Industries, Intermodal Logistics and Ports in Far Eastern Russia: Current Status and Future Projects

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Abstract: This paper summarizes the current situation of industries including natural resources (oil, gas, coal), grain and automobile production as well as logistics infrastructure including railways and ports in Far Eastern Russia (FER). Also, the problems that logistics in FER are facing are discussed and the feasibility of infrastructure projects to improve the situation including a new LNG plant, petrochemical plant, coal terminal, grain terminal as well as expansion of existing container terminal and railway capacity are considered.

Keywords: Far Eastern Russia, Intermodal Transport, Port Logistics, Future Port Plan

1. INTRODUCTION

Far Eastern Russia (FER) with its abundant natural resources and vast land which connects the two largest economies of the world, Europe and East Asia, has great potential. However, population density in FER is very low and long distance shipping is needed when trading with other regions.

Although FER is part of East Asia, it has been somewhat overlooked in the context of transportation in Eastern Asia, mainly due to lack of information and its great distance from the center of economic growth in Eastern Asia such as China and Southeast Asia.

Therefore, in this paper, the current status of economics and industries including natural resources (oil, gas, coal), grain and automobile production in FER are reviewed in Chapter 2. As well, logistics infrastructure including railways and ports in FER are reviewed in Chapter 3. After those reviews, the problems that logistics in FER are facing are discussed and the feasibility of infrastructure projects to improve the situation including new construction of terminals and capacity improvement of existing infrastructure are considered in Chapter 4. Finally, conclusion is stated in Chapter 5.

2. CURRENT STATUS OF ECONOMIES AND INDUSTRIES IN FAR EASTERN RUSSIA

2.1 Economic Situation of FER

Figure 1 shows a breakdown by federal district of Gross Domestic Products (GDP) in Russia in 2010 and growth of Gross Regional Domestic Products (GRP) in each federal subject of Far Eastern (FE) federal district. As shown in the figure, the GRP of FE federal district shares 5.6% of the whole Russian GDP. Also, the growth rate of GRP in FE federal district during the last decade is almost similar with the growth rate of the whole Russian GDP. For the growth rate of GRP in each federal subject of FE federal district, that of Sakhalin Oblast is the largest; those of Primorsky Krai and Khabarovsk Krai are quite similar to the average growth rate of GRP in the whole FE federal district.

Figure 2 shows a breakdown of GRP by industrial sector in each federal subject of FE federal district. Compared with the breakdown of the whole Russian GDP, the shares of fishery, mining, construction and transportation & communication industry are larger in the GRP of the whole FE federal district, while the shares of manufacturing and commercial are quite smaller. In particular, the share of mining is quite larger in GRP of Sakha Republic, Sakhalin Oblast, and Chukotka Autonomous Okrug. In Primorsky Krai and Khabarovsk Krai, the share of construction and transportation & communication industry are larger in their GRP.

Figure 3 shows the amount of trade from and to FE federal district and breakdown by partner countries. The amount of imports in FE federal district is US$ 9.2 billion in 2011, while the amount of exports is quite larger at around US$ 24.8 billion in 2011. The major partner countries are Japan and Korea for export and China for import. Figure 4 shows a breakdown of trade amount in FE federal districts by major commodities. “Fuels & Minerals” shares almost two-thirds in the export, while “Machinery, Equipment, Transport Means” shares almost half in the import.

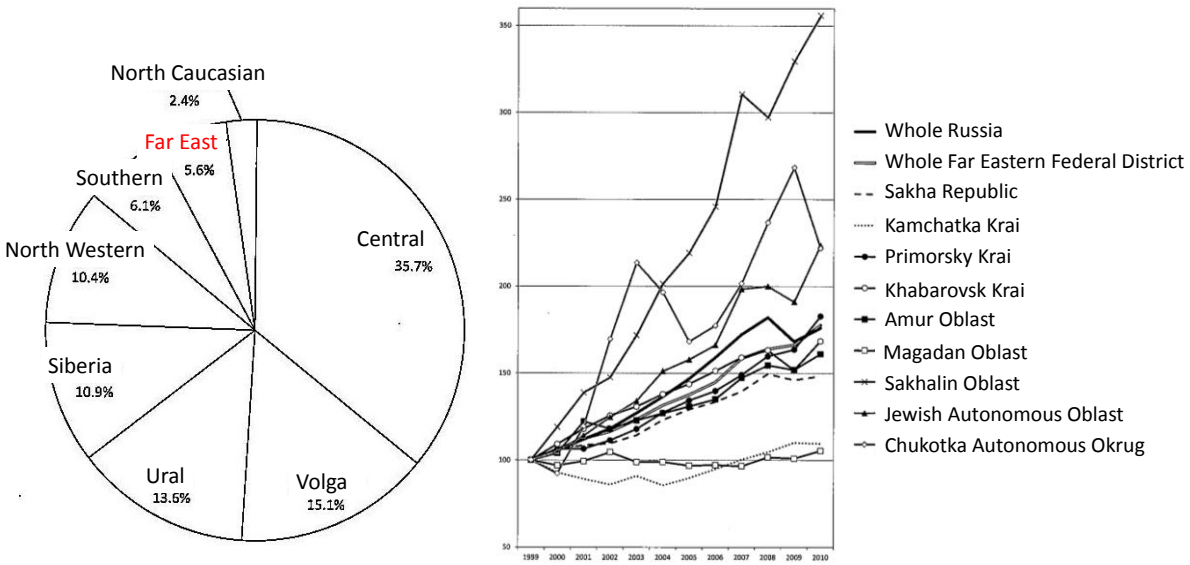


Figure 1. Breakdown of Russian GDP by federal district (2010, left) and growth of GRP in each federal subject of FE federal district (right) (source: Hattori, 2012)

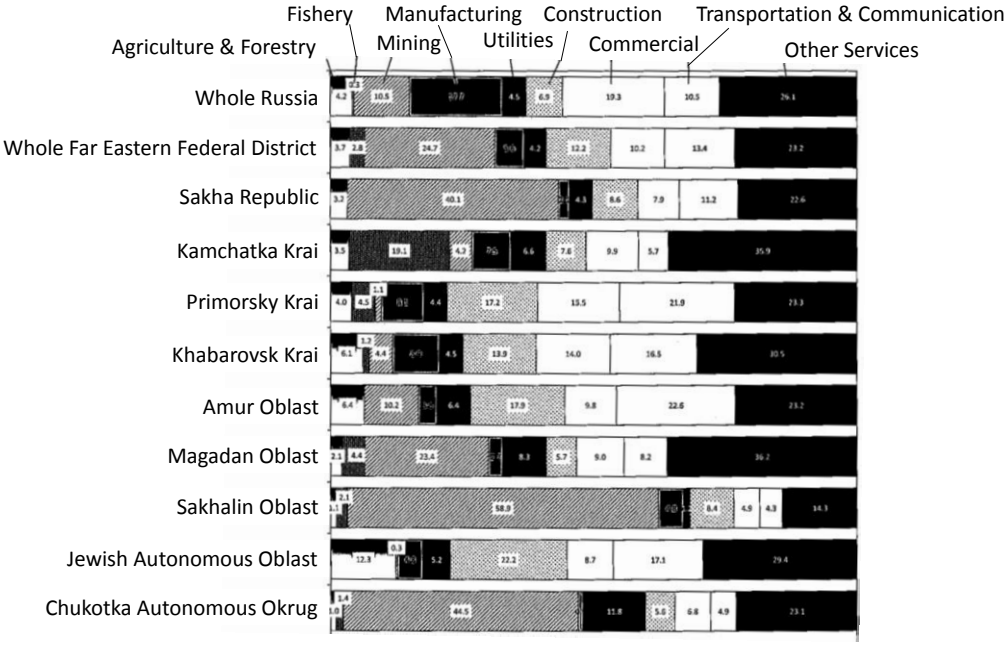


Figure 2. Breakdown of GRP by industrial sector in each federal subject in FE federal district (source: Hattori, 2012)

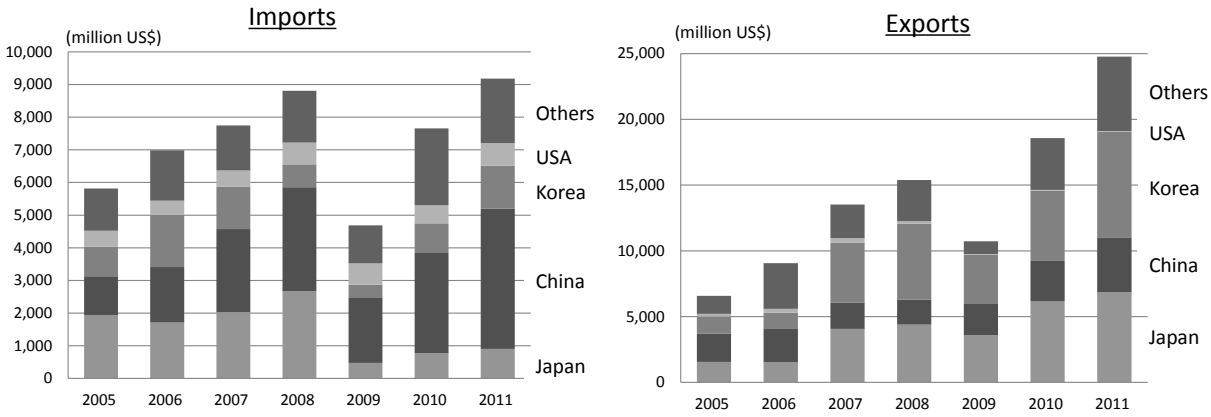


Figure 3. Trade amount in FE federal district and breakdown by partner countries (source: Russian Far Eastern Customs, etc.)

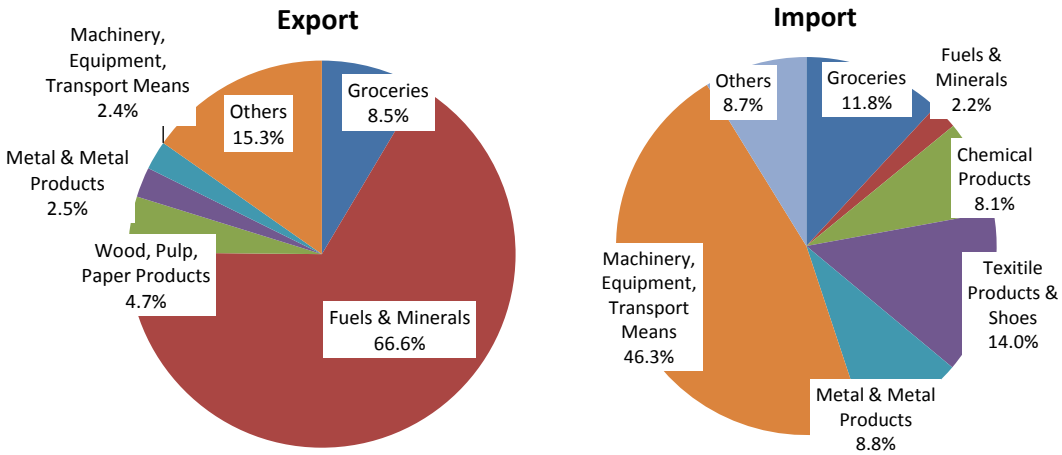


Figure 4. Breakdown of trade amount in FE federal district by major commodities (source: Russian Far East Customs)

2.2 Current Industries in FER

2.2.1 Crude Oil and Natural Gas

Figure 5 shows the amount of exports in crude oil, oil products and natural gas from Russia. Reflecting a peak out of production of natural resources and a policy by the federal government to encourage the export of processed goods, export volumes of crude oil and natural gas have stalled during these few years, while exports of oil products have increased.

The production area of crude oil and natural gas in Russia has shifted to the east and north of the country as shown in Figure 6. Due to that reason, the amount of exports in both crude oil and natural gas in east Russia including Eastern Siberia and Sakhalin Oblast are expected to increase in future as shown in Table 1. The pipelines for exporting natural resources via FER to Asian countries have been constructed. Figure 7 shows a map of ESPO (East Siberia-Pacific Ocean) pipeline for crude oil export which was completed for all the routes to FER (Kozmino Oil Terminal) in December 2012. Before the completion of the pipeline, crude oil was partly transported by railways (TSR: Trans-Siberian Railways) for the uncompleted section. The ESPO pipeline also has a feeder line to China. The past records on the exported amount via the ESPO pipeline since its partial inauguration are shown in Table 2.

Figure 8 shows a map of the existing and planned gas pipeline in the east part of Russia. The red line in the map represents a planned line which does not exist. Also, a plant making LNG (liquefied natural gas) in Vladivostok is still under study; therefore, all gasses sent from Sakhalin to Primorsky Krai via the pipeline are tentatively used in Russia, not exported to foreign countries.

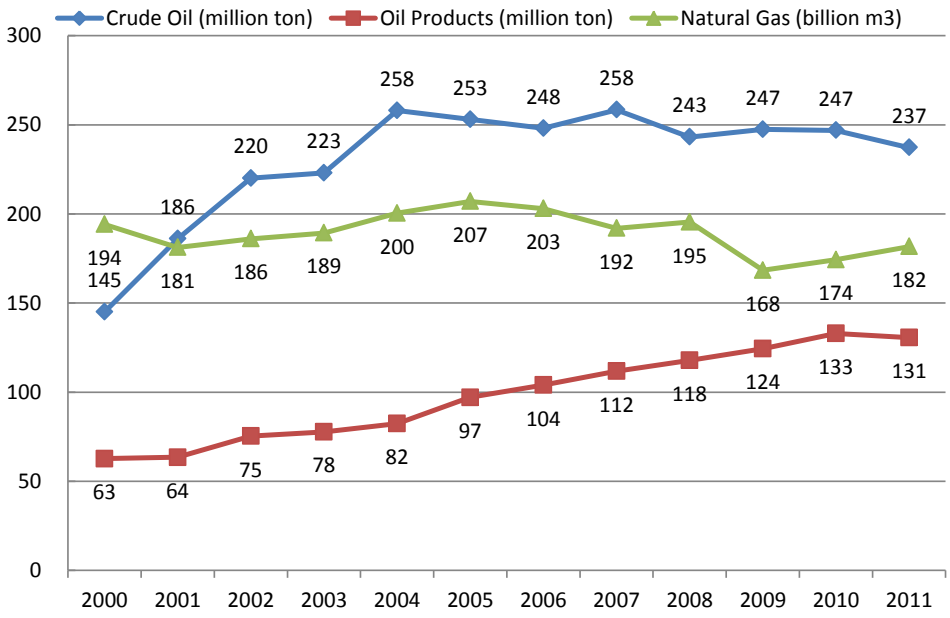


Figure 5. Russian export of oil and natural gas (source: Russian Statistical Yearbook, etc.)

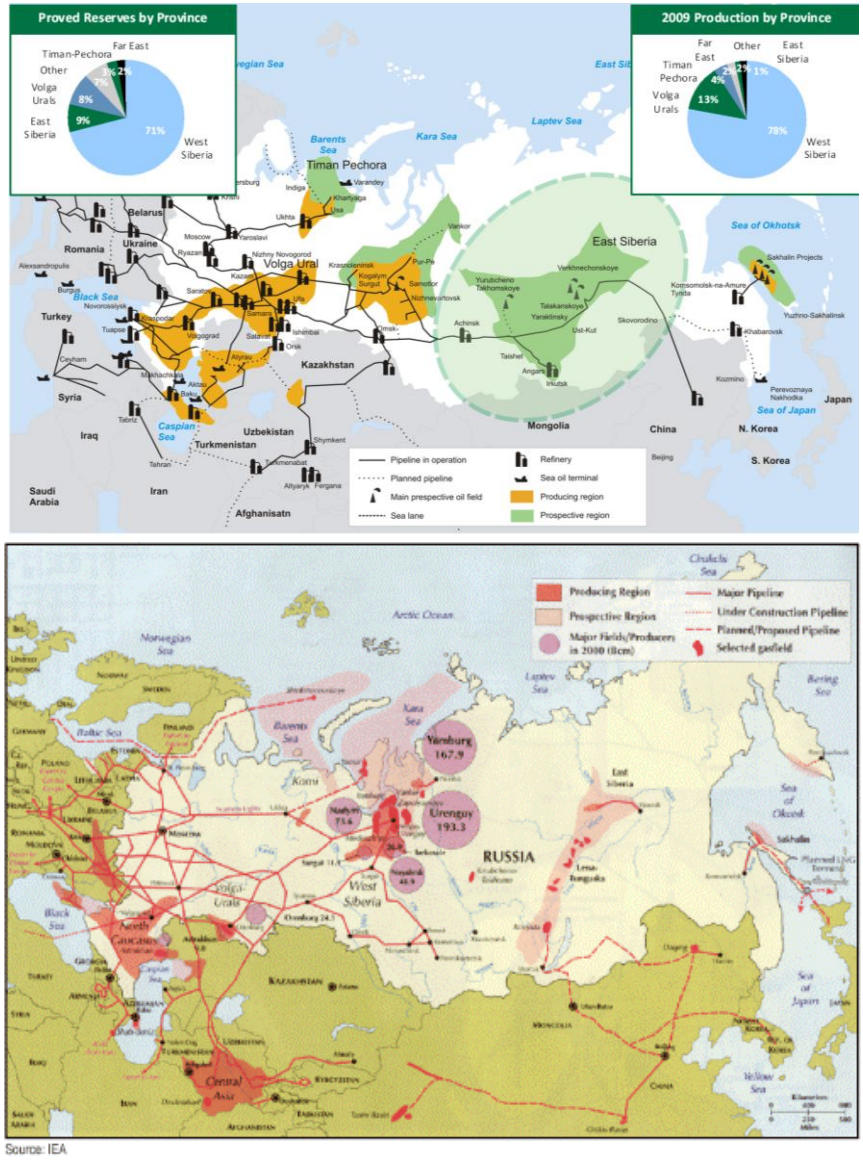


Figure 6. Current and expected production area of crude oil (above) and natural gas (below) in Russia (source: website)

Table 1. Expected export amount of crude oil (million tons) and natural gas (billion m^3) from FER (source: Itoh, 2009)

Crude Oil

	2010	2015	2020	2025	2030
West Siberia	20	30	35	35	30
East Siberia and Sakha Republic	6	20	35	45	55
Sakhalin Oblast	18	20	25	27	35
Total	44	70	95	107	120

Natural Gas

	2010	2015	2020	2025	2030
West Siberia	0	15	30	40	60
East Siberia and Sakha Republic	0	30	60	82	82
Sakhalin Oblast	13.4	13.4	18	20	23
Total	13.4	58.4	108	142	165
Country for export					
China	3.5	40	78	102	125
Japan	5	5	7	10	10
Korea	3	10	15	20	20
Other countries (Asia, Pacific, USA)	1.9	3.4	8	10	10

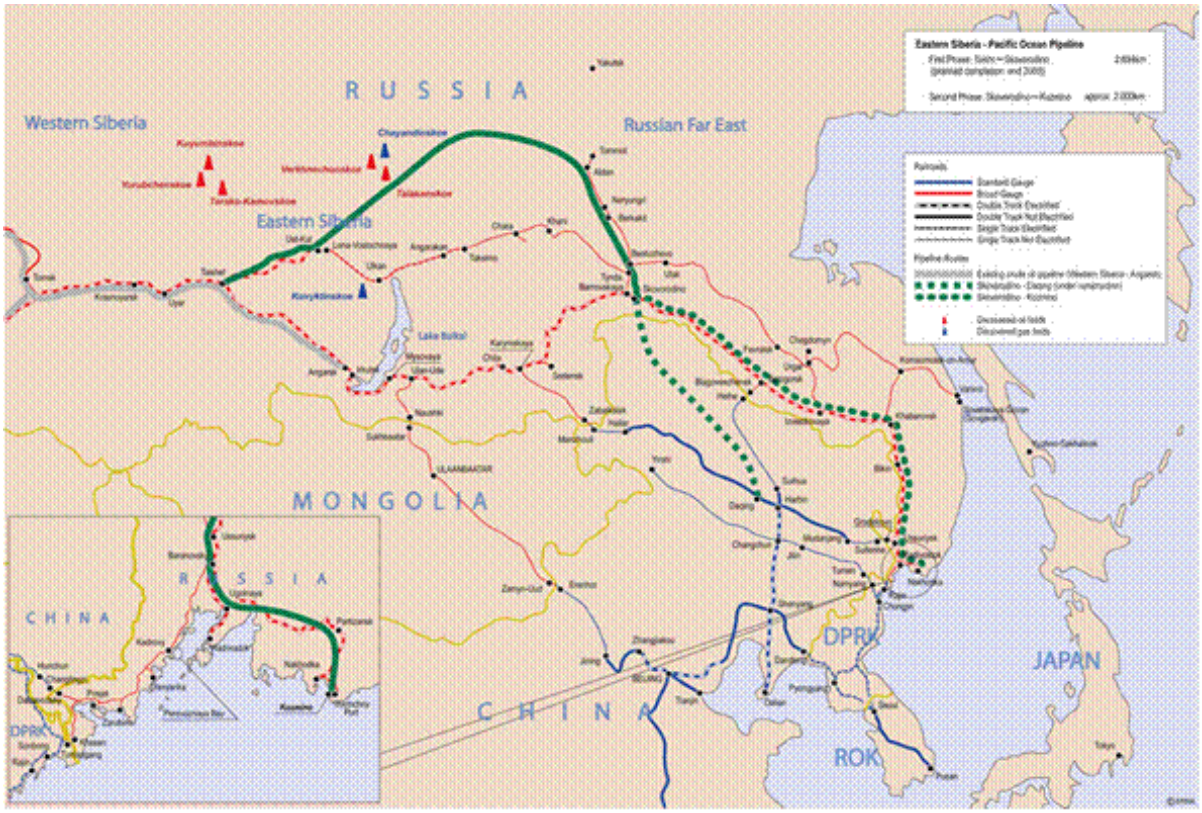


Figure 7. Map of ESPO pipeline (source: ERINA)

Table 2. Exported amount of crude oil through ESPO pipeline (thousand tons)
(source: Monthly Report for Russia and NIS countries, February 2013)

	2010	2011	2012
Total	15,343	30,199	31,392
via Kozmino	15,343	15,199	16,302
for Japan	4,500	3,500	3,300 (until August)
Chinese Feeder	0	15,000	15,090

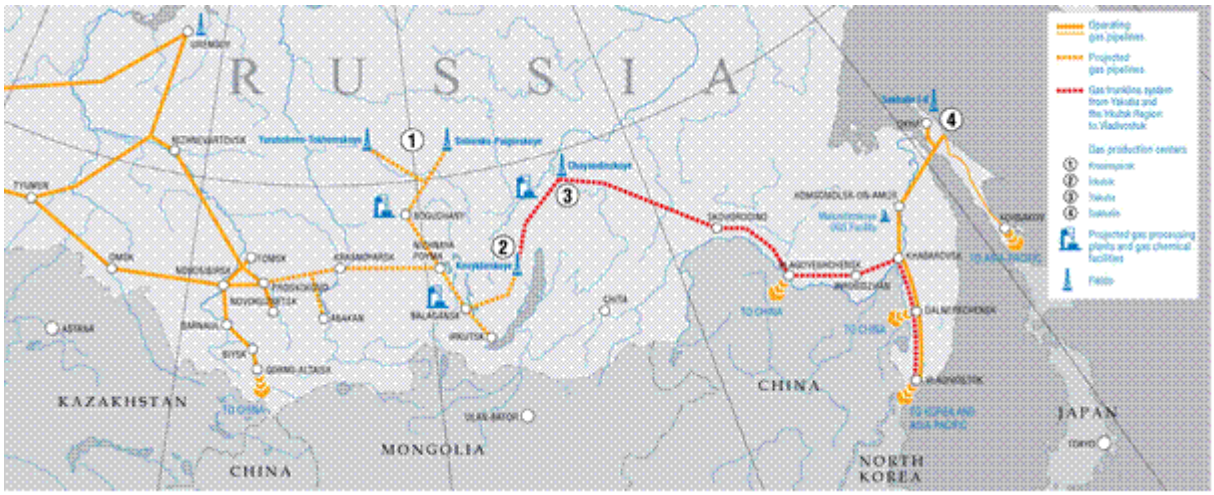
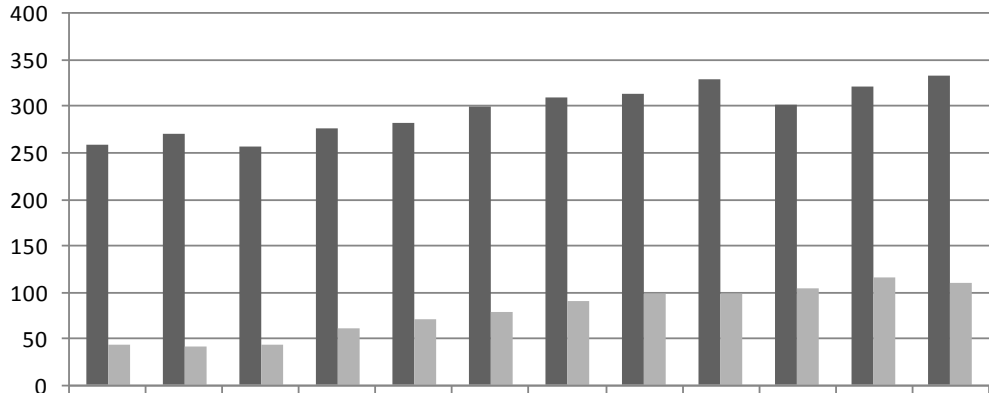


Figure 8. Gas resources development and gas transmission system shaping in Eastern Russia
(source: GAZPROM website)

2.2.2 Coal

Figure 9 shows the production and export volumes of coal in Russia. Both the production and export have increased in recent years, reflecting the increase in international price of the coal. In particular, export to Asian countries via the ports in FER has rapidly increased. In the decade ending in 2010, the amount of exported coal increased by 3.3 times. The amount of exported coal via FER ports in 2010 is 33.5 million tons which shares more than half of the total exported amount via FER ports.

Figure 10 shows a breakdown by exported countries of coal from the ports in FER. Export to Japan shares more than half of the total export from FER ports. For export to China, some of them are considered to be exported via land shipping. As shown in the next chapter, coal exports are booming in FER ports. Reflecting the expected increase in export demand to Asia in future, many projects for the development of coal mining are planned in east Russia and its neighboring area (i.e. Mongolia) as shown in Table 3. All of these mining fields are far from FER Ports.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Output (million ton)	258	270	256	277	282	299	310	314	329	301	322	334
Export (million ton)	43.6	41.5	43.2	60.5	71.8	79.7	91.4	98.0	97.4	105.0	115.7	110.5
Export amount (million US$)	1,136	1,211	1,151	1,722	2,755	3,756	4,342	5,355	7,752	7,367	9,181	11,373
unit price (US$/ton)	26.0	29.2	26.6	28.5	38.4	47.1	47.5	54.6	79.6	70.1	79.4	103.0

Figure 9. Production and export of coal in Russia
(source: Vardari, et al., 2012 and Sakaguchi 2012a)

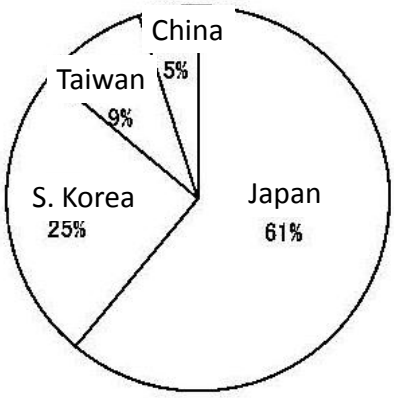


Figure 10. Breakdown by country of coal export from FER in 2010
(source: Vardari, et al., 2012)

Table 3. Major projects for the development of coal mining planned in east Russia and its neighboring area (source: authors from various sources)

	Projects	Area	Planned Annual Production Amount (million ton)	Estimated reserve (million ton)	Company	Memo
1	Coal projects in the south of Republic of Sakha, such as Elga Coal Deposit	Sakha Republic	30.0	> 2100	Mechel	Operation was started in August 2011
2	Production increase of Urgal Coal Dposit	Khabarovsk Krai	8.0			
3	Production increase of Erkovets Coal Deposit	Amur Oblast	3.5			
4	Dvelopment of Svobodnoe Coal Deposit	Amur Oblast	1.5			
5	Development of Solnetsvskoe Coal Deposit	Sakhalin Oblast	2.5			
6	Dvelopment of "Ogodzha Coal Mine"	Amur Oblast	3.0	83	Rostprom	capital participated by China Shenhua Energy (CSEC)
7	Mugachi Coal Deposit	Sakhalin Oblast				Regional Corporation Program between Far Eastern & East Siberian Russia and Northeeast China (2009-2018)
8	Krutogorova Coal Deposit	Kamchatka Krai				
9	Magadan coastal coal fields	Magadan Oblast			China Shenhua Group (under discussion for finnancing)	
10	Expansion and renovation of "Tugnui Coal Mine"	Republic of Buryatia (Siberian Federal District)			SUEK	Financed and insured by Japanese Banks
11	Elegest Coal Deposit and other deposits in Ulug-Khem Coal Basin	Krasnoyarsk Krai (Siberian Federal District)		900	EPK (Yenisei Industrial Company)	Owner of field had been changed after signing to conduct a feasibility study with Mitsui Bussan and OPK
12	Tavan Tolgoi Coal Deposit	South Mongolia	15.0			estimated to produce more than 30 years
13	Ulaan Ovoo Coal Deposit	Mongolia		142		15km from Russian border. Operation was started in July 2011. 75% of production will be exported to Asia and the Pacific by maritime shipping

2.2.3 Grain

Figure 11 shows production (left) and export/import (right) volumes of grains in Russia. The major grain produced in Russia is wheat. The main partners for export are Middle Eastern countries including Egypt, Turkey, and Yemen. As shown in the figure, the exported amount fluctuated greatly depending on the production level in the crop year. For example, in the crop year 2010/2011, since the amount of production rapidly decreased due to a very poor harvest, the federal government urgently prohibited exports for more than ten months; therefore, the exported amount in the crop year 2010/2011 is very small.

The production amount of grains in FER is very low: only 610 thousand tons in 2011. The export amount of grains to Japan is almost 20 thousand tons in 2011. Most (about 17 thousand tons) is wheat for animal consumption. However, the export of grains such as wheat and soybean from FER ports is expected to increase in future; accordingly there is a project to construct a grain terminal in FER ports as shown in the next chapter.

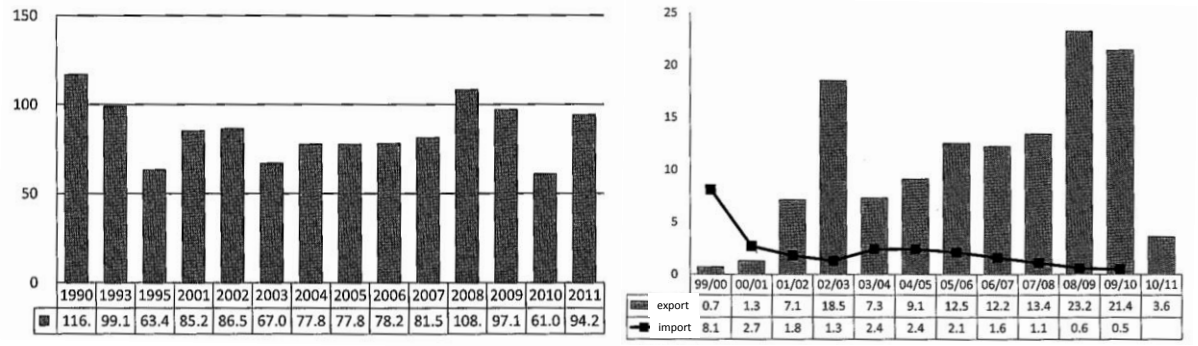


Figure 11. Production (left) and export/import (right) of grains in Russia (million ton) (source: Sakaguchi 2012b)

2.2.4 Automobile

Figure 12 shows the number of passenger cars sold in Russia. The marked had clearly shifted from domestic produced cars and imported used cars to imported new cars in the 2000s and has recently shifted to domestic production of foreign brand cars. Most of the used cars are imported from Japan. Figure 13 shows the number of passenger cars imported to Russia from Japan. Since scrapped cars are included in Japanese Trade Statistics, the number of used cars shown in Figure 13 is larger than the number of them shown in Figure 12. The number of imported used cars rapidly decreased in 2009 due to the economic downturn and a sharp increase of customs duty. Even after the accession to the WTO in 2012, the import has not recovered because the effective import tax rate has been kept high by introducing recycling tax. Table 4 shows the number of imported cars via FER ports (including not only passenger cars, but other types of cars). By comparing with the result shown in Figure 13, it is estimated that most imported passenger cars via FER ports are used cars and that the number of new cars imported are around 30 to 40 thousand.

Russian government has been encouraging the domestic production of new cars by establishing assembly plants in Russia for foreign auto makers either through its own investment or joint project with domestic makers. The government effectively imposes high import tax on imported new and used cars with non-tariff barriers such as recycling tax, while it exempts import tax to auto parts for domestic assembling for a specified term. Recently, the number of domestically produced cars with a foreign brand has increased as shown in Figure 12. Japanese auto assemble makers has also established the assemble plant in Russia. In particular, two Japanese auto makers (Mazda, September 2012; Toyota, February 2013) started operating a plant in FER (in the Vladivostok port). Figure 14 shows the amount of auto parts imported to Russia; the amount rapidly increased in 2012.

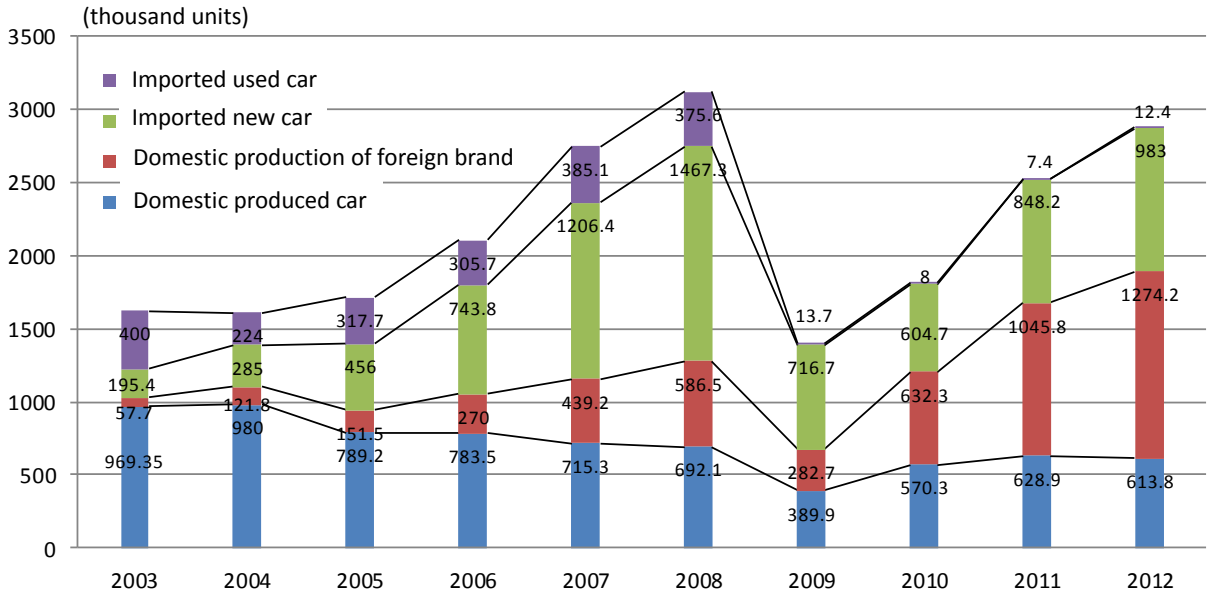


Figure 12. Russian market of passenger car (source: Sakaguchi and Tomiyama 2012, etc.)

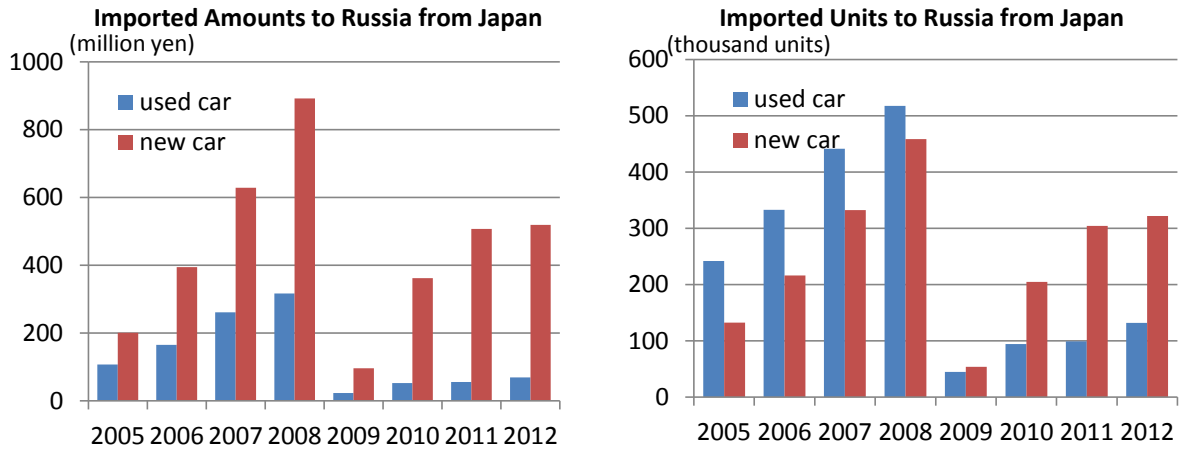


Figure 13. Import of passenger cars to Russia from Japan (source: Japanese Trade Statistics)

Table 4. Number of imported cars via FER Ports (including both new and used cars) (source: Monthly Russian Reports, May 2012)

	2009	2010	2011
Passenger car	55,849	122,447	151,025
Bus	1,285	6,087	12,644
Truck	3,652	10,305	27,413
Total	60,786	138,839	191,082
Japanese car	55,620	111,560	132,180

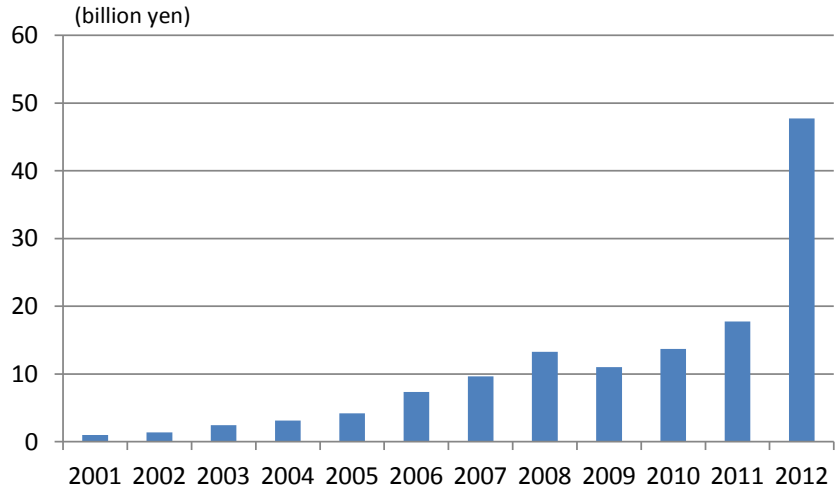


Figure 14. Import of automobile parts to Russia from Japan (source: Japanese Trade Statistics)

3. CURRENT STATUS OF INTERMODAL LOGISTICS AND PORTS IN FAR EASTERN RUSSIA

3.1 Current Status of Intermodal Logistics in FER

Since the size of economy in FER is quite small as described in 2.1 and production sites of natural resources are far from the coastal area as described in 2.2.1 and 2.2.2, long distance transportation of export and import cargo is required. The major transport means for long distance shipping is a railway (TSR: Trans-Siberian Railway), although in recent years several long distance shipping services by truck connecting between FER and West Russia such as Moscow are available due to the completion of a highway across the whole of Russia.

In other words, the capacity of export and import via FER ports is limited by the capacity of TSR, rather than the capacity of ports themselves. The annual capacity of the TSR is said to be around 100 million tons, although nobody knows the precise number. Figure 15 shows a breakdown of contents of cargo in Russian Railways. Natural resources such as coal, oil, and iron ore are major commodities to be transported by Russian Railways. On the other hand, container cargo shares only 1.6% of the total amount of railway shipping. As described in 2.2.1, the oil transport by railways is expected to decrease due to the completion of the ESPO pipeline. Since a drastic increase of the railway capacity is not expected in the near future, it attracts attention in what cargo the shipping amount is expected to increase instead of oil.

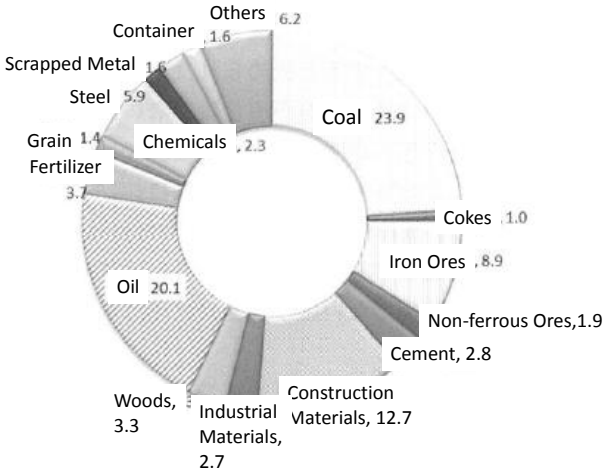


Figure 15. Breakdown of contents of cargo in Russian Railways (source: Tsuji, 2012)

3.2 Current Status of Ports in FER

There are 21 major ports open for international trade in FER. Table 5 shows a breakdown of the amount of cargo handled in all FER Ports by commodities. Coal and Cokes shares more than 35% of the total amount and its increasing rate is quite large. Both Crude Oil and Oil Products also have significant shares (around 20% of the total). On the other hand, the share of Chemical Fertilizer has significantly decreased after the fertilizer terminal was converted to a coal terminal in Vostochnyy Port that will be mentioned later in detail. Also, exports of Scrap have fallen, reflecting the federal government's policy to limit the export of scrap. The export of Grains is quite small and fluctuating as mentioned in 2.2.3.

Table 6 shows the amount of cargo handled in major FER Ports and breakdown by commodities. The port handled coals and crude oil most in Vostochnyy, while container cargo and steel are handled most in the port of Vladivostok.

Table 7 shows a breakdown by direction and cargo type. 80% of the cargo amount handled in FER Ports is for export, while the amount of imported cargo is very small. In particular, all liquid bulk are exported other than those that are domestically shipped.

From now on, the authors will focus on the major ports in Primorsky Krai (i.e., Vladivostok and Vostochnyy) and neighboring ports in which the relationship with Japanese industries is relatively close (i.e., Zarubino and other planned ports and terminals around Vladivostok). Figure 16 shows the location of above ports in Primorsky Krai.

Table 5. Breakdown by commodities of the cargo amount handled in FER Ports (source: Morcenter-TFC 2012)

	2011	2012		
	'000 ton	'000 ton	increasing rate (%)	share (%)
Crude Oil	28,720	28,897	0.6	21.5
Oil Products	25,666	26,866	4.7	20.0
Coal and Cokes	41,926	48,206	15.0	35.9
Container Cargo	8,769	10,172	16.0	7.6
Steels	4,686	5,541	18.3	4.1
Woods	3,494	3,200	-8.4	2.4
Ferry Cargo	3,134	2,700	-13.9	2.0
Ores	1,516	1,584	4.5	1.2
Chemical Fertilizer	443	55	-87.6	0.04
Scraps	941	716	-23.9	0.5
Grain	95	51	-46.6	0.04
Others	6,122	8,790	43.6	6.5
Total	125,512	134,372	7.1	100.0

Table 6. The amount of cargo handled in major FER Ports and breakdown by commodities (source: Morcenter-TFC 2012)

'000 ton

	Total	Ore	Coal	Ferti-lizer	Grain	Sugar	Woods	Steel	Non-Ferrous Metal	Scrap	Package & Individual Goods*	Refri-gerated goods	Container Cargo	Ferry Cargo	Crude Oil	Oil Products	Others
Vanino Port Total	20,338	1,222	13,460				1,003	156	169	7	136		31	1,350		2,802	4
Sovetskaya Gavan Port Total	659	45	21				166				29					198	199
Nikolayevsk-on-Amur Port Total	179	54	4				15	3		3	57		14				28
De-Kastri Port Total	7,388						281				5				7,103		0
Vladivostok Port Total	13,232	35	1,356		46	62	46	1,583		473	702	578	4,392			2,783	1,179
Vladivostok Commercial Port	6,644	4	545		34	62	32	1,436		65	430		3,093			439	504
Vladivostok Fishery Port	2,779	31	810				7			363	70	153	884				462
Primosky Oil Products	1,874															1,874	0
Zarubino Port Total	122									5	63	49					5
Origa Port Total	1,464	76	8				1,182										200
Posyet Port Total	5,823		4,582				42	16		25	0	1				1,121	38
Vostochnyy Port Total	42,522		21,797										3,601		16,299	472	352
Vostochnyy Port	18,039		18,037										2				0
Vostochny-Ural Terminal	372		372														0
VSC	4,433		482										3,599				352
Maly Port	2,538		2,538														0
Kozmino Oil Export Terminal	16,299														16,299		0
Nakhodka Port Total	16,991	105	4,408	55			463	3,763	519	15	209	48	165			7,148	93
Nakhodka Commercial Port	6,888	20	2,450	55			56	3,748	514		45		0				1
Nakhodka Fishery Port	607						238	15	5		159	28	156				5
Nakhodka Oil Port	6,780															6,780	0

*including Vehicles

Table 7. Breakdown by cargo type (export/import/transit/domestic) of the cargo amount handled in FER Ports (source: Morcenter-TFC 2012)

('000 ton)

	Dry Cargo	Liquid Bulk	Total	Share
Total	78,610	55,762	134,372	100.0%
Export	59,571	49,270	108,841	81.0%
Import	7,881	0	7,881	5.9%
Transit	386	0	386	0.3%
Domestic	10,771	6,492	17,264	12.8%

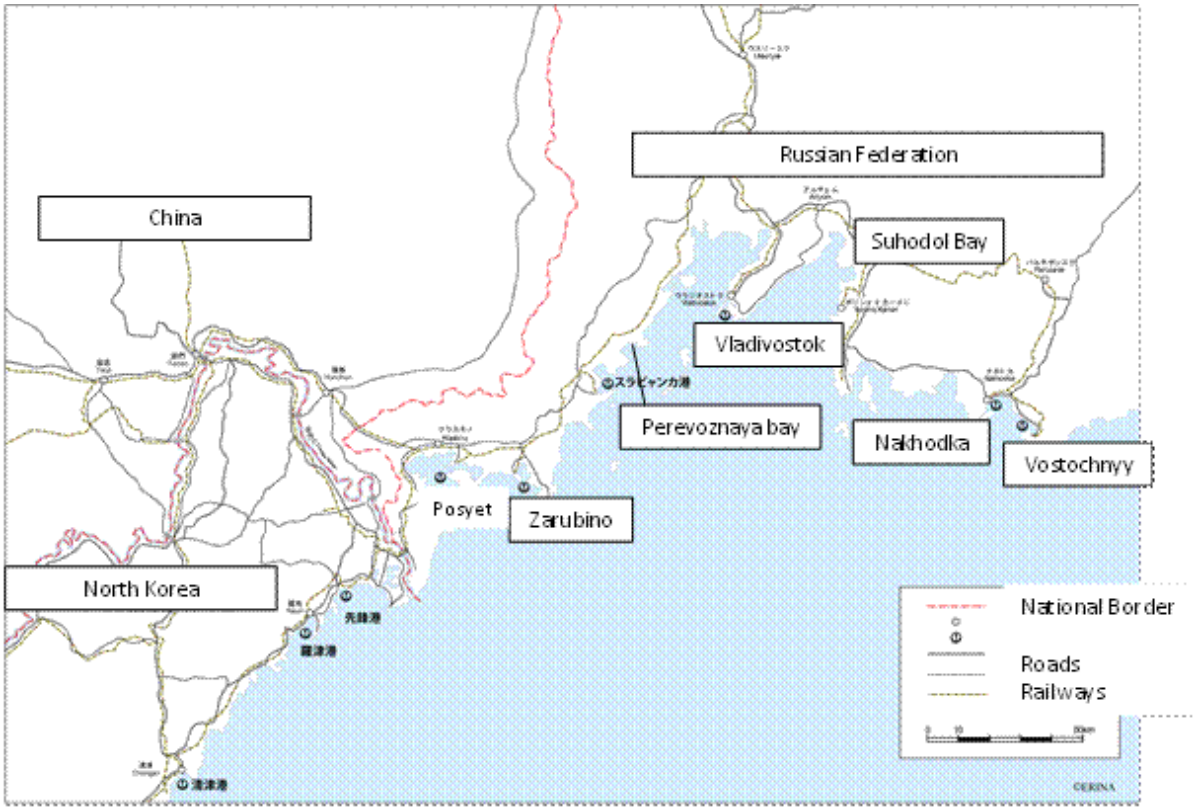


Figure 16. Location of Ports in Primorsky Krai (source: ERINA)

3.2.1 Port of Vladivostok

The port of Vladivostok is located in the west head of Muravyov-Amursky Peninsula projected out from Peter the Great Gulf, along the Zolotoy Rog as shown in Figure 17.

The Vladivostok Commercial Ports is the largest operator in the port of Vladivostok as shown in Table 6, located on the west coast of Zolotoy Rog. It used to be a state-owned company, but was privatized and is now owned by FESCO (Far-East Shipping Company). From the end of 2012, more than half of shares of FESCO have been held by SUMMA Group, which is one of the largest industrial conglomerates newly emerged in Russia. The layout of the Vladivostok Commercial Ports is shown in Figure 18. The imported cars are mainly handled in Berth No.3 to 5, while Berth No. 14 to 16 serves as a dedicated container terminal.

Figure 19 shows the past handling records of containers and cars in Vladivostok Commercial Ports. The amount of container cargo has been steadily increasing except for 2009 and overtook that in Vostochnyy ports in 2009, while the amount of imported cars is not expected to increase due to the reasons described in 2.2.4. In an interview with the authors, a representative of Vladivostok Commercial Ports said that they will put more priority on container cargo in future.

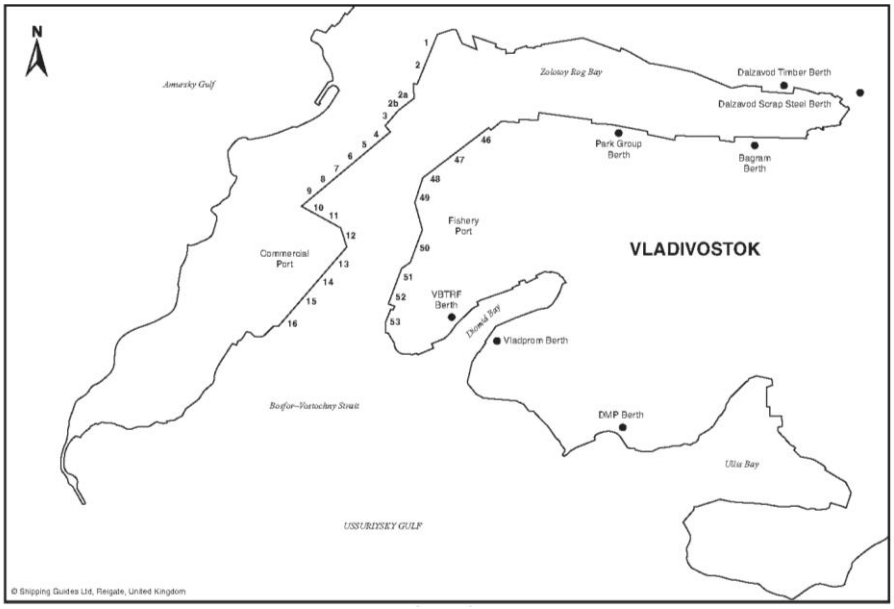


Figure 17. Map of port of Vladivostok
(source: Shipping Guides Ltd, Guide to Port Entry 2011/2012 Edition)

Figure 18. Layout of Vladivostok Commercial Port
(source: Vladivostok Commercial Port website)

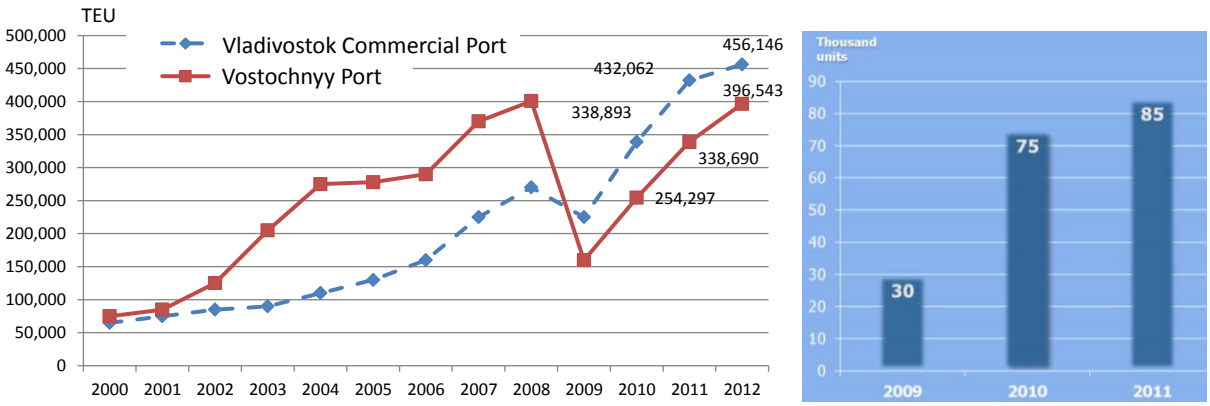


Figure 19. The amount of handled in Vladivostok Commercial Port; container (left) and vehicles (right) (source: Vladivostok Commercial Port website and Tsuji, 2013)

3.2.2 Port of Vostochnyy

The port of Vostochnyy is located in the east of Nakhodka Bay. As shown in Table 6, the port handles the largest amount of cargo in FER ports, specializing in coal and crude oil. Figure 20 shows the layout of port of Vostochnyy. Note that Kozmino Oil Export Terminal is not included in this map; it is located in the next small bay.

As described in 2.2.2, exports of coal to Asia are booming. Therefore, VSC (Berth No.5 to No.9; container terminal) and Vostochny-Ural Terminal (Berth No.10; shifted to coal terminal from fertilizer terminal) started to handle coal in 2012 and 2011 respectively. The Vostochnyy Port (Berth No.11 to No.14 and No.49 to No.50) also became dedicated coal terminals in recent years as shown in Table 8.

Figure 20. Layout of port of Vostochnyy (source: Vostochny Port)

Table 8. The amount of cargo handled by commodities in the Vostochnyy Port (source: Vostochnyy Port)

(単位：000t)

Nomenclature of cargo	2011	2010	2009	2008	2007
Metal production	0.0	12.6	69.8	181.2	2.5
Chemical cargoes	0.0	0.0	18.3	126.1	115.2
Others cargoes	1.0	0.8	1.2	13.2	7.9
Timber	0	0	0	26.8	187.5
Coal export	16,194.9	14,415.1	14,081.8	14,030.5	15,610.7
Coal cabotage	302.3	271.8	409.0	362.6	367.0
Clinker	0.0	0.0	0.0	33.9	41.0
Coke	0	0	0.9	221.1	0.0
Pipes	0.0	0.0	4.9	3.1	14.1
Total:	**16,498.2**	**14,700.3**	**14,585.8**	**14,998.5**	**16,346.0**

3.2.3 Port of Zarubino

Port of Zarubino is located on the west side of Troitsa Bay, close to the national borders of China and North Korea (80km from China and 100km from North Korea). The distance from Vladivostok City is about 200km. The port has no breakwaters since it is surrounded by Zarubino peninsula as shown in Figure 21.

It has only four berths with maximum water depth of 9 m; only a very small amount of

cargo is handled here as shown in Table 6. However, it has functioned as an import port of new vehicles from Far East Asian countries (i.e. Japan and South Korea) to western Russia such as Moscow by Russian Railway (see Figure 21) in recent years. In 2012, about 40,000 cars were imported through the port of Zarubino and transported to western Russia by railways. In early 2013, Russian government decided not to keep the discount of railway fare for imported cars, reflecting its policy of encouraging domestic production of foreign brand cars as described in 2.2.4 and actually the fare has increased. Therefore, the number of imported cars is expected to drastically decrease in 2013.

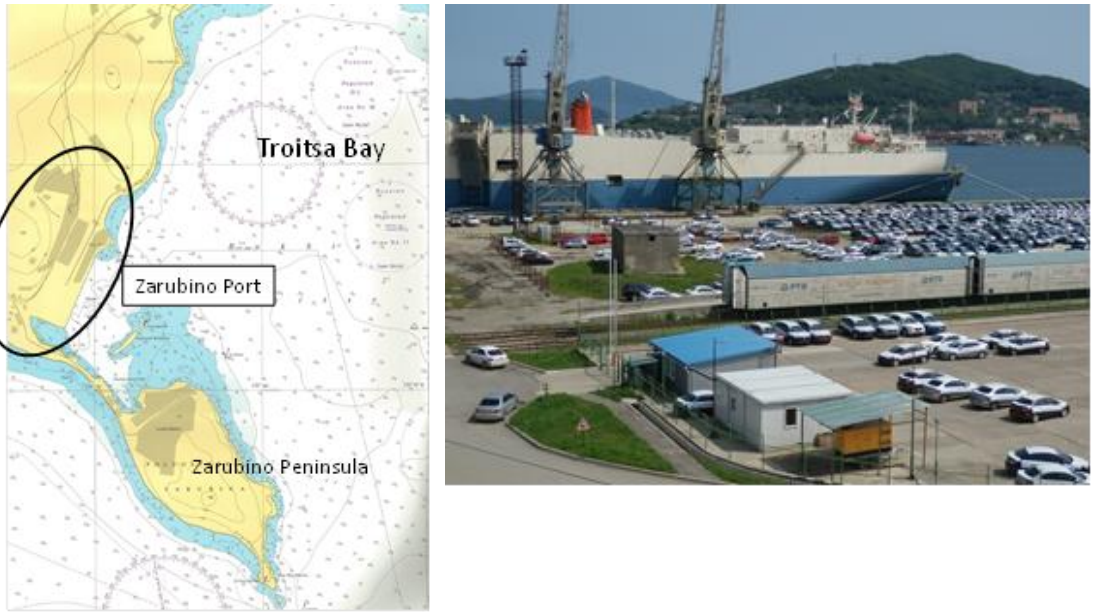


Figure 21 Location of port of Zarubino (left) and handling imported car from RORO ship to dedicated wagon of railways (source: hydrographic chart and authors)

4. MAJOR PROJECTS AND THEIR FEASIBILITY ON INTERMODAL LOGISTICS AND PORTS IN FAR EASTERN RUSSIA

The current status of industry and logistics systems in FER has been reviewed in the previous chapters. In this chapter, several projects to construct and improve logistics facilities (mainly focused in ports) are introduced and their feasibility is discussed.

4.1 LNG Plant for export in Perevoznaya bay

As mentioned in 2.2.1, a development project of an LNG plant which will connect with the existing gas pipeline around Vladivostok is under planning. The future prospect of the LNG market is uncertain, since both the demand and supply are expected to drastically change. A change on the demand-side is expected since Japan will seek more fuel for thermal power plants as it tries to move away from nuclear energy following the accident at the Fukushima Daiichi Nuclear Power Plant. On the supply-side, the supply of natural gas is expected to dramatically increase as part of the "Shale Gas Revolution." Before this revolution occurs, the Russian government would like to construct the plant for exporting natural gas.

A feasibility study was jointly conducted by Japanese companies (Japan Far East Gas Co., Ltd.) and Gazprom at the end of 2010; in addition, Agency of Natural Resources and Energy in Japan and Gazprom signed a memorandum on marketing collaboration during the

APEC summit in September 2012. In February 2013, Gazprom announced that a plant with an annual production capacity of 15 million tons of LNG will be constructed at a cost of 220 billion Rubles in Perevoznaya bay which is located on the opposite shore of Vladivostok in Amur Bay (see Figure 16), although it is unclear whether the project includes any foreign companies.

The project will definitely be carried out because the pipeline up to Vladivostok has already been completed. The points are whether Japanese companies will participate in the plant construction and purchase the product, and whether the plant is constructed in the planned place because there are some arguments from the environmental viewpoint.

4.2 Petrochemical Plant (Petrochemical Complex) in Port of Vostochnyy

Petrochemical plant and export facility of chemical products are planned to be constructed between Berth No.1 and No.31 in the port of Vostochnyy (see Figure 20). In line with the government's policy of encouraging the export of value-added products rather than not raw materials, Rosneft launched a study at the end of 2010 on the development of a petrochemical complex; total investment is estimated at US$10 billion. In the first phase, a petrochemical plant with an annual capacity of 3.4 million tons is planned to be constructed for the export of chemical products such as polymers to China.

Until now, the feasibility of the project was uncertain mainly because the shipping cost of the material is expected to be high due to the long distance transport by railway from West Russia. However, reflecting the policy to encourage the export of value-added products, President Putin attended the inauguration ceremony held in September 2012 and the project is expected to advance from now on. The problem related to rail transportation cost is expected to be solved by subsidies from the federal government; a similar framework of subsidization has already been realized for the car transportation from Far East to West Russia made in assembling factory in Vladivostok as described in 2.2.4.

The project is vital for boosting the economic growth of FER, according to the "long-term forecast of social and economic development until 2030" published by Ministry of Economic and Development. Some Japanese companies have apparently also expressed interest in the project.

4.3 New Coal Terminal in Sukhodol Bay

Coal is handled at many terminals in FER ports as shown in Table 6. In addition, since coal exports to Asian countries are booming, there are many projects to construct new terminals as well as increase the capacity of the existing terminals. However, there are two major problems with these projects. First problem is the overcapacity of the coal terminals compared with the capacity of rail transport. The total capacity of all the coal terminals planned in FER ports is over 100 million tons which is almost equal to the total capacity of the TSR.

Second problem is the necessity of "access-free" terminal. Almost all existing and planned coal terminals are owned by coal mining companies for their exclusive use; small mining companies are not able to use them for the most part. Therefore, the government recognizes the necessity of access-free coal terminals but does not have enough funds to invest. A project to construct an access-free terminal in Sukhodol Bay, located on the opposite shore of Vladivostok in the Ussuri Bay (see Figure 16) was shelved due to insufficient funds; in addition, another coal mining company (Siberian Business Union) began to invest for a dedicated coal terminal in Sukhodol Bay in February 2013. Therefore, the realization of an "access-free" coal terminal in Sukhodol Bay seems less likely. Instead, the SUMMA Group,

which is an independent industrial conglomerate without any capital relationship to the coal mining companies as mentioned in 3.2.1, has a plan to construct a large coal terminal at Berth No.15 to No.19 in port of Vostochnyy (see Figure 20) that is expected to function as an "access-free" coal terminal for small mining companies.

4.4 Grain Terminal in Port of Zarubino

Reflecting the prospect that export demand of grains would increase in future as described in 2.2.3, various plans for the development of a grain export terminal in FER have been proposed in recent years. The SUMMA Group as mentioned in 3.2.1 and 4.3 has also expressed an interest in constructing a grain terminal. They were originally targeting the port of Vostochnyy for the grain terminal but since 2012 they have shifted to the port of Zarubino mainly because the site designated for the grain terminal in the port of Vostochnyy was used to construct a coal terminal instead (as described in 4.3).

According to several sources, the grain terminal planned in the port of Zarubino has two berths with the capacity of 10 million tons and will cost five to seven billion Rubles. The railway to access the port of Zarubino is also expected to be improved because its capacity is very limited. There are several development plans within Troitsa Bay including more splendid one but this project is considered to be most feasible since the SUMMA Group has the power to implement it. Also, for the existing operator in the port of Zarubino, the project would be beneficial because the railway infrastructure which is essentially important infrastructure for the long distance transportation of imported new vehicles is expected to be improved.

4.5 Container Terminal Expansion in Vladivostok Commercial Port

The Vladivostok Commercial Port would like to increase the amount of container cargo handled as described in 3.2.1. Tentative increase of the capacity (up to around 600 thousand TEU per year) will be implemented by the improvement of handling efficiency such as by renewing the equipment in the existing terminal (Berth No.14 to 16 shown in Figure 18).

In future, the Vladivostok Commercial Port has an expansion plan of the container terminal as shown in Figure 22. Since the Vladivostok Commercial Port is indirectly owned by the SUMMA Group through the FESCO as described in 3.2.1, feasibility of the investment plan is expected to be high. However, as well as other projects that the SUMMA Group plans in FER, this project will probably be implemented by Russian investors alone; at least it will be headed by them (i.e. more than half amount will be invested by them). In other words, there seems to be little room for Japanese investors to take part.

In addition to the port facility improvement itself, improvement of the road and railway access to the Vladivostok Commercial Port including the construction of bypassed rail and inland container depot (see Figure 23) is needed. However, it is considered difficult to completely solve the hinterland access problem because there is heavy traffic congestion in Vladivostok City and capacity constraint in Russian Railways.

Another problem is that there are many terminals to handle containers in Vladivostok City other than the Vladivostok Commercial Port, although the amount is small. For example, the container cargo accommodating auto parts for the assembling plant in Vladivostok described in 2.2.4 is unloaded at Dalzavod terminal which is located at the end of the Zolotoy Rog (see Figure 17). Since it is located in the assembling plant, it is quite convenient for the car assembling companies; on the other hand, it implies that no one can control the operation and management for the entire of the port of Vladivostok.

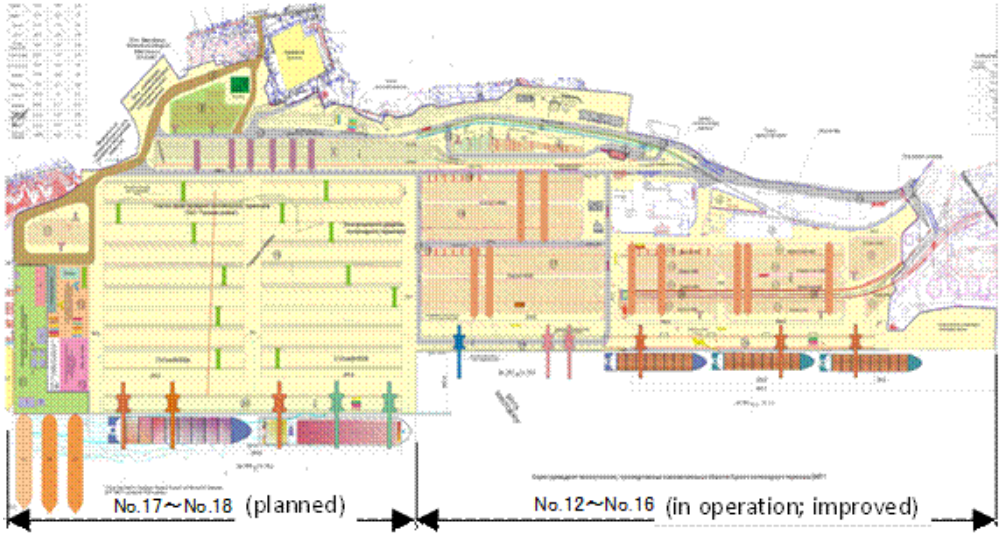


Figure 22. Future expansion plan of the container terminal in the Vladivostok Commercial Port (source: Vladivostok Commercial Port)

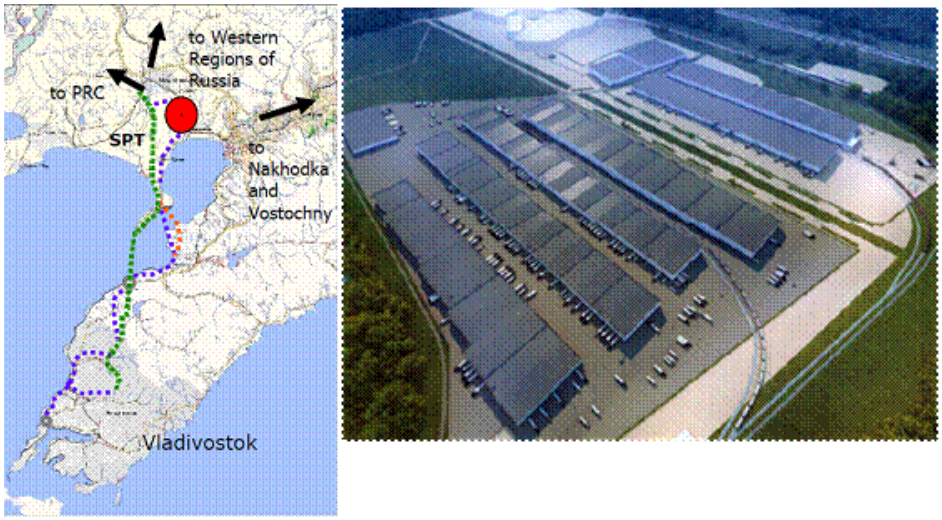


Figure 23. Plan of inland depot near the City of Vladivostok (source: Vladivostok Commercial Port)

4.6 Capacity Expansion of Trans-Siberian Railways

As mentioned in 3.1, the capacity of TSR is very critical for the international freight transport in FER. However, the amount of investment for the improvement will be tremendously large; therefore, it will still be a constraint not only for the international freight transport but also the economic development in FER. In particular, some huge projects are planned for improving the capacity of the BAM (Baikal-Amur Mainline) Railways which is parallel aligned with TSR connecting between East Siberia and FER. Due to an opening of Kuznetsovsky Tunnel which is located between Komsomolsk (intersection of BAM Railways and feeder line to Khabarovsk) and Vanino (one of the major FER Ports) in December 2012 at a cost of 60 billion Rubles, one of the bottlenecks of BAM Railways has been removed; however, its capacity is still limited, since it is unelectrified and has a single track. The BAM-2 project, including electrifying with double track, is estimated to cost more than 870 billion Rubles. Therefore, it is very difficult for Russian Railways to finance it itself. The capacity will be expanded in anyway, but it should proceed gradually and take a long time.

5. CONCLUSION

The authors summarized the current situation of industry as well as logistics infrastructure including railways and ports in FER in this paper. Also, the problems that logistics in FER are facing with are discussed and the feasibility of infrastructure projects to improve the situation is considered. Several projects to promote international trade as well as to boost the regional economy in FER are planned; however, from the financial aspect, it is difficult to implement some of the projects, especially improvement of railway infrastructure. Some projects have advanced after being spurred on by President Putin on the occasion of the APEC summit which was held in September 2012 in Vladivostok. Another key player is the SUMMA group, which is a new industrial conglomerate led by Ziyavudin Magomedov. It is expected to promote many projects in FER with its funding capacity through various channels.

The potential of FER to connect Europe and Far East Asia is considered high; however, low population density and the necessity of long distance transportation are large disadvantages. One of the key points for the development of the region is considered to be the establishment of a framework for international cooperation including Japan, China, South Korea, North Korea, and Mongolia.

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