts in the total volume of domestically produced agricultural goods

Source: Federal State Statistics Service

As shown in Fig. 10, Fig.11, Fig.12, the problem of regional production imbalance was not solved. Thus, on one side - domestic containerized freight

turnover is growing, but on the other side - the number of empty containers is also growing (Fig. 13). Regions with low levels of cargo containerization (oriented on raw material production) and underdeveloped regions have to send back the received containers in an empty state, since they cannot offer anything to fill them with.

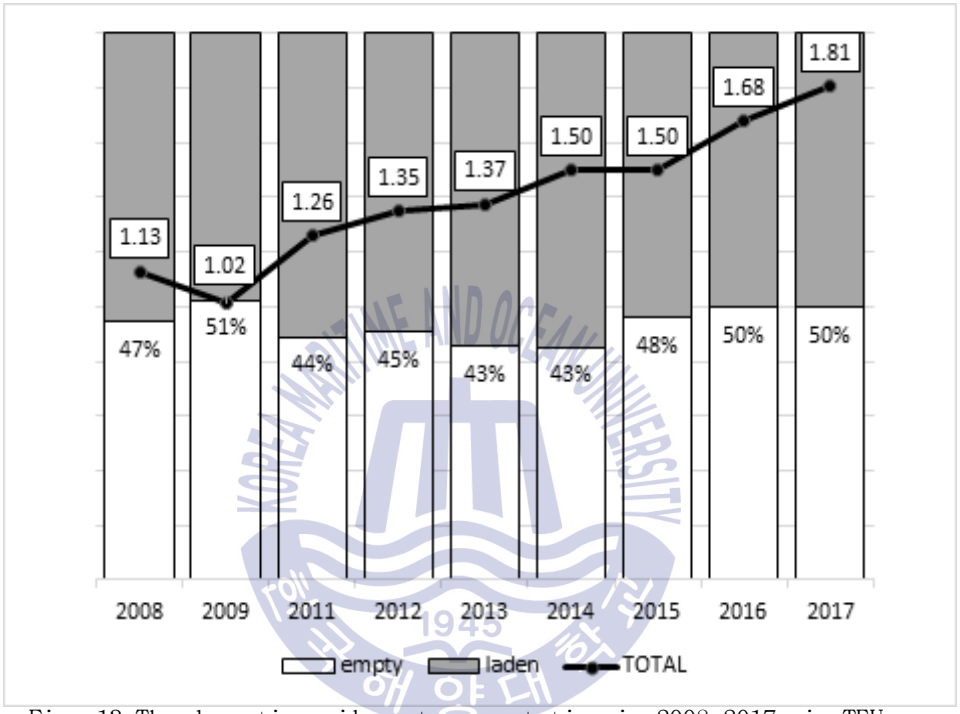


Fig. 13 The domestic railway transportation in 2008-2017, in TEUs

Source: Transcontainer Annual Report

The share of empty containers was high in all periods. However, the most significant increase in domestic empty containers volumes occurred in 2015-2017 (Fig.13), when active industrial growth stimulated domestic freight turnover. Thus, we can conclude that intensive industrial growth in Russia, combined with heavy imbalance in regional development and production structure leads to an increased amount of empty containers on domestic rail routes.

2.2.2. Export oriented and import oriented regions

The Central district is the main destination of Russian import - the import share of this region in 2016 was 60%. The traditional scheme of importing goods to Russia from Europe and Southeast Asia involves their initial shipping to Moscow or St. Petersburg regions with the subsequent distribution of them throughout the country. However, at the same time, Russian largest exporters are located in the Volga, Siberia, Ural and other Federal districts (Table 10).

Table 10 The share of regions in foreign trade (2016)

Federal district	Import	Export
Central	**60%**	48%
Northwest	**18%**	11%
South	4%	4%
North Caucasus	1%	0%
Volga	6%	**11%**
Ural	6%	**9%**
Siberia	3%	**9%**
Far East	3%	**7%**

Source: Federal State Statistics Service

Major exporters need at least 8 days of railway travel at an average speed of 300km/day to reach the ports of Northwest Sea Basin (St.Petersburg) and the Southern Sea Basin (Novorossiysk) ports, and about 20 days of travel to reach the ports of Far East Sea Basin (Vladivostok, Vostochny).

Thus, unloaded containers must be sent from western regions of the country to central regions in order to be loaded with export cargo. For example, in order to export goods from the Ural district, empty containers are usually delivered from St. Petersburg. To provide transportation of goods to Siberia and the Far East, empty containers from all over the country are pulled towards Moscow (Shavzis, 2008).

According to the report at the International Transport Forum "South-Trans-2017", in 2015-2016, the seaport of Novorossiysk experienced an unprecedented growth of relocating empty containers for export loading. In 2015 empty container relocation for export loading achieved 24 606 TEUs, as opposed to mere 2 785 TEUs in 2014. In 2016 - relocated empty containers amounted to 42 094 TEUs (PortNews, 16.03.2017).

The increase in domestic empty traffic occurred during the period of extensive containerization of exports. Empty containers were often unavailable, when exporters need them. Usually it made more sense to import empty containers than to request and gather them across the country. As a result, growing export containerization is driving the demand for imported empty containers. The Southern and Baltic basins are the primary corridors for empty containers inbound flows.

Besides, an empty container, owned by a shipping line, must be returned to its owner after unloading. Shipping companies have dedicated terminals for empty containers in major cities of the country (Fig.14).

Fig. 14 A map of dedicated terminals for empty containers

In that regard, an additional empty run is created. Empty containers must be:

- Moved to a storage from areas with no specialized terminals;
- Moved to a storage from areas with no available storage space;
- Moved to a storage from areas with high drop-off rate;
- Moved from a storage to export loading areas;
- Moved from a storage to seaports for empty export transportation.

Modern Russian logistics is more focused on imports, which is the reason for weakening of logistics links within the country. Not only individual industries, but also entire geographical zones were excluded from the economical and production turnover (Belov and Vasilevskii, 2018).

2.3. Foreign relations

The European Union is Russia's largest economic partner. It has the leading position in Russian foreign trade pattern. In 2017, the EU made up 42.2% of Russia's foreign trade turnover, APEC countries - 30.5%, CIS countries - 12.4%, EAEU countries - 8.7%.

In 2017, Russia's main trade partners (by total trade turnover) among the countries outside the former Soviet Union were China ($87 billion), Germany ($50 billion), Netherlands ($39.5 billion), Italy ($24 billion), USA ($23.2 billion), Turkey ($21.6 billion), Republic of Korea ($19.3 billion), Japan ($18.3 billion), Poland ($16.5 billion), France ($15.5 billion).

The other major economic partner is China. In 2017, almost 11% of Russia's total export value went to China (1st place in export ranking). Increase in raw material prices and high demand stimulated the growth of export from Russia to China. Russian export to China consisted of crude oil (58.2% of total export value), oil products (6.8%), lumber (5.2%), coal (4.5%), and also metals, ore and round wood. China also became the largest buyer of Russian food products. Raw materials to manufactured goods ratio was 63% to 37%.

China gave 21.1% of total imports in Russia in 2017 (1st place in import ranking). Russia buys automobiles, household appliances, computers, machines and manufacturing equipment, fruits and vegetables (Federal Customs Service, 2017).

Statistics for TOP 12 countries is given in Table 11.

Table 11 Top twelve major trade partners of the Russian Federation (2017)

Country	Share in exports to Russia (rank)	Share of raw materials	Share of manufactured goods	Non-raw non-energy exports			Share in imports to Russia (rank)
				Low level of processing	Medium level of processing	High level of processing	
China	10.9% (1)	**63.7%**	36.3%	41.8%	17.9%	40.7%	21.1% (1)
Netherlands	10% (2)	**53%**	47%	78.1%	13.5%	8.4%	1.7% (13)
Germany	7.2% (3)	**77%**	23%	24.4%	25.5%	50.1%	10.7% (2)
Turkey	5.2% (4)	43.1%	**56.9%**	**55%**	40.8%	4.2%	1.5% (16)
Belorussia	5.2% (5)	46.5%	**53.5%**	10.4%	31.9%	**57.6%**	5.3% (4)
Italy	3.9% (6)	**72.8%**	27.2%	64.8%	20.9%	14.3%	4.4% (5)
Kazakhstan	3.5% (7)	6.3%	**93.7%**	6%	28%	**66%**	2.2% (9)
Republic of Korea	3.4% (8)	**63.9%**	36.1%	71.3%	8%	20.7%	3% (8)

Poland	3.3% (9)	**69.6%**	30.4%	38.9%	45.6%	15.5%	2.2% (11)
USA	3% (10)	2.4%	**97.6%**	**60.7%**	13.6%	25.7%	5.5 (3)
Japan	2.9% (11)	**68.9%**	31.1%	83.9%	6%	10.1%	3.4% (7)
United Kingdom	2.4% (12)	**51.4%**	48.6%	75.2%	8.7%	16.1%	1.8% (12)

Source: Russian export center

Goods with low level of processing are crude metals, fertilizers, grain, fish, lumber, oil-bearing plants etc.

Goods with medium level of processing are multi-staged intermediate products and low-tech products: chemicals, plywood, rolled metals, paper, textile, meat, vegetable oil, flour etc.

Goods with high level of processing resulted from deep processing of basic materials, i.e. machines and equipment, clothing, food products, household chemicals, fine chemistry etc.

The country structure of foreign trade suggests that the export of raw materials dominates in Russian export. Among the top twelve (Table 11) only in four of them non-commodity exports prevail over raw materials. Mainly low-processed products are exported to USA and Turkey. And goods with high level of processing are exported to Kazakhstan and Belarus.

Table 12 Russian export pattern by commodities

Country	Top 5 exported commodity groups
China	Fuel - 64,9% Lumber - 8,4% Technical equipment and computers - 4% Fish - 2,8% Ores - 2,7%
Netherlands	Fuel - 85% Copper - 5,2% Fish - 1,9% Ferrous metals - 1,5% Organic chemistry goods - 1,3%
Germany	Fuel - 84,3% Ferrous metals - 1,7% Inorganic chemistry goods - 1,3% Technical equipment and computers -1,2% Lumber - 1,1%
Turkey	Fuel - 58,7% Ferrous metals - 18,5% Aluminum - 4,5%

	Grain - 4,3% Oils and fats - 1,7%
Belorussia	Fuel - 50,4% Ferrous metals - 6,9% Technical equipment and computers - 5,7% Electrical devices, communications equipment - 4,1% Plastics - 3,6%
Italy	Fuel - 85,8% Ferrous metals - 3,9% Precious metals and gems - 3,9% Paper and cardboard - 0,7% Lumber - 0,7%
Kazakhstan	Fuel - 13,8% Technical equipment and computers - 8,4% Ferrous metals - 7,2% Electrical devices, communications equipment - 6,0% Automotive - 5,7%
Republic of Korea	Fuel - 72,8% Fish - 9,7% Aluminum - 3,2% Ferrous metals - 2,7% Inorganic chemistry goods - 2,1%
Poland	Fuel - 80,4% Aluminum - 2,5% Raw rubber and GMRG - 2,3% Ferrous metals - 2,2% Organic chemistry goods - 2%
USA	Fuel - 32,1% Aluminum - 16,6% Ferrous metals - 15,1% Precious metals and gems - 7,7% Inorganic chemistry goods - 6,4%
Japan	Fuel -74,9% Aluminum - 7,6% Precious metals and gems - 4,6% Lumber - 3,9% Fish- 2,4%
United Kingdom	Fuel - 70,2% Precious metals and gems - 18,5% Inorganic chemistry goods - 2,2% Lumber - 1,4% Ferrous metals - 1,4%

Source: Russian Export Center

If compared to 2015-2016, in 2017, the share of some EU countries in Russian exports decreased (Netherlands, Italy - by 2%). Turkish, Japanese and Ukrainian shares decreased by 1%. On the other hand, Russian export shares to Belarus and

China increased by 1% and 3% respectively (Federal Customs Service, 2016).

The leading export recipients of Russian non-raw non-energy goods in 2017, as opposed to the previous year, were:

- China (+$3.09 billion), increased volumes of engineering products, lumber, copper;
- Kazakhstan (+$2.3 billion), household chemicals, cars and components, railway equipment, steel products, sugar;
- Egypt (+$2.15 billion), engineering products, grain, rolled steel, vegetable oils;
- Belarus (+$2.09 billion), steel products, cars and components, power equipment, industrial equipment;
- Turkey (+$1.7 billion), steel and rolled products, aluminum, pipes, grain;
- USA (+$ 1.3 billion), cast iron, platinum, aluminum, steel and rolled, rocket engines;
- Republic of Korea (+ $757 million), agricultural goods, metallic goods, chemicals.

In 2017, the countries of APEC supplied more than 40% of total Russian imports. China's share in Russian imports was 21%, Germany - 11%, Italy - 4%, France - 4%. CIS countries contributed 11% of total import values, including 8% from EAEU countries.

In 2017, China (26%), Germany (12%) and the United States (8%) were Russia's main suppliers of machinery and equipment.

Import of mechanical equipment amounted to $45 billion. These goods were imported from the Czech Republic, Hungary, Poland and other countries. The increase in imports of mechanical equipment also occurred due to the increase in the import of bulldozers and graders (2 times in quantitative terms), rubber and plastic processing equipment, computers parts, liquid pumps, pneumatic tools, internal combustion engines, industrial machinery and equipment etc. The import of bulldozers and graders increased by $0.8 billion, these were mainly imported from China (2.3 times increase), Japan (1.5 times increase), Republic of Korea - (3 times increase).

Import of computers parts from China increased significantly (by $340 million); computer parts were also imported from Singapore, Vietnam and Republic

of Korea - by $100 million, $7 million and $10 million, respectively.

The increase in the import of auto parts was registered from Germany (+34%), Japan (+52%), China (+29%), Republic of Korea (+64%) and Czech Republic (+52%), which was due to industrial assembly increase and model range expansion of Mazda, Toyota, Volkswagen, and Skoda automobiles.

In the pharmaceutical sector, the main suppliers of imported medicines were Germany - 21%, France - 10%, Italy - 7%, India - 6%, and Switzerland - 5%.

Among the imported rubber products, tires and pneumatic tires took the largest share - 48%, vulcanized rubber pipes and tapes - 28%, natural and synthetic raw rubber - 12%. Rubber products were imported mainly from China - 14%, Japan - 12%, Germany - 10%, Republic of Korea - 7% (Federal Customs Service, 2017).

The country pattern of Russian foreign trade affects transportation market in short and long runs. Expansion of economic and trade cooperation with other countries and quality improvements in trade pattern positively affects Russian container business. In case of current international relationships deterioration, Russia can always reroute its international operations to more appealing countries and to its domestic market.

2.3.1. Expansion of cooperation with the countries of the Asia-Pacific region

The recent changes in Russian foreign policy stimulate the shift in cooperation priorities from the EU and CIS towards Asia-Pacific countries. The share of APEC countries in 2017 increased up to 30.5% from 23.2% in 2010 (by 7.3 %). The shares of EU and CIS countries continue to decrease over recent years (Fig. 15).

During the 2014 recession period, the decline of Russian exports to APEC countries started later than in other directions, and it was less significant either. Besides, the recovery of pre-crisis export values in the first quarter of 2016 was faster on the APEC direction than on EU and CIS directions.

Total Russian import values reached local minimum in the fourth quarter of 2015, the maximum annual decrease was 39.7% in January-July 2015. Import from the EU in that period decreased by 45%, from CIS - by 40.6%, from APEC - by 36.8%. Import values from APEC were the first to return to a positive trend (Analytical Center under the Government of Russian Federation, 2017).

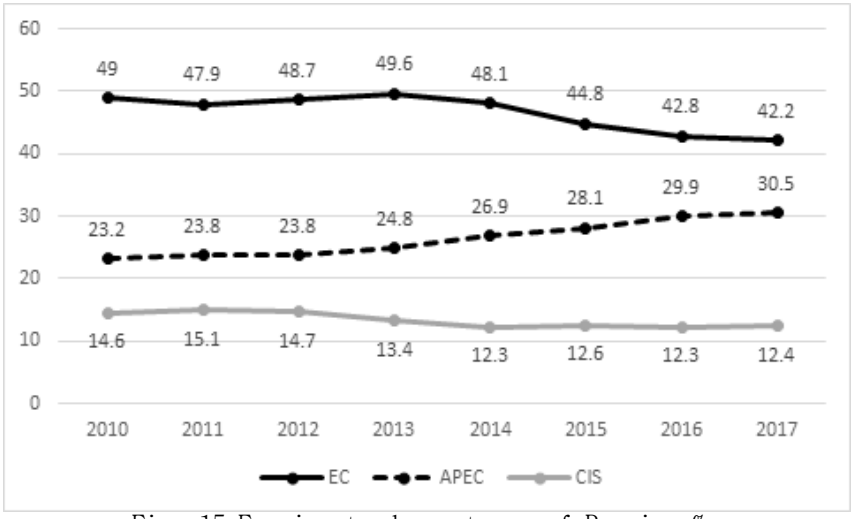


Fig. 15 Foreign trade partners of Russia, %

Source: Federal Customs Service

As a result in the first six months of 2017, the large-capacity container railroad traffic from Russia to Asia-Pacific countries (Republic of Korea, China) reached 461 600 TEUs or +48%, compared to the same period of 2016 (RZD-Partner, 11.08.2017).

Today the increase in demand for container transportation mostly occurs due to Asian countries. The future increase in container turnover volumes will depend on mutual trade relationships between Russia and Asia-Pacific. The trade cooperation between Russia and APEC countries moves in multiple directions.

Russia - Asia-Pacific cargo traffic greatly stimulates the development of Russian container market, and speeds up the development of transport corridor projects.

The "Samarga" international transport corridor is also being planned for opening in Russian Far East. It will allow travel distance decrease for the cargo, going by TSR to the Pacific Ocean by more than 500 kilometers. The Industrial and Commercial Bank of China (ICBC) will act as an agent, helping Russia to find investors from China, South Korea, and Japan (RIA News, 29.08.2016).

Russia and the Republic of Korea have agreed to continue their cooperation on the project for creation of a railroad transport corridor that will connect the

Republic of Korea with Russia and Europe (RIA News, 26.08.2016).

The project of TSR extension to the island of Hokkaido was being studied in Japan (Vzglyd, 24.05.2017).

The Northeast Passage goes along the eastern and northern shores of Russia. It significantly increases the amount of cargo transported from Asia-Pacific to Europe. It also can be competitive with the international trade passage, which goes through Indian Ocean - Suez Canal - Mediterranean Sea - Gibraltar (Lipina and Zaykov, 2015).

In addition, export of transport services is a promising direction for the national economy, and in 2017, it increased by 17.9%. Moreover, 75% of all Russian transit cargo are goods, going from China and India to Europe. The major part of containerized cargo from Asia passes through Russian territory by rail.

The sustainable economic cooperation between industrial and resource-rich regions of Russia (North, Siberia, and Far East) and Asian market makes it possible for the Russian macro regions to supply their products for export. Russia has developed a number of programs to level out the socio-economic disparities between its regions, which should turn into "growth locomotives".

Regions have prospects for launching the process of innovative development, which requires the creation of industrial complexes for the processing of natural and marine resources. Thus, qualitative improvements in the commodity structure of the country's exports can occur.

Implementation of investment projects for regional integrated development is impossible without removing the infrastructure constraints and developing transport accessibility.

In the federal target program "Economic and social development of the Far East and the Baikal region for the period until 2018", some of the target indicators were: The production capacity of the ports increased by 15.65 million tons. The 48 passing loops were built on the Baikal-Amur Mainline. The cargo turnover at the Eastern range of the Trans-Siberian and Baikal-Amur railroads increased to 587.6 billion ton-km per year.

Russia plans to develop transport infrastructure, making maximum use of Russian-Chinese regional transport cooperation. This is the opportunity to link the European part of Russia with Asia-Pacific countries. The development of port infrastructure will increase container turnover and reduce the costs associated

with the loading and unloading of vessels.

The major Asia-Pacific countries are interested in cooperation to develop and modernize their industrial complexes, which will stimulate Russia's industrial growth.

Also, several large investment projects with Asia-Pacific countries participation were completed in Saint-Petersburg:

- The "Baltic Pearl" Residential complex (Chinese investments = more than $5 billion);
- "Nissan" car factory (Japanese investments = more than $200 million);
- "Toyota" car factory (Japanese investments = $230 million);
- "Hyundai Motors" car factory (South Korean investments = more than $600 million);
- "Hyundai" auto parts industrial complex (South Korean investments = $200 million).

As a result, these projects have created a stable container flow and a positive background for new shipping lines development. For example, the joint regular container route from Busan to St. Petersburg with the transshipment of cargo in Vladivostok has been launched recently.

However, there are negative factors that inhibit the positive dynamics.

The ongoing development of the Asia-Pacific countries requires a substantial flow of raw materials and energy resources. In this regard, the Asia-Pacific countries are especially interested in Russian raw resources. This means that mostly raw materials and energy carriers, i.e., non-containerized cargo, will be supplied in large quantities.

Investment projects with Asia-Pacific countries create a stable flow of import containers. These will increase the number of empty containers in the container network, after import cargoes are unloaded from them.

In addition, the cooperation between companies from Asia-Pacific countries and Russian companies occurs mainly in - Moscow and St. Petersburg regions. Thus, the container traffic goes mainly to the western part of the country, creating an additional empty run.

The development of international transport corridors aims to expand the transit flow. And most containers return empty on their way from Europe to China, which creates additional empty traffic.

2.3.2. International transport corridors

The geographical location of Russia determines its unique transport capabilities. In the 21st century, main trade and financial flows will be located in the China-Europe-USA “triangle”. The development of land transport corridors between Europe and Asia is a key idea of Russian transport agenda for the nearest decades (Chumlyakov, 2013).

The main part of all containerized cargo flows goes in the transcontinental “EAST – WEST” direction.

Fig. 16 The “East-West” International Transport Corridor

Source: Russian Railways

The “East-West” International Transport Corridor provides two-way cargo flow from Europe and CIS to Mongolia, North Korea, China, and Far Eastern seaports. The transportation from China is organized across the three main routes: Russia –

Zabaikalsk border point; Mongolia – Naushki border point; Kazakhstan – Dostyk, Altincol.

The major part of this route goes through high-speed Trans-Siberian Railway (TSR). The Trans-Siberian Railway is a 10 000 km-long railway line. In the East, it provides access to the railway networks of North Korea, China and Mongolia. In the West, it can access European countries via Russian ports or land border crossings with the former republics of the Soviet Union. The Trans-Siberian Main Line was also mentioned as a priority route between Europe and Asia in the projects of international organizations, namely the United Nations Economic Commission for Europe (UNECE), the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) and the Organization for Co-operation between Railways (OSJD).

Currently, 10 shipping lines operate on the sea section of the TSR, ensuring the delivery of foreign trade and transit cargo from the ports of South Korea, Japan, China and Vietnam to the ports of Vostochny, Nakhodka, Vladivostok and Vanino.

At the current moment, the projects of international transport corridors in the Primorsky region are also being implemented. The first development stage was completed in 2016-2017 when border-crossing procedures were simplified.

The second development stage started in 2018 and will be completed in 2019. It includes operation and development of the "Primorje-1" ITC and construction of roads and infrastructure facilities for the "Primorje-2" ITC.

The third stage is the longest one – it will last from 2020 to 2030. By 2030, it is planned to complete the construction and start the full operation of both transport corridors.

Transport Corridor "Primorje-1" passes through Harbin – Suifenhe – Grodekovo on its way to Far Eastern seaports. The main elements are: border stations of Suifenhe (China) and Grodekovo (Russia); Container terminal of Vostochny port; "Transcontainer" PJSC (major container platform owner company in Russia) and shipping companies: CMA, CGM, and Maersk Line.

Transport Corridor "Primorje-2" goes through Hunchun-Kraskino-Posiet or Zarubino – to the ports of the Asia-Pacific Region. Corridor "Primorje-2" connects the province of Jilin with the ports of Slavyanka, Zarubino and Posiet. In the Zarubino port, it is planned to launch the first stage in 2018. The

facilities will provide transshipment of 500 thousand TEUs per year. In April 2018, a test cargo from Japan to China was transported along the “Primorje-2” transport corridor.

Other ITCs, like ITC No. 2 (Russia, Belarus, Poland, Germany), ITC No. 9 (Russia, Finland, Lithuania, Belarus, Ukraine, Moldova, Romania, Bulgaria and Greece), and The Export Railway Route to China on the "circular" scheme Vorsino-Chengdu-Vorsino are making a steady headway.

The next transcontinental direction is “North - South”. The “North-South” ITC is aimed at ensuring reliable transport ties between the countries of Europe, CIS, Persian Gulf and South Asia. This route shortens the travel distance by 2 times and more, which positively influences travel time and fees, when compared to sea transport. The delivery time from Mumbai to Vorsino (Kaluga region) is 22 days.

The “North-South” International Transport Corridor (NSITC) is a 7,200-km-long multimodal network of ship, rail, and automobile road routes between India, Iran, Afghanistan, Armenia, Azerbaijan, Russia, Central Asia and Europe. It contributes to the development of economic potential of the participating countries and attracts trade flows between Europe, Persian Gulf, and South Asia. It can become the shortest and cheapest route from Europe to South and South-East Asia.

The main cargo turnover of the international trade is formed on the Asia-Pacific - Europe route, and Chinese export gives the largest contribution to it (Zbarashchenko, 2013).

Experts from the Eurasian Development Bank anticipated that railway container traffic between the EU and China (transit through the Eurasian Economic Community) will increase in the nearest future. In 2010-2016, transit container traffic from China to the EU increased from 5 600 TEU to almost 100 000 TEU. At the end of 2017, the volume of transit container traffic across the EAEC along the China-Europe-China route reached 262 000 TEU, exceeding the 2016 value by a factor of 1.8.

Moreover, the explosive growth of container traffic by 2019-2020 is expected. Container traffic is predicted to increase from 400 - 500 000 TEU in 2020 to 1 000 000 TEU by 2030 (Eurasian Development Bank, 2018).

However, if we consider in more detail the direction of container flows - there is a large imbalance between East-West and West-East freight traffic.

Fig. 17 The "North-South" International Transport Corridor

Source: Valdai discussion club

According to EDB experts' calculations, the maximum potential container traffic of EAEC railway networks on the East-West route is estimated at 4 750 000 TEU and West-East route is estimated at 650 000 TEU. Including:

- From EU to China 300 000 TEU
- From China to EU 4 200 000 TEU
- From EAEC to China 100 000 TEU

- From China to EAEU 500 000 TEU
- From EU to EAEC 250 000 TEU
- From EAEC to EU 50 000 TEU

Thus, we can see that containers return empty from Europe to China.

Russia is interested in developing its transit potential, but certain deterrents create variety obstacles. Due to the large imbalance, almost all railway container traffic between Europe and China remains unprofitable. The increase of container traffic was largely supported by railway transport subsidies provided by China (Carnegie Moscow Center, 05.09.2016). The Chinese government is supporting international rail transportation, including transit routes. These subsidies make prices of rail shipments from China more attractive in comparison with sea freight. Therefore, cancellation of, or reductions in government support may have an adverse effect on rail container transportation on relevant routes.

Besides, the TSR annual traffic estimated capacity is 250 000 - 300 000 TEU (Gazeta.Ru, 29.12.2015). The international transit requires at least 500 000 TEU per year. Only the breakthrough transport technologies can eliminate the backwardness of Russian logistics in a relatively short time (EastRussia, 29.05.2017). Russian transport system potential is sensitive to the problems, created by excessive empty traffic, and foldable containers may help to improve the situation.

2.3.3. International UNIONS

The international organizations and unions affect international trade and economic stability, impact on openness of borders, the geography of cooperation and other economic environment. Russia is a member of a number of international alliances and these memberships affect the country's container market.

World Trade Organization (WTO)

Negotiations on Russia's accession to the World Trade Organization had been held for 18 years, from 1993 to 2011. On August 22, 2012, Russia was included in the official list of WTO member countries.

In theory, it is assumed that Russia's membership in the WTO will help

strengthen interregional and economic ties, stimulate foreign trade, and foreign investment (Rykov and Kolesnik, 2015). Although a more or less reliable assessment of the objective consequences of Russia's accession to the WTO can only be given in the long and medium term (5-6 years after the reduction of tariffs), the short-term effects are still insignificant (Khmelev, 2016).

The membership in the WTO implies the fulfillment of a number of obligations, primarily aimed at liberalizing access to the Russian market for foreign players. Russia pledged to reduce the import duty rates on all goods for two or three years after joining the WTO (transitional period). The transition period for the most sensitive import duties is set at five to seven years.

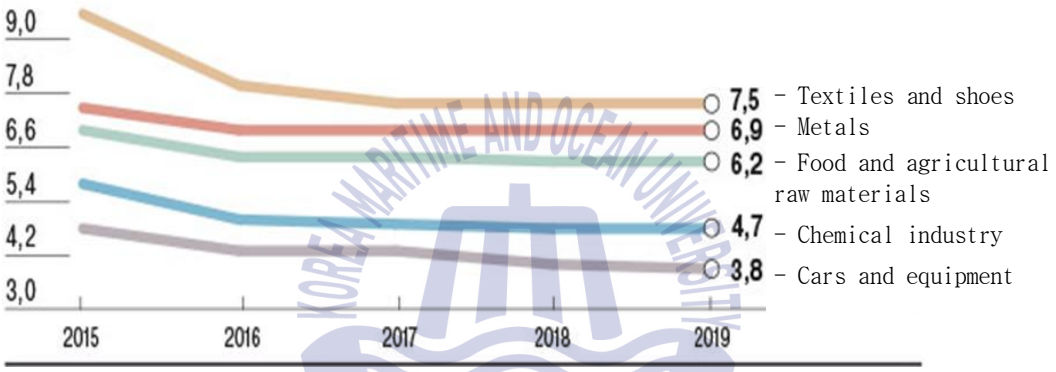


Fig. 18 Weighted average tariff in 2015-2019 by major groups of imports (%)
Source: Kommersant, 27.06.2017

From 2012 to January 1, 2017, the average import duty in Russia had decreased from 9.6% to 5.4%. By the end of the transition period (in 2019), it should be 4.5%.

Joining the organization had an immediate effect - according to the results of the first half of 2013, imports increased by 3.4% from $145 721 million to $150 678 million (Vesti.Ekonomika, 21.07.2018).

However, the total market liberalization of Russia did not happen, due to special protectionist measures (in the automobile industry and a number of other engineering industries), anti-Western counter-sanctions also enforced protectionism. In addition, import performance greatly suffered from depreciation of ruble that started at the end of 2015.

There was also no significant changes in exports. The top ten Russian export

goods are raw materials (with the exception of rolled steel, which is considered a semi-finished product), on which WTO obligations have minimal impact (Zhiryaeva, 2018).

Nevertheless, individual exporters definitely received some benefits due to foreign trade liberalization, e.g. there was an increase in exports of Russian sunflower, rapeseed and soybeans. While in 2013, Russia supplied 88 900 tons of sunflower abroad, in 2017, it was 305 500 tons - export amount increased almost five times.

In addition, export sales of Russian semi-finished aluminum products increased from 167 000 tons in 2015 to 209 000 tons in 2017.

On June 29, 2018, Russia filed a lawsuit against the United States because of the steel and aluminum duties imposed by the US.

Traditionally, Russia has several industries, which are especially efficient and competitive: military and space industries, ferrous and non-ferrous metallurgy, power industry, petroleum industry, mining and some others. Other sectors of Russian economy, as automotive industry, agriculture, agricultural machinery, light industry and pharmaceuticals are more vulnerable and less efficient (Chaplygin and Dolina, 2015).

The WTO accession impact on the selected industries is shown in Table 13.

Table 13 The impact of Russia's accession to the WTO on the selected industries

	INDUSTRY	CUSTOMS POLICY CHANGES AFTER THE ACCESSION	ECONOMICAL IMPACT AND CONSEQUENCES
1	Production of: perfumes, cosmetics and hygienic goods, furs and fur coats, cut flowers and buds, tea, coffee, confectionery, chocolate and other sweets, alcohol.	Reduction of import duties	Despite the import duties reduction, prices increased due to the devaluation of the ruble.
2	Agro-industrial complex	Reduction of import duties. Protectionism increase (food embargo)	Increased export of agricultural commodities. The government announced the import substitution

			program and started an extensive support of home producers.
3	Pharmaceutical industry	Hidden protectionism	Price of imported drugs increased. There is a problem of the functioning of national manufacturers of import analogue pharmaceutical products
4	Meat packing industry	Reduction of import duties. Introduction of non-tariff barriers.	Imported goods caused intensive competition. Home producers need state support, which has to be reduced under the WTO standards.
5	Light industry	Reduction of import duties	Home producers suffered significant losses due to extensive competition, national currency devaluation, and raw materials price increase. The government continues to support the industry even despite the WTO ban.
6	Manufacturing industry	Reduction of import duties	Industry continued to grow even despite intensive foreign competition.
7	Mechanical engineering	Reduction of import duties	Competition increased, national manufacturers started to create cooperation networks with foreign companies.
8	Agricultural engineering	Reduction of import duties	Home producers intensified production cooperation with foreign partners.
9	Automotive industry	Reduction of import duties. Hidden protectionism	Increased competition, rise in prices for finished goods due to raw materials and components price increase.

Source: Fomina, 2018

However, for the most part, Russian foreign trade structure had not changed upon the accession to the WTO. Raw materials and goods with low level of processing are still the major part of the export. Other commodity groups are mainly imported.

Hereby, the Russia's accession to the WTO resulted in empty container traffic increase, due to the following:

- Increase of finished products import (through import duties reduction)
- Russian export had kept its raw-oriented commodity structure
- Russian export of finished goods is insignificant and discriminated despite the WTO regulations
- Russian finished products have low competitiveness due to internal reasons and the WTO accession only aggravated the situation.
- Cooperation with foreign companies in mechanical engineering increases import of machine parts and equipment

However, the accession to the WTO also contributed to the export containerization growth.

Eurasian Economic Union (EAEU)

The Eurasian Economic Union (EAEU) is a political and economic union of states located in central and northern Eurasia. The Treaty aiming for the establishment of the EAEU was signed on May 29th,2014,and became effective on January 1st, 2015.

The EAEU provides free movement of goods, services, capital and labor within the united market, pursues single economical and foreign policy, and establishes a single set of customs tariffs for third countries. The members of the EAEU are the Republic of Armenia, the Republic of Belarus, the Republic of Kazakhstan, the Kyrgyz Republic and the Russian Federation.

The EAEU mutual and foreign trade shares are presented in Figure 19.

In 2017, the share of mutual trade between the members of the EAEU was 14.5%.

Republic of Belarus' share was 52.5%, Kazakhstan - 22.4% and Russia - 8.9%.

In mutual trade commodity structure mineral products occupied the largest share (27.7% of the total trade volume), 84.6% of mineral products was supplied by the Russian Federation. Machinery, equipment and vehicles occupied 18.5% of the mutual trade volume (57.2% was supplied by Russia and 39.4% by Belarus), food

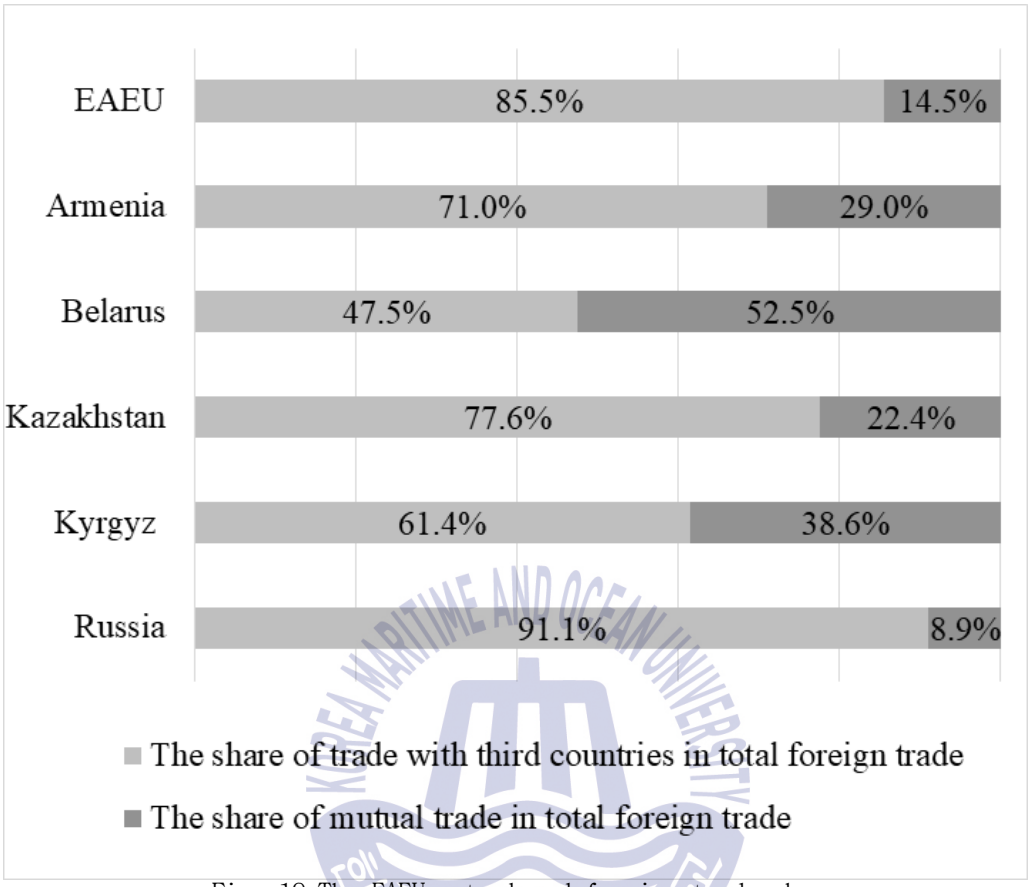


Fig. 19 The EAEU mutual and foreign trade shares

Source: Eurasian Economic Commission

products and agricultural raw materials – 15.1% (53.4% – Belarus, 35.4% – Russia). The share of metals and metallic products amounted to 13.1% of the total mutual trade volume (61.3% was supplied by the Russian Federation).

According to the Russian Academy of Sciences, by 2030, the volume of mutual trade between Russia, Kazakhstan and Belarus will reach $400 billion, and the union's GDP will exceed $2.4 trillion (Pak and Piskulova, 2015). The government states that cooperation with the EAEU is extremely important for the development of Russia’s foreign economic relations at this point.

The elimination of customs barriers between integrating countries with similar levels of economic development leads to an increase in intra-industry trade. Production cooperation is also vital, especially when commodity export prices are

low. Technological and scientific cooperation helps to increase competitiveness.

Agricultural industry seems to be the most prominent area for EAEU cooperation and trade. Russia, Belarus and Kazakhstan have large potential for mutual development of manufacturing and trading in dairy, meat products, and grain. Russian industries have especially strong positions in food products, furniture, and household chemicals manufacturing.

The EAEU conducts the policy of import substitution in pharmaceutical industry. Since May 2017, a single drug market began to operate on the EAEU territory; currently 70% of total pharmaceutical goods on Russian market are imported (Vinokurov, 2015).

The EAEU development process is divided into two stages. The first stage is formation of a single internal market that would serve as a reliable platform for providing its participants with goods and services. The second stage is promotion of EAEU member states' competitive goods and services to foreign markets (Vinokurov, 2015).

The creation of free trade zones with foreign countries is an important development trend. The first free trade zone was established on May 29th, 2015 with Vietnam. By 2025, the EAEU plans to reduce its customs tariffs from 9.7% to 2% and Vietnam, in turn, plans to reduce its tariffs from 10% to 1%. Import duties are going to be removed completely for about 60% of the traded commodities. At the end of the transition period, the share of zero duty commodities will be 88%. Russian government expects the trade with Vietnam to double by 2020 (from $3.7 billion in 2014).

The Union is focusing on the Eastern direction in order to expand trade and economic relationships with the Asian region. On November 27, 2015, the Memorandum of Cooperation was signed between the EAEU and the Ministry of Industry, Trade and Energy of the Republic of Korea. China is expected to become a major trade and industrial cooperation partner for the EAEU member states - several treaties and agreements on that matter have already benn signed. The process of free trade zone negotiations between the EAEU and the Republic of India started in 2017. Preliminary trade and cooperation agreements were signed in May 2018 between Cuba and the EAEU, and between EAEU and Iran.

The EAEU is currently negotiating the FTA agreements with Israel, Serbia and

Singapore. Trade and cooperation agreements will allow the EAEU countries to become participants of global production and supply chains. Moreover, modern FTAs concern not only trade markets, but also investment flows.

Modern Russian transportation complex is highly underdeveloped. According to the World Economic Forum, Russia ranks 93th among 148 countries in the Global Competitiveness ranking in terms of overall infrastructure development. Particularly weak positions are the road network quality - 136th place, airport infrastructure - 102nd place, seaport infrastructure - 88thplace, and only the rail infrastructure performed better - 31st place (Lipina and Zaykov, 2015).

Transport system development is one of the most important issues in economic cooperation. The key subjects are infrastructure projects financing, development of transit potential, multimodal transportation, development of Eurasian transport corridors and routes, and electronic document management systems.

The EAEU defined the priority tasks of the coordinated transportation policy:

1. Creation of a common market for transport and logistics services;

2. Formation and development of Eurasian transport corridors, transit potential expansion;

3. Collective development of regional transport and logistics infrastructure, including the creation of modern logistics centers.

The railway network integration of the EAEU is especially succesful. Since January 1st, 2015, the EAEU rail carriers have received free access to each other's markets. When exporting goods to third countries or importing goods from third countries, through the EAEU seaports, a single railway tariff is in effect. The largest railway operator of the EAEU - the United Transport and Logistics Company - Eurasian Rail Alliance was created. The number of carriers in EAEU countries continues to grow - 6% in 2017. In the past 2017, the total warehouse space of the EAEU countries increased by 5-10% (Bannyh, 2018).

In addition, the unique geographical location at the crossroads of key trade routes between Europe and Asia, may allow the EAEU countries to secure 2-3% of the total trade flows from China to the EU by 2020 (Pak and Piskulova, 2015).

The implementation of transportation, logistics, technological, and educational projects is a difficult task. That is why the EAEU countries lay emphasis on their cooperation with the Asian countries. If the EAEU states successfully

implement their transport and infrastructure projects, this will result in the creation of favorable conditions for the entrance of the leading South Asian states to European markets. (Zubenko and Avarskii, 2016).

Russian ports alone give the turnover, which is ten times higher than the total multimodal turnover of the rest EAEU members. Most of the goods, imported from the Asia-Pacific countries, entering the territory of the Union go through Russia. From the ports of the Russian Far East (Vladivostok, Vostochny), 25% of the transit goods are being transported by rail through the Russian territory to Kazakhstan and Belarus.

Hereby, the EAEU creates intra-industry trade, production and sales cooperation. It help to increase industrial production and competitiveness of goods in foreign markets, thereby increasing the export of finished goods. Free trade zones creation stimulates trade flows and develops favorable conditions for increased investment flows. And development of the transport and logistics infrastructure of the EAEU will contribute to the creation of new industries, labor and capital mobility. Infrastructure development will also stimulate other sectors of the economy. However, there are negative factors that disturb the positive dynamics. At the present stage, the foreign export commodity structures of the EAEU is dominated by raw materials (non-containerized cargo), the largest share of foreign imports is taken by containerized cargo. Free trade zones, agreements, and the consequent development of the transport network will create additional flow of import containers and, therefore, additional amounts of empty export containers. More over, it puts additional burden on Russian port's throughput capacities.

3. Factors of foldable containers implementation

3.1. Certification

All containers must be certified in order to confirm their compliance with the established requirements. Certification is mandatory for all legal entities that design, manufacture, and supply containers. Regardless of the owner, all containers must be certified before receiving operation admission.

The Russian Product Classification, which serves as a basis for container certification, divides containers by weight class (up to or more than 10 tons of gross weight) and application possibilities: universal, specialized (for bulk, gas or liquid), and multi-purpose.

Based on container's purpose, different requirements and permissions exist for every container type, governed by various regulatory legal acts. For example, railway containers and medical cargo containers are required to have a certificate of conformity in the GOST R national standardization system. Containers used for transportation and/or storage of food products are also liable to mandatory hygienic certification. A hygienic certificate (sanitation certificate) confirms that a container meets all sanitation rules and regulations. Technical regulations may also require mandatory labeling (pictogram and symbols) of containers for identification and safety purposes.

Some container types cannot receive Russian certificates and therefore cannot be used throughout the Russian Federation. For example, containers with automatic roof opening (used on bulk containers) are not allowed to be transported by rail, because in Russia passenger trains often use the same railways as cargo trains. If, for some reason, container roof opens in transit, it may endanger passenger trains that are passing by.

The specifics of certification may affect the variety of types of foldable containers. It also may affect the use of other types of containers - for example, for bulk cargoes, hampering the development of this area and, for its part, affected the empty export containers traffic.

3.2. Technology

3.2.1. Container types

Shipping containers differ in types and sizes. The most common are standard 20-foot and 40-foot containers. However, there are also 45-foot, 53-foot containers, High Cube containers, Open Top, Flat Rack, Tank, Pallet Wide, AFAM (Advanced Air Fresh Management) containers, Garmentainers, Slide door container. Such variety provides many opportunities for transporting cargoes of different types, volumes or sizes. Shippers just have to choose the type that fits their requirements best.

However, foldable containers cannot offer such diversity - they currently support only 20-foot, 40-foot, and 40-foot High Cube sizes.

Moreover, perishable, temperature-sensitive, or hazardous cargo often requires a refrigeration system. A refrigerated container or reefer has an integral refrigeration system for controlling the inside temperature. Due to their integrated refrigeration systems, such containers cannot be folded or collapsed in any way. Besides, increasing export containerization in Russia is driven mostly by agricultural and mineral goods - this type of cargo requires specialized non-foldable containers.

According to Drewry maritime research consultancy, shipments of refrigerated containers demonstrate leading growth rates in the market - in 2017, there was an 8% increase , and we have every reason to believe that the trend will continue in the future (InfraNews, 31.08.2018).

According to MB-FESCO TRANS, in Russia the average growth rate of Russian refrigerated container logistics market in the next three years will be about 25-30% (RZD-Partner, 09.01.2017). In 2016, 397 520 TEUs of refrigerated containers passed through Russian seaports. In 2017, Russian ports processed 450 280 TEUs, which was 13% higher.

In addition, in recent years, the prerequisites for extensive bulk container use have been created. Containerized Bulk Handling technologies have been implemented in the countries that actively export ore, coal, and grain. In

response to the new market trend, various technologies are being developed in both Russia and the rest of the world:

- Open top containers - containers with an open top, covered by tarpaulin; there are also variants with a removable solid roof.
- Rotating containers, which can be rotated 360 degrees around the long axis. They are equipped and are handled by special motorized rotating devices, attached to container cranes. This technology allows dumping the cargo right in to bulker vessels cargo holds. A standard multimodal container is not compatible with rotating devices.
- Specialized heavy-duty containers for heavy cargo loads.

Container transportation of grain also requires special equipment:

- Sealable containers;
- Specialized containers with roof hatches;
- Special 20-foot containers with sealed lids.

However, Russian import consists mostly of consumer goods, machinery, and equipment. These commodities are usually shipped in standard containers.

The extensive implementation of specialized bulk cargo containers will make many standard containers unnecessary on export directions, which in turn may lead to empty traffic increase.

3.2.2. The issues of folding technology

The first 20-foot foldable container had 500-600kg heavier tare weight than of a standard container, and its maximum gross weight was 20 tons, whereas standard container had a gross weight of 24 tons (Konings, 2005).

The modern 40-foot Standard High Cube container (Hapag-Lloyd) has the following specifications:

- Capacity 76.3 m3
- Tare Weight 3,900 kg
- Gross Weight 32,500 kg (max)
- Payload (kg) 28,600 kg (max)

For comparison, the 4FOLD foldable container, which was designed by Holland Container Innovations, has the following specifications:

- Capacity 72.9 m3
- Tare Weight 5,900 kg
- Gross Weight 32,500 kg (max)
- Payload (kg) 26,600 kg (max)

We can see that the present-day foldable container's tare weight is 2 000 kilograms heavier than of a standard container. Thereby, payload may become a relevant issue. In general, we may assume that foldable containers can accommodate less cargo, than their conventional counterparts can. Moreover, unfortunately, most foldable container manufacturers tend to keep their containers' specifications unavailable for public access.

Another issue is a foldable container's lifespan. Since foldable containers are designed to have moving parts, they are much more vulnerable to damage and wear, and their expected lifespan is much shorter than of standard containers.

If the number of foldable containers, laden on a train or vessel, is not a multiple of four (or any other number, which makes up one full bundle), then the stack will be incomplete, i.e. lesser than a standard container, which can cause problems during handling and transportation.

Furthermore, foldable containers require additional time for folding and unfolding operations. It means that additional personnel and working hours are required. Usually, at least two people and a forklift carry out folding/unfolding operations.

3.2.3. Differences between folding technologies

Nowadays many companies around the world have proposed various designs of folding containers. There are no unified standards. Each company presents its own design: containers can be folded horizontally or vertically, can be made of different materials, can be stacked differently etc. The most common models of collapsible containers are presented below and the most modern ones are summarized in Table 14.

Two of the early designs were presented by the Swiss based Fallpac AB and SIO Container Company (SCC) during 1980s and 1990s. The SIO was a fully dismountable 20-foot dry freight box that, once dismantled, could be folded and stacked six high and interlocked to the exact dimensions of a standard 20-foot container. The

Fallpac was a 20-foot container that combined dismountable and collapsible features - i.e. the roof was dismountable and the remaining parts were foldable. Four folded Fallpac units could be stacked inside a fully assembled fifth unit, which had the dimensions of a single 20-foot standard container (Konings and Thijs, 2001).

In 2008, the India Institute of Technology developed the technological concept in which container walls, powered by hydraulics could be retract down to about 1/4th of the normal container size.

In 2009, the Cargoshell company (Netherlands) presented a new concept of folding container. The Cargoshell's prototype was a folding container made of composite materials and aluminum. Only one person was required for folding and unfolding without any auxiliary motors or separate container elements. The dimensions of a folded Cargoshell container equaled 1/4th of a conventional steel container.

The Compact Container Systems company (Boston,USA), restarted their trademark FOLDX containers in 2009. When FOLDX-540-footHC ("HighCube") and FOLDX-520-foot STD ("Standard") containers are folded, five of them are the same size as one standard open box. All containers can be quickly and safely folded, or erected, in minutes with a two-person team on the ground and one crane operator.

In 2010, STAXXON company (New Jersey, USA) demonstrated their 20-foot vertical folding shipping container that allowed two to five empty containers to fit in the same space as one container.

The Dutch Holland Container Innovations company (HCI) was founded in 2008. Their first prototype was presented in 2008. After several improvements and redesigns, in 2013, HCI presented the 4FOLD container.

This container allows four empty units to be folded into the same footprint as one single standard 40-foot High Cube. It can be folded/unfolded within four minutes by two men with standard tools. 4FOLD is the first ISO and CSC certified foldable 40-foot HC maritime container. The design has also received rail operations approval from the International Union of Railways (UIC) and the Association of American Railroads (AAR). HCI cooperates with the Chinese CXIC Group in container manufactruing, and is now working on a redesign that will cut down the production costs. The 4FOLD containers are manufactured in China and are available for sale or lease all over the world.

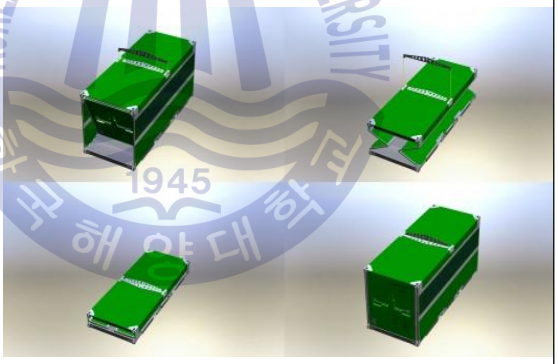
In 2015, the Navlandis Logistics Technologies company (Spain) developed another

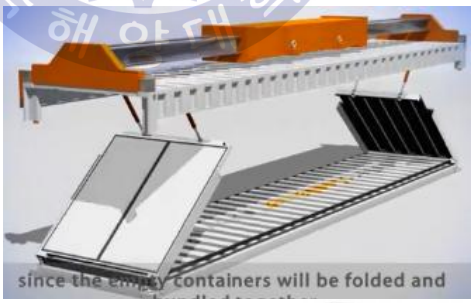
project of a foldable 20-foot container called ZBox. The container folds in a "Z" shape. ZBox containers can be combined in sets of five in the same space that a regular container would occupy. It has the same strength properties as conventional containers and can be handled by traditional lifting and relocation terminal equpment and machinery.

In 2016-2017, the Australian CEC Systems developed the COLLAPSECON® system. It is a 40-foot High Cube container, which can be collapsed to achieve a 4:1 ratio.

In 2017, Korea Railroad Research Institute demonstrated a foldable shipping container, which folds to a quarter of its original size in less than ten minutes. New containers are also competitive price-wise and take just two people and one piece of equipment to fold or unfold them.

Table 14 Common models of foldable containers on the market

DESIGNER	TYPE OF FOLDING	FOLDING SCHEME	FOOTPRINT DECREASE RATIO
Cargoshell NAME: Cargoshell	Horizontal		4:1
Compact Container Systems Name: FOLDX	Horizontal		5:1

Navlandis Logistics Technologies Name: ZBox	Horizontal		5:1
STAXXON Name: STAXXON	Vertical		2:1 3:1 4:1 5:1
Holland Container Innovations Name: 4FOLD	Horizontal	 	4:1

CEC Systems Name: COLLAPSECON	Vertical		4:1
Korea Railroad Research Institute	Horizontal		4:1

Source: Author's own processing

Needless to say, foldable containers of different designes are absolutely incompatible and cannot be stacked together. In addition, they require different skills and knowledge from operating staff, some models may require special tools and additional equipment or machinery.

Thus, the company that decides to use folding containers has to stick to one

particular technology from the start, because transition costs are going to be significant. Besides, additional complexities can arise in case of cooperation with other companies that have chosen different foldable technologies.

Moreover, as can be seen from the historical overview above, over the years, foldable containers design has been changing and improving. Design changes/improvements (especially without reverse compatibility support) can lead to significant costs and even the inability to use outdated containers, rendering the subsequent sale of them almost impossible.

3.3. Environmental initiatives

Resolving the environmental issues is a priority task on Russian government's current agenda. This will eventually lead to a long term and consistent enforcement of environmental, technical, sanitation, and health requirements.

On March 1, 2018, Russian president Vladimir Putin delivered an annual message to the Federal Assembly in which he outlined the key areas for Russia's future development in the upcoming years. The environmental requirements for enterprises will be tightened. More than 300 industrial enterprises will make a switch to modern eco-friendly technological standards in 2019, and all enterprises with environmentally hazardous production must adopt the new standards by 2021.

Environmental risk assessment and management is particularly relevant at the moment. In 2016, total environmental protection costs in Russian transportation industry amounted to 5.735 billion ruble (Federal State Statistics Service). It is expected, that basic environmental payments will be quadrupled, and payments for excessive emissions will increase tenfold (Transler, 20.10.2017). In such conditions, financial stability of enterprises is at a great risk.

Russia is also obliged to fulfill the requirements of the international organizations, in which it has entered. For instance, the Organization for Economic Cooperation and Development (OECD) requires its member states' companies to constantly improve their environmental activities, especially on supply chain levels (RZD-Partner, 09.01.2018). Therefore, logistics companies should evaluate and consider all the possible consequences for the environment, health and safety, take action to reduce negative impact, and issue public reports.

The most common methods of corporate environmental improvement are empty mileage reduction, loading and unloading operations speed increase, required terminal area reduction, energy saving measures etc. Eco-friendly transport is another important development trend.

Figure 20 shows different Russian modes of transport, compared by their negative environmental impact.

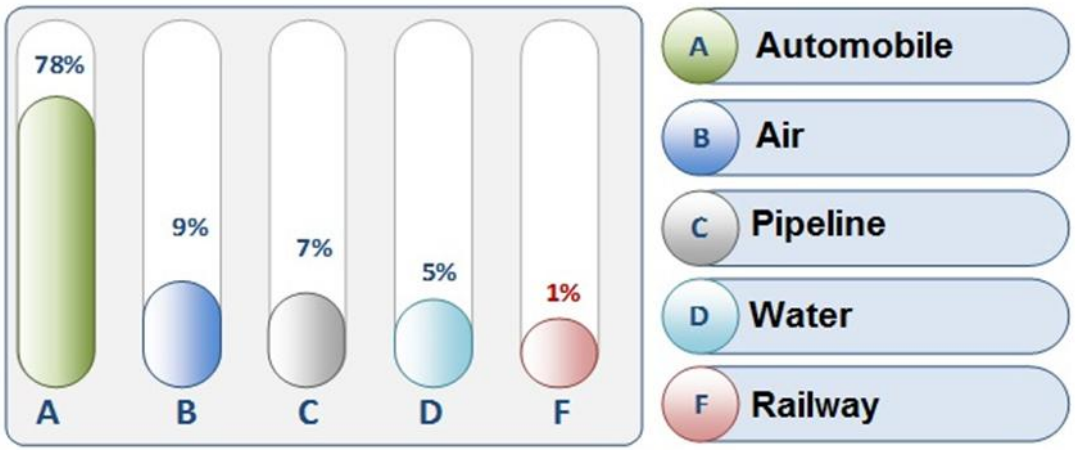


Fig. 20 Negative impact on the environment in Russia by modes of transport
Source: Russian Railways

Taking into account railway transport's relative environmental safety, its role and importance in promoting eco-friendly logistics is increasing (Bogomolov, 2011).

Railway transport is leading in CO2 emissions reduction in Russia. From 1990 to 2009, the reduction rate of CO2 emissions for railway transport amounted to 70%, for air transport - 40%, and only 10% for automobile transport.

The most important issue is the quality of power sources in use. Increasing numbers of modern cargo trains are powered by electricity. Automobile transport, as the most "dirty" type of transport, may experience significant difficulties, when the environmental legal and fiscal burden is increased. From July 1, 2018, the new traffic regulations were introduced in Russia - zones of emission class restriction for trucks and other motor vehicles.

Railway transport is also energy efficient due to its relatively large cargo capacity. Careful planning can also be used to improve the energy efficiency of railway logistics.

Thus, we can conclude that, from the environmental and economical point of view, railway container transportation has a great potential. Modern containerization technologies ensure not only reduction of harmful gas emissions but also minimize dust emission when handling bulk cargoes.

In the meantime, containerization of Russian railway network is progressing steadily (Fig.21).

Fig. 21 Russian railway network containerization rates in 2006-2017 (percentage of total shipped cargo)

Source: Transcontainer Annual Report

Despite the stable grow, Russian railway containerization level is still low. For instance, in Europe the share of railway container cargo is 14%, in India - 16%, in the USA - 18% (RZD-Partner, 02.2018). For Russia, there is definitely a room for improvement.

The sea transport, in fact, is more "dirty" in terms of sulfur oxides emissions in comparison with other types of transport (Morskoy flot, 2018). However, the requirements of international organizations, such as the International Convention for the Prevention of Pollution from Ships (MARPOL) in particular, are getting tougher every year. The IMO (International Maritime Organization) is regularly introducing changes in maritime environmental laws and procedures for shipowners.

In 2020, it is planned to start the reduction of nitrogen emissions and sulfur in marine fuel all over the world. Vessels operating in the Nitrogen Emission Control Areas (NECA) (the coast of the United States and Canada, as well as the territorial waters of the United States in the Caribbean) should be outfitted with diesel engines that meet Tier III ecological standard. The Baltic Sea and the North Sea will be declared Emission Control Areas in 2021.

Another important initiative is the Ballast Water Management Convention (BWMC) (Kalinin and Minakov, 2018). It came into force in September 2018. According to this doceument, from 2024, all vessels will have to be equipped with special ballast water treatment systems. Needless to say, this kind of refit is going to be extremely costly, especially when a shipowner's fleet is numerous.

In August 2017, the IMO announced the GloFouling project, which aims to "implement recommendations for monitoring the biofouling of ships." This initiative is positioned as a logical extension of the BWMC. The project is at its earliest stage, and the adoption of a new convention will happen no earlier than in four years from now (Sea news of Russia, 2018).

All the abovementioned initiatives will definitely increase shipowners' costs and, therefore, freight rates and tariffs will be increased accordingly. In addition, shipowners will have to consider fleet size cutbacks, since old vessels will not likely meet future technical and environmental requirements and refit will be too expensive for their current utility.

Environmental laws can significantly influence production and transporation levels both directly and indirectly. For example, in 2016 (когда это было?), due to the toughening of environmental laws in China, thousands of factories were closed, and Chinese exporters were forced to look for alternative manufacturers. China share of world's industrial production and exports is so large that the aforementioned events caused a sharp drop in container transportation rates (Tremblay, 2016).

The effects of environmental requirements tightening are multidimensional. Environmental initiatives may cause:

- Increased enterprise financial and fiscal burden;
- Freight rates and tariffs volatility;
- Promotion of eco-friendly transport and new transporation technologies;
- Cargo fleet renewals and cutbacks;
- Renewal of obsolete cargo fleets.

These factors may directly and indirectly influence the capacity and financial aspects of logistics routes.

3.4. Finance, access of finance, investment risk, budget subsidy

Every new technological innovation needs substantial financial resources in order to be adopted. Foldable technologies in the transportation industry are not an exception.

Innovation financing sources in Russia may be divided into two categories:

- Private financing, which may take form of special foundations, joint stock ventures, bank loans and foreign investments;
- Government financing, which is performed through special federal funding programs and subsidies.

In 2005, following the Chinese positive experience, Russian government established several special economic zones with different purposes (industrial, research, transport, recreational and tourism) throughout the country. These special economic zones were defined as the main locomotives of local economies. All of them provided their participants with all kinds of benefits and privileges in taxing, banking and administrative formalities.

The more recent example of innovations financing is the Resolution of the Government of the Russian Federation №158 dated February 15, 2018, which approved the so-called "Project Finance Factory Program" for financing the investment projects on syndicated loan agreements basis. According the Program, the project finance is a long-term (not less than 3 years) financing of an investment project in the form of a loan, under which the debt is repaid at the expense of income from the use or sale of property created and/or acquired in the course of implementation of the investment project or corresponding technology.

The government also specified the most important sectors for financing: manufacturing, infrastructure, electronic component base and radio electronics, production of high-tech products and creation of new types of innovative products, new types of materials and equipment, end-to-end digital technologies, promising industrial technologies, expansion of export infrastructure and international integration, environment-friendly technologies etc.

Within the framework of the Program, project financing is implemented with the use of state support measures such as:

- Subsidies from the federal budget to compensate for accompanying costs during

the provision of loans;

- State guarantee of the Russian Federation on bonded loans arranged by Project's management authorities.

The state corporation "Bank for Development and Foreign Economic Affairs" (Vnesheconombank) was appointed as the Program operator. The Program and the Rules became effective from 16 February 2018.

This all looks very promising in theory, however in practice, technological innovation financing in Russia usually proceeds very slowly and on a small scale, due to numerous reasons:

1. Extreme corruption on all administrative levels bogs down any new incentives and prevents new players from entering technological innovations market without knowing/bribing the right people in high places.

Government or regional officials often demand their share of profit (the so-called "kickback") for giving a green light to new projects, and financial subsidies may be partially or even completely plundered on their way to the target project, especially when it comes to subsidies from the federal budget.

2. Excessive amount of bureaucracy and complicated documentary procedures. It is very hard to establish a legal entity in Russia while being a foreigner due to the overcomplicated and non-transparent nature of Russian laws and business regulations.

Even in special economic zones, designed to attract foreign investments, it is highly recommended to have local intermediaries deal with application documents and registration fees. Otherwise, a single inaccurately filled up application form or a missing required document may become a reason for application refusal.

3. The majority of Russian financial resources and foreign investments is traditionally concentrated in oil and gas extraction industries, wood industry, fishery and agriculture. Transport and logistics infrastructure is underdeveloped and underfinanced.

4. Budget disagreements between Russian central government and local governments. Large investment projects and innovation financing expenses are usually distributed among the federal (central) budget and local (regional) budgets. Unfortunately, both parties try to minimize their share and shuffle off the burden on their counterpart. This kind of struggle always leads to massive slowdowns and underfunding of investment projects and innovations.

It is worth mentioning that most of the abovementioned Special Economic Zones

projects in Russia failed to make any significant economical impact or were not even created in the first place. Mainly this happened because the central government expected regional governments to handle SEZ development, while regional budgets were unable (or unwilling) to support such tasks. The notorious administrative corruption only aggravated the matter.

5. Mediocre business climate - this includes political, social, and economic factors, such as:

- Complicated laws and legal procedures;
- Unreliable and sluggish judicial system;
- High taxes and legislative burdens on business entities;
- Insignificant role of labor unions;
- High rates of inflation;
- Difficult of access bank loans with high interest rates;
- Ineffective patent policy regulations, which prevent intellectual property protection.

All these factors create significant obstacles to investments and innovations.

6. In general, Russian domestic transport market is very conservative and has low demand for innovations.

Most market participants prefer quick profit and do not wish to invest into long run projects, where profits may be significantly delayed or may not occur at all.

Also old and underdeveloped Russian transport infrastructure may not be compatible with modern technological solutions without proper upgrades and renovations, which requires significant funding as well, and thus Russian logistics companies are happy with the current situation as it stands.

In order to gain financing for innovative technology implementation, without getting government support or attracting shareholders, the transport company can also apply for a private investment credit from a commercial bank. Loan terms and interest rates depend on project costs, available credit support, project presentation, planning etc.

Usually Russian commercial banks provide financial credits for a term from one to fifteen years and more, and interest rates are quite hefty, starting from an average value of 10%. Banks will also require a credit support, which takes a form of a collateral (real estate rights, land rights or any property rights, shares and stocks etc.), and it can be substantial, depending on the total

project cost. Moreover, loan-subscriber will sometimes have to provide his own minimal share of the investment cost.

In any case, a lending bank gains a partial (sometimes even full) control over production and implementation process, to make sure loaned funds are utilized properly and bring maximum profits. Bank representatives may participate in negotiations on equipment purchase prices, terms and conditions of goods deliveries and so on.

The abovementioned facts may have both positive and negative impact. Commercial banks provide legal advice and may be useful intermediaries between different suppliers and contractors, which helps to speed up production and implementation process. However, lending banks also become a kind of supervision body for their obligators, with all the rights to interfere with fund disbursement, research, production and implementation activities, which is not necessarily a good factor.

Any new technological implementation project bears significant risks of failure. In general, there are numerous politic, economic and social occurrences, which may reduce our innovation efforts to nothing and all the invested funds will be lost in the process. These are the investment risks.

Investment climate and risk are defined by strengths and weaknesses of a country. By analyzing political, social and economic features of Russia, we can formulate its strong and weak sides, which define investment risks.

Strengths:

- Political stability - the current regime is going to stay for long, without unexpected political course shifts;
- Trained and educated workforce - the Soviet legacy of exceptional education and manpower development systems (especially in IT, engineering, and exact sciences);
- Low public debt, sufficient foreign exchange reserves and current account surplus;
- Ongoing purge (sanation) of the banking sector with reduction in the number of ineffective and fraudulent banking institutions;
- Maintained regional and energy power - Russia has been a political and economic leader in the local region since the Russian Empire times, and its energy superiority is acknowledged everywhere.

Weaknesses:

- The economy growth is heavily dependent on the world price of hydrocarbons;

- Declining demography, except in major cities - may limit the investment project location choice to the most populated areas;
- Absence of commercial agreements beyond its immediate neighbors (mostly former USSR republics);
- Dependence on foreign capital goods and technology - the majority of hi-tech parts and equipment is imported.
- Weak infrastructure aggravated by lack of investment - especially transport infrastructure.
- Regional disparities despite redistribution - further limits the project location choice;
- U.S. and European economic and political sanctions;
- Mediocre business climate and high bureaucratic pressure on foreign investors;
- High levels of corruption and lack of governance.

Considering the positive sides, Russian economy is a suitable destination for logistics innovation investments - rich human and natural resources, vast undeveloped territories, and a strong geographical position - right in the middle between Europe and Asia.

However, the current transport infrastructure is old, underdeveloped and lacks government funding. Also Russian poor business environment is plagued by state interventionism, when Russian government can interfere with large business by seizing their property, executing hostile takeovers and performing other actions for its own convenience. Even companies with large share of foreign investments are not safe from such interventions.

Concluding all the above-mentioned statements, we can say that Russia is definitely a suitable place for collapsible containers technology implementation, but the immediate business difficulties and long-run risks may be quite significant.

4. Factors that determine Russian transportation market participants' opinion

4.1. Questionnaire

The questionnaires were made using the Google Forms platform. In July - August 2018, invitation messages were sent by e-mail to forty-eight randomly chosen Russian major companies: container terminals, transportation and logistics companies, container operators, port operators, and shipping lines operators. Besides, the call to participate was published on specialized logistics web-forums, and sixty-five people viewed the publication.

Seventy-one completed questionnaire returned for analysis - a response rate of 63% was achieved. One of the questionnaires was not filled in completely and was discarded.

For the purpose of this paper's analysis, the survey respondents were divided into several groups, based on their company's annual turnover, professional experience, position and primary working location.

Table 15 shows the classification of respondents according to their company's turnover in the last financial year. The respondents were mainly represented by small and medium size businesses, 31% and 30% respectively.

Table 15 Classification of respondents by their company's annual turnover

Class	Turnover	Number of respondents	Share
Very small business	less than $5 million	16	23%
Small business	$5 - $15 million	22	31%
Medium business	15$ - 30$ million	21	30%
Large business	more than $30 million	12	17%
		71	100%

Source: Author's calculations

Table 16 shows the professional experience of the respondents. Most respondents have more than 11 years of professional experience.

Table 16 Classification of respondents by their professional experience

Class	Number of respondents	Share
1 year - 10 years	25	35%
11 years - 25 years	35	49%
26 years and over	11	15%
	71	100%

Source: Author's calculations

Tables 17 and 18 show the position and primary working location of the respondents.

Table 17 Classification of respondents by their position

Class	Number of respondents	Share
Employee	26	37%
Supervisor	24	34%
Senior Manager	18	25%
CEO	3	4%
	71	100%

Source: Author's calculations

Table 18 Classification of respondents by primary working location

Class	Number of respondents	Share
Field	26	37%
Office	45	63%
	71	100%

Source: Author's calculations

Also, all the respondents were asked the general question if they are interested in container folding technologies. About 40 respondents (56%) replied

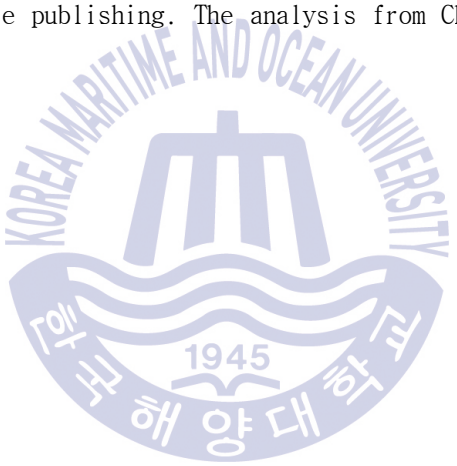
positively, 31 of them (44%) replied negatively.

The questionnaire consisted of two parts.

In Part A, the respondents provided scores that reflected the importance of 19 factors that affect the container market. The scale ranged from 1 (not important at all) to 5 (extremely important).

In Part B of the questionnaire, the respondents gave scores that reflected their level of agreement with the current trends in Russian container industry that affect the number of empty containers. The scores ranged from 1 (strongly disagree) to 5 (strongly agree).

The factors and attributes for the questionnaire were formulated after studying the current market and economic trends. The pilot study with logistics company specialists (Yusen Logistics RUS LLC, Nakhodka Branch[1]) was carried out to test the questionnaire before publishing. The analysis from Chapter 2 was also taken into consideration.



1) Yusen Logistics is a global company that is providing logistics services in 44 countries and regions.

4.2. Important Factors of Russian Container Market

Table 19 Descriptive statistics

	Min	Max	Mean	SD
Transportation costs per container	3	5	3.85	0.75
Availability of free space for container loading on the specified vessel at any time	1	5	3.83	1.12
Container vessels' loading/unloading speed	1	5	3.39	1.39
Additional free space onboard, available for laden containers	1	5	3.83	1.12
Saving more empty ground slots at the container terminal	1	5	3.44	0.91
Increase of the railway network cargo capacity	3	5	4.49	0.77
Availability of empty containers at any time	3	5	4.37	0.64
Container maximum payload	1	4	2.00	0.93
Lifespan of a shipping container	1	4	2.33	1.09
Compatibility of different types of containers	1	5	3.59	1.09
Shipping container purchase cost	1	5	3.63	1.12
Greater variety of available specialized container types on the market	1	5	3.79	1.05
No need for additional container maintenance equipment	1	5	2.83	1.04
No need for additional container maintenance workforce	1	5	3.00	1.06
Reduction of harmful emissions into the atmosphere	1	5	3.41	0.96
Fuel saving	3	5	3.90	0.96
Container terminal area reduction	1	5	2.72	1.29
Reducing the number of empty containers transported by sea	2	5	4.11	0.84
Reducing the number of empty containers transported by railroad	2	5	4.07	0.87

Source: Author's calculations

The descriptive statistics, presented in Table 19, indicate that "Increase of the railway network cargo capacity" and "Availability of empty containers at any time", are considered the most important factors by Russian container market professionals. These attributes have a mean of 4.49 and 4.37, respectively. A standard deviation is 0.77 and 0.64, respectively.

On the contrary, "Container maximum payload" and "Lifespan of a shipping container" are considered the least important - they have a mean of 2.00 (SD of 0.93) and 2.33 (SD of 1.09), respectively.

4.3. Factor Analysis

For factor analysis purposes, 12 attributes were chosen to be partitioned into a smaller number of more meaningful factors. Essentially, factor analysis is a tool for reducing data and removing duplication from a set of correlated variables. After performing factor analysis, we obtained correlated variables with a smaller set of derived variables. The factors obtained are relatively independent of each other.

Table 20 Measure of Sampling Adequacy and Bartlett test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.539
Bartlett test of sphericity	Chi-square	778.786
	Degrees of freedom	66
	p-value	0.000

Note) H0: variables are not intercorrelated
Source: Author's calculations

Table 20 shows the suitability of the available data for factor analysis as a whole. The results of the KMO test allow us to draw a conclusion regarding the overall suitability of the available data for factor analysis, that is, how well the constructed factor model describes the structure of respondents' answers to the questions being analyzed. The results of this test range from 0 (the factor model is completely inapplicable) to 1 (the factor model perfectly describes the data structure). Factor analysis should be considered suitable if KMO is in the range from 0.5 to 1. In our case, this indicator is 0.539 (approximately 53.9%), which is a normal result.

The significance of the Bartlett test reviews the hypothesis that the variables involved in factor analysis are not intercorrelated with each other. At an acceptable level of significance (below 0.05), factor analysis is considered suitable for analysis of the sample under study. In our case, the test under consideration shows a very low significance (less than 0.001), from which the conclusion about the applicability of factor analysis follows.

Therefore, it can be concluded that the available data are suitable for the study using factor analysis.

Table 21 Variance explained by the factors

Factor analysis/correlation			Number of obs	71
Method: principal-component factors			Retained factors	4
Rotation: (unrotated)			Number of params	42
Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	4.0125	1.0883	0.3344	0.3344
Factor2	2.9242	1.2904	0.2437	0.5781
Factor3	1.6338	0.3472	0.1362	0.7142
Factor4	1.2866	0.5715	0.1072	0.8214
Factor5	0.7151	0.1275	0.0596	0.8810
Factor6	0.5876	0.1858	0.0490	0.9300
Factor7	0.4019	0.2328	0.0335	0.9635
Factor8	0.1691	0.0278	0.0141	0.9776
Factor9	0.1413	0.0785	0.0118	0.9893
Factor10	0.0628	0.0253	0.0052	0.9946
Factor11	0.0375	0.0100	0.0031	0.9977
Factor12	0.0275	.	0.0023	1.0000

Source:Author'scalculations

From the table we can see that four factors have values of greater than one. Therefore, four factors were selected for analysis. The first factor explains 33.44% of total variance, the second factor - 24.37%, the third - 13.62%, the fourth - 10.72%.

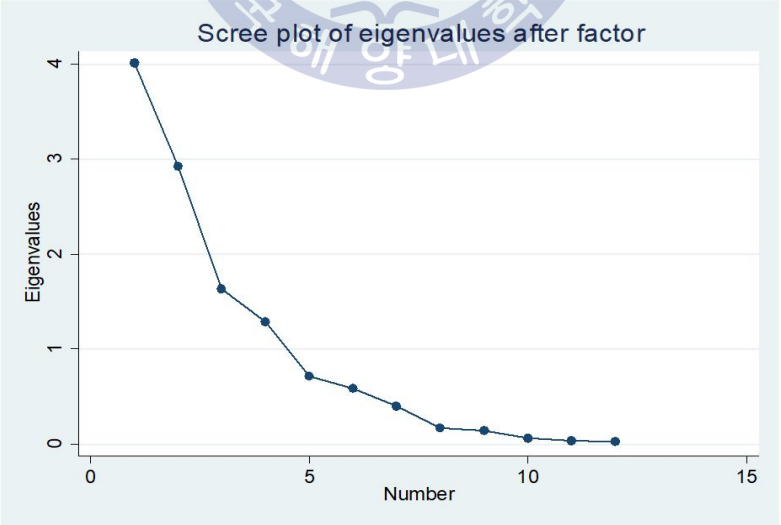


Fig. 22 Scree plot for factor analysis

Source: Author's calculations

The next step in interpreting the results factor analysis results is to consider the resulting rotated matrix of factor coefficients. Varimax rotation was performed, variances were sorted and results are shown in Table 22. This table represents the main results of the factor analysis.

Table 22 Rotated factor loadings (pattern matrix) and unique variances sorted

Variable	Factor1	Factor2	Factor3	Factor4	Uniqueness
Empty containers take too much space aboard cargo trains, which does not leave enough space for laden containers;	0.9239				0.0539
Loading/unloading empty containers onboard/from a vessel takes a significant time;	0.9135				0.1398
Empty containers take too much space aboard container vessels, which does not leave enough space for laden containers;	0.9025				0.1473
The number of empty containers in Russia may increase;	0.6607				0.2464
The share of non-raw material products in Russia's turnover may increase significantly;		0.8899			0.1268
The capacity of the Trans-Siberian Railway is sufficient for increasing volumes of container traffic;		0.8255			0.2464
The number of laden containers in the export direction may increase;		0.7889			0.1046
Smaller maximum payload of a folding container may limit its use;		0.6055			0.3258
The implementation of new container types in Russia is associated with considerable problems;			-0.8909		0.0619
The growth of specialized containers market does not affect the demand for standardized shipping containers;			0.7637		0.1947

The reduction of container terminal areas in Russia is a pressing issue.				-0.8052	0.2414
Tightening of environmental laws and requirements may significantly affect Russian container transportation market;				0.7176	0.2539

Source: Author's calculations

It is worth noting that a positive factor loadings value indicates a direct connection, a negative value indicates the opposite connection of this characteristic with a factor.

Therefore, the first factor includes the following variables:

- Empty containers take too much space aboard cargo trains, which does not leave enough space for laden containers;
- Loading/unloading empty containers onboard/from a vessel takes a significant time;
- Empty containers take too much space aboard container vessels, which does not leave enough space for laden containers;
- The number of empty containers in Russia may increase;

The second factor:

- The share of non-raw material products in Russia's turnover may increase significantly;
- The capacity of the Trans-Siberian Railway is sufficient for increasing volumes of container traffic;
- The number of laden containers in the export direction may increase;
- Smaller maximum payload of a folding container may limit its use;

The third factor:

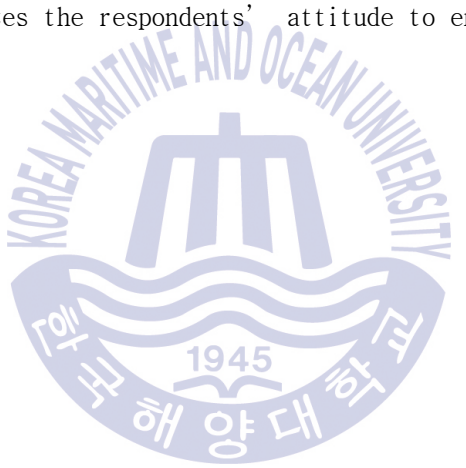
- (-)The implementation of new container types in Russia is associated with considerable problems;
- The growth of specialized containers market does not affect the demand for standardized shipping containers;

The fourth factor:

- (-) The reduction of container terminal areas in Russia is a pressing issue.
- Tightening of environmental laws and requirements may significantly affect Russian container transportation market;

Based on the conducted interpretational analysis, the following definitions can be assigned to these factors.

- Factor 1 characterizes the respondents' attitude to empty containers problems;
- Factor 2 characterizes the respondents' attitude to laden containers issues;
- Factor 3 characterizes the respondents' attitude to the issues, related to types of containers;
- Factor 4 characterizes the respondents' attitude to environmental issues and land use;



4.4. Analysis of variance

Next, we saved the resulting factors (factor scores) as variables and we can use the results of factor analysis to build the sections. One-way analysis of variance was used to examine whether there are differences among the groups. We are interested if the same or differently experts measure the trends in the container market.

Analysis of variance tests the null hypothesis that the opinions of the respondents in categories (business size, experience, position, primary working location, and interest in folding technology) are not significantly different.

The description of the classes is based on factor scores with a mean of zero and standard deviation of one. The negative value of the resulting factor indicates that respondents place less emphasis on the corresponding factor.

The results of ANOVA of the factor analysis results, divided by business size, are shown in Table 23.

Table 23 ANOVA of the factor analysis results by business size

Factors	Business size (Turnover in the last financial year)				F	p-value
	Class 1 Very small (n=16)	Class 2 Small (n=22)	Class 3 Medium (n=21)	Class 4 Large (n=12)		
1)Empty containers	-0.365	-0.186	0.191	0.493	2.32	**0.0829****
2) Issues related to laden containers	0.134	0.207	-0.246	-0.128	0.90	0.4465
3) Types of containers	0.048	0.129	0.003	-0.309	0.51	0.6774
4) Environmental issues and land use	-0.217	-0.164	0.439	-0.177	2.01	**0.1202*****

Note) ** significant at p = 0.10 level, *** significant at p = 0.15 level
Source: Author's calculations

The analysis shows that there is difference in opinions: at the 10% significance level in Factor 1 – empty containers; at the 15% significance level

in Factor 4 - environmental issues and land use. Figure 23 shows that Large and Medium-sized businesses have their own assessment of empty containers problems, which differs from Small and Very small companies' point of view. In addition, respondents from Medium-sized firms have different views on environmental issues and land use in contrast to Large, Small and Very small firms, it can be also seen on Figure23.

A comparison of the factor mean score coefficients showed that Very small and Small businesses put their highest mean scores in Factor 2 (0.134 and 0.207, respectively). Respondents from Medium-sized businesses showed their highest mean scores in Factor 4 (0.439), whereas Large businesses - in Factor 1 (0.493).

The lowest mean score receives Factor 1 in Very small and Small firms (mean = -0.365 and -0.186), Factor 2 in Medium firms (mean = -0.246) and Factor 3 in Large firms (mean = -0.309).

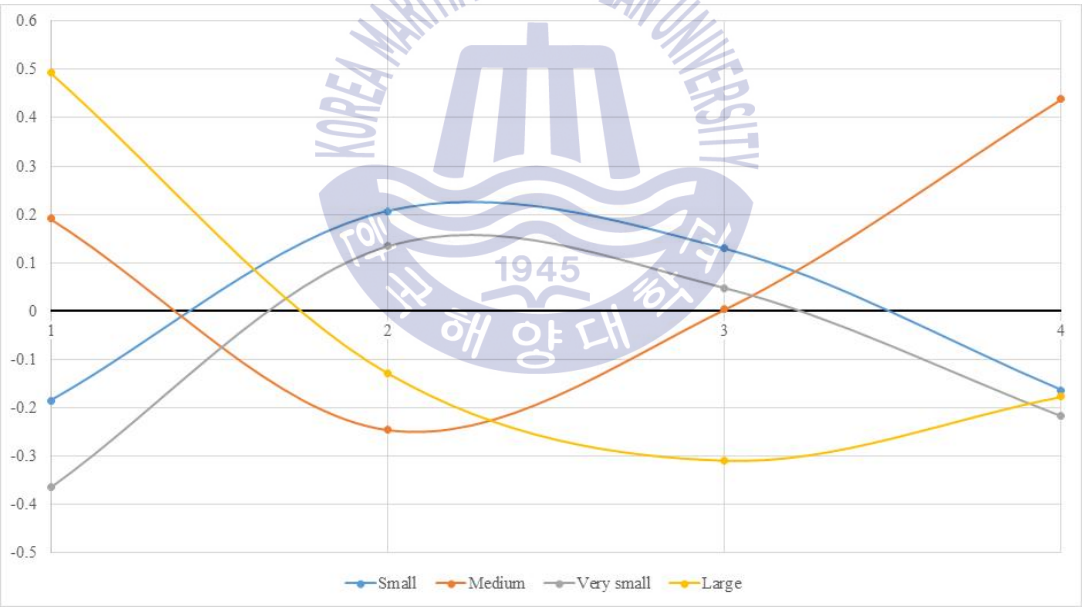


Fig. 23 ANOVA of the factor analysis results by business sizes

Source: Author's calculations

The results of ANOVA of the factor analysis results according to professional experience of the respondents are shown in Table 24.

Table 24 ANOVA of the factor analysis results by respondents' professional experience

Factors	Professional experience			F	p-value
	Class 1 1 year - 10 years (n=25)	Class 2 11 years - 25 years (n=35)	Class 3 26 years and over (n=11)		
1) Empty containers	-0.2311	0.1820	-0.0538	1.27	0.2865
2) Issues related to laden containers	0.2645	-0.1477	-0.1313	1.37	0.2621
3) Types of containers	0.0776	-0.0111	-0.1410	0.18	0.8335
4) Environmental issues and land use	-0.2216	0.0280	0.4146	1.60	0.2093

Source: Author's calculations

The analysis shows that there is no difference in opinions, at the 5/10/15% significance levels.

A comparison of the factor mean scores showed that Class 1 respondents (1-10 years of experience) put their highest scores in Factor 2, the Class 2 respondents (11-25 years of experience) - in Factor 1, and Class 3 respondents (26 years of experience and over) - in Factor 4.

The results of ANOVA of the factor analysis results according to respondents' positions are shown in Table 25.

Table 25 ANOVA of factor analysis results by respondents' positions

Factors	Respondent's positions				F	p-value
	Class 1 Employee (n=26)	Class 2 Supervisor (n=24)	Class 3 Senior Manager (n=18)	Class 4 CEO (n=3)		
1) Empty containers	-0.2417	-0.0254	0.2604	0.7355	1.49	0.2251
2) Issues related to laden containers	0.0521	-0.0784	0.084	-0.3301	0.22	0.8843
3) Types of containers	0.1641	0.1838	-0.4181	-0.3846	1.76	0.1640
4) Environmental issues and land use	-0.1250	-0.0664	0.3365	-0.4043	1.01	0.3918

Source: Author's calculations

The analysis shows that there is no differences in opinion, at the 5/10/15 % significance levels.

A comparison of the factor mean scores showed that the Employees and Supervisors put their highest scores in Factor 3, Senior Managers - in Factor 4 and CEOs - in Factor 1.

The results of ANOVA of factor analysis results according to respondents' primary working location are shown in Table 26.

Table 26 ANOVA of factor analysis results between working locations of the respondents

Factors	Primary working location of the respondents		F	p-value
	Class 1 Field operator (n=26)	Class 2 Office manager (n=45)		
1) Empty containers	-0.0736	0.0425	0.22	0.6403
2) Issues related to laden containers	0.2519	-0.1455	2.67	**0.1071*** **
3) Types of containers	0.0712	-0.0411	0.21	0.6512
4) Environmental issues and land use	-0.0357	0.0206	0.05	0.8209

Note) *** significant at p = 0.15 level
Source: Author's calculations

The analysis shows a difference in opinion at the 15% significance level. Figure 24 shows that Office-working respondents and Field-working respondents have different judgements concerning the issues related to laden containers.

A comparison of the factor mean scores showed that the Field operators put their highest scores in Factor 2, and Office managers - in Factor 1.

The results of ANOVA of the factor analysis results according to respondents' interest in folding technology are shown in Table 27. Of 71 respondents - 40 people (56%) replied positively, 31 people (44%) replied negatively.

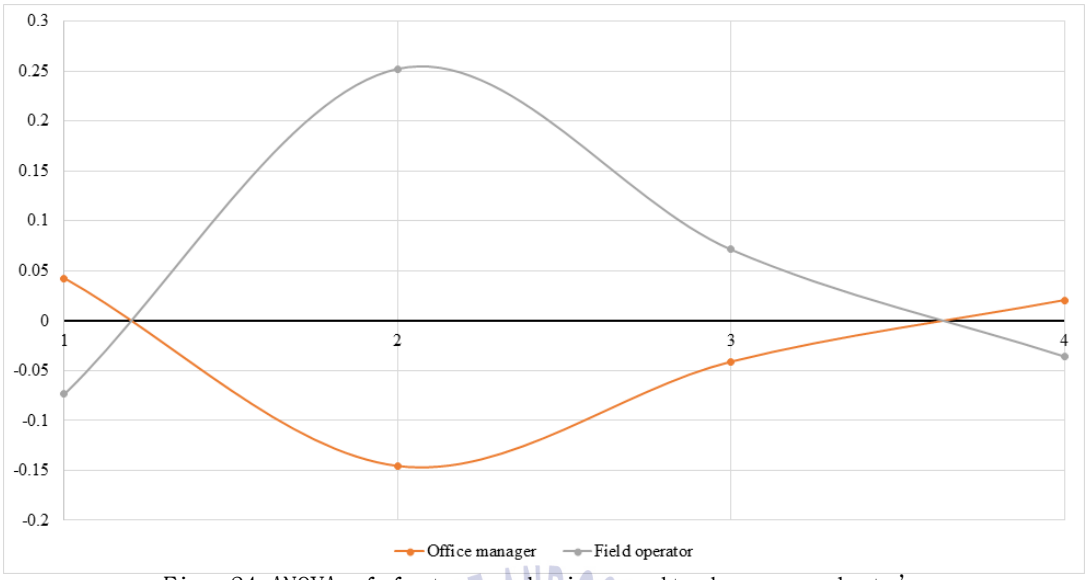


Fig. 24 ANOVA of factor analysis results by respondents' primary working location

Source: Author's calculations

Table 27 ANOVA of the factor analysis results by interest in folding technologies

Factors	Interest in folding technology		F	p-value
	Class 1 Positive reply (n=40)	Class 2 Negative reply (n=31)		
1) Empty containers	0.2700	-0.3483	7.28	**0.0088***
2) Issues related to laden containers	0.1383	-0.1785	1.77	0.1874
3) Types of containers	-0.0188	0.0243	0.03	0.8584
4) Environmental issues and land use	-0.1762	0.2273	2.92	**0.0918****

Note) * significant at p = 0.05 and 0.01 levels, ** significant at p = 0.10 level
Source: Author's calculations

The analysis shows that there is a difference in opinions: at the 5% significance level in Factor 1; at the 10% significance level in Factor 4. Figure 25 shows that between specialists who were interested in folding technology and

who were not, there was also a difference in opinion concerning the problems of empty containers and environmental issues and land use.

A comparison of the factor mean scores showed that Class 1 respondents (positive reply) put their highest scores in Factor 1, Class 2 respondents (negative reply) - in Factor 4.

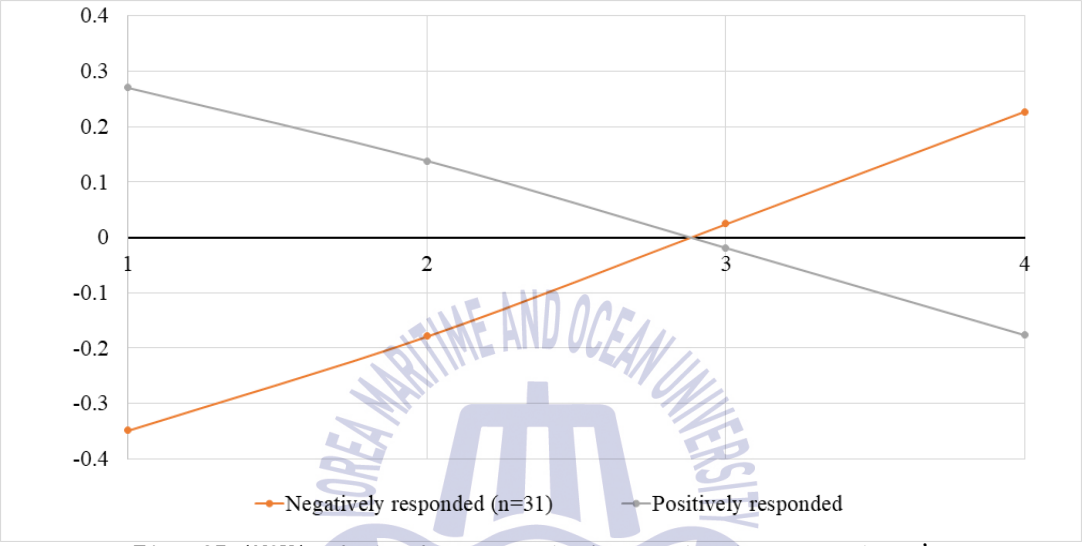


Fig. 25 ANOVA of the factor analysis results by respondents' interest in folding technology

Source: Author's calculations

5. Case study: The ports of the Russian Far Eastern sea basin and Busan port

5.1. The ports of the Russian Far East

Over the past five years, the ports of the Far Eastern sea basin accounted for about 25% of total Russian freight turnover. There are 22 seaports in the basin, operating with foreign trade and local cabotage cargo. More than 75% of the basin cargo turnover is processed in four main ports - Vostochny, Vladivostok, Vanino and De-Kastri.

The Far Eastern basin is the leader in containerized cargo growth rates (+23,9%). The total volume of container transit via Far Eastern terminals amounted to 1.48 million TEU in 2017, which accounted for about 32% of the total container turnover of Russia.

Containers go mostly through the Vostochny and Vladivostok container terminals. In 2017, the port of Vladivostok reached the throughput of 838 760 TEU. The Vladivostok container terminal increased its throughput up to 467 950 TEU, the Vladivostok sea fishing port increased it throughput to 155 850 TEU. The total volume of containers, handled in the Vostochny Port reached 370 790 TEU.

The overview of container cargo turnover handled at the ports of Vladivostok and Vostochny in 2010-2017 is presented in Table 28.

The port of Vladivostok gave more than 50% of the basin total container turnover. Container handling volumes of the port of Vladivostok show a steady increasing trend. The share of the Vostochny port about 28% on the average. In recent years, there has been a slight decrease of Vostochny's share, due to the growth of the cargo throughputs in the port of Vladivostok.

Table 28 shows that container throughputs experienced a significant decline in 2014-2016, which happened due to general recession of Russian container market. In 2017, the indicators showed a strong recovery trend.

Table 28 Container cargo turnover in the ports of Vladivostok and Vostochny in 2010-2017

Year	Vladivostok		Vostochny	
	TEUs	Share of total basin container turnover	TEUs	Share of total basin container turnover
2010	435 416	52%	254 334	29%
2011	599 871	52%	338 752	29%
2012	699 859	52%	396 668	29%
2013	822 582	52%	474 621	30%
2014	870 097	54%	474 675	30%
2015	619 383	51%	353 171	29%
2016	642 521	54%	301 313	25%
2017	838 762	57%	370 791	25%

Source: ASOP

5.1.1. The port of Vladivostok

There are two major container terminals in the port of Vladivostok: Vladivostok Container Terminal (VCT) that is located on Vladivostok Commercial Port territory and Vladivostok Sea Container Terminal (VSCT) on Vladivostok Sea Fishing Port territory.

Vladivostok Container Terminal is the leader in container handling in the Russian Far East. Over the last several years, VCT has been actively developing and upgrading its container handling facilities. The ships that drop anchor in the port connect VCT with South Korea, China, Japan, Taiwan, Singapore, Malaysia, Indonesia, Philippines, and the USA.

The terminal has three quays with the total area of 250 000 sq. meters and the total quay wall length of 741 meters, the depth is 12-14 meters. The annual throughput capacity is 600 000 TEU. Container storage area capacity is 15 000 TEU. Numerous shipping lines provide regular transportation to different destinations (Table 29).

Table 29 Shipping lines of Vladivostok Commercial Port

Shipping company	Shipping line	Geographical rotation
Sinokor Merchant Marine	PVS	Vladivostok -Kwangyang - Busan - Vostochny
Hyundai Merchant Marine	CRE (CRX)	Shanghai - Ningbo - Busan - Vostochny - Vladivostok - Busan -Shanghai
FESCO Ocean Management Ltd.	FCDL-S	Vladivostok - Vostochny - Shekou- Yantian - Xiamen - Ningbo - Shanghai - Vladivostok
	FCDL-N	Vladivostok - Vostochny - Busan - Qingdao - Shanghai - Ningbo - Busan - Vladivostok - Vostochny
	JTSL	Vostochny - Vladivostok - Busan - Sendai - Yokohama - Shimizu - Nagoya - Kobe - Toyamashinko
	KSDL	Vladivostok -Busan-Vladivostok
Maersk	PHI4	Vladivostok - Donghae - Lianyungang - Shanghai - Hong Kong - Yantian - Kaohsiung - Manila (North Harbour) - Manila (South Harbour) - Batangas
	PH4	Manila (North Harbour) - Manila (South Harbour) - Batangas - Yantian - Hong Kong - Cagayan de Oro - General Santos - Davao- Cagayan de Oro- Keelung- Shanghai- Ningbo- Busan- Vladivostok- Donghae- Busan- Shanghai- Xiamen- Hong Kong- Yantian- Kaohsiung- Manila (North Harbour)
CMA CGM	SSLEUR Russian Far East Express	Vladivostok - Vostochny - Shekou - Yantian - Xiamen - Ningbo - Shanghai - Vladivostok
	SSLEUR Russian Far East Express - 2	Vladivostok - Vostochny - Busan - Qingdao - Shanghai - Ningbo - Busan - Vladivostok

Source: Commercial Port of Vladivostok

Vladivostok Sea Container Terminal maintains export and import shipping lines to the ports of Japan, South Korea, China, and Vietnam. It also provides cabotage to Sakhalin, Chukotka, Magadan and Petropavlovsk-Kamchatsky.

VSCT has its own 9 kilometer-long rail section that is connected to Mys Churkin

Station, which is the terminal point of the Trans-Siberian Railway.

The terminal is has four quays with the total area of 50 000 sq. meters and the quay wall length of 600 meters, the depth is 9.25 meters. The annual throughput capacity is 150 000 TEU. Container storage area capacity is 5 000 TEU. The following shipping lines in Table 30 are being maintained currently on a weekly basis.

Table 30 Shipping lines of Vladivostok Sea Container Terminal

Shipping company	Shipping line	Geographical rotation
Sinokor Merchant Marine	PVS	Vladivostok (Fishing Port) -Kwangyang - Busan - Vostochny
Maersk	IA5-S	Vladivostok (Fishing Port) - Shanghai - Ningbo - Ho Chi Minh - Yangon - Port Klang - Singapore - Tanjung Pelepas - Kuantan - Sihanoukville - Ho Chi Minh
	IA5-N	Port Klang - Singapore - Tanjung Pelepas - Kuantan - Sihanoukville - Ho Chi Minh - Hong Kong - Shanghai - Ningbo - Busan - Vladivostok (Fishing Port)
SASCO	SCL	Shanghai - Ningbo - Vostochny - Vladivostok (Fishing Port)

Source: Vladivostok Sea Container Terminal

As we can see from Table 31, in 2010-2017, the average shares of container export and import volumes in the port of Vladivostok were nearly equal - 35% and 36% respectively.

Table 31 Container transportation in the port of Vladivostok in 2010-2017 by route type

Year	Export	Import	Cabotage	Transit
2010	37%	31%	32%	0%
2011	38%	36%	26%	0%
2012	36%	38%	26%	0%
2013	35%	40%	25%	0%
2014	33%	42%	23%	2%
2015	35%	33%	30%	2%
2016	33%	33%	31%	3%
2017	35%	38%	26%	2%

Source: Author's calculations based on ASOP statistics

The share of import containers in the port of Vladivostok increased from 31% in 2010 to 42% in 2014. On the other hand, the share of export containers decreased from 37% in 2010 to 33% in 2014. In 2015-2016, due to market conditions changes, the import to export ratio had also changed: 35-33% - export containers, and 33% - import containers. In 2017, export recovered to about 35% of the total container volumes, import increased to about 38%.

The transit of containers through the port of Vladivostok makes only a small contribution to the total turnover. However, there was a slight rise in transit percentages in 2014-2017.

5.1.2. Vostochny Port

The Vostochnaya Stevedoring Company (VSC) is the main operator of the Vostochny Port. According to ASOP, VSC has the second largest container throughput in the Russian Far East.

The terminal has four quays with the total area of 770 000 sq. meters and the quay wall length of 1284 meters, the depth is 13.5 m. The terminal's annual throughput capacity is 650 000 TEU. Container storage area capacity is 22 380 TEU. The following international shipping lines are operating in the terminal (Table 32).

Table 32 The liner services in Vostochny Port

Shipping company	Shipping line	Geographical rotation
Sinokor Merchant Marine	PVS	Vladivostok -Kwangyang - Busan - Vostochny
	KHPR	Busan - Ulsan - Gwangyang - Hong Kong - Haiphong - Shekou - Xiamen - Busan - Vostochny - Busan
Hyundai Merchant Marine	CRE (CRX)	Shanghai - Ningbo - Busan - Vostochny - Vladivostok - Busan -Shanghai
FESCO Ocean Management Ltd.	FCDL-S	Vladivostok - Vostochny - Shekou- Yantian - Xiamen - Ningbo - Shanghai - Vladivostok
	FCDL-N	Vladivostok - Vostochny - Busan - Qingdao - Shanghai - Ningbo - Busan - Vladivostok - Vostochny
	JTSL	Vostochny - Vladivostok - Sendai -

		Yokohama - Shimizu - Nagoya - Kobe - Toyamashinko - Busan
	KSDL	Vostochny - Busan - Vostochny
Maersk	TP2-W	Los Angeles - Oakland - Vostochny - Busan - Shanghai - Ningbo -Chiwan - Singapore
	IA4-S	Vostochny - Busan - Kwangyang -Shanghai - Xiamen - Yantian - Hong Kong - Tanjung Pelepas - Jakarta - Surabaya - Jakarta
	IA4-R	Xiamen - Tanjung Pelepas - Jakarta - Surabaya - Jakarta - Tanjung Pelepas - Singapore - Batangas - Manila - Subic Bay - Hong Kong - Yantian - Kaohsiung - Ningbo - Shanghai - Kwangyang - Busan - Vostochny - Busan - Kwangyang - Shanghai - Ningbo - Keelung - Xiamen
CMA CGM	SSLEUR Russian Far East Express	Vladivostok - Vostochny - Shekou - Yantian - Xiamen - Ningbo - Shanghai - Vladivostok
	SSLEUR Russian Far East Express - 2	Vladivostok - Vostochny - Busan - Qingdao - Shanghai - Ningbo - Busan - Vladivostok
APL		Vostochny - Busan - Vostochny
Heilongjiang Land-sea Channel	LSC	Vostochny-Taicang-Vostochny
SASCO	SCL	Shanghai - Ningbo - Vostochny - Vladivostok

Source: Vostochny Port

The ratio of transit containers in the Vostochny Port is relatively large, as indicated in Table 33.

The share of transit containers increased increasing from 4% in 2010 to 13% in 2017, with the highest share of 20% in 2013. The share of transit containers in the Vostochny Port is significantly larger than in the port of Vladivostok.

Despite the fact that in 2010, the import containers share was prevailing over the export share (60% against 32%), in the following years it decreased significantly - to 36% in 2017.

Table 33 Container transportation in the port of Vostochny in 2010-2017 by route type

Year	Export	Import	Cabotage	Transit
2010	32%	60%	3%	4%
2011	36%	49%	7%	8%
2012	31%	44%	8%	17%
2013	34%	38%	8%	20%
2014	40%	33%	8%	19%
2015	41%	35%	9%	16%
2016	37%	36%	15%	12%
2017	39%	36%	12%	13%

Source: Author's calculations based on ASOP statistics

5.1.3. Container port empty traffic

Empty containers occupy a substantial share of the total traffic of the ports of the Russian Far East. Due to the general growth of Russian container market, port container turnovers also grew in 2010-2015. So consequently, the empty turnover also grew, and its average annual value was 43 % for the port of Vladivostok and 25% for Vostochny Port.

Table 34 Total container volumes, handled in the ports of Vladivostok and Vostochny, by laden/empty state 2010-2017, in TEUs

Year	Vladivostok			Vostochny		
	Laden	**Empty**	Empty share	Laden	**Empty**	Empty share
2010	235 636	**199 780**	46%	200 828	**53 506**	21%
2011	332 538	**267 333**	45%	235 462	**103 290**	30%
2012	394 760	**305 099**	44%	291 153	**105 515**	27%
2013	466 854	**355 728**	43%	353 710	**120 911**	25%
2014	512 774	**357 323**	41%	360 163	**114 512**	24%
2015	374 508	**244 875**	40%	283 986	**69 185**	20%
2016	426 173	**216 348**	34%	261 236	**40 077**	13%
2017	560 015	**278 747**	33%	315 052	**55 739**	15%

Source: ASOP

However, in 2015, levels of import had dropped and export containerization had increased, which caused a container shortage on the market. This fact resulted in a decrease in empty container shares in the following years. In table 35, we considered reviewing empty traffic values for exports and imports separately.

Table 35 Total export and import container volumes, handled by the port of Vladivostok by laden/empty state in 2010-2017, in TEUs

Year	Export			Import		
	Laden	Empty	Empty share	Laden	Empty	Empty share
2010	19 018	140 339	88%	135 126	537	0.4%
2011	27 041	200 769	88%	214 143	1 135	0.5%
2012	27 120	224 601	89%	264 156	1 633	0.6%
2013	23 191	268 123	92%	327 183	856	0.3%
2014	24 543	266 675	92%	364 342	1 428	0.4%
2015	54 372	159 515	75%	203 878	2 271	1.1%
2016	82 595	130 834	61%	210 480	3 425	1.6%
2017	102 723	188 976	65%	310 452	4 336	1.4%

Source: ASOP

We can clearly observe an imbalance pattern in Russian foreign trade. Russian container market is characterized by its unevenness: container imports prevail over exports. Laden containers are imported into the country, and subsequently they leave the country while being empty.

Almost all export containers leave the port of Vladivostok in an empty state. The highest share in 2013-2014 reached 92%, and even the minimum valueof 61% in 2016, was relatively high. In addition, there was a noticeable increase in empty containers import - from 0.4% in 2010 to 1.6% in 2016 (1.4% in 2017). As discussed earlier in this paper, there was a shortage of empty containers available, and thus new empty containers had to be ordered separately.

Table 36 Total export and import container volumes, handled by Vostochny Port by laden/empty state in 2010-2017, in TEUs

Year	Export			Import		
	Laden	Empty	Empty share	Laden	Empty	Empty share
2010	36 419	44 037	55%	153 698	87	0.1%
2011	41 290	79 528	66%	164 777	1 423	0.9%
2012	60 424	64 210	52%	172 587	160	0.1%
2013	90 610	68 607	43%	181 691	958	0.5%
2014	121 286	69 262	36%	156 771	327	0.2%
2015	109 048	34 999	24%	118 435	5 636	4.5%
2016	93 387	18 862	17%	107 059	537	0.5%
2017	114 374	29 423	20%	131 153	1 526	1.2%

Source: ASOP

In Vostochny Port the empty turnover was smaller, but still natable. In 2017, 20 % of export containers were empty, the maximum value was 66% (in 2011), the minimum was 17% (in 2016). There was an increase in empty import traffic - from 0.1% in 2010 to 1.2 % in 2017, the maximum value was observed in 2016 - 4.5%.

Table 37 Total cabotage container volumes, handled by the ports of Vladivostok and Vostochny by laden/empty state in 2010-2017, in TEUs

Year	Vladivostok			Vostochny		
	Laden	Empty	Empty share	Laden	Empty	Empty share
2010	81 492	58 904	42%	4 553	4 283	48%
2011	91 354	65 429	42%	11 898	12 171	51%
2012	103 484	78 865	43%	16 396	13 870	46%
2013	116 480	86 749	43%	23 078	16 100	41%
2014	117 111	82 565	41%	22 715	16 026	41%
2015	108 886	79 660	42%	17 059	13 234	44%
2016	115 241	81 856	42%	26,699	19 691	42%
2017	132 049	84 943	39%	24,563	21 513	47%

Source: ASOP

Cabotage from the ports of Vladivostok and Vostochny is carried out to the ports of the Sakhalin Island, Magadan, Petropavlovsk-Kamchatsky, Kuril Islands. The share of empty containers on these routes is also high.

5.2. The port of Busan

Container shipping services between the ports of the Russian Far East and the South Korean port of Busan are in high demand and continue to develop "The New Northern Policy", declared by the president of the Republic of Korea, provides for the creation of a single economic space to incorporate the Korean peninsula and the Russian Far East. The key point of the new policy is the creation of a Eurasian economic community based on cooperation between the Republic of Korea and Russia. The transit potential of the Trans-Siberian Railway is a priority for South Korean transportation development strategy. Containers from South Korea are delivered from the port of Busan to Vladivostok (Vostochny) and transshipped to the railway. The largest container shipping customers on Russian direction are Hyundai Motor and Samsung Electronics (PrimaMedia.ru, 29.12.2017).

In 2016, a container rail line from the Vostochny port to Hyundai Motor Company factory in Saint Petersburg was launched. The train delivers 100 TEUs of auto parts, which are sent by sea from the port of Busan.

According to RZD-Partner (30.03.2017), the CRX shipping line of Hyundai Merchant Marine and KHPR line of Sinokor Merchant Marine were launched at the end of 2017. The lines provide five container ships (1000-1700 TEU each) with an additional call to Korea.

China also plans to transport cargo to the countries of the Asia-Pacific through the ports of the Russian Far East. According to the Suifenhe Station (China) administration (VladNews, 28.11.2017), in 2017, 83 container trains (with more than 9 000 containers) went through the Harbin-Suifenhe-Vladivostok-Busan route. This cargo turnover was 267% higher than in 2016.

Korean logistics company Hyndai Glovis signed an agreement with the shipping company Fesco to open a new regular container line Busan-Vladivostok-Saint Petersburg. This route requires approximately 10 days of travel, which is significantly faster than the traditional Asia-Europe maritime container route (via the Suez Canal). (RZD-Partner, 14.08.2018).

The container traffic turnover between the port of Busan and Russian ports in 2010-2017 is presented in Table 38.

Table 38 Container turnover between the port of Busan and Russian ports in 2010-2017, TEUs

Ports	2010	2011	2012	2013	2014	2015	2016	2017
Vladivostok	201 410	246 797	245 405	254 664	254 193	187 726	196 831	254 497
Vostochny	191 245	227 929	254 847	262 555	211 078	155 916	123 209	163 186
Saint Petersburg	17 342	11 929	17 167	20 006	24 702	24 476	22 565	18 564
Korsakov	10 566	11 358	11 131	10 600	9 266	9 623	8 424	7 967
Novorossiysk	6 244	17 805	16 792	12 390	16 116	14 255	6 707	7 763
Okhotsk	809	441	3 686	2 637	1 162	1 851	1 341	1 126
Kholmsk	2 711	982	1 362	1 942	2 289	2 321	1 684	819
Kaliningrad	9 244	4 655	762	601	1 044	3 066	415	451
Ust'-luga	0	0	0	81	614	1 802	855	319
Kronshtadt	78	0	2 306	11 921	24	279	136	61
Other	4 350	7 684	10 972	8 171	4 844	1 760	8 313	15 647
Total	444 000	529 579	564 428	585 567	525 332	403 076	370 479	470 399

Source: The port of Busan (Shipping Port Logistics Information System)

A significant share accounted for the ports of Vladivostok and Vostochny. The ports of the European part of Russia (Saint Petersburg, Novorossiysk, Kaliningrad, Ust'-luga and Kronshtadt) represented only the average of 8% over the past eight years.

Table 39 Shares of Vladivostok and Vostochny ports in the total container turnover between the port of Busan and Russian ports in 2010-2017

Ports	2010	2011	2012	2013	2014	2015	2016	2017
Vladivostok	45%	47%	43%	43%	48%	47%	53%	54%
Vostochny	43%	43%	45%	45%	40%	39%	33%	35%

Source: Author's calculations based on Busan Port statistics

While in 2010-2013, the shares of the two Russian ports were approximately the same, the port of Vladivostok has managed to surpass the Vostochny Port and currently accounts for 54% (versus 35%) of the total turnover. In 2010-2017 the total container turnover between the port of Busan and Russian ports increased from 444 000 to 470 399 TEU (6% increase). The maximum value was reached in 2013 - 585 657 TEU. Container traffic between the port of Busan and Russian ports suffered a decline in 2014 -2016. However, in 2017, there was a strong recovery trend.

5.2.1. Transshipment

Along with the growth of exports and imports, there was also an increase in the number of transit containers going through the port of Busan to third countries. As we can see in Fig 26, since 2013, the transit volumes have been growing much faster than imports or exports.

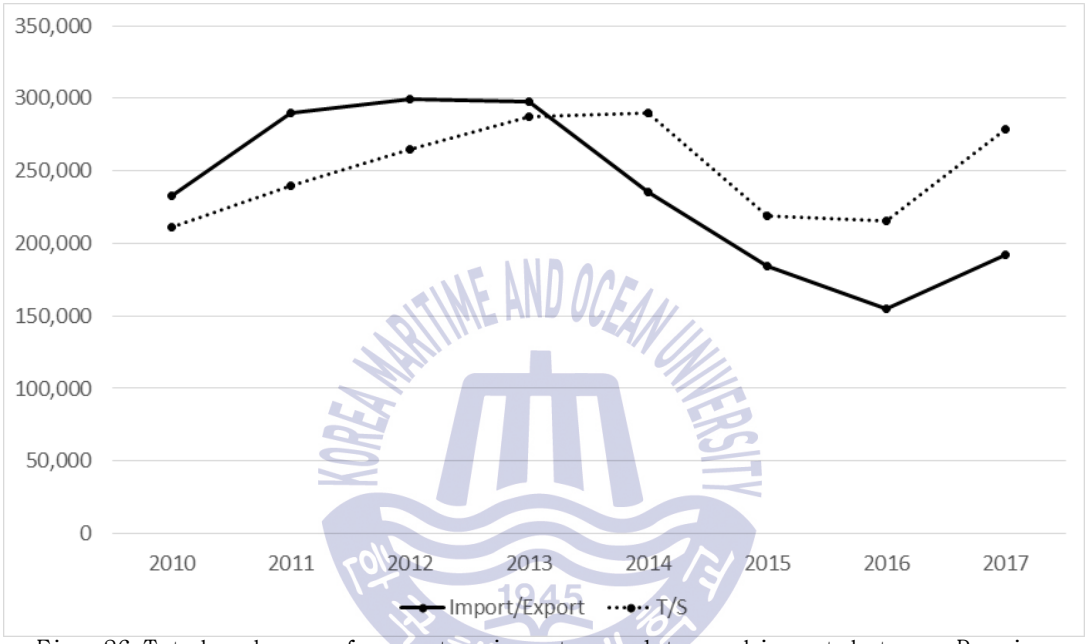


Fig. 26 Total volumes of exports, imports, and transshipment between Russian ports and the port of Busan in 2010-2017, TEUs

Source: Author's calculations based on Busan Port statistics

Container transshipment volumes from or to the ports of Vladivostok and Vostochny through the port of Busan in 2010-2017 are presented in Table 40.

Table 40 Transshipment traffic from/to ports of Vladivostok and Vostochny through port of Busan, TEUs

Years	Vladivostok - Busan	Busan -Vladivostok	Vostochnyy Port - Busan	Busan - Vostochnyy Port
2010	19 425	77 273	29 640	67 170
2011	22 981	100 382	30 281	72 199

2012	19 634	111 152	32 012	74 305
2013	17 580	128 752	42 726	71 153
2014	19 535	135 823	45 193	57 147
2015	29 518	80 215	40 342	39 309
2016	43 972	81 199	39 619	29 823
2017	59 536	111 400	49 991	33 880

Source: Port of Busan (Shipping Port Logistics Information System)

5.2.2. Empty containers

Nevertheless, there are negative factors that inhibit the positive dynamics. The main factor is the export orientation of Russian economy, which contributes to the increase of empty containers amount.

Tables 41 and 42 demonstrate the volume of containers transported between the ports of Vladivostok and Vostochny and the port of Busan, by laden/empty state (in TEUs, transshipment excluded).

Table 41 Total container turnover between Busan and Vladivostok by laden/empty state (in TEUs, transshipment excluded) in 2005-2017

Year	Vladivostok - Busan			Busan - Vladivostok		
	Laden	Empty	Empty share	Laden	Empty	Empty share
2005	1 341	27 744	95%	12 025	129	1.1%
2006	850	44 969	98%	11 007	256	2.3%
2007	939	61 742	99%	15 488	210	1.3%
2008	1 071	68 773	98%	20 761	26	0.1%
2009	867	45 127	98%	18 990	297	1.5%
2010	1 118	75 019	99%	28 450	126	0.4%
2011	2 888	91 448	97%	28 966	134	0.5%
2012	2 447	79 877	97%	31 972	323	1.0%
2013	2 602	72 033	97%	33 316	382	1.1%
2014	3 328	61 089	95%	33 922	496	1.4%
2015	6 694	44 920	87%	23 210	3,170	12%
2016	8 272	33 823	80%	26 722	2,843	9.6%
2017	7 311	42 500	85%	32 429	1,321	3.9%

Source: Port of Busan (Shipping Port Logistics Information System)

More than 85% of all containers that went from Vladivostok to Busan in 2017 were empty. In 2005-2014, on average, 97% of containers were empty. The minimum share was in 2016 - 80%.

Table 42 Total container turnover between Busan and Vostochny Port by laden/empty state (in TEUs, transshipment excluded) in 2005-2017

Year	Vostochny - Busan			Busan - Vostochny		
	Laden	Empty	Empty share	Laden	Empty	Empty share
2005	10 576	33 864	76%	48 510	254	0.5%
2006	5 602	34 433	86%	62 486	164	0.3%
2007	6 331	54 388	90%	82 284	306	0.4%
2008	6 855	51 589	88%	72 310	199	0.3%
2009	5 930	20 850	78%	32 112	88	0.3%
2010	6 614	37 665	85%	49 945	211	0.4%
2011	6 193	60 871	91%	58 292	93	0.2%
2012	9 459	69 920	88%	69 134	16	0.0%
2013	12 783	72 647	85%	63 212	35	0.1%
2014	16 781	31 288	65%	59 945	724	1.2%
2015	17 592	18 808	52%	37 508	2 358	5.9%
2016	13 818	7 985	37%	31 962	2	0.0%
2017	12 475	18 686	60%	47 731	423	0.9%

Source: the port of Busan (Shipping Port Logistics Information System)

In 2017, the share of empty containers that went from Vostochny to Busan was 60%. In 2005-2014, on average, 83% of the containers were empty. The minimum value was in 2016 - 37%. The majority of the containers that went from Busan to Vladivostok or Vostochny were laden.

Table 43 Total transshipment traffic from/to the port of Vladivostok through the port of Busan, by laden/empty state (in TEU) in 2010-2017

Year	From Vladivostok			To Vladivostok	
	Laden	Empty	Share	Laden	Empty
2010	3 376	16 048	83%	77 204	68
2011	5 238	17 742	77%	100 058	323
2012	6 543	13 091	67%	110 123	1,028
2013	6 145	11 435	65%	128 441	311
2014	8 919	10 616	54%	135 128	695

2015	22 900	**6 617**	22%	80 078	**136**
2016	41 559	**2 413**	5%	81 133	**65**
2017	52 269	**7 267**	12%	110 516	**884**

Source: the port of Busan (Shipping Port Logistics Information System)

Table 44 Total transshipment traffic from/to the Vostochny Port through the port of Busan, by laden/empty state (in TEU) in 2010-2017

Year	From Vostochnyy Port			To Vostochnyy Port	
	Full	**Empty**	Share	Full	**Empty**
2010	22 480	**7 160**	24%	67 159	**11**
2011	22 547	**7 734**	26%	72 198	**1**
2012	28 856	**3 156**	10%	74 125	**180**
2013	37 508	**5 217**	12%	70 712	**441**
2014	43 149	**2 044**	5%	56 593	**554**
2015	39 270	**1 072**	3%	39 204	**104**
2016	39 330	**289**	1%	29 671	**151**
2017	48 609	**1 382**	3%	33 780	**100**

Source: the port of Busan (Shipping Port Logistics Information System)

5.3. Railway container transportation

The Far East is usually the fastest route from Asia to Central Russia. Improvements in the reliability and frequency of container train dispatches from Far Eastern terminals contributed to the growth of container transportation.

Most of the cargo, imported through the Far Eastern ports, goes to Central and Western parts of Russia and former USSR countries via the Trans-Siberian Railway.

The port of Vladivostok dispatches container trains to the following cities and countries: Moscow, Novosibirsk, Yekaterinburg, Krasnoyarsk, Saint Petersburg, Belarus, Uzbekistan, Kazakhstan, and China (Suifenhe). Container trains from Vostochny Port go to Moscow, Novosibirsk, Kazakhstan, Uzbekistan, Slovakia, Poland, and Hungary.

Russia's largest intermodal container operator is PJSC «TransContainer». It owns the largest stock of specialized container flatcars (59% Russia's total flatcar stock amount).

TransContainer railway container operations span over large areas, including Russia, CIS, Asia and Europe. TransContainer maintains the import and transit of goods from South Korea and China (Samsung, Hyundai, Ssang Young, etc.). On December 31st 2017, TransContainer assets included 25 251 flatcars, 69 595 containers, 42 terminals in Russia, 19 terminals in Kazakhstan, and 1 terminal in Slovakia.

In 2017, TransContainer's market share in railway container transportation was 46% (47.2% in 2016), including 50% (51.7% in 2016) in domestic traffic and 42.1% (42.7% in 2016) in international traffic.

The TransContainer's container transportation data is presented in Table 45. The share of empty containers transported by the company is barely changing - about 40% on the average.

Table 45 Total amount of containers, shipped by TransContainer in 2008-2017, in thousands of TEU

Year	Laden	Empty	Empty share
2008	525	325	38.2%

2009	480	324	38.1%
2010	562	333	39.2%
2011	591	342	40.2%
2012	599	364	42.8%
2013	525	342	40.2%
2014	545	336	39.6%
2015	534	359	42.2%
2016	575	350	41.2%
2017	615	351	41.3%

Source: TransContainer Annual Reports for 2008-2017

An empty run ratio of a container is the mean distance of the empty run divided by the mean distance of the complete (laden and empty) run. The company's ratio stood at 30.6% in 2017 as compared to 31.9% in 2016 (Table 46).

Table 46 TransContainer's empty run ratios in 2008-2017, percentage

Year	Mean annual	1st quarter	2nd quarter	3rd quarter	4th quarter
2008	38.9	39.6	38.7	39.1	38.2
2009	41.3	37.0	42.4	43.9	41.9
2010	39.2	40.3	39.6	39.8	36.9
2011	34.4	36.1	34.0	32.9	34.4
2012	35.8	39.3	35.6	35.4	33.0
2013	30.5	29.2	30.8	30.8	31.2
2014	28.8	28.3	28.6	28.7	29.6
2015	31.2	28.7	31.7	32.9	31.6
2016	31.9	29.3	32.3	34.0	32.1
2017	30.6	31.8	29.7	30.2	30.8

Source: TransContainer Annual Reports for 2008-2017

The stock turnover value is the average interval (in days) between two successive laden trips of a single container. The company's stock turnover stood at 37.88 days in 2017 as compared to 36.4 days in 2016 (Table 47).

Table 47 TransContainer stock turnover in 2008-2017, in days

Year	Mean annual	1st quarter	2nd quarter	3rd quarter	4th quarter
2008	23.35	23.7	21.5	22.6	25.6
2009	27.68	31.7	24.8	23.3	30.9
2010	21.78	23.8	21.2	20.8	21.3

2011	21.90	22.4	21.4	21.8	22.0
2012	34.10	23.1	22.4	22.6	24.1
2013	38.20	26.0	25.0	26.7	30.6
2014	37.90	43.6	35.2	35.1	37.5
2015	35.40	37.6	33.8	31.7	38.4
2016	36.40	43.4	32.2	32.7	37.7
2017	37.88	41.2	35.7	38.3	36.3

Source: Transcontainer Annual Reports for 2008-2017

Empty runs do not generate revenues and negatively affect a company's profit. Empty runs also create additional infrastructure and locomotive deterioration as well as additional costs of the services provided by third parties.

5.3.1 Drop-off charges

After a container is delivered, and the goods are unloaded, the consignee must return the empty container to its owner. For such purposes, shipping companies have special terminals for storing and reclaiming empty containers (stocks) that are usually located in close proximity to major cities and/or transport hubs. Thus, consignees may conveniently save on relocation costs by returning empty containers at the closest appropriate stock. However, if a container is returned at a place that is not the place of delivery (specified in the B/L), shipping companies collect an additional fee - the so-called drop-off charge.

Drop-off charges depend on total accumulated amounts of empty containers, because they require both storage costs and storage space. Empty outbound containers that are unclaimed for export cargo still have to be relocated. In Russia, an overwhelming majority of export containers is exported empty. Therefore, large drop-off charges cause additional costs. Table 48 shows the drop-off rates (for import cargo via Vladivostok/Vostochniy ports) of selected shipping companies on Russian market as of August 2018.

In case of a large accumulation of empty containers, shipping companies raise their drop-off rates. In case of a critical accumulation of empty containers, shipping companies may even stop accepting containers at stocks and/or impose a prohibitive rate.

Table 48 Drop-off rates of major shipping companies as of August 2018, in US dollars.

Shipping company	City	Drop-off rate	
		20-foot container	40-foot container
Sinokor Merchant Marine	Moscow	200	Prohibitive rate (2000)
	Yekaterinburg	100	Prohibitive rate (2000)
	Novosibirsk	400	Prohibitive rate (2000)
Hyundai Merchant Marine	Moscow	600	300
	Yekaterinburg	300	300
	Novosibirsk	600	300
FESCO Ocean Management Ltd.	Moscow	80	150
	Yekaterinburg	80	130
	Novosibirsk	70	150
Maersk	Moscow	152	400
	Yekaterinburg	50	200
	Irkutsk	N/A	Prohibitive rate (2000)
CMA CGM	Moscow	150	25
	Yekaterinburg	50	50
	Novosibirsk	300	50
APL	Moscow	150	25
	Yekaterinburg	50	50
	Novosibirsk	150	50

Source: Author's own processing

All the above-mentioned facts indicate that a large-scale implementation of foldable containers may significantly decrease reposition and handling costs for both shipping companies and consignees.

5.4. Cost-effective analysis

In this section, we will discuss some particular cases of how empty containers create additional costs.

According to Konings (2005), the number of links in the logistic chain distinguishes the logistic concept. In port-to-port concept, the containers are transported between two seaports. In maritime-continental concept, the transportation of containers over land is also included. Figure 27 shows the port-to-port concept. Figure 28 shows the maritime-continental concept.

Fig. 27 Port-to-port logistic concept

Source: Author's own processing based on the research by Konings (2005)

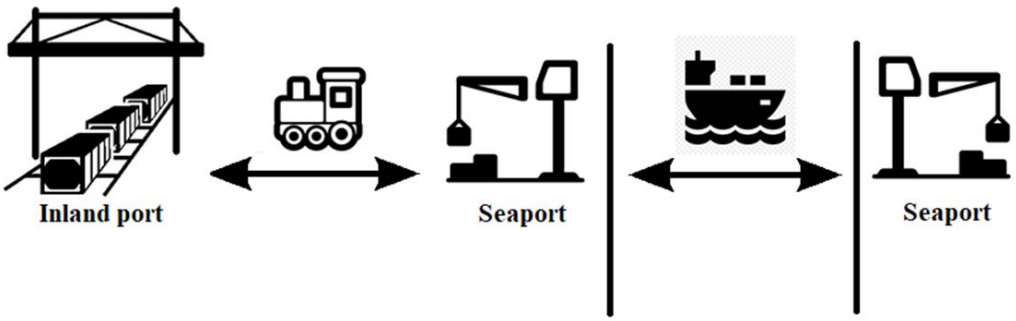


Fig. 28 Maritime-continental logistic concept

Source: Author's own processing based on the research by Konings (2005)

As a specific illustration, we shall consider a common case of transportation of a container from the port of Busan to Moscow through Vostochny Port. Furthermore, we shall investigate the maritime transportation between the port of Busan and the ports of Vostochny and Vladivostok. The examples are based on the statistical data from Tables 41 and 42.

In the following cases, we shall analyze and evaluate the potential of application of foldable containers and upcoming additional charges. The economic benefits of foldable technology implementation will also be calculated.

5.4.1. Busan – Moscow container route

For the purposes of this case, we made the following assumptions:

- One container is transported from Busan to Moscow through Vostochny Port, and in the opposite direction.
- From Vostochny Port to Moscow (Kupavna station) the container is transported by rail, the travel distance is 9 291 kilometers.
- The container is considered laden on the Moscow direction, and empty on the Busan direction.
- Foldable container is a container that can be collapsed when it is empty. Four folded containers can be bundled into a single stacked unit, which equals in size to one standard container.
- Both the standard and the foldable container are 40-foot containers.
- Folding/unfolding operations require two people and a forklift. According to popular employment websites, the average hourly rate of a warehouse worker is $3.8, the average hourly rate of a forklift operator is $5.7. The average fuel rate of one forklift for one working hour is $13 (as of August 2018). Considering container transfer and preparations for the procedure, we assume that it takes 30 minutes of staff and equipment time per container. Therefore, the cost of one folding or unfolding operation is $11.5.
- The depreciation is the allocation of the cost of assets to periods in which the assets are used. The depreciation for 1 day can be calculated as the price of a container divided by the number of service life days. The price of a standard container is $6 000. The life expectancy of a standard container is set at 10 years. The price of a foldable container is $12 000. The service life is set at 5 years. Therefore, the depreciation of a standard container

for one day is $1.67; the depreciation of a foldable container for one day is $6.67.

◆ Folding/unfolding operations are carried out at the railway or sea terminals.

Table 49 summarizes transportation costs for a standard container. Table 50 summarizes transportation costs for a foldable container.

All these assumptions, and the rates in Tables 49, 50 and 51, were made in conformity with the data received from open-source information, specialized tariff calculation programs and expert consultations.

Table 49 Transportation and handling costs for a standard container, in US dollars

Loading status	Days	Activities	USD
Laden	1	Terminal Handling Charge (Busan)	140
	5	Sea Freight from Busan to Vostochny + DTHC	450
	3	Container handling at the seaport	124
		Port services for train departure	523
	18	Railway transportation from Vostochny to Moscow	1 213
	5	Container handling at the railway terminal, storage	87
Empty	5	Container handling at the railway terminal, storage	87
	18	Railway transportation from Moscow to Vostochny	707
	3	Port services for container transfer from railway	523
		Container handling at the seaport	41
	5	Sea Freight from Vostochny to Busan + ODHC	400
	1	Terminal Handling Charge (Busan)	126
		Depreciation for 64 days	107
	64	Total:	4,528
		Laden transportation share:	2,590 (57%)
		Empty transportation share:	1,938 (43%)

Source: Author's calculations

Table 50 Transportation and handling costs for a foldable container, in US dollars.

Loading status	Days	Activities	USD
Laden	1	Terminal Handling Charge (Busan)	140
	5	Sea Freight from Busan to Vostochny + DTHC	450
	3	Container handling at the seaport	124
		Port services for train departure	523
	18	Railway transportation from Vostochny to Kupavna	1,213
	5	Container handling at the railway terminal, storage	87
Empty (folded)	5	Container handling at the railway terminal, storage	22
	18	Railway transportation from Kupavna to Vostochny	303
	3	Port services for container transfer from railway	131
		Container handling at the seaport	21
	5	Sea Freight from Vostochny to Busan + ODHC	113

1	Terminal Handling Charge (Busan)	35
	Folding and unfolding charges	23
	Depreciation for 64 days	427
64	Total:	3,609
	Laden transportation share:	2,750 (76%)
	Empty transportation share:	860 (24%)

Source: Author's calculations

The cost advantage of a foldable container over a standard container is approximately 20.3%. During the standard container's trip, "empty" operations accounted for 43% of the total trip cost. For the folding container, "empty" operations accounted for only 24% of the total trip cost.

In addition, it is useful to estimate the storage cost of an empty container at stock terminals in seaports.

Table 51 Storage cost of an empty container at seaport terminals, in US dollars.

Storage for 10 days	Container type	USD
Port of Busan	standard	97
	foldable	24
Vostochny Port	standard	168
	foldable	42

Source: Author's calculations

Thus, by using foldable containers we can save up to 75% on storage costs alone.

5.4.2. Maritime transportation between the port of Busan and the ports of Vostochny and Vladivostok.

For the purposes of this case, we made the following assumptions:

- The containers are transported from Busan to Vostochny/Vladivostok or in the opposite direction.
- Sea Freight (Busan – Vostochny/Vladivostok) is $450 for a laden container and $400 for an empty one.
- Terminal Handling Charge at the ports of Vostochny/Vladivostok has been

already included in the rate.

- Terminal Handling Charge at the port of Busan is $140 for a laden container and $126 for an empty one.
- The transit time is 5 days, the period of stay at ports - 6 days. The total is 11 days.
- The depreciation of a standard container for one day is $1.67; the depreciation of a foldable container for one day is $6.67.
- The cost of a single folding/unfolding operation is $11.5.

All these assumptions, and the rates in Table 52, were made in conformity with the data received from open-source information, specialized tariff calculation programs and expert consultations.

Table 52 Transportation and handling costs for a foldable container on the Busan - Vladivostok/Vostochny line, in US dollars.

Loading status	Transportation cost	
	Standard	Foldable
Laden	608	686
Empty	544	244

Source: Author's calculations

Table 53 Total number of containers on the Busan - Vladivostok/Vostochny route in 2005-2017, in TEUs

Year	Vladivostok/Vostochny- Busan			Busan - Vladivostok/Vostochny		
	Laden	Empty	Empty share	Laden	Empty	Empty share
2005	11 917	61 608	84%	60 535	383	1%
2006	6 452	79 402	92%	73 493	420	1%
2007	7 270	116 130	94%	97 772	516	1%
2008	7 926	120 362	94%	93 071	225	0%
2009	6 797	65 977	91%	51 102	385	1%
2010	7 732	112 684	94%	78 395	337	0%
2011	9 081	152 318	94%	87 258	227	0%
2012	11 906	149 797	93%	101 106	339	0%
2013	15 385	144 680	90%	96 527	417	0%
2014	20 109	92 376	82%	93 867	1 220	1%
2015	24 286	63 727	72%	60 718	5 528	8%
2016	22 090	41 807	65%	58 684	2 845	5%

2017	19 786	**61 185**	76%	80 160	**1 744**	2%
Total	170 737	**1 262 053**	88%	1 032 688	**14 586**	1%

Source: Port of Busan (Shipping Port Logistics Information System)

According to Table 53, in 2005-2017, there were 1 262 053 empty containers on the Vladivostok/Vostochny - Busan route and 14 586 empty containers on the Busan - Vladivostok/Vostochny route. Figures 29 and 30 graphically represent an imbalance between the route directions.

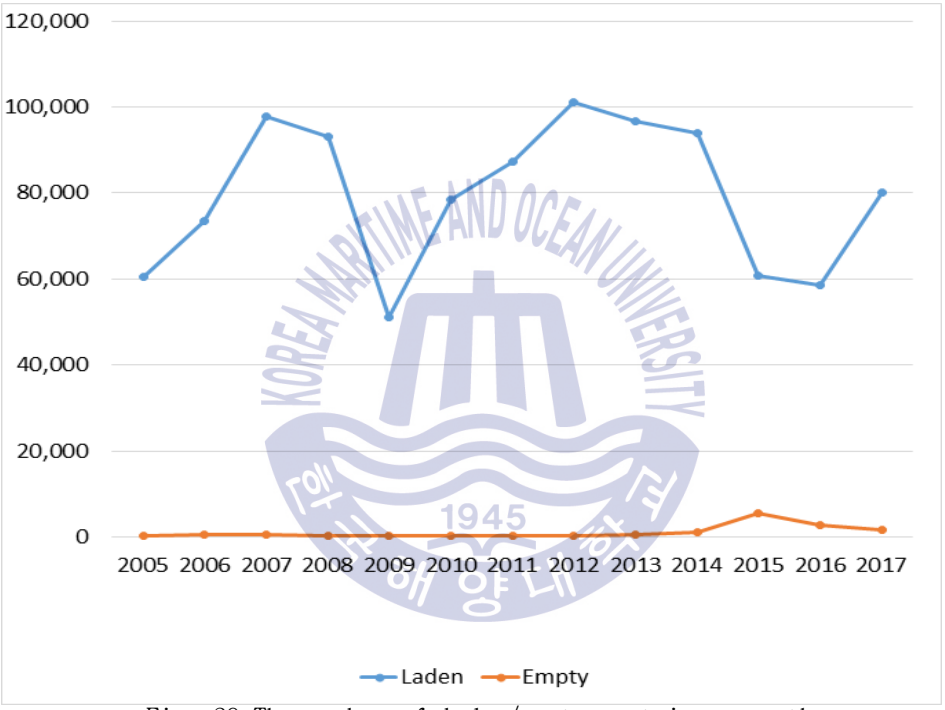


Fig. 29 The number of laden/empty containers on the Busan -Vladivostok/Vostochny route

Source: Author's own processing

We can see a remarkable laden/empty container ratio on the route directions. There are only few outbound empty containers, going from Busan (2% at average over 13 years) - the majority of the containers that were leaving Busan were loaded with cargo. A lot more empty containers went from Vladivostok/Vostochny to Busan (86% on average over 13 years). Empty container costs were calculated in accordance with years and route directions in Table 54.

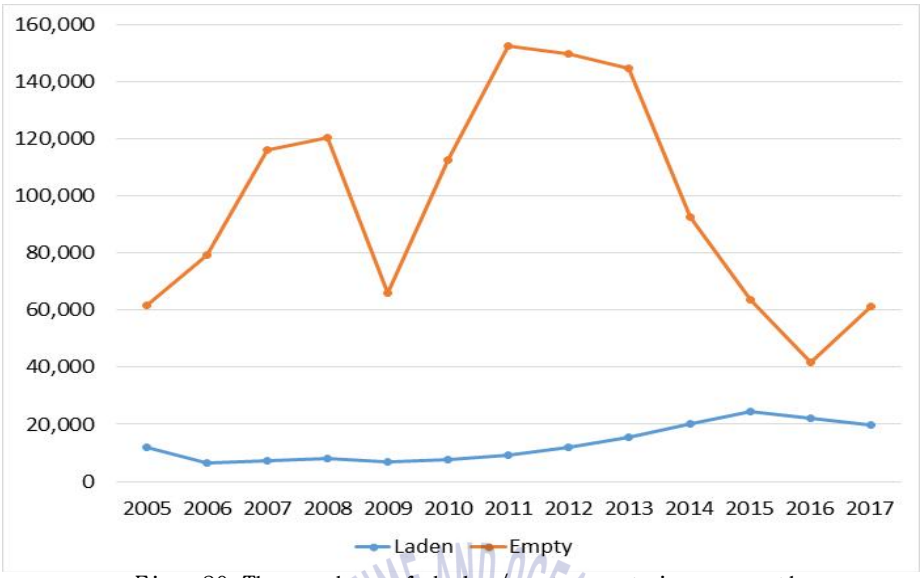


Fig. 30 The number of laden/empty containers on the Vladivostok/Vostochny - Busan route

Source: Author's own processing

Table 54 Transportation costs for standard containers over 13 years on the route, in US dollars

Year	Vladivostok/Vostochny - Busan		Busan -Vladivostok/Vostochny	
	Laden	Empty	Laden	Empty
2005	7 245 695	33 518 790	36 806 087	208 376
2006	3 922 902	43 199 717	44 684 420	228 507
2007	4 419 953	63 182 211	59 446 680	280 737
2008	4 818 962	65 484 551	56 588 409	122 278
2009	4 132 819	35 895 395	31 070 697	209 464
2010	4 701 311	61 306 961	47 665 205	183 349
2011	5 521 217	82 870 639	53 053 875	123 502
2012	7 239 007	81 498 919	61 473 948	184 437
2013	9 354 285	78 714 811	58 689 703	226 874
2014	12 226 540	50 258 394	57 072 236	663 757
2015	14 766 212	34 671 660	36 917 050	3 007 582
2016	13 431 015	22 745 792	35 680 806	1 547 860
2017	12 030 152	33 288 651	48 738 349	948 846

Source: Author's calculations

Calculated empty transportation costs for foldable containers are presented in Table 55. In this case, we assumed that 100% of the containers on the route were foldable.

Table 55 Transportation costs for foldable containers over 13 years on the route, in US dollars

Year	Vladivostok/Vostochny - Busan		Busan -Vladivostok/Vostochny	
	Laden	Empty	Laden	Empty
2005	8 172 484	15 003 066	41 513 913	93 270
2006	4 424 676	19 336 265	50 399 955	102 280
2007	4 985 304	28 280 462	67 050 439	125 658
2008	5 435 350	29 310 994	63 826 570	54 732
2009	4 661 443	16 066 838	35 044 916	93 757
2010	5 302 651	27 441 097	53 762 009	82 067
2011	6 227 430	37 093 035	59 839 938	55 280
2012	8 164 940	36 479 051	69 337 013	82 555
2013	10 550 781	35 232 880	66 196 638	101 549
2014	13 790 423	22 495 741	64 372 283	297 099
2015	16 654 942	15 519 093	41 639 069	1 346 199
2016	15 148 961	10 181 054	40 244 699	692 825
2017	13 568 915	14 900 055	54 972 417	424 705

Source: Author's calculations

Table 56 shows the amount of savings from the usage of foldable containers in accordance with years and directions.

Table 56 Savings from using foldable containers on the route, in US dollars

Years	Vladivostok/Vostochny - Busan		Busan -Vladivostok/Vostochny	
	Laden	Empty	Laden	Empty
2005	-926 789	18 515 724	-4 707 826	115 107
2006	-501 774	23 863 452	-5 715 535	126 227
2007	-565 351	34 901 748	-7 603 759	155 078
2008	-616 388	36 173 557	-7 238 161	67 546
2009	-528 624	19 828 556	-3 974 219	115 708
2010	-601 340	33 865 863	-6 096 804	101 282
2011	-706 213	45 777 603	-6 786 063	68 223
2012	-925 933	45 019 868	-7 863 065	101 883
2013	-1 196 496	43 481 931	-7 506 935	125 325
2014	-1 563 883	27 762 654	-7 300 047	366 658
2015	-1 888 730	19 152 567	-4 722 019	1 661 383
2016	-1 717 946	12 564 738	-4 563 893	855 035
2017	-1 538 764	18 388 596	-6 234 069	524 141

Source: Author's calculations

Since a collapsible container is two times more expensive than a standard one, and its life expectancy is twice shorter, the use value of a collapsible container is higher. This is especially notable when a foldable container is transported laden, since its resizing advantages are useless in this state.

Only in case of empty transportation, folding technology brings great savings. However, Table 57 shows that these benefits alone are enough to cover the above-mentioned losses. Thus, the chain savings can reach $38.2 million a year as it was in 2011.

Table 57 Annual costs and savings using different types of containers, in US dollars

	Total annual cost Standard cont.	Total annual cost Foldable cont.	Annual savings	
2005	77 778 948	64 782 733	12 996 216	17%
2006	92 035 545	74 263 176	17 772 369	19%
2007	127 329 580	100 441 864	26 887 716	21%
2008	127 014 200	98 627 646	28 386 554	22%
2009	71 308 375	55 866 954	15 441 421	22%
2010	113 856 826	86 587 825	27 269 002	24%
2011	141 569 234	103 215 684	38 353 550	27%
2012	150 396 311	114 063 559	36 332 752	24%
2013	146 985 674	112 081 849	34 903 824	24%
2014	120 220 927	100 955 546	19 265 382	16%
2015	89 362 504	75 159 302	14 203 202	16%
2016	73 405 473	66 267 539	7 137 934	10%
2017	95 005 998	83 866 093	11 139 905	12%

Source: Author's calculations

5.5. Sensitivity analysis

The sensitivity analysis was performed across the following ranges: lifespan, purchase price of a foldable container, sea freight rates, folding/unfolding charges, and the rate of empty containers on a route.

Table 58 shows how annual savings change in case of extension or shortening of foldable containers lifespan. In case of a 3-year lifespan, the savings are lower by 9% at average. Accordingly, in case if the lifespan is extended an increase in savings can be achieved.

Table 58 Sensitivity analysis of a foldable container lifespan

Year	3 years	5 years (Default value)	7 years	10 years
2005	8%	17%	20%	23%
2006	11%	19%	23%	26%
2007	13%	21%	25%	28%
2008	14%	22%	26%	29%
2009	13%	22%	25%	28%
2010	15%	24%	28%	30%
2011	18%	27%	31%	34%
2012	16%	24%	28%	31%
2013	15%	24%	27%	30%
2014	8%	16%	20%	22%
2015	7%	16%	20%	22%
2016	1%	10%	13%	16%
2017	3%	12%	15%	18%

Source: Author's calculations

Table 59 shows how annual savings may change in case of increase or decrease of a foldable container purchase price.

Table 59 Sensitivity analysis of a foldable container purchase price

Years	$6 000	$10 000	**$12 000 (Default value)**	$15 000	$20 000
2005	23%	19%	**17%**	14%	8%
2006	26%	21%	**19%**	16%	11%
2007	28%	23%	**21%**	18%	13%
2008	29%	24%	**22%**	19%	14%
2009	28%	24%	**22%**	18%	13%
2010	30%	26%	**24%**	21%	15%
2011	34%	29%	**27%**	24%	18%
2012	31%	26%	**24%**	21%	16%
2013	30%	26%	**24%**	21%	15%
2014	22%	18%	**16%**	13%	8%
2015	22%	18%	**16%**	13%	7%
2016	16%	12%	**10%**	7%	1%
2017	18%	14%	**12%**	9%	3%

Source: Author's calculations

Table 60 shows how average annual savings change in case if both the lifespan and the price are also changed. This allows us to simulate different market and technological scenarios. Figure 31 shows the graphic representation of the data in Table 60.

Table 60 Sensitivity analysis of a foldable container lifespan versus its purchase price

		Lifespan			
		3 years	**5 years (Default value)**	7 years	10 years
Price	$6 000	22%	26%	28%	29%
	$10 000	15%	22%	25%	27%
	$12 000 (Default value)	11%	**19%**	23%	26%
	$15 000	6%	16%	21%	24%
	$20 000	-3%	11%	17%	22%

Source: Author's calculations

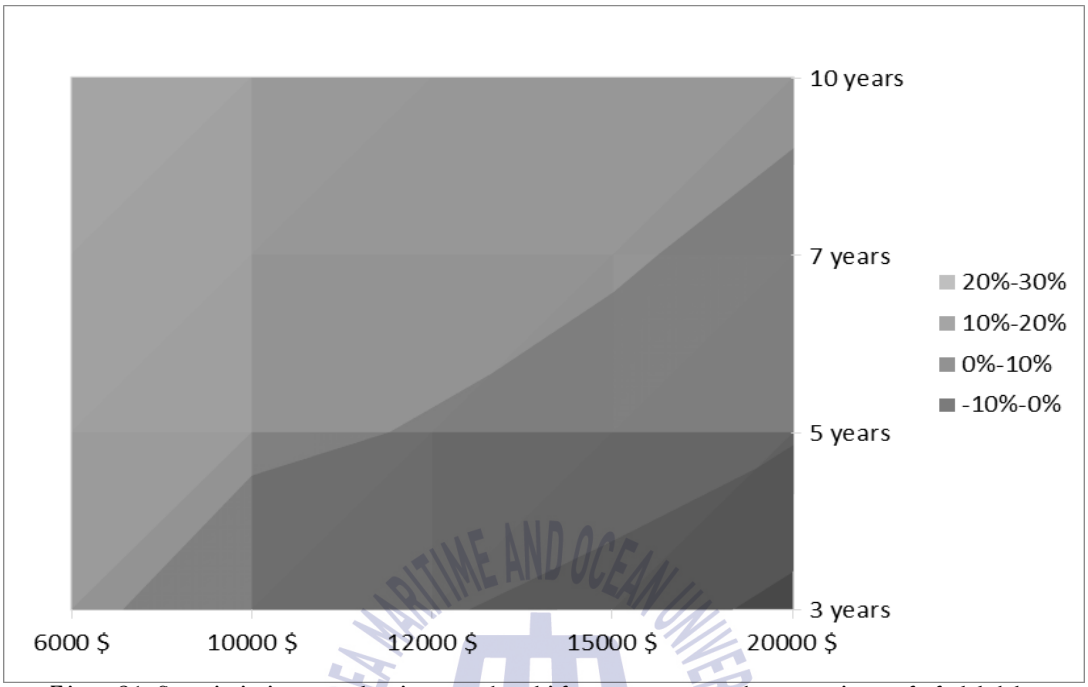


Fig. 31 Sensitivity analysis on the lifespan vs purchase price of foldable containers

Source: Author's calculations

Table 61 shows how sea freight rates volatility affects annual savings.

Table 61 Sensitivity analysis of sea freight rates

	-50%	-20%	-10%	Default value	+10%	+20%	+50%
2005	8%	14%	16%	**17%**	18%	19%	21%
2006	11%	17%	18%	**19%**	20%	21%	23%
2007	13%	19%	20%	**21%**	22%	23%	25%
2008	14%	20%	21%	**22%**	23%	24%	26%
2009	13%	19%	20%	**22%**	23%	24%	26%
2010	15%	21%	23%	**24%**	25%	26%	28%
2011	18%	25%	26%	**27%**	28%	29%	31%
2012	16%	22%	23%	**24%**	25%	26%	28%
2013	15%	21%	23%	**24%**	25%	26%	28%
2014	8%	14%	15%	**16%**	17%	18%	20%
2015	8%	13%	15%	**16%**	17%	18%	20%
2016	2%	7%	9%	**10%**	11%	12%	13%
2017	3%	9%	11%	**12%**	13%	14%	16%

Source: Author's calculations

Table 62 shows how annual savings change in case of an increase or a decrease of folding/unfolding charges.

Table 62 Sensitivity analysis of folding/unfolding charges

	10$	23 $ (Default value)	50$	100$
2005	19%	**17%**	12%	3%
2006	22%	**19%**	15%	6%
2007	23%	**21%**	16%	8%
2008	25%	**22%**	18%	9%
2009	24%	**22%**	17%	8%
2010	26%	**24%**	19%	10%
2011	29%	**27%**	22%	14%
2012	26%	**24%**	19%	11%
2013	26%	**24%**	19%	10%
2014	18%	**16%**	11%	3%
2015	18%	**16%**	11%	3%
2016	12%	**10%**	5%	-3%
2017	14%	**12%**	7%	-2%

Source: Author's calculations

Table 63 shows how the amount of empty containers on a shipping route affects annual savings.

Table 63 Sensitivity analysis of the volume of empty containers on a route

	-50%	-20%	-10%	Default value	+5%	+10%	+20%	+50%
2005	-1%	9%	13%	**17%**	19%	20%	24%	36%
2006	2%	12%	16%	**19%**	21%	23%	27%	38%
2007	3%	14%	17%	**21%**	23%	25%	29%	41%
2008	3%	15%	18%	**22%**	24%	26%	30%	43%
2009	2%	14%	18%	**22%**	24%	26%	30%	42%
2010	4%	16%	20%	**24%**	26%	28%	32%	45%
2011	5%	18%	23%	**27%**	29%	32%	36%	50%
2012	4%	16%	20%	**24%**	26%	28%	33%	46%
2013	3%	15%	19%	**24%**	26%	28%	32%	46%
2014	-2%	9%	12%	**16%**	18%	20%	23%	35%
2015	-3%	8%	12%	**16%**	18%	20%	24%	36%
2016	-7%	3%	6%	**10%**	11%	13%	16%	27%
2017	-4%	5%	8%	**12%**	13%	15%	18%	29%

Source: Author's calculations

Figure 32 shows the combined annual savings drops in case of unfavorable changes of the factors. Presented as the difference between the default value and the most unfavorable factor value.

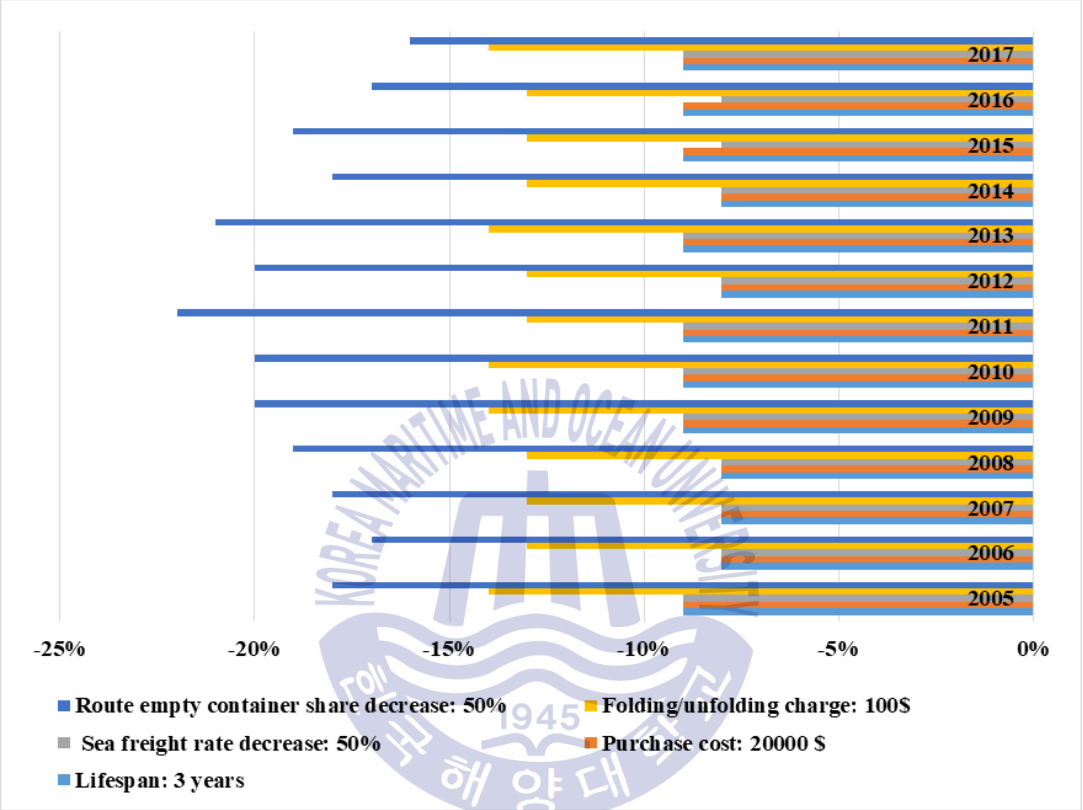


Fig. 32 The combined annual savings drops, caused by different factors

Source: Author's calculations

6. Conclusion

Our analysis of the empty container traffic factors based on the 2005-2007 data shows that the amount of empty containers highly depends on the amount of imported laden containers. Any decrease in laden containers imports reduces the number of empty containers that should be returned and vice versa. Thus, growing amounts of laden export containers (with such raw bulk cargo as steel products, mineral fertilizers, lumber, coal, ore, and grain) stimulated the increase of empty import containers amid falling import rates.

Current foreign relations trends lead to the increase of laden containers imports. Modern investment project cooperation with the Asia-Pacific region creates a stable inflow of containerized goods. Russia's accession to the WTO stimulated the growth of finished goods import due to import tariff reductions. In addition, the Eurasian Economic Union attracts additional flows of import containers through Russian territory, which creates additional burden on Russian transportation system capacity.

Moreover, the reviewed trends only marginally contribute to the development of finished goods exports. A strong foreign trade imbalance still persists in Russian economy. The Asia-Pacific countries are more interested in Russian natural resources and raw materials, so mostly these commodities are exported in large quantities. Russian membership in the WTO significantly challenges the competitiveness of its products. On top of that, some Russian goods, which are highly competitive on the international market (e.g. steel products), still suffer from discrimination despite the WTO.

Russian domestic railway container turnover is increasing, but the differences in level of development and economic specialization of Russian regions increase the share of empty containers. Economic cooperation with companies from the Asia-Pacific countries takes place mainly in the central regions of the country - Moscow and St. Petersburg. Thus, laden containers from the Far Eastern ports go mainly to the central part of the country, creating an additional empty run on their way back.

Since Russian regions are divided into export-oriented and import-oriented, such division contributes to the increase of empty traffic on domestic railway routes. In some cases due to the territorial issues, regional companies even prefer to import empty containers from abroad, rather than relocate them from another region, which further increases the number of empty import containers.

The analysis of the factors, which influence the implementation of foldable containers, shows that recent growth of containerized exports happened mainly due to the intensified bulk cargo containerization. However, this growth is limited, and the development of specialized containers for bulk cargo will decrease the demand for standard containers on export directions, which in turn will lead to empty traffic increase.

Russia's desire to develop its transportation services market, namely transit, faces the issue of trade flows imbalance between China and Europe, since the majority of railway cargo usually goes to Europe from China, and container trains return mostly empty from Europe, all this can potentially limit the profitability of Russian transit services. Moreover, Russian intermodal transportation infrastructure is outdated and underdeveloped, and the throughput capacity of Russian seaports and the Trans-Siberian Railway is limited.

Current environmental initiatives make empty containers transportation more and more expensive. They also reduce the transport links capacity. In such circumstances, empty container traffic becomes increasingly unprofitable, but folding technologies may become an effective solution to this.

The investment climate in Russia is generally favorable and suitable for logistics innovation investments - rich human and natural resources, vast undeveloped territories, and a strong geographical position. The government is pursuing a policy to attract investments in the transportation sector. It also provides subsidies for the most important economy sectors: infrastructure, innovative products, expansion of exports, eco-friendly technologies etc. Several Special Economic Zones are established and do provide their participants with all kinds of benefits and privileges in taxation, banking and administrative formalities.

However, multiple investment risks and issues remain highly pertinent. Extreme corruption on all administrative levels bogs down any new incentives and prevents new players from entering technological innovations market. Russian business

environment is plagued by state interventionism. Russian transport market is very conservative and unresponsive to technological innovations. Most market participants prefer quick profit and do not wish to invest into long-term projects, where profits may be significantly delayed. Complicated laws and legal procedures, high taxes and legislative burdens on business entities, high rates of inflation, not easily accessible bank loans with high interest rates, and ineffective patent policy regulations further contribute to deterioration of the investment climate.

Current main trends and drivers of Russian container transportation market are summarized in Table 64.

Table 64 Overview of current main trends and drivers of Russian container transportation market

TRENDS & DRIVERS		OUTCOMES & CONDITIONS
Economic	Decrease in import of laden containers	The number of returning empty containers is reduced
	Increase in export of laden containers	The number of empty export containers is reduced
		The number of empty import containers is increased
	Increase of processed goods export share	The number of empty export containers is reduced in the long run
Regional	Disparities in the industrial development of Russian regions	The number of empty containers on domestic railroad routes is increased
	Russian regions are divided into export-oriented and import-oriented	The number of empty containers on domestic railway routes is increased
		The number of empty import containers is increased
	Uneven availability of container storage places	The number of empty containers on domestic railway routes is increased
Foreign	The expansion of cooperation with the countries of the Asia-Pacific region	Trade traffic with the Asia -Pacific countries stimulates the development of transport corridor projects and develops Russian transport infrastructure
		Economic cooperation between undeveloped, but resource-rich regions of Russia and the Asian market boosts regional growth rates

		Industrial cooperation stimulates Russian industrial growth
		Investment projects with the Asia-Pacific countries create a stable flow of import containers. The number of empty export containers is increased.
		The Asia-Pacific countries' major interest lies in Russian raw materials and natural resources. Mostly non-containerized cargo is exported to the Asia-Pacific in large quantities.
		The cooperation mainly occurs in Moscow and St. Petersburg regions. The majority of laden containers goes to the western part of the country, creating additional empty traffic in the opposite direction.
	International transport network development	Increases the total container traffic, but the number of empty containers also increases accordingly.
		Container traffic between Europe and China is unprofitable due to a large imbalance (most of the laden traffic goes to Europe); the TSR traffic capacity is limited.
	The WTO membership	Stimulates import of finished goods due to reduced tariffs; foreign engineering cooperation increases imports of machine parts and components. The number of outbound empty containers increases accordingly.
		The competitiveness of Russian goods faces great challenges; Raw material (non-containerized) export values remain unchanged; Russian goods suffer from trade discrimination despite the WTO regulations; Empty export container traffic still prevails
		A slight increase of containerized non-raw goods exports
	The Eurasian Economic Union	Industrial production growth, favorable regime for investment flows
		Transportation and logistics infrastructure development
		Creates additional flows of import containers; Empty export container numbers increase
		Puts additional burden on the throughput capacity of Russian seaports and railways.

Certification & Technological	Certification process and requirements	Affect the variety of types of foldable containers; Affect the use of other types of containers (for example, for bulk cargoes, hampering the development of this area), thereby lowering the demand for folding containers.
	Range choice	Relatively small range of foldable containers on the market limits their application
		Extensive use of specialized bulk containers may increase the export traffic of empty conventional containers
	The issues of folding technology	Payload, life span, additional time and workforce for folding/unfolding and bundling requirements of foldable containers may hinder their application.
	Technological competition and compatibility issues	Different types of foldable containers are incompatible and not interchangeable with each other
Ecological	Environmental laws	Tightening of environmental requirements increases the losses from empty container traffic. Environmental initiatives reduce the capacity of transport links.
Investment	Investment advantages	Russian economy is a suitable destination for logistics innovation investments - rich human and natural resources, vast undeveloped territories, and a strong geographical position.
		The government develops and subsidizes infrastructure, innovative products, export, eco-friendly technologies etc.
		Several Special Economic Zones were established, The SEZ provide their participants with all kinds of benefits and privileges in taxation, banking and administrative formalities.
	Investment risks	Extreme corruption on all administrative levels
		State interventionism.
		High conservatism of the market.
		Low interest in long-term investments
		Complicated laws and legal procedures, high taxes and legislative burdens, high rates of inflation, not easily accessible bank loans with high interest rates, ineffective patent policy

Source: Author's own processing

The factor analysis was used to analyze the data, received after the questionnaire survey from 71 specialists of the Russian transportation industry was conducted.

The respondents provided scores that reflected the importance of 19 factors that affect the container market. The descriptive statistics indicated that "Increase of the railway network cargo capacity" and "Availability of empty containers at any time", are the most important factors for the participants of Russian container market. On the contrary, "Container maximum payload" and "Lifespan of a shipping container" are the least important attributes.

We suggest that there is clearly a demand for technologies that facilitate the simplified relocation of empty containers and improve the use of the existing infrastructure capacities. Moreover, the market participants are optimistic about overcoming the technological obstacles.

Furthermore, the respondents evaluated the statements that reflected the current trends in Russian container industry affecting the empty containers traffic. The 12 statements were divided into four grouped factors.

Factor 1 characterizes the respondents' attitude to empty containers problems: "empty containers take too much space", "loading/unloading empty containers takes a significant time", and "number of empty containers in Russia may increase".

Factor 2 characterizes the respondents' attitude to laden containers issues: "the capacity of the Trans-Siberian Railway is sufficient for increasing volumes of container traffic", "the share of non-raw material products in Russia's turnover may increase significantly", "the number of laden containers in the export direction may increase", "smaller maximum payload of a folding container may limit its use".

Factor 3 characterizes the respondents' attitude to the issues, related to types of containers: "the implementation of new container types in Russia is not associated with considerable problems" and "the growth of specialized containers market does not affect the demand for standardized shipping containers".

Factor 4 characterizes the respondents' attitude to environmental issues and land use: "the reduction of container terminal areas in Russia is not a pressing issue" and "tightening of environmental laws and requirements may significantly affect Russian container transportation market".

The evaluation pattern of these attributes was consistent with the key findings in Chapter 2. In the questionnaire analysis, we were also interested if there was

a significant difference in opinion between different categories of respondents.

The analysis of variance showed that there was a difference in opinions. Large and Medium-sized businesses have their own assessment of empty containers problems, which differs from Small and Very small companies' point of view.

The respondents from Medium-sized firms have different views on environmental issues and land use in contrast to Large, Small and Very small firms.

Furthermore, the Office-working respondents and Field-working respondents have different judgements concerning the issues related to laden containers.

In addition, between specialists who were interested in folding technology and who were not, there was also a difference in opinion concerning the problems of empty containers, environmental issues and land use.

We can also conclude that regardless of work experience and position, the respondents estimate the processes of Russian container market in a similar way.

The recent changes in Russian foreign policy stimulate the shift in cooperation priorities from EU and CIS towards Asia-Pacific countries. The share of APEC countries in 2017 increased up to 30.5% from 23.2% in 2010. Accordingly, the share of Russian Far Eastern seaports basin in total Russian container turnover increased from 26.6% in 2012 up to 32% in 2017. Container flows mostly travel through the ports of Vostochny and Vladivostok.

If we look at the container turnover between the port of Busan and the ports of the Russian Far East, we can see that more than 85 % of containers that traveled from Vladivostok to Busan in 2017 were empty. In 2005-2014, on average, 97% of the containers were empty. The minimum share was in 2016 - 80%. At the same time, the share of empty containers that went from Vostochny to Busan in 2017 was 60%. In 2005-2014, on average, 83% of containers were empty. The minimum value was in 2016 - 37%. The findings indicate that the existing imbalance issue may be resolved by folding technology implementation.

In this research, we considered a common case of transportation of a container from the port of Busan to Moscow through Vostochny Port (maritime-continental concept). Furthermore, we investigated the maritime transportation between the port of Busan and the ports of Vostochny and Vladivostok (port-to-port concept).

The cost-effective analysis results showed that the cost advantage (in a maritime-continental concept) of a foldable container over a standard container was approximately 20.3%. During the standard container's trip, "empty"

operations accounted for 43% of the total trip cost. For the folding container, “empty” operations accounted for only 24% of the total trip cost. We also have discovered that by using foldable containers we can save up to 75% on storage costs alone.

In 2005-2017, there were 1 262 053 empty containers on the Vladivostok/Vostochny - Busan route and 170 737 laden containers over the same years. The calculations shows that folding technology can save millions of dollars. The average cost advantage of a foldable container, over a standard container, on the port-to-port route was 20% over 13 years.

Despite that a collapsible container is two times more expensive than a standard one ($12 000 vs $6 000), its life expectancy is twice shorter (5 years vs 10 years), and it requires additional folding/unfolding costs, its benefits are substantial enough to compensate the arising losses.

The sensitive analysis showed that even if the expected lifespan is decreased (down to 3 years), purchase cost is increased (up to 20,000$), or sea freight rate is decreased (by 50%) the positive gains remain, however savings drop is approximately 9%.

On the contrary, increased folding/unfolding charges (up to $100) or decreased share of empty containers on a route (by 50%) disrupted positive gains - savings drops were 13% and 19% respectively.

Based on the study's results, folded technology holds great cost reduction potential. Considering transportation industry’s growing interest, all the drawbacks, like additional costs, smaller payload, and shorter lifespan are outweighed.

Moreover, Russian container market is not completely unaware of foldable containers. In 2017, the Multimodal Container Services - Russian logistics operator started to use foldable containers on the Shanghai - Vladivostok - Moscow route. The ”Tetris” container terminal in Moscow region received became the officially certified folding facility, it was certified by the HCI Company - the developer of “4FOLD” containers.

However, there is no explosive growth of foldable containers market in Russia and throughout the world. The analysis highlighted investment risks of Russian container market: corruption, conservative market, complicated laws and legal procedures, high taxes, high interest rates and volatile political situation. The

same risks may be applied to the majority of other countries as well.

The implementation of new technology requires intensive initial investment, which contradicts the priority of quick profit - the preferred strategy of Russian businesses.

In addition, Russian economic development strategies are aimed at increasing the production and export volumes of finished goods, which is going to significantly reduce the empty container traffic in a long-term period. In this case, foldable container adopters may suffer the economic losses, described in the sensitivity analysis chapter.

However, the analysis of factors shows that the aforementioned changes may only occur in a long-run prospect. In general, positive changes from foldable technology implementation will only be noticeable after overcoming plenty of structural problems of Russian container market that are yet to remain unsolved.

Whatever the case, at least while the issues of Russian domestic railway container transportation still exist, the empty traffic problem remains. And so, foldable technologies should not be neglected.

References

Analytical Center under the Government of Russian Federation, 2017. Dynamics of foreign trade, No.29, September.

Eurasian Development Bank, 2018. Silk Road Transport Corridors: Assessment of Trans-EAEU Freight Traffic Growth Potential. Centre for Integration Studies, Report No. 49.

European Commission DG Mobility and Transport (2015). Analysis of recent trends in EU shipping and analysis and policy support to improve the competitiveness of short sea shipping in the EU. FINAL REPORT.

Federal Customs Service, 2016. Statistics of foreign trade of the Russian Federation.

Federal Customs Service, 2017. Statistics of foreign trade of the Russian Federation.

Akintoye, A., 2000. Analysis of factors influencing project cost estimating practice. Construction Management & Economics, Vol. 18(1), pp.77-89.

Anushan, S.C.S., Selvabaskar, S. and Alamelu, R., 2016. Factors Contributing and Curtailing Online Shopping Behavior: A Factor Analysis Approach. Indian Journal of Science and Technology, Vol.9(27).

Bannyh, I. N., 2018. Analysis of the State, Dynamics and Trends in the Development of the Customs Infrastructure in the Places of Movement of Goods across the Customs Border of the Eurasian Economic Union Countries in 2017. The Journal Customs Policy of Russia in the Far East, No. 2(83), pp. 103-110.

Belov V.I. and Vasilevskii D.A., 2018. Development of the Industrial Sector as

the Basis for the Growth of the Economy of the Russian Federation. . Administrative Consulting, No.5, pp. 102-112.

Bogomolov, O.A., 2011. Economics and ecology of railway transport in modern realia. Naukovedenie, No. 1(6).

Chaplygin, V.G. and Dolina, V.M., 2015. Russia and the WTO at the modern stage. IKBFU's Vestnik: Humanities and social science, No. 9, pp.127-132.

Chumlyakov, K.S., 2013. The strategic role of transport corridors in the development of international transit. Russian Foreign Economic Journal, No. 11, pp. 62-67.

Dvorets N.N., and Shevelev A.Y., 2015. Research of dependence of the course of ruble in relation to the dollar on oil prices. International Journal of Applied and Fundamental Research, Vol.6(2), pp.293-295.

Fomina E.A., 2018. Improvement of customs policy in the conditions of Russia's membership in the WTO. Theory and practice of service: economics, social sphere, technology, No.1 (35), pp. 40-43.

Gagarinskiy, A.V., 2015. The analysis of a condition of a problem of economic development of the enterprises of metal-working industry in Russia. Naukovedenie, Vol.7, No.3.

Goh, S.H. and Lee, L.J., 2016. Commercial Viability of Foldable Ocean Containers. International Conference on Industrial Engineering and Operations Management, Kuala Lumpur, Malaysia, March 8-10, pp. 2434-2446.

Intihar, M., Kramberger, T., and Dragan, D., 2017. Container throughput forecasting using dynamic Factor Analysis and ARIMAX model. Traffic&Transportation, Vol. 29, No. 5, pp.529-542.

Kalinin, O. and Minakov, S, 2018. Ballast Water Management Systems:

Installation Issues. Morskoy flot, No. 1. Retrieved November 14, 2018, from http://www.morvesti.ru/analitics/detail.php?ID=71688

Karmelic, J., Dundovic, C., and Kolanovic, I, 2012. Empty container logistics. Traffic&Transportation, Vol.24, No.3, pp.223-230.

Khmelev, I., 2016. The consequences of Russia's accession to the WTO and prospects of development of Russian economy. Transport business in Russia, No.2, pp. 80-82.

Konings, R. and Thijs, R., 2001. Foldable containers: A new perspective on reducing container- repositioning costs. European Journal of Transport and Infrastructure Research, No. 1(4), pp.333-352.

Konings, R., 2005. Foldable Containers to Reduce the Costs of Empty Transport? A Cost-Benefit Analysis from a Chain and Multi-Actor Perspective. Marine Economics&Logistics, No.7, pp.223-249.

Lee, S.W. and Kim, C.H., 2006. Performance Evaluation of Asian Port Distriparks Using Factor Analysis. Ocean Policy Research, Vol21, No.1, pp.53-82.

Lipina, S.A. and Zaykov, K.S., 2015. Priorities and opportunities of cooperation between Russia and the Asian-Pacific states. Arctic and Sever, No. 21, pp.33-41.

Lu, C.S., Shang, K.C., and Lin, C.C., 2016. Identifying crucial sustainability assessment criteria for container seaports. Maritime Business Review, Vol.1, Issue 2, pp.90-106.

Lu, J., Gong, X. and Wang, L., 2011. An Empirical Study of Container Terminal's Service Attributes. Journal of Service Science and Management, No.4, pp.97-109.

Moon, I., Do Ngoc, A.D., and Konings, R, 2013. Foldable and standard containers in empty container repositioning. Transportation Research Part E, No.49, pp.107-124.

Myung, Y.S. and Moon, I., 2014. A network flow model for the optimal allocation of both foldable and standard containers. Operations Research Letters, no. 42, pp. 484-488.

Nasonov, V. V., 2013. Problems of sustainable balanced development of regions, monitoring of economic development of regions. Problems of the modern economy: Proceedings of the III Intern. scientific conf. pp.138-145.

Obolensky, V.P., 2012. Global crisis and foreign trade of Russia. Russian Foreign Economic Journal, No. 1, pp. 4-16.

Ou, X., Arinez, J., Chang, Q., and Xiao, G., 2017. Cost Analysis and Fuzzy Control for Collapsible Container Usage Based on Closed-Loop Supply Chain Model. Journal of Manufacturing Science and Engineering, vol. 139 (8).

Pak, E.V. and Piskulova, N.A., 2015. Eurasian Economic Union: measuring interim economic results of integration. Russian Foreign Economic Journal, No. 10, pp. 22-34.

Pang, K. and Lu, C.S., 2018. Organizational motivation, employee job satisfaction and organizational performance: An empirical study of container shipping companies in Taiwan. Maritime Business Review, Vol. 3, Issue 1, pp.36-52.

Rykov, V.M. and Kolesnik, V.A., 2015. Russia in Wto: Accession: Positive and Negative Aspects. Baikal Research Journal, Vol.6, No.1.

Saeed, N., 2009. An analysis of carriers' selection criteria when choosing container terminals in Pakistan. Maritime Economics & Logistics, No.11, pp.270-288.

Shavzis, S.S., 2008. The role of seaports in the container transportation system of Russia. Transport of the Russian Federation, No.6, pp.44-45.

Shin, C.H., Kim, S.N., Den, M., and Wang, G.F., 2018. Economic Analysis of Foldable Containers on the Jeju-Mokpo Container Route. J . Navig. Port Res., Vol.42, No.5, pp.331-340.

Shintani, K., Konings, R., and Imai, A., 2010. The impact of foldable containers on container fleet management costs in hinterland transport. Transportation Research Part E, No.46, pp.750-763.

Shintani, K., Konings, R., and Imai, A., 2012. The effect of foldable containers on the costs of container fleet management in liner shipping networks. Maritime Economics & Logistics, No.14, pp.455-479.

Tremblay, J.F., 2016. How China Is, Slowly, Tightening The Environmental Screw. Chemical&Engineering news, Vol.94, Ni. 1, pp.11-13.

Vinokurov, E., 2015. Eurasian Economic Union will promote import substitution. Journal of Eurasian Economic Integration, No. 1(26), pp.90-94.

Wang, K., Wang, S. Zhen, L., and Qu, X., 2017. Ship type decision considering empty container repositioning and foldable containers. Transportation Research Part E, No.108, pp.97-121.

Yakovlev A.A., 2018. Some questions of activation of participation of native business in states of EAEU. Economic Security Bulletin, No.2, pp.380-384.

Yang, C.C. and Wong, C.W.Y., 2016. Configurations of environmental management strategy: evidence from the container shipping service industry. Int. J. Shipping and Transport Logistics, Vol. 8, No. 3, pp. 334-356.

Zbarashchenko, V., 2013. Transit potential of the Russian Federation: state and prospects. SeaPorts, No. 10. Retrieved November 14, 2018, from http://www.morvesti.ru/analitics/detail.php?ID=29340

Zhang, S., Ruan, X., Xia, Y., and Feng, X., 2017. Foldable container in empty container repositioning in intermodal transportation network of Belt and Road Initiative: strengths and limitations. Maritime Policy & Management, Vol. 45. Issue. 3, pp. 351-369.

Zhiryaeva, E. V., 2018. Economic and Political Results of the Russian Federation WTO Membership: Assessment on the Base of International Organizations Theories. Administrative Consulting, No.3, pp. 52-64.

Zubenko, V.V. and Avarskii, S.A., 2016. Mutual complementarity of the EEU economies: between the past and the future. National Interests: Priorities and Security, No.11, pp.127-142.

ACRA, 2018. A change in economic policy is the main channel for the impact of sanctions on the Russian economy. Retrieved November 14, 2018, from https://www.acra-ratings.ru/research/819.

Asian and Pacific Collaboration center. Investment projects. Retrieved November 14, 2018, from http://apcc.spb.ru/ru/deyatelnost-ru/4-greece-first-minute.html

Carnegie Moscow Center, 05.09.2016. Why China Subsidizes Loss-Making Rail Transport via Russia and Kazakhstan. Retrieved November 14, 2018, from https://carnegie.ru/commentary/64555.

EastRussia, 29.05.2017. And a decade is not enough. Retrieved November 14, 2018, from https://www.eastrussia.ru/material/i-desyatiletiya-malo/.

Gazeta.Ru, 29.12.2015. China bypasses Russia. Retrieved November 14, 2018, from https://www.gazeta.ru/business/2015/12/27/7995287.shtml

Gydok, 2006. The advantages of Transsib are objective, but not obvious to everyone. Retrieved November 14, 2018, from http://www.gudok.ru/newspaper/?ID=739074

InfraNews, 31.08.2018. The market for container refrigerated shipments is growing faster than the average. Retrieved November 14, 2018, from http://infranews.ru/logistika/more/52183-rynok-kontejnernyx-refperevozok-rastet-bystree-srednego/

Kommersant, 27.06.2017. Russia pays WTO bills. Retrieved November 14, 2018, from https://www.kommersant.ru/doc/3336506

MOLIT, 2017. Press Release of January 22, 2017. Retrieved November 14, 2018, from https://www.ktdb.go.kr/downloadBbsFile.do?atchmnflNo=9817.

Morskoy flot, 2018. Problems and solutions to ensure environmental safety. Retrieved November 14, 2018, from http://www.morvesti.ru/analitics/detail.php?ID=71472

PortNews, 16.03.2017. In Novorossiysk, there is an explosive growth of empty containers sent. Retrieved November 14, 2018, from http://portnews.ru/news/235895/

PrimaMedia, 06.07.2015. New container train from Vladivostok to Moscow launches FESCO. Retrieved November 14, 2018, from https://primamedia.ru/news/448081/

PrimaMedia, 12.03.2015. A new container train to St. Petersburg launched TransContainer in Primorye. Retrieved November 14, 2018, from https://primamedia.ru/news/425842/

PrimaMedia.ru, 29.12.2017. South Korea goes to Transsib through Vladivostok. Retrieved November 14, 2018, from https://primamedia.ru/news/658577/

Russian Railways. Environmental strategy of JSC "Russian Railways" for the period up to 2017 and the outlook to 2030. Retrieved November 14, 2018, from http://www.rzd.ru/doc/public/ru/accessible?STRUCTURE_ID=704&layer_id=5104&id=6415

RIA News, 26.08.2016. Russia and South Korea will continue to cooperate on the project of the railway corridor to Europe. Retrieved November 14, 2018, from

https://ria.ru/economy/20160826/1475413939.html

RIA News, 29.08.2016. In the Far Eastern FD, a transport corridor will be created connecting the Trans-Siberian Railway and the Pacific Ocean, 29.08.2016. Retrieved November 14, 2018, from https://ria.ru/economy/20160829/1475493025.html

RZD-Partner, 01.09.2017. Export in containers is a delicate matter. Retrieved November 14, 2018, from http://www.rzd-partner.ru/zhd-transport/comments/eksport-v-konteynerakh-delo-tonkoe/

RZD-Partner, 02.2018. Containeromania 2017. Retrieved November 14, 2018, from http://ac.gov.ru/files/content/16041/rzhd-partner-pdf.pdf

RZD-Partner, 09.01.2017. The market of temperature logistics in containers will grow in the next 3 years, increasing by 25-30% per year. Retrieved November 14, 2018, from http://www.rzd-partner.ru/logistics/news/rynok-temperaturnoy-logistiki-v-konteynerakh-budet-rasti-v-blizhayshie-3-goda-prirastaya-na-25-30-v-/

RZD-Partner, 09.01.2018. Efficient ecology. Retrieved November 14, 2018, from http://www.rzd-partner.ru/zhd-transport/interview/effektivnaya-ekologiya/

RZD-Partner, 11.08.2017. The volume of container traffic by rail in the direction of Russia - Asia-Pacific countries has grown by 48% since the beginning of the year. Retrieved November 14, 2018, from http://www.rzd-partner.ru/zhd-transport/news/obem-perevozok-ktk-zheleznodorozhnym-transportom-v-soobshchenii-rossiya-strany-atr-vyros-s-nachala-g/

RZD-Partner, 14.08.2018. New route laid from South Korea to St. Petersburg. Retrieved November 14, 2018, from http://www.rzd-partner.ru/auto/news/novyy-marshrut-prolozhen-iz-yuzhnoy-korei-v-sankt-peterburg/

RZD-Partner, 21.03.2016. The share of logistics costs in the GDP of the Russian Federation reaches 19%, with the world average of 11.7%. Retrieved November 14,

2018, from http://www.rzd-partner.ru/logistics/news/dolia-logisticheskikh-izderzhek-v-vvp-rf-dokhodit-do-19--pri-srednemirovom-pokazatele-v-11-7----mnen/

RZD-Partner, 30.03.2017. Port Vostochny has linked direct container service with Vietnam, China and South Korea. Retrieved November 14, 2018, from http://www.rzd-partner.ru/wate-transport/news/port-vostochnyy-svyazal-pryamoy-konteynernyy-servis-s-vetnamom-kitaem-i-yuzhnoy-koreey/

Sea news of Russia, 2018. All covered with greenery. Retrieved November 14, 2018, from http://www.morvesti.ru/analitics/detail.php?ID=70592

SeaNews, 05.05.2017. The service of sending non-primary exports to China has become regular. Retrieved November 14, 2018, from http://seanews.ru/2017/05/05/4025967/

SeaNews, 14.09.2017. New container train Vorsino - Chengdu - Vorsino. Retrieved November 14, 2018, from https://clck.ru/EhpTh

TransContainer Press Releases, 01.09.2016. TransContainer and Glovis have dispatched the first train from Vostochny port to Shushary station. Retrieved November 14, 2018, from https://trcont.com/en/press-centre/press-releases/-/asset_publisher/3m9B8CrlzS4s/content/transkontejner-i-glovis-otpravili-pervyj-poezd-s-porta-vostocnyj-na-stanciu-susary

Transler, 20.10.2017. Will environmental fees grow? Retrieved November 14, 2018, from http://transler.ru/articles/ecologie/kologicheskie_sbori_virastut.html

Vedomosti, 17.04.2018. UC Rusal dramatically reduce the export of aluminum. Retrieved November 14, 2018, from https://www.vedomosti.ru/business/articles/2018/04/18/767005-rusal-eksport-alyuminiya

Vesti.Ekonomika, 21.07.2018. Russia in the WTO: economic consequences.

Retrieved November 14, 2018, from https://www.vestifinance.ru/articles/104273

VladNews, 28.11.2017. Primorye-1: a one-way track. Retrieved November 14, 2018, from https://vladnews.ru/2017-11-28/121473/primore_igra

VR Transport. Energy-efficient trains - for the environment and customers. Retrieved November 14, 2018, from https://www.vrtranspoint.fi/en/vr-transpoint/environment-and-responsibility/environment/energy-efficient-trains-for-the-environment-and-customers/

Vzglyd, 24.05.2017. Japan knows the advantages of Transsib over sea route to Europe. Retrieved November 14, 2018, from https://vz.ru/news/2017/5/24/871554.html

YakutiaMedia, 19.05.2015. FESCO Transport Group launches container service in Yakutia. Retrieved November 14, 2018, from https://yakutiamedia.ru/news/438709/