Asia-Pacific Economic Cooperation

Maximizing Energy Efficiency of Supply Chain Connectivity Through Improving Rail-waterway Intermodal Container Transport (RWICT) in APEC Economies

Maritime Expert Group

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Abstract

APEC's 21 member economies accounts for approximately 55 per cent of world GDP, and 49 per cent of world trade. It is estimated that one percentage point increase in the ratio of trade to GDP would lead to a two to three per cent increase in income per person and energy efficiency. Supply chain connectivity plays a very important role not only in facilitating trade and investment but also in improving the efficiency of energy use, especially in the APEC region where trade corridors crossing ocean and land and rail system are in fast growth. It is estimated that the volume of trade originating from East Asia (China, Japan, Korea, Singapore and so on) constitutes a very significant portion of the overall trade in the APEC region. It is noted that a considerable amount of these trade cargoes are generally transported by sea only or delivered via a single economy, the cross-border rail-waterway intermodal container transport (RWICT) has not been paid due attention to.

If the rail-waterway transport, especially via the New Eurasia Land Bridge, can be further promoted, considerable benefits can be obtained, for example, transport distance and time reduction, less CO2 emission, and better economic performance. However, there are some practical challenges in realizing this concept. First, information regarding demand, supply, rail facility, rail capacity and so on for RWICT is still unclear and needs to be identified. Second, the potential shipment flow, the operation process of rail-waterway intermodal container transport system and the minimized environmental damage and cost reduction by the new way need to be designed and proposed explicitly. Besides, a bilateral or multilateral trade agreement is to be achieved so as to smooth the trade procedure between China, Russia and other Asia economies that will use the intermodal container transport corridor. Furthermore, relevant policies need to be recommended.

Against this background, the current report explores the development of RWICT in the Asia-Pacific region, with a focus on the intermodal container transport of goods from East Asia economies like Korea and Japan, via China and to Central Asia or even East Europe. In the analysis, China has been taken as the subject several times as the it is and will continue to be a major player in the

promotion of RWICT via the New Eurasia Land Bridge among APEC economies, especially among East Asia economies. The report aims to demonstrate that an improved RWICT system in the trade corridor covering APEC economies, or a better utilization of the New Eurasia Land Bridge, is the best choice for the Asia-Pacific region to maximize energy efficiency and reduce logistic costs for supply chain trade.

To this end, the potential benefit of improving RWICT via the New Eurasia Land Bridge based on information about container demand and supply, and potential transport routes and freights will be quantified; existing problems and impediments in developing the rail-waterway corridor will be analyzed by looking into the demand and supply deficiency, the shipment and trade procedure, the current management mechanism and so on; and recommendations on construction of infrastructure, simplification of shipment procedure and so on will be provided, so as to improve the performance of the corridor.

The analysis comprises of four sections: section one deals with the current status and trend of RWICT development in the Asia-Pacific region; section two compares RWICT with other transport modes, in the form of rail vs sea and rail vs road, mainly from the perspective of energy consumption; section three proposes suggestions in relation to China's RWICT and some general recommendations; and section four is equivalent to a mini instruction manual, providing key information for the reference of various parties who intend to get involved in RWICT via the New Eurasia Land Bridge.

Contents

I. STATUS AND TREND

One who wants to demonstrate the significance of promoting RWICT in Asia-Pacific region must start with the working mechanism, and the current development status and trend of this transport mode.

A. Working mechanism of RWICT

RWICT is an important part of intermodal container transport. It involves multiple transport entities and government agencies. RWICT is different from any single transport mode in terms of business operation, management, division of transport responsibilities, etc. It is only natural that RWICT has its special working mechanism, as is shown is the following two charts which describe respectively the basic links and the business flow of RWICT (in the case of in China).

Between container ports and terminal customers are different infrastructural facilities, and RWICT in China operates as is shown in the following figure. In the process, trucking or “drayage” on top of rail and sea is used. This is the case with the inland point; containers (emptied or loaded) rely on trucking to be transported to container yards. However, at the point of port, containers from inland or sea should continue to be transported by rail directly into or out of container yards. The former transshipment model can be defined as “water<—>rail” and the latter “water<—>rail<—>road”. For container ports, competence of undertaking transshipment directly “between water and rail” is an important measurement of the ports’ capability of operating RWICT and their development level.

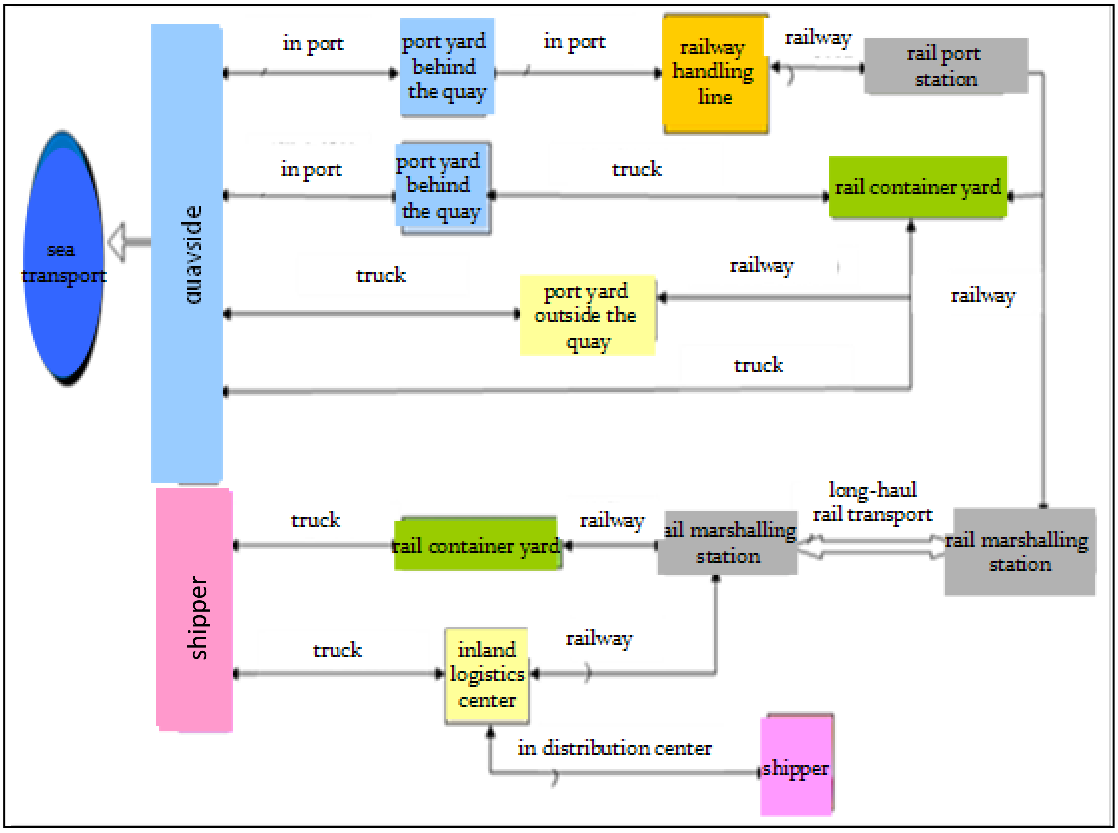


Figure 1 Basic links of RWICT

The topological graph of China's RWICT business flow is as Figure 2 shows. In China, port container transport divides into transport serving foreign trade and transport serving domestic trade. Inward and outward foreign trade containers are subject to customs regulation, commodity inspection, and animal and plant as well as health quarantine. Transport of domestic trade containers serves the domestic trade, and thus, refers to transport within China. Transport of domestic trade containers is free from customs supervision.

In this intermodal transport mode, consigned by shippers, RWICT operators undertake the "door to door" intermodal container transport across continents and sea, and they are responsible for organizing the whole process, during which they need make transport and handling contracts with shipping companies, wharf companies, railway companies, etc. Operators for RWICT can be shipping companies, non-vessel carriers, and other legal entities like freight forwarders and transport companies who are qualified for RWICT.

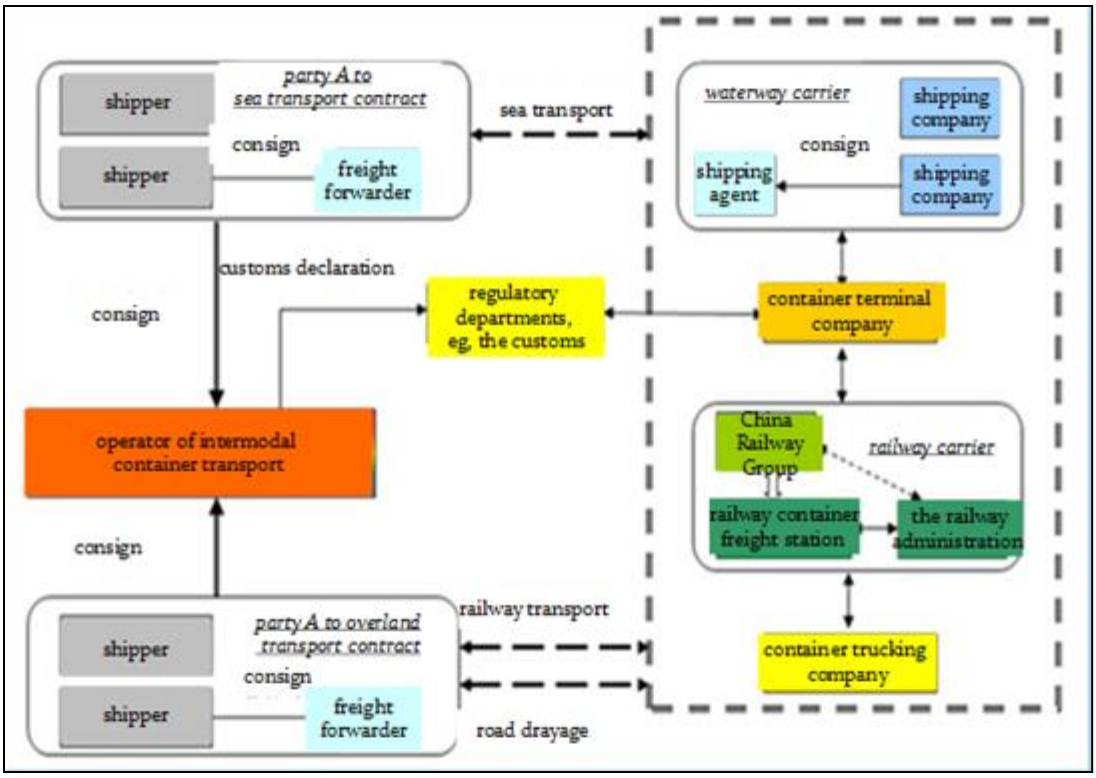


Figure 2 Topological graph of RWICT business flow

For RWICT in practice, the boundary between consumers, organizers and operators are not that clear-cut. Shipping companies, port companies, railway companies, etc. firstly are intermodal transport operators. When they undertake "door to door" container transport business, they are transport operators for a certain section, accountable to their customers and other intermodal transport operators; at the same time, they are organizers of the intermodal transport business, and when they deliver forwarding orders to companies engaged with other transport modes, they themselves become customers. As a highly market-oriented transport form, the intermodal container transport requires various transport entities to assume their responsibilities and rights in line with their identities in the market.

Cargo owners can directly or by freight forwarders contract with shipping companies, port companies, rail freight stations and truck companies to make RWICT true. Cargo owners also can make a “port to port” transport contract with intermodal transport operators to accomplish all the operations. For small and medium shippers, the latter choice is a better one as it can greatly simplify the work and improve efficiency.

B. Major RWICT routes in the Asia-Pacific region

In the Asia-Pacific Region, three major land bridges stand out: the first Eurasia Land Bridge, the second Eurasia Land Bridge and North American Land Bridge. This part briefs on each land bridge, especially the first two ones, reviewing their railway technical parameters, major ports, freight rate policies and operating modes.

Eurasia Land Bridge refers to a rail-waterway intermodal transport corridor, carrying goods by sea from China, Japan, Korea and Southeast Asian economies to Russia or east China, and then to Europe via the Trans-Siberian railway/Trans-China railway and the railway network connecting European and Asian countries. Currently there are two of them, and the third one is to be built (see Figure 3).

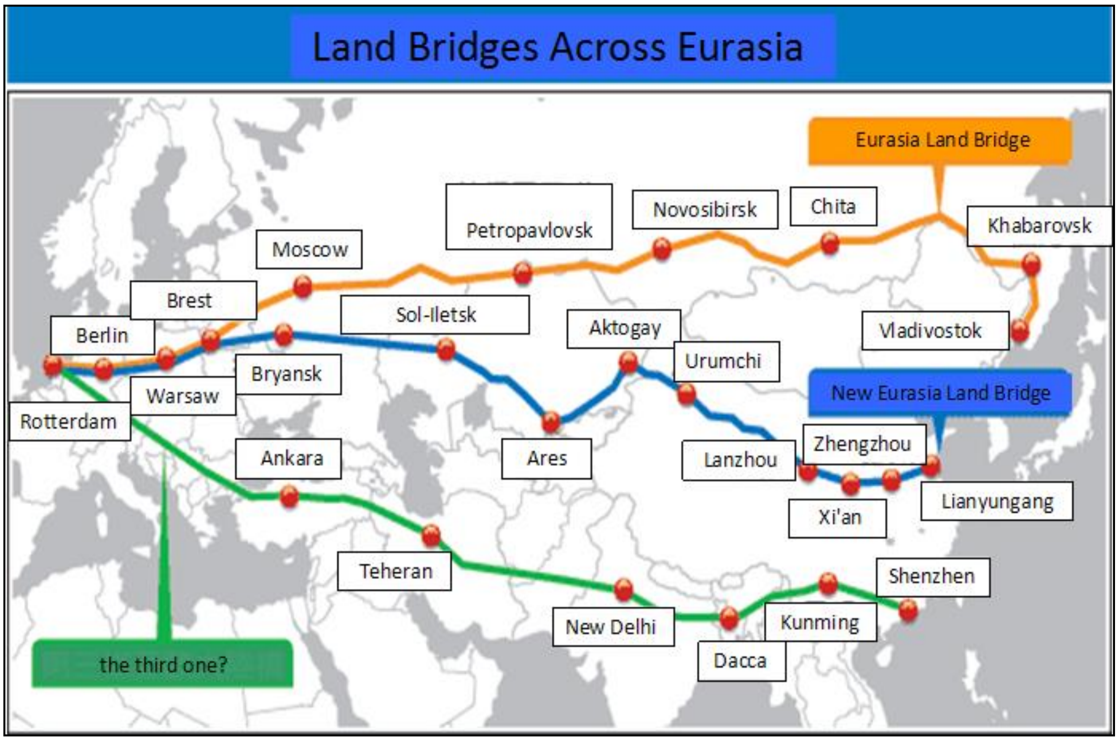


Figure 3 Eurasia Land Bridges

1. The Siberian Land Bridge

The first Eurasia Land Bridge or the Siberian Land Bridge (SLB) starts from Vladivostok in east Russia, travels by way of the Trans-Siberian Railway to Moscow and then to European countries, and finally reaches the Port of Rotterdam in Netherlands. It extends for 13,000 km or so. The SLB is one of the world's most famous intermodal container transport corridors, connecting the Far East, Southeast Asia and Australia with the Middle East and Europe. (See Figure 4)

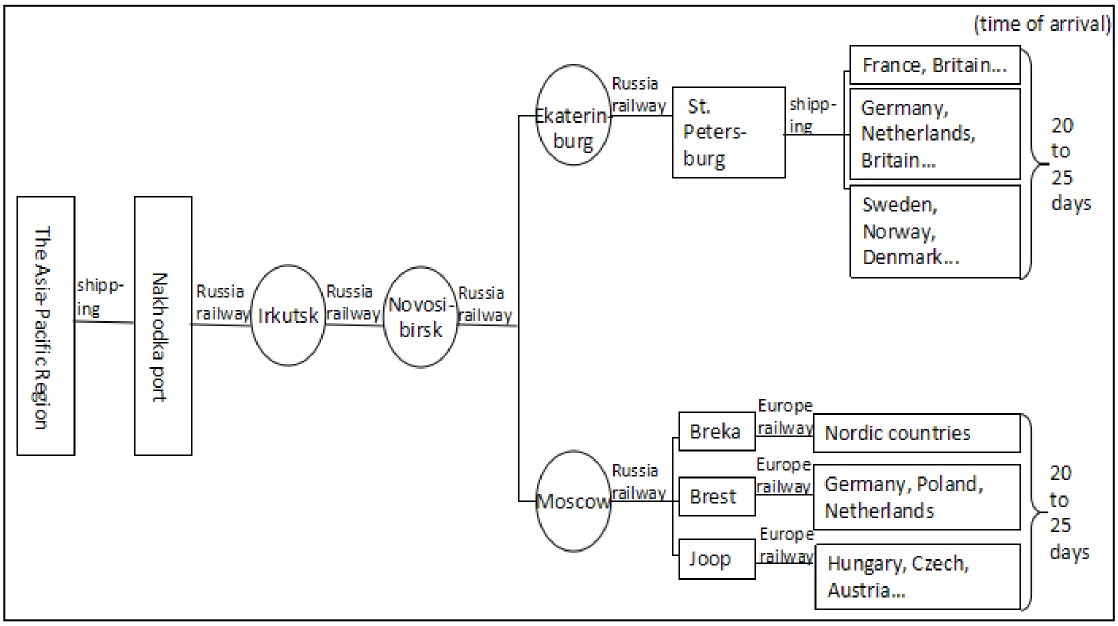


Figure 4 SLB route

The construction of the SLB was officially finished by the All-Union Foreign Trade Transportation Corporation in 1971. Now its annual freight volume is up to 360,000 TEUs (2010) and is expected to top one million TEUs. Operators who take this corridor are mainly Japanese, Korean, Chinese and European freight forwarders. And 70% of the goods that China, Japan and South Korea export to Central Asia is via this bridge. Thus it is vital in connecting the Eurasian continent and promoting the international trade.

The SLB is the world's longest land bridge transport line. Compared with the waterway transport line by way of the Cape of Good Hope and the Suez Canal, this route has greatly reduced the transport distance from the Far East, Japan, Korea, Southeast Asia and Oceania to Europe. It is shorter by 1/3 in distance and 35 days in shipment time, and about 20% lower in costs, which have attracted a lot of Eurasian customers.

a. Railway technical parameters

The TransSib railway, built in 1891, is the core section of the SLB. In different studies, its starting and ending points may vary a bit. In this study, the TransSib starts from the far east port of Russia, the Nakhodka port, and travels across Moscow and Brest to the center of Europe, and finally to Hamburg and Germany. (See Table 1)

Item	Description
Distance	12,243 km (to Hamburg), including 9,843 km in Russia (80.4% of the entire journey)
Maximal axle load	6,000 tonnes, an equivalent of 120 TEUs
Railway lines	electrified lines for the whole journey
Transport routes	1. To Western Europe: Nakhodka--Khabarovsk --Chita--Irkutsk--Krasnoye--Novosibirsk--Moscow--Smolensk--Minsk marshalling station--Brest--Malashevich--Warsaw--Berlin--Frankfurt(Rhine)--Hamburg 2. To Northern Europe: Nakhodka--Khabarovsk--Chita--Irkutsk--Krasnoye--Novosibirsk--Yekaterinburg--St. Petersburg--Finland
Ports along the bridge	8 ports along the route to Hamburg
Ports and stations for transshipment	Nakhodka, Malashevich
Gauge standard	In Russia and Belarus, broad gauge of 1,520 mm is in use; and in Poland and Germany, standard gauge of 1,435 mm is used.
Travel speed	900 km/day
Travel time	20 days
Transport mode	Container block train of maximal axle load
Terminal	Nakhodka port
Container type	Russian railway containers and consumers' self-owned containers

Table 1 Major technical parameters of the SLB

b. Ports

Nakhodka, Vostochny and Vladivostok are the main boarding ports for the SLB. Take the Nakhodka as an example. The Nakhodka port is one of Russia's major ports and the transport hub of the far east Russia. This port has unique geographical advantages: it is separated by the Sea of Japan with Japan, the United States and Southeast Asian countries; it is adjacent to China and North Korea, and located against Russia and Eurasia; it is connected with the central and western regions of Russia and the western Europe through TransSib railways; meanwhile it enjoys road, railway and air transport facilitation, and is known as the "gateway to the far east Russia". The Nakhodka port has developed into a modern port, open to navigation with more than 100 ports in more than 40 countries. With 22 berths, 35 km long of quay, 292,100 m^2 of warehouses and yards, and an annual throughput of more than 25 million tons, this port is responsible for 40% of Russia's imports and exports.

c. Freight rate policy

Russia gains about eight to nine billion U.S. dollars each year from the cross-border intermodal transportation. In 1989 when the transportation volume of the SLB dropped to the bottom, Russia adopted a more flexible price policy so as to attract more customers. Based on a detailed estimation and analysis of freight rates, the Russian government formulated different charging policies for cargoes from different countries and regions and of different types and volumes. Specifically, cargoes transported from a third country to other countries via Russia enjoy the cheapest price; then are cargoes from other Russian Federation countries to Russia; cargoes from a third country to Russia is more expensive; and cargoes transported around Europe are charged with the highest fees when in west Europe. In addition, cargoes from different Asian countries enjoy different preferential transport prices. For example, cargoes from Hong Kong and Southeast Asian countries enjoy cheaper prices than cargoes from Japan.

As Russia's transport and railway sectors undergone deeper reform, and the Russia National Railway Company has became the only rail carrier in Russia. In recent years, a number of state-owned and private operators engaged in SLB transport business have been set up. The tariff policies have been adjusted accordingly. The Russia National Railway Company has adopted various preferential price policies in light of the nature of companies, business category and freight volume; rail transport operators who have to use their own cars also enjoy appropriate preferential price policies. These tariff policies have greatly improved the enthusiasm of rail transport operators.

d. Operating mode

The SOJUZTRANSIT acts as the chief operator for SLB transport businesses. It has the right to issue licenses for goods in transit, and the unified bill of lading for the intermodal transport, responsible for the entire transport. As for different transport sections, cargo is consigned and accepted for carriage by relevant entities in a relay manner.

The current reform of Russia's railway sector is expected to establish professional operating companies to meet different demands of the rail transport market, that is, to provide professional comprehensive logistics services, on top of the Russia National Railway Company as the only carrier for rail transport. The TransContainer is a wholly-owned subsidiary of the Russia National Railway Company, specializing in integrated container shipping services. Thus the SLB transport business is mainly operated by the Russia National Railway Company or the TransContainer and its international partners. Currently different transport lines are operated by different joint ventures established by Russia and other countries.

2. The New Eurasia Land Bridge

The New Eurasia Land Bridge starts from China's coastal port cities, such as Lianyungang and Rizhao, and extends to some European ports, such as Rotterdam and Antwerp, with a total length of 10,900 km. The Bridge, put into operation in the early 1990s, is an international sea-land-sea transport route, traveling across Asia and Europe and connecting the Pacific and the Atlantic.

The New Eurasia Land Bridge via Alashankou is responsible for transporting goods from China, Japan, Korea and Southeast Asian countries to central Asia, west Asia and Europe. After sea transport, goods will be transshipped at Lianyungang, and then transported by train across China and outside China via Alashakou; then at Kazakhstan's Duositeke port, goods will be transported in two directions: one is going northward to Russia, and traveling through TranSib railways to the northern and western Europe; the other is going on westward to Almaty and then to central and west Asia. (See Figure 5)

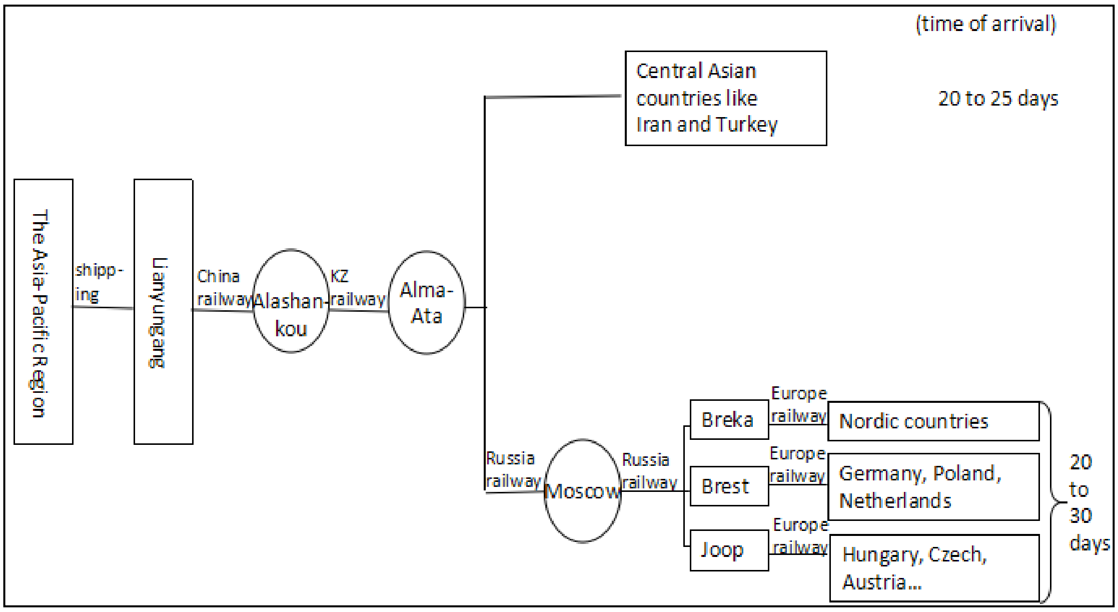


Figure 5 Transport Route for the New Eurasia Land Bridge Via Alashankou

a. Railway technical parameters

The main body of the New Eurasia Land Bridge via Alashankou is in China, Kazakhstan and Russia, stretching 4,131 km in China. (See Table 2)

Item	Description
Distance	10,721 km (to Hamburg), including 4,131 km in China, 1,911 km in Kazakhstan, 2,891 km in Russia and Belarus, and 1,788 km in Poland and Germany.
Maximal axle load	In China: 4,000 tonnes, an equivalent of 80 to 100 TEUs; in Russian Federation countries: 6,000 tonnes, equivalent to 120 TEUs.
Railway lines	China: double-track electrified lines; Kazakhstan: electrified lines for some sections; Russia: electrified lines.
Transport routes	1. To Western Europe: Lianyungang--Zhengzhou--Lanzhou--Alashankou--Dostyk--Almaty--Moscow--Smolensk--Brest--Malashevich--Warsaw--Berlin--Frankfurt(Rhine)--Hamburg 2. To Central Asia:

	Lianyungang--Zhengzhou--Lanzhou--Alashankou--Dostyk--Almaty--Tashkent-- Ashkhabad--Iran--Afghanistan
Ports along the bridge	12 ports along the route to Hamburg
Ports and stations for transhipping	Lianyungang, Dostyk, Malashevich
Gauge standard	In Kazakhstan, Russia and Belarus, broad gauge of 1,520 mm is in use; and in China, Poland and Germany, standard gauge of 1,435 mm is used.
Traveling speed	692 km/day
Traveling time	19 days
Transport mode	Container block train of maximal axle load
terminal	Lianyungang
Container type	Russian railway containers and consumers' self-owned containers

Table 2 Main technical parameters for the New Eurasia Land Bridge via Alashankou

b. Ports

The boarding ports for the New Eurasia Land Bridge via Alashankou are Lianyungan, Tianjin and Qingdao. Here the introduction focuses on Lianyungang port.

Lianyungang Port is located at the southwest coast of the Haizhou Bay along Chin's coast and in the northeast of Jiangsu Province. It is the starting port for China's railway artery Longhai—Lanxin rail line. At the end of 2012, Lianyungang Port has built 52 production berths, of which 47 berths can handle a tonnage of 10,000 (the maximum being 300,000 tons), and 16 are specialized berths. The the port has a quay shoreline extending 11.9km, and an integrated throughput of 111,830,000 tons. It is a large-scale integrated port combining various functions, such as transport organization and management, transloading, handling and storage, intermodal transport, etc. The port is open to navigation with ports in more than 160 countries and regions, and has opened over 40 container and freight liner routes to Europe, the Americas, the Middle East, Northeast Asia and Southeast Asia, and two passenger liner routes to Korea. Meanwhile, it has built many "dry ports" in inland cities.

c. Freight rate policy

With the reform of China's railway system deepening, the Ministry of Railways has, since 1999, issued a series of policies related to rail freight rates, especially some preferential policies for the development of container transport. To be specific, for international containers to be imported or exported at container freight stations or containers to be imported or exported in north Shenzhen, Manzhouli, Suifenhe and Alashankou, freight rates may fall in the range of 30%; when containers used for transporting containerizable cargo are repositioned, the freight rate may fall in the range of 30%; for containers transported by liner train, certain fall in freight rates may be applied for. Compared with the freight rate policies of Russia, China's policies are relatively conservative, limited in the floating range, and far less flexible. And the charges for cross-border containers and international intermodal transport in China are higher than in other countries.

d. Operating mode

The New Eurasia Land Bridge via Alashankou now has two routes in operation (or test run), the Lianyungang--Alashankou--Almaty and the Lianyungang--Alashankou--Almaty--Moscow route. The two routes are co-run by China Shipping Group and Kaztransservice. China Shipping Group, as the first intermodal transport operator, signs agency agreements with cargo owners and commissions Railway Administrations along the routes to accept for the carriage within China. Transport tasks in Kazakhstan and Russia are then undertaken by Kazakhstan and Russia.

3. The North American Land bridge

The North American Land Bridge represents the "sea-land-sea" intermodal transport from the Far East to Europe via major railroads in North America. It is the world's oldest and most influential land bridge transport line, which is of most extensive service range. This route comprises the American Land Bridge, the Canadian Land Bridge and the Mexican Land Bridge. The American Land Bridge has two transport lines: the north one is rail-road transport lines from the Pacific coast in the west to the Atlantic coast in the east; the south one is rail-road transport lines from the Pacific coast in the west to the Gulf Coast in southeast. (See Figure 6)

Figure 6 North American Land Bridge

The Canadian Land Bridge was put into operation in 1979. This bridge shares similar transport route with the north line of the American Land Bridge: Japan and the Far East--west coast of Canada (Vancouver and Prince Rupert)--east coast of Canada (Montreal)--Europe.

The Mexican Land Bridge stretches across the Isthmus Tehuantepec, and connects Salina Cruz port at the Pacific coast and the Coatzacoalcos port at the Gulf Coast, extending 291 km on land. The Bridge was put into operation in 1982, but currently its service scope is still very limited, and its impact on other ports and land bridges are also very small.

In the report, analysis centers on the New Eurasia Land Bridge as efforts to develop RWICT via this bridge will achieve the maximum effect in improving energy efficiency and supply chain connectivity in the Asia-Pacific region. Apparently, this bridge has far broader impact than the North American Land Bridge in the region, and it enjoys advantages that the SLB does not have. First, the bridge stays clear from extremely cold areas, and its ports do not freeze and can operate throughout the year; second, the bridge is 2,000 to 2,500 km shorter than the SLB, and much shorter if the destination is in Central or West Asia, which means reduction in transport time and costs; third, the bridge reaches out to over 30 countries and regions across Eurasia, broader in impact than the SLB.

C. Development Status of RWICT in the Asia-Pacific region

1. General situation

Goods from East Asia account for a large proportion of the total trade in the Asia-Pacific region. Though as is mentioned in the abstract, the cross-border intermodal container transport of these goods has not yet been paid due attention to, this transport mode is growing increasingly popular in the region, which can be drawn out from the following picture collected from the workshop of this project:

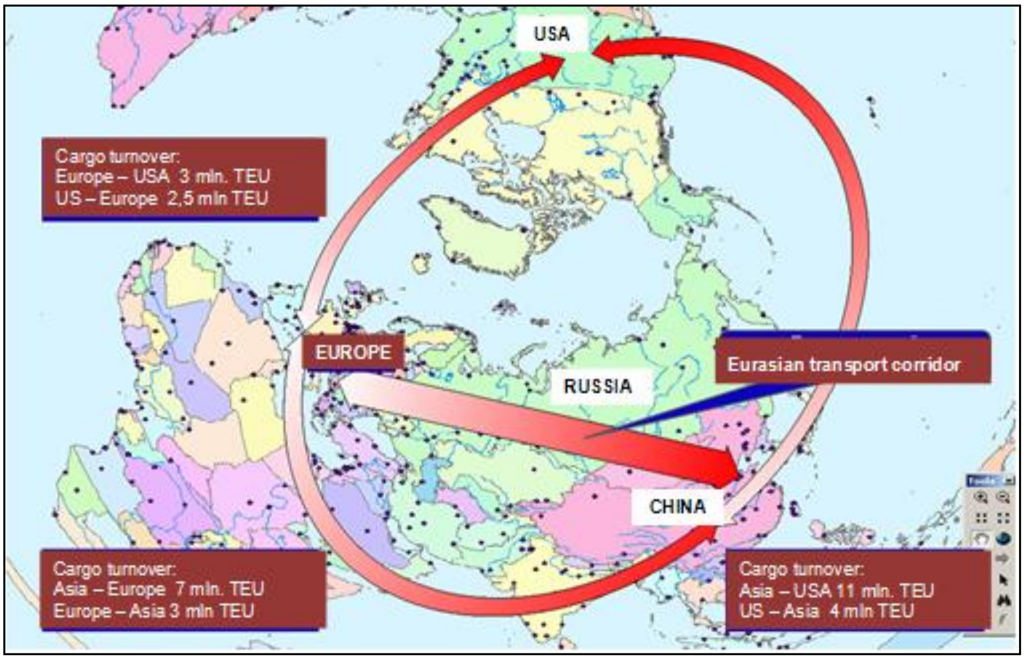


Figure 7 Eurasian transit corridor at the global cargo turnover map
Source: presentation of Russian expert at the workshop

The above picture clearly depicts the cargo turnover between continents, including Asia, Europe and America. These cargo turnovers, seen from another perspective, actually represents the potential demand for the Eurasian transport corridor. In other words, the Eurasian transport corridor has large development potential. A couple of representative economies and countries along this corridor can be very convincing. Take Kazakhstan as an example. According to data collected from the workshop, in 2013, the share of freight using containers amounted to 1.6% of the total volume of freight volume; 592 thousand TEUs were transported within the territory of Kazakhstan, up by 54 million or 10% from

2012; 1,653 container trains operated in Kazakhstan, 318 or 24% more than in 2012. The following two figures describe respectively the dynamics of the organization of container trains in Kazakhstan from 2010 to 2013 and the dynamics of container traffic through Dostyk/Altynkol from 2009 to 2013.

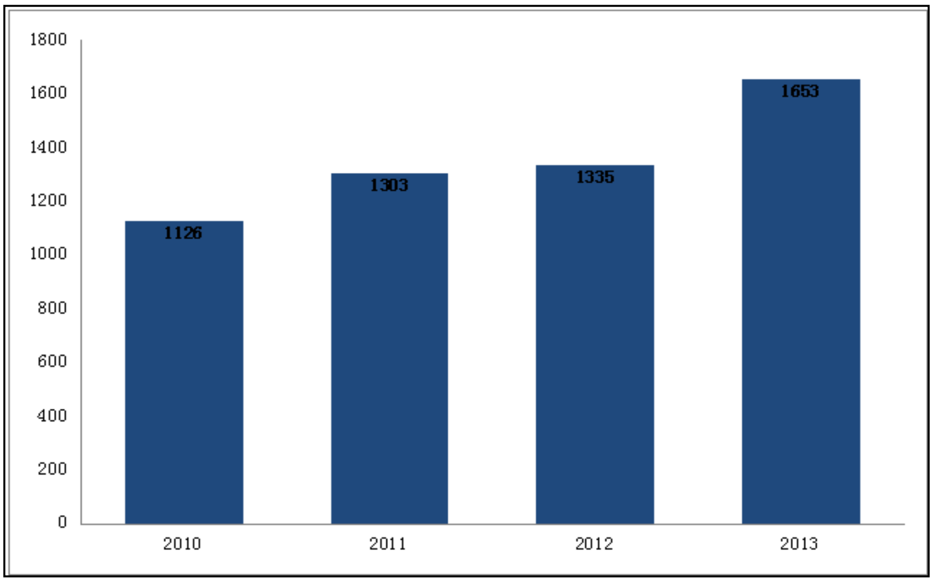


Figure 8 Dynamics of the organization of container trains in the Republic of Kazakhstan, units

Source: presentation of the Kazakhstan speaker at the workshop

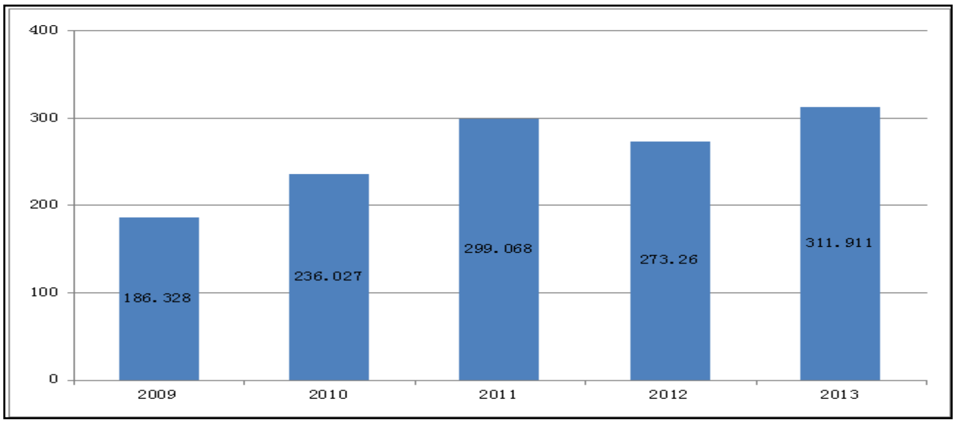


Figure 9 Dynamics of container traffic through Dostyk/Altynkol for 2009 2013 years, TEU

Source: presentation of the Kazakhstan speaker at the workshop

In figure 8, container trains in Kazakhstan has been increasing, which is very obvious from 2012 to 2013; in figure 9, container trains in the country is also on the rise, particularly in 2013. This helps verify the development momentum of RWICT in the region. Despite this conclusion, China, as a convincing example of the momentum, still calls for specific attention.

2. Development Trend of RWICT in China

Those who want to know the development trend of RWICT in the Asia-Pacific region cannot afford to ignore China.

Since the reform and opening up, China ports' container transport has boomed, with the container throughput remaining the first in the world since 2003; the rail container transport also witnesses rapid development. For container throughputs of China's ports and rail container transport volumes since 2000, see Figure 10 and 11. According to statistics, on November 11, 2010, the container throughput of China's ports reached 132,98 million TEUs, increasing 20% over last year and exceeding year 2008; the rail container transport volume reached 3.36 billion tons, increasing by 11.4% over last year and surpassing year 2008.

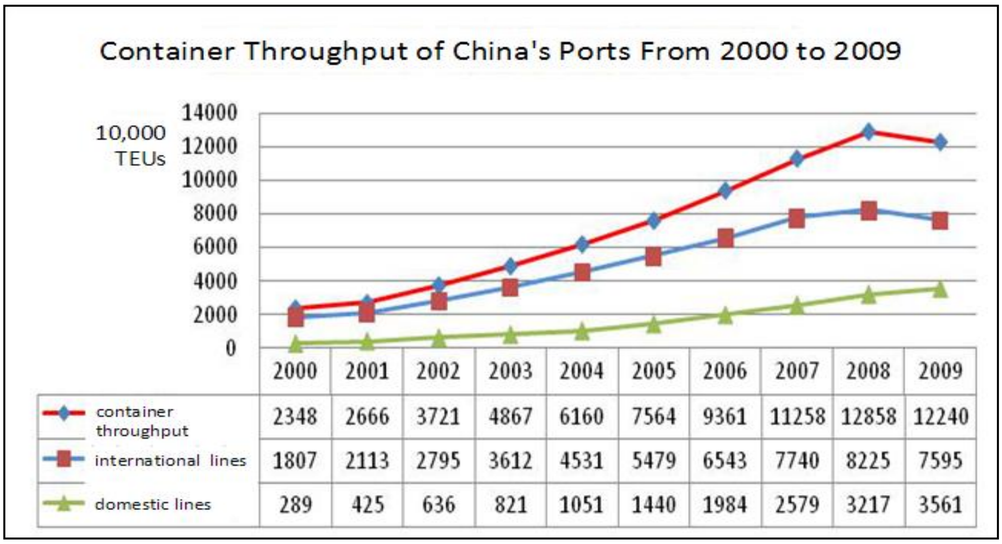


Figure 10 Container throughputs of China's ports since 2000

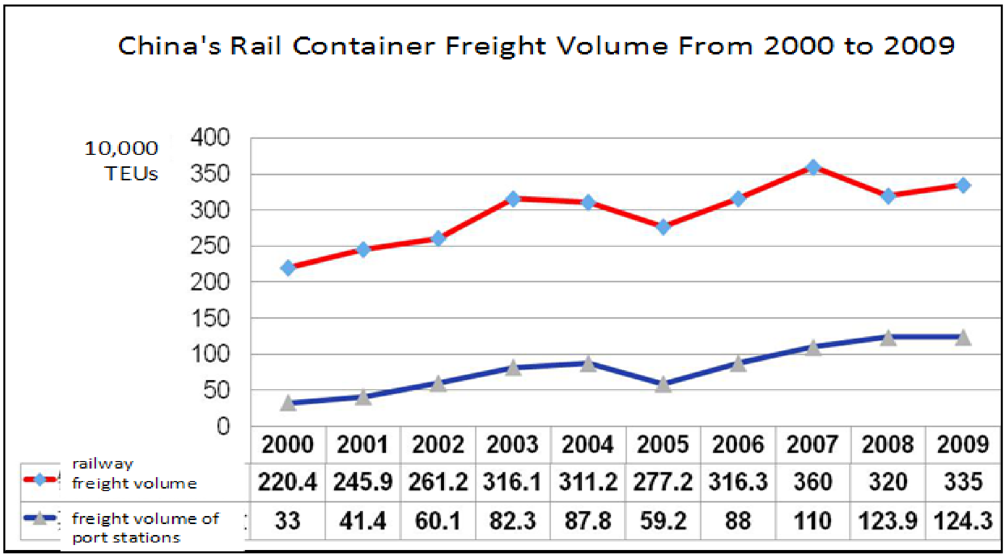


Figure 11 Rail container transport volumes since 2000

Table 3 presents very representative figures in relation to China's RWICT development, including the container throughput of major ports, the railway freight volume in aggregating and segregating containers and its proportion of the total freight volume from 2006 to 2010.

Unit: 10, 000 TEUs

No.	Year	2006			2007			2008			2009			2010		
		Through-put	Rail freight volume	Railway Propor-tion	Through-put	Rail freight volume	Railway Propor-tion	Through-put	Rail freight volume	Railway Propor-tion	Through-put	Rail freight volume	Railway Propor-tion	Through-put	Rail freight volume	Railway Propor-tion
1	Dalian	321.2	13.9	4.33%	381.3	16.39	4.30%	452.5	22.1	4.89%	457.6	23.2	5.07%	526.3	25.53	4.85%
2	Tianjin	595	16.25	2.73%	710.2	17.91	2.52%	850.3	17.49	2.06%	870.4	10.56	1.21%	1008.6	15.43	1.53%
3	Lianyungang	130.2	10.26	7.88%	200	15.73	7.86%	296.5	13.7	4.62%	300.3	12.46	4.15%	387.1	19.3	4.99%
4	Qingdao	770.2	7.55	0.98%	946.3	11.27	1.19%	1002.4	11.44	1.14%	1026.2	11.31	1.10%	1201.2	13.79	1.15%
5	Shanghai	2171.8	7.56	0.35%	2615.2	10.78	0.41%	2800.6	11.43	0.41%	2500.2	12.12	0.48%	2906.9	12.71	0.44%
6	Ningbo	706.8	4.23	0.60%	935	5.61	0.60%	1084.6	4.87	0.45%	1042.3	3.95	0.38%	1300.3	6.82	0.52%

Table 3 The container throughput of major ports, the railway freight volume in aggregating and segregating containers and its proportion of the total freight volume from 2006 to 2010

As we can see from the above table, the development of China's RWICT is in full swing. Both ports and the railway sector are now seriously engaged with this transport mode. More importantly, in many regions of China, many routs for RWICT have been developed. Now in China the international RWICT system has formed, with major economic zones as hinterlands, container ports as hubs, great railway lines as the backbone, and inland container yards as nodes.

Even more noteworthy is that in China, eight cities has operated railway express between China and Europe, namely, Chongqing, Zhengzhou, Wuhan, Chengdu, Xi'an, Suzhou, Hefei and Guangzhou. These Sino-Europe rail transport routes all join the New Eurasia Land Bridge at some points, thus representing an important supplement to land bridge transport in China. In recent years China has been witnessing increase in rail freight rate and decrease in sea freight rate, which means the choice of taking rail instead of sea to transport goods from China or other East Asian countries to Central Asia and Europe grows less attractive. Despite this trend, trans-Eurasia land bridge transport is still well received among local governments, foreign trade enterprises, international logistics enterprises, freight forwarders and so on. Various parties still hold high expectations of this transport mode, which accounts for the growing number of Sino-Europe railway express. The following table summarizes the three most representative Sino-Europe express railway lines operated by China, which may shed light upon the reasons why they are growing more popular.

Trans-Eurasia railway lines connecting China and Europe	Time in operation	Transport route	Schedule of the block train	Contents of the block train (key brand products)	Total length	Time consumed and time reduced (compared with sea)	Freight rates	Features	Common challenges
"Yuxin'ou" Railway (Yu: Chongqing; Xin: Xinjiang; Ou: Europe)	March, 2013	Chongqing-Alashankou (border port)-Kazakhstan-Russia-Belarus-Poland-Duisburg (Germany)	One liner train per week, and three per week (during the busiest hours)	Vehicles produced by Ford	11,179 km	16 days & 20 days saved	About 0.7 $ per TEU·km (for door to door transport)	Be listed in the Sino-European SSTL (Secure Smart Trade Line) Pilot Program and enjoying convenient customs clearance; the use of electronic lock in monitoring electronic products in transit; unified waybill for the whole journey; the destination of Antwerp newly added and broader market	
"Zheng'ou" International	July, 2013	Zhengzhou-Alashankou (border	Two liner trains per	Textile, industrial	10,214	16-18 days & 20 days	About 0.4 $/FEU·km,	"Door to door" transport service; 24 h monitoring of	

(Zheng: Zhengzhou; Ou: Europe)		port)-Kazakhstan-Russia-Belarus-Poland-Hamburg (Germany)	week	and electronic products	km	saved	and 2,000 to 3,000 Yuan cheaper per TEU than road freight	goods in transit for ensuring the safety of the goods; one-time commodity examination and quarantine; high value-added goods to be transported; adequate transport demand (from half of China's provinces, and from Korea, Japan, HK, and Chinese Taipei); another 13 destinations added and broader market	The rising rail freight and declining sea freight further raise the price gap between the two transport modes, and thus raising the level of subsidy on rail transport; Transport of goods from Europe back to China has not yet been adequately organized.
"Hanxin'ou" Railway (Han: Wuhan; Xin: Xinjiang; Ou: Europe)	April, 2014	Wuhan-Alashankou (border port)-Kazakhstan-Russia-Belarus-Poland-Czech	One liner train per week	Electronic products made by Foxconn, and cars made by Dongfeng Automobile Company	10,863 km	14 days & 23 days saved	About 1 $ /TEU·km	Simplified customs clearance (taking only 2 hours at Alashankou port); balanced development of rail, water and air in Wuhan and apparent advantages in developing RWICT; locating in central China with broad radiation (Wuhan)	
Notes on SSTL: On 19 September 2006, China and the EC agreed to launch a pilot project on smart and secure trade lanes (SSTL), with particular emphasis on sea containers. It aims to improve cooperation on supply chain security and to work towards mutual recognition and reciprocity of security measures. The pilot project initially involves the ports of Rotterdam (NL),									

Felixstowe (UK) and Shenzhen (China). The project begins to look at rail containers after seven years of implementation, and in China, only cities like Shenzhen, Shanghai, Tianjin, Dalian and Chongqing are listed in the project for rail transport.

Table 4 Typical Sino-Europe express railway lines

3. Insufficient demand for international container transport in China

In spite of the good development momentum of RWICT in China, its potential has not yet been fully tapped into, especially considering the status of this transport mode in west China. The demand for international container transport in China is mainly in the eastern coastal region, and the Midwest accounts for a very small proportion. As the Midwest lags behind the eastern region in economic development and foreign trade, it is only natural that its total volume of containerizable goods in foreign trade is relatively small; and meanwhile, the demand for containers in Midwest is significantly less than the eastern region.

As a matter of fact, on the whole in China, the demand for international container transport is insufficient. In 2007, northeastern provinces like Jilin and Heilongjiang had 387,000 laden TEUs imported and exported in the foreign trade, and about 533,000 TEUs (both empty and laden) of international containers transported. In the same year, Dalian Port's rail-waterway freight volume accounted for 4.72% of its total container throughput, of which 60% was from Jilin and Heilongjiang. This figure suggests that even for the relatively well-developed inland provinces in Northeast China, there are not ample goods for international rail-waterway container transport. Even if all of the 533,000 TEUs in Jilin and Heilongjiang were transported by rail-water and transshipped at Dalian port, the port's proportion of rail-waterway freight volume to its total container throughput would only be raised to 15.86% from the current 4.72% .

Insufficient demand for container transport has an adverse impact on organizing the source of goods for international container rail-water transport. For medium-and-long-distance transport between coastal ports and the Midwest, rail is more cost effective and energy efficient. However, if the container freight volume is below the minimum quantity requirement for a operating block train, the transport efficiency and effectiveness of the block train transport would be greatly reduced. By using non-direct block trains, small quantities of containers also have access to international rail-water container transport, but because of several times of marshalling and unmarshalling along the way, the transit time will be much longer and the punctuality will be greatly reduced. On one hand, transporting large cargo volume over long distance is where rail has its advantage; on the other hand, for now and a long period to come, the demand for international container transport in Midwest is and will be below the basic volume for international rail-water container transport, which is the main reason why China's block train lines lack stability and permanence.

Though the demand for international container transport is currently behind the transport capacity, it will not be a long time before the demand can catch up. The mode of rail-waterway intermodal container transport will be in more intense demand considering many development strategies China has adopted. Firstly, China is promoting the development of the western region and revitalizing the central region, which means greater freight volume between the Midwest and east, deeper hinterlands for container ports along the coast, and extended container transport into the inland. Secondly, China is accelerating industrial restructuring and transferring the processing trade from the coastal area to inland, which means increased exchanges of international cargoes there and more prominent role of rail transport. Thirdly, China is promoting a scientific concept of development and sustainable development, which means more attention will be attached to building the Yangtze river into a golden waterway and to the electrification of major railway lines and the use of double-deck container block trains.

There is another important reason for the future growth of the demand for international container transport, which can be summarized as with the growing popularity of the New Eurasia Land and Chinese government's efforts to improve the intermodal facility, especially the express railway lines between China and Europe, APEC economies and the Western Europe will grow more interested in transporting goods via trans-China railways.

D. Key Challenges confronting China in developing RWICT

As an emerging transport form in China, RWICT does have a promising future, but before that, a series of bottleneck problems confront China's RWICT, crying for solution. The most fortunate thing is that China has identified these challenges and all the gaps between China and developed countries.

1. Bottleneck problems in China

a. Poor transfer, unstable operation and difficulty with repositioning empty containers

Reviewing the rail-waterway intermodal transport system that has initially formed in China, we will find that the poor transit between ports and rail yards, and the gap between the facility capability and the transportation needs are an important manifestation of the existing problems.

China's use of railway is the most intense in the world, and more often than not, the transport capacity of major trunk lines are supersaturated. This means the railway container transportation can be easily impacted by festival passenger transport rush, seasonal freights, and urgent transport of important goods. So operational unsteadiness and failure to deliver cargoes on schedule can be serious problems.

China exports more than it imports and exports more loaded containers than empty ones, therefore, there is an apparent imbalance of container traffic between China and other countries — more loaded containers are out. The increasing outflow of loaded containers means more empty containers to be repositioned, and this represents a huge challenge for railway transport.

b. Rigid management, access only to limited information, and underdeveloped services

There exit many differences in terms of marketization, interests distribution pattern and power operation among major carriers and regulatory authorities for China's container transport. These differences bring about many problems to RWICT, such as rigid management, access only to limited information and underdeveloped services. For example,

> China's railway freight rates are controlled by the government, and the rates for container block trains fall to the grasp of the Ministry of Railways, which means the rate always fails to reflect the market changes.

> Railway transport is subject to multi-level management, rigid planning and severe fragmentation. The freight forwarding industry develops slowly. Container freight stations have not yet broken away from the traditional marketing model of "waiting for goods to be consigned".

> For different links of the rail-waterway container transport business, information is not equally available for sharing. Waterway transport information is more transparent than rail transport information; and static information are more readily available than real-time dynamic information.

> Railway container transport runs limited liner trains. Container transport

still largely relies on non-direct block trains that are originated from other stations and arranged after many times of marshalling and unmarshalling. As a result, increased dwell time at station and extended transport time frequently occur.

c. Unfit price

Cargo transport is a service industry responsible only for transporting cargoes instead of adding their value. People are highly demanding in terms of transport time and quality, and they want the minimum transport costs. Customers' choice of RWICT highly depends on the entire logistics costs of "door to port" services. Judging from China's container sources and the transport market, for most consumers, the intermodal container transport is neither attractive in freight rate nor competitive in pricing mechanism.

Currently, for medium-and-long-distance "door to port" container transport, railway is more competitive than highway, therefore, customs will choose railway to transport containers to and out of ports as long as they have access to allocated rail transport capacity. In other words, the current railway freight rates are more suitable for medium-and-long-distance container transport where the comparative advantage of railway is shown.

People's dissatisfaction with the freight rate of RWICT is mainly with short-distanced "door to port" transport. Increasing the capacity of the short-and-medium-distance railway container transport is a must. At current rates, the rail freight rate per mileage is lower than the highway freight rate per mileage. However, if all the handing costs and drayage costs added, the entire costs of the short-and-medium-distance rail-waterway intermodal container transport are significantly higher than the costs of the water-highway intermodal transport.

2. Gaps between China and developed countries

a. In aggregating and segregating containers in hinterlands, railway carries small transport capacity and accounts for a small proportion.

Currently, in developed countries like US, container transport volume accounts for 50% of its railway freight volume; in France, the figure is 40%, UK 30%, and Germany 20%. As we can see, the average is around 30%. However, in so large a trading country as China, the figure is only 2%. What's more, for most of

China's ports, the railway involvement in the transport of containers is no more than 5%. So there is a large gap between China and developed countries in terms of both railway container transport volume and the railway involvement in the transport of containers in hinterlands.

b.The management system and the market mechanism have not yet been rationalized.

For a long time in China, transport modes of different nature are managed separately: highway and waterway by the Ministry of Transportation, and railway by the Ministry of Railways. The different management patterns in place have caused regional and department segmentation.

Since the reform and opening up, China's transportation industry has undergone deeper market-oriented reform. While the waterway and highway transport markets have been opened, the rail transport is still under monopoly and has to follow unified planning, which has distorted the market competition environment of RWICT.

c. RWICT infrastructure lacks scientific planning and systematic construction.

Developed countries attach great importance to the seamless connection between railway and port, and the unified planning and simultaneous construction of container terminals and railway operating lines, so as to build ports into rail-waterway intermodal transport hubs with great handing capacity. In inland areas, developed countries coordinate the planning and construction of container yards that fit the layout of the city and industrial areas, so that long-distance rail transport and short-distance drayage can be integrated reasonably to form a reasonable and efficient RWICT network.

After large-scale infrastructure construction, the size and capacity of China's transport industry have risen to the advanced world level. However, the current construction focuses more on improvements of port, road and rail system respectively, and does not pay due attention to the "seamless connection" between various modes of transport and setting aside space for further development.

d. Operating entities for RWICT are absent.

The intermodal container transport, as an advanced form of organization and management, is a major foundation of modern logistics, the reason of which lies in the emergence of intermodal transport operators. These operators fall in between customers and the traditional transport industry.

In China, the railway transport sector has not been liberalized. Whether it is shipping companies who operate intermodal transport through the journey or cargo owners who adopt intermodal container transport, they all need to go separately through railway, ports, truck and other related formalities. Adequately capable and professional operators for "port to railway to door" container transport are absent in China, resulting in segmentation of operation of container block trains, construction of container freight stations, offering of trucking services, information services, etc.

3. Problems confronting other countries

In developing RWICT across Eurasia, not only China, other economies and countries along the New Eurasia Land Bridge are also confronted with pending issues. In this part, the cases of Kazakhstan and Korea are under analysis, information used here being from the workshop.

a. Kazakhstan

Kazakhstan is the destination of many goods transported from East Asia, and sometimes serves as the transit country for goods transported to other countries, thus deserving due attention. The country faces different challenges in developing transport and logistics system, such as transnationalization of the world market, developing export and transit potential, intensified competition from alternative routes, strengthening intermodality, improvement of supply chains, economic diversification, and ensuring non-discriminatory access of Kazakhstan products to global markets, etc. Meanwhile, the country also has many constraints in developing container traffic, such as high costs of transportation via China in comparison with alternative routes, lack of regular logistics services at ports for the transport of containers in Central Asia, lack of information on cars and containers in transit within PRC, and lack of complete container trains in Central Asia.

b. Korea

Korea is involved in the RWICT across Eurasia in three ways, via the Trans-Mongolian Railway corridor (linking ROK, China and Mongolia), the Trans-China Railway corridor (linking ROK, China and Kazakhstan), and the Trans-Siberian Railway corridor (linking ROK, Russia and Kazakhstan). The economy is usually where cargo departs for Central Asia and even East Europe. In promoting RWICT via these three sea-rail corridors, the economy, like China and Kazakhstan, also faces many pending issues which can be summarized as follows: need of transshipment due to the different railway gauges between China, Russia, Mongolia and Kazakhstan; lack of infrastructure and systems necessary for faster handling of transshipment cargoes; shortage of wagons in Mongolia and Kazakhstan and resulted congestion at transshipment points; the reality that Russia and China put priorities on strategic commodities and passengers when assigning wagons; backward port infrastructure, customs clearance and transshipment facilities; unnecessary customs procedure, complicated paperwork, repetitive work, etc.; lack of customs information system; insufficient commodities, increasing cost, and lack of competitive advantages compared to maritime transport routes.

As a matter of fact, bottleneck problems faced by China and pending issues confronting Kazakhstan are not concerns of these countries alone. To a great extent, these challenges are interrelated, and one country or economy may account for problems of another country.

These challenges may seem real and true, but not reasons for us to not choose RWICT. After all, challenges can be tackled, but advantages of RWICT over other transport modes are incomparable.

II. COMPARISON

As is stated at the very beginning, the focus of this report is the correlation between an improved RWICT system in the trade corridor covering APEC economies (the New Eurasia Land Bridge in this case) and energy efficiency maximization. As is stated in the *Railway Handbook 2013* jointly issued by UIC and IEA, modal shifts to rail can be a major driver for decarbonisation of the transport sector. According to the Handbook, in 2010, the world's share of CO_2 emissions from fuel combustion by sector is as follows:

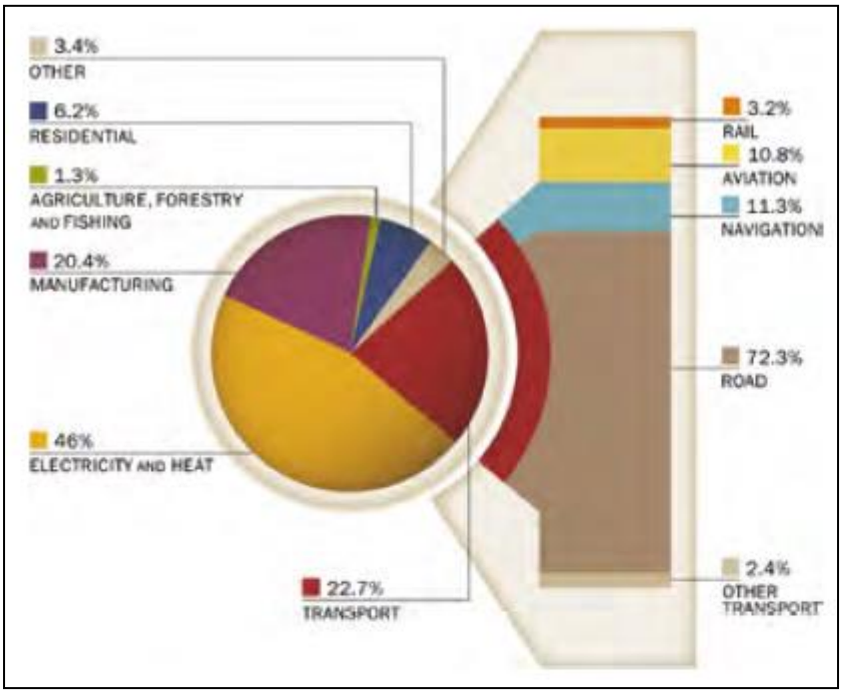


Figure 12 Share of CO_2 emissions from fuel combustion by sector

Note: Emissions from rail electrical traction are included in the transport sector.

Source: *Railway Handbook 2013*

As is shown above, the transport sector accounts for about 23% of the total energy related CO_2 emissions, of which 3% is resulted from rail activity. Therefore railways generate less than 1% of total energy-related CO_2 emissions. In the same year, the world transport modal share is as follows:

	Passenger PKM	Freight TKM	Total TU
ROAD	83.1%	10.0%	33.7%
NAVIGATION	0.3%	79.3%	53.8%
RAIL	6.5%	10.4%	9.2%
AVIATION	10.1%	0.3%	3.3%

Figure 13 World transport modal share, 2010

Source: *Railway Handbook 2013*

As Figure 13 shows, the modal of rail has far from been utilized, and the above two figures tells but only one truth, that is, modal shift to rail is a must. In the case of APEC economies, modal shifts to rail and rail-waterway intermodal container transport can be a major driver for energy efficiency maximization. This section will be devoted to discussing the advantages of taking the New Eurasia Land Bridge from the perspective of energy consumption. A comparison between rail and sea is first conducted, which is the main contents; then rail and road is compared briefly; and finally analysis on development potential of RWICT in China is added, as China is a major player in the Asia-Pacific Region and its development potential in RWICT means a great deal to energy efficiency maximization in the region.

A. Comparison between rail and sea

1. Distance and logistics cost comparison

Transportation is the fastest energy consumption-growing industry in China. It is assumed that the development of rail-waterway transport system will help reduce energy consumption by reducing inefficient transport activities, like detour, congestion and energy-intensive road transport. In particularly, for the cargo movement from East Asia to Central Asia and even East Europe, the rail-waterway intermodal transport can save distance significantly compared with the sea transport. In the section, three transport routes from Yokohama to central Asia and Europe are compared. The three routes are:

a. Eurasia:
   Yokohama via Vladivostok to Moscow and then to Hamburg
b. New Eurasia
   Yokohama via Lianyungang to Alma-Ata to Rotterdam
c. Sea Route
   Yokohama to Hamburg
   Yokohama to Rotterdam
   Yokohama via Hamburg to Moscow
   Yokohama via Abbas to Alma-Ata

The three routes are drawn out in Figure 14.

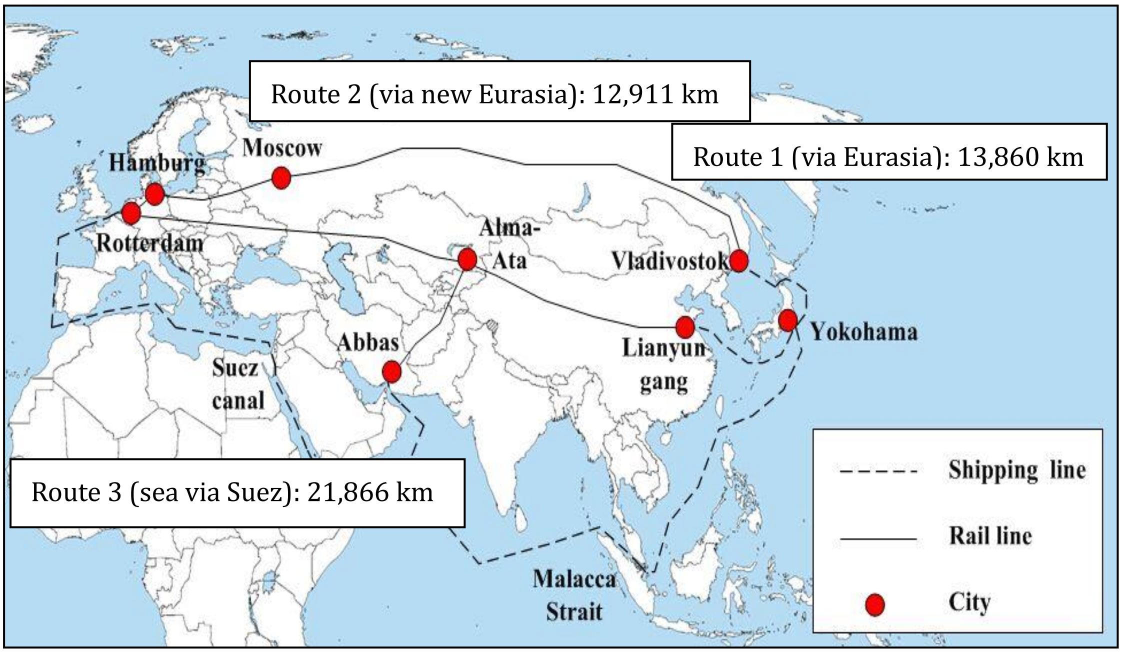


Figure 14 Routes from Yokohama to Europe

The advantages of taking land bridges over the sea route for transporting goods from East Asia to Central Asia and even East Europe are manifest in the distance, time consumption and energy consumption. As distance and time consumption are convenient to calculate, the comparison in the two aspects is presented in this introduction part, but the analysis on energy consumption unfolds in detail by adopting a certain methodology and some data.

The following table compares the distance, time and cost of the two land bridges with the sea route. (See Table 5)

As is shown in the table, it is only 13860 km from Yokohama to Hamburg, including 1617 km of sea transport and 12443 km of rail transport via Eurasia. Compared to 21866 km by sea, the distance can be saved by 36%. Similarly, the New Eurasia can even save almost 40% in distance to Rotterdam in contrast to sea. If the destination is in central Asia or east Europe, the distance can be further reduced. For example, to Moscow, by taking the Eurasia, the distance can be shorted by 55% compared to the sea; to Alma-Ata, the figure is also 55%.

distance, cost and time		Eurasia (via Vladivostok)	New Eurasia (via Lianyungang)	Sea (viaSuez)	Contrast
Moscow	Distance	10905		24008	↓ 54.6%
	Cost	3521		2336	↑ 50.7%
	Time	18.4		47.1	↓ 60.9%
Alma-Ata	Distance		7033	15477	↓ 54.6%
	Cost		3581	2483	↑ 44.2%
	Time		13	30	↓ 56.7%
Abbas	Distance			11588	--
	Cost			811	--
	Time			23.1	--
Hamburg	Distance	13860		21866	↓ 36.6
	Cost	4606		1531	↑ 200%
	Time	23.2		43.6	↓ 46.8%
Rotterdam	Distance		12911	21407	↓ 39.7%
	Cost		5247	1500	↑ 250%
	Time		23.3	42.7	↓ 45.4%

Table 5 Comparison of distance and time between land bridges and the sea route

However, the reduction of distance does not mean the same proportion of reduction for energy consumption because shipping is the most energy-efficient transport mode. It is interesting to look at the real picture of the energy consumption of these routes and to compare them, so as to recognize the way to maximize the energy efficiency of supply chain connectivity of Eurasia land bridges.

2. Literature review regarding energy consumption of different transportation modes

In recent years, climate change has been a haunting concern worldwide, concentrating brainstorming and practical efforts from various parties and sectors for the solution of this problem. In the case of the transport sector, policies that reduce the demand for transport, encourage modal shift towards more environmentally-friendly modes, improve transport management and enhance vehicles' energy efficiency have been announced to meet targets set by the Kyoto protocol and the 2020 climate and energy package. In this global campaign against climate change, one can never pay too much attention to the transport sector, whose importance in responding to the climate change is well justified.

Transport is a significant and growing contributor to GHG emissions. According to the International Transport Forum, “the sector as a whole accounted for approximately 13% of overall GHG emissions and 24% of CO_2 emissions from fossil fuel combustion in 2006;” and “Transport is the second largest CO_2-emitting sector after electricity production.” (2006) it is also found that “the rate of transport emissions growth has accelerated globally from an annual average growth of 2.11% between 1990-2000 to an annual average growth rate of 2.26% between 2000-2006.” (2009) Take U.S. as an example. In the economy, transportation is second only to electricity generation in terms of the volume and rate of growth of GHG emissions. Today, the U.S. transportation sector accounts for one-third of all U.S. end-use sector CO_2 emissions, and if projections hold, this share will rise to 36 percent by 2020. U.S. transportation is also a major emitter on a global scale. (David Greene & Andreas Schafer, 2005) Given the transportation sector’s impact on climate, any serious GHG mitigation strategy must include the sector.

Efforts to reduce the sector’s GHG emissions may well start with the promotion of more environmentally-friendly transport mode, which in most cases is the sea transport. The US Transportation Energy book states the following figures for freight transportation in 2010:

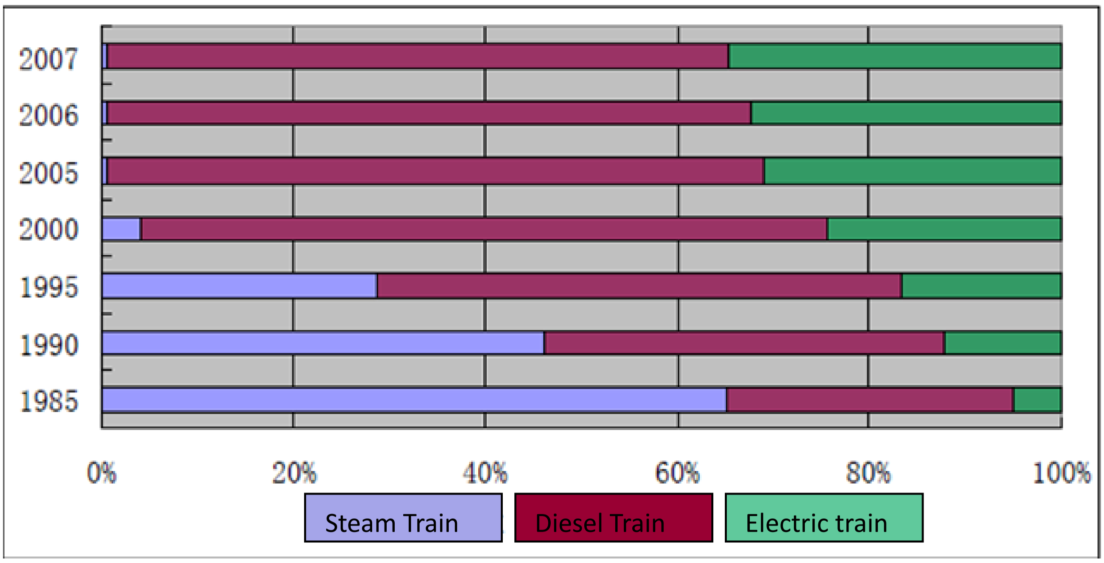
Transportation mode	**Fuel consumption**	
	BTU per short ton mile	**kJ per tonne kilometer**
Domestic Waterborne	217	160
Class 1 Railroads	289	209
Heavy Trucks	3,357	2,426
Air freight (approx)	9,600	6,900

As the table presents, waterborne transport mode is the most energy efficient one, consuming less fuel than railway, and much less than trucks and air. Generally speaking, this fact applies everywhere, but under different circumstances, sea transport may not be the appropriate choice. In the context of the Asia-Pacific Region, if cargoes are to be transported from east Asia to middle Asia and even

East Europe, the sea route (via Suez) is not necessarily the most energy-efficient route. No previous studies have ever shed light on this, and their focus was usually on the overall performance of the land bridges but from the perspective of energy consumption alone. For example, Gu Longgao discussed about the economic strategy of the Eew Eurasia Land Bridge (1998); Li Kaiyi (2004) explored the New Eurasia Land Bridge strategy for economic development (China Section) (2004); Elena Ilie discussed about how the New Eurasia Land Bridge provides rail connection between China and Europe (2010); and Ksenia K A Novikova and Otieno Robert Kennedy gave insight into the efficiency characteristics of the New Eurasia Land Bridge, examining aspects of the infrastructure, and establishing dimensions of efficiency and inefficiencies (2012). In light of the gap in the previous studies, this part intends to address the energy consumption aspect of Eurasia Land Bridges.

3. Energy consumption calculating methodology

The analysis of energy consumption of these three routes falls into three parts: energy consumption of diesel train, electric train and container ship. The reason for this division, especially the division of train into diesel and electric traction, has everything to do with China's current status of rail transport. Figure 15 shows the composition of China's trains, and Figure 16 compares the energy consumption of diesel train and electric train (ton·10,000 km).



Source: China Railway Plain Statistics 2007

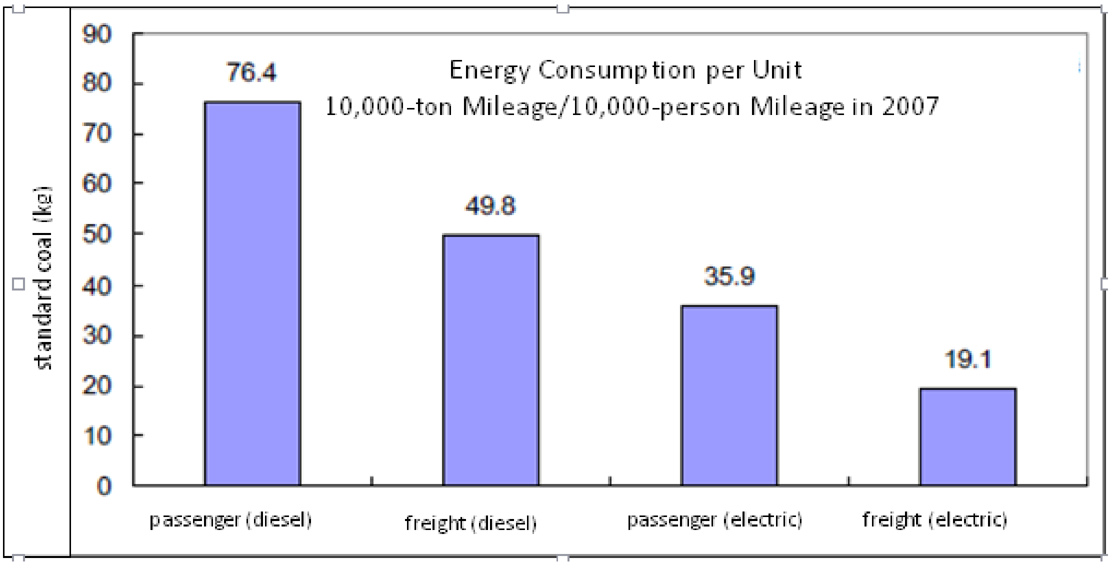


Figure 16 Energy consumption per unit 10,000-ton mileage/10,000-person mileage in 2007
Source: Energy Consumption, Emissions and their Comparison among Different Transport Modes, report issued by Beijing Jiaotong University, funded by the Energy Foundation

As Figure 15 shows, diesel trains account for more than half of China's total trains, and the number of electric train are increasing quickly; and Figure 16 suggests that the energy consumption of freight diesel train is over two and half times that of electric train in 2007. These facts have important bearing on the comparison of energy consumption between the three routes, as the energy consumption of taking the New Eurasia Land Bridge by electric train and consumption by diesel train will be radically different.

Methodology for calculating the energy consumption of diesel train, electric train and container ship is presented below respectively.

a. Energy consumption of diesel train

Energy consumption in unit traction section (1km) of diesel trains is generally calculated with equation 1:

$$E_i = \sum(e_i \cdot \Delta t)\ (kg) \tag{1}$$

(Source: Energy Consumption, Emissions and Their Comparison Among Different Transport Modes, report issued by Beijing Jiaotong University)

Where,

i The certain type of diesel train

e_i The fuel consumption of train i at certain speed,

Δt The operating time.

Energy consumption by distance of diesel trains is generally calculated with equation 2:

$$E = \frac{e_i \cdot 60 \cdot L}{G \cdot V} \tag{2}$$

(Source: Energy Consumption, Emissions and Their Comparison Among Different Transport Modes, report issued by Beijing Jiaotong University)

Where,

E The fuel consumption of a train

L The distance

G The train traction weight

V The speed of a train

b. Energy consumption of electric train

Energy consumption by distance of electric trains is generally calculated with equation 3 and 4, as are shown below.

$$Q_i = \frac{U \cdot \sum\left[(I_p + I_{po}) \cdot \Delta t\right]}{60 \times 1000} \ (kw \cdot h) \tag{3}$$

(Source: Energy Consumption, Emissions and Their Comparison Among Different Transport Modes, report issued by Beijing Jiaotong University)

Where,

U is voltage of power grid, basically 25000V; I_p is the average active current and I_{po} auxiliary power supply active current; and Δt represents the operating time.

$$\mathrm{Q} = \frac{U \cdot (I_p + I_{po}) \cdot 10}{G \times L} \ (kw \cdot h) \tag{4}$$

(Source: Energy Consumption, Emissions and Their Comparison Among Different Transport Modes, report issued by Beijing Jiaotong University)

Where,

Q The fuel consumption of a train

L The certain distance

G The train traction weight

V The speed of a train

c. Energy consumption of 8,500 TEU container ships

Generally, energy consumption of 8,500 TEU container ships is calculated with equation 5:

$$W = 0.7 \cdot V^2 - 0.6 \cdot V \tag{5}$$

(Source: Det Norske Veritas)

Where,

W The fuel consumption of a 8500 TEU ship

V The sailing speed of the ship

It can be noted that the energy consumption of container ships depends greatly on operating speed and ship size, and the two have an exponential relationship, as the combustion curve in Figure 17 shows.

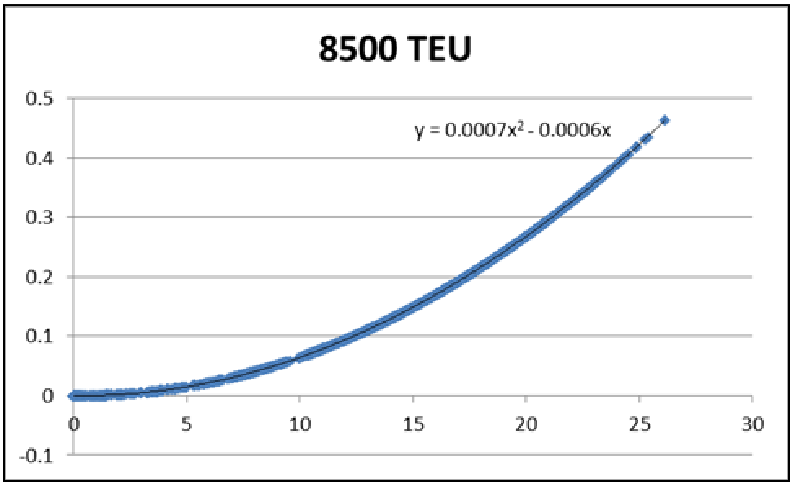


Figure 17 The fuel consumption curve of a 8500 TEU ship
Source: Det Norske Veritas (DNV)

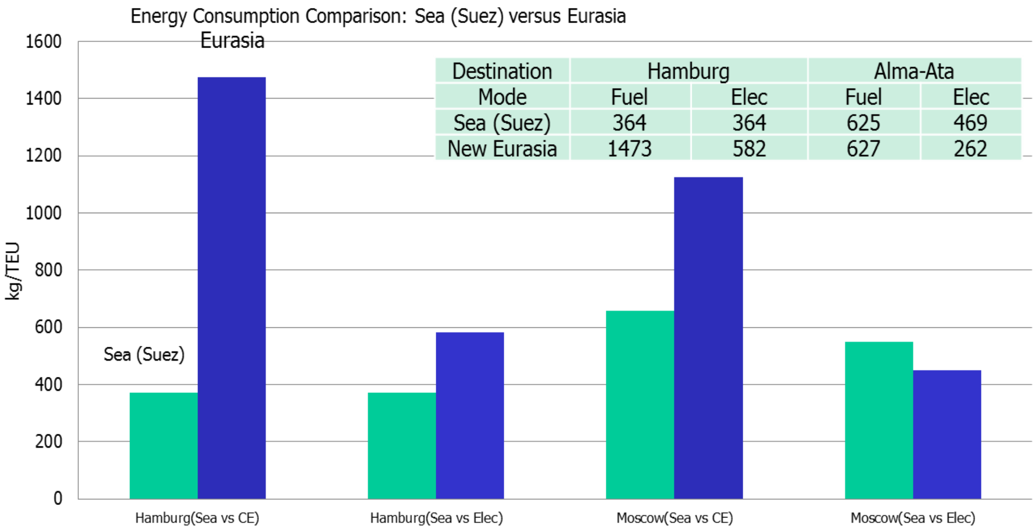
Generally, for small ships, the combustion curve grows rather slow, and for bigger ships, much steeper.

4. Energy Consumption comparison

Based on the data we collected from investigation, the comparison and analysis draw the following two main conclusions:

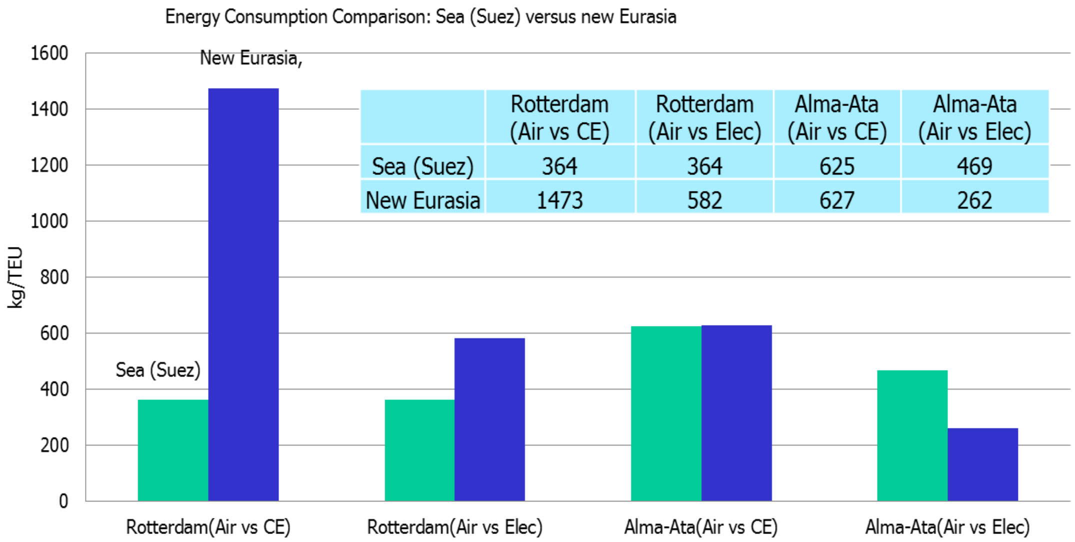
One: the sea is much more energy efficient than the Eurasia for the trade from the Far East to Europe (Hamburg). However, if the destination is Moscow, then the electric train is more energy efficient. (see Figure 18)

Two: the sea is much energy efficient than the new Eurasia for the trade from the far East to Europe (Rotterdam). But for Alma-Ata, even the diesel train will be more energy efficient, the electric train is significantly energy efficiency. (see Figure 19)



Destination	Hamburg		Alma-Ata	
Mode	Fuel	Elec	Fuel	Elec
Sea (Suez)	364	364	625	469
New Eurasia	1473	582	627	262

Figure 18 Energy consumption comparison: sea VS Eurasia



	Rotterdam (Air vs CE)	Rotterdam (Air vs Elec)	Alma-Ata (Air vs CE)	Alma-Ata (Air vs Elec)
Sea (Suez)	364	364	625	469
New Eurasia	1473	582	627	262

Figure 19 Energy consumption comparison: sea VS new Eurasia

5. Conclusion

For the cargo movement from East Asia to Central Asia and even East Europe, sea, rail (land bridges) and road are all options as transport modes. Compared with the sea route via Suez, transport via the Eurasia Land Bridge and the New Eurasia Land Bridge can save distance and time by a good proportion if certain proportional of price is preferred; energy consumption reduced need be looked upon on a “case-by-case” basis. In most cases, sea transport is indeed the most energy efficient mode; transport by sea via Suez for goods from Far East to Europe is much more energy efficient than Eurasia land bridges. However, if destinations are in closer distance, there may be a totally different result as regards energy consumption: if the destination is Moscow, transport by electric train via the Eurasia Land Bridge is more energy efficient; and if the destination is Alma-Ata, transport even by diesel train via the New Eurasia Land Bridge will be more energy efficient. In addition, transport by Eurasian land bridges is apparently more energy efficient than by road. These findings is be of great help in choosing the most energy efficient transport route and thus finding the way to maximize the energy efficiency of supply chain connectivity of cross-Asia land bridge.

As this study makes an initial and preliminary attempt to compare in a quantified manner sea and land bridge routes from East Asia to Central Asia and East Europe, authors of this study are fully aware of where the limitations lie. Firstly, transport routes either by sea or by land bridges selected for comparison is far from insufficient, and the departing points and destinations have been selected randomly instead of being adequately justified. Secondly, though the study has quantified the comparison in terms of transport distance, transport time and energy consumption, the economic benefits of taking land bridges have not been quantified if the three factors of distance, time and energy consumption considered, which the biggest challenge for further research is also. And thirdly, the comparison focuses on distance, time and energy consumption, but in practice, even the combined consideration of these three factors cannot fully justify customers’ choice of whatever transport routes; this means such factors as transport safety, customs procedures, information sharing, freight rate policies, new government initiatives, etc. call for due attention from any future research, so as to ultimately provide customers with reliable and specific reference for choosing transport routes.

B. Comparison between rail and road

The advantages of rail over road are more apparent than those of rail over sea, which, in this context, means that Eurasia land bridges enjoy more apparent advantages over road transport. In this part, a quick comparison between rail and road is conducted, using some practical data collected instead of any methodology; and the comparison falls into two parts of logistic costs and energy efficiency.

1. Logistic costs

As the backbone of overland transport, railway has a significant cost advantage in terms of freight featuring long distance and large volume. According to the National Development and Reform Commission (NDRC) and the Ministry of Railways: for twenty-foot equivalent units (TEUs), the standard base price one is 337.5 yuan/TEU, and base price two 1.4 yuan/TEU·km; for forty-feet equivalent units (FEUs), the standard base price one is 459 yuan/FEU, and base price two is 1.904 yuan/FEU·km, and freight rates of empty containers are 40% of loaded container freight rates. In practice, the railway sector adopt the "door-to-door fixed costs". In other words, transport of self-owned containers in different regions will enjoy charges only about 60% of the standard price. As the road transport market has been liberalized, freight rates are determined by the market. At present, the road freight rate is about 0.35 yuan/ton·km. For road container transport, the freight rate of laden containers are about 6 to 7 yuan/TEU·km; the freight rate of empty containers is not accounted for separately, as empty container delivery and laden container pick-up are generally done at the same time. In Table 6, freight rates of typical railway and highway lines are compared.

Unit: yuan

No.	Line	Railway mileage (km)	Highway mileage (km)	Railway "door to door fixed costs" + "door to station" drayage	Trucking freight rate
1	Pinghu-Dongguan	37	104	1163.9	624
2	Beilun port,	93	95	750.9	570

	Ningbo-Yuzhao				
3	Beilun port, Ningbo-Shaoxing	144	136	872.9	816
4	Tanggu, Tianjin-Dahongmen, Beijing	175	118	1459.8	708
5	Huangdao, qingdao-Zibo	246	287	1453.1	1722
6	Tanggu, Tianjin-Baoding	295	167	1727.3	1002
7	Huangdao, Qingdao-Jinan	357	393	1688.5	2358
8	Beilun port, Ningbo-Jinhua	363	458	1685.1	2748
9	Dayaowan, Dalian-Shenyang	412	415	1749.6	2490
10	Tanggu, Tianjin-Shijiazhuang	448	309	2059.4	1854
11	Huangdao, Qingdao-Tengzhou	522	464	1923.5	2784
12	Beilun port, Ningbo-Wenzhou	599	480	2573.2	2880
13	Tanggu, Tianjin-Handan	608	461	2412.9	2766
14	Tanggu, Tianjin-Hohhot	674	658	2973	3948
15	Dayaowan, Dalian-Changchun	705	735	2372.3	4410
16	Pinghu, Shenzhen-Zhuzhou	788	914	3188	5484
17	Tanggu, Tianjin-Baotou	823	805	3289	4830
18	Pinghu, Shenzhen-Changsha	833	922	3293.9	5532
19	Pinghu, Shenzhen-Nanchang	896	993	3401.1	5958
20	Dayaowan, Dalian-Xiangfang, Harbin	966	973	2924.5	5838

21	Dayaowan, Dalian-Daqing	1094	1055	3100.5	6330
22	Lianyungang port-Xi'an	1099	1147	3247.9	6882
23	Pinghu, Shenzhen-Wuhan	1274	1462	4264.6	8772
24	Huangdao, Qingdao-Xian	1335	1362	3609.1	8172
25	Tanggu, Tianjin-Shizuishan, Ningxia	1416	1312	5116.3	7872
26	Pinghu, Shenzhen-Chongqing	1863	2005	5642	12030
27	Luchao port, Shanghai-Yibin	2725	2477	6689.7	14862
28	Lianyungang port-Wuxi, Xinjiang	3617	3827	8421.6	22962

Table 6 TEU freight rates of typical railway and highway lines

Notes: 1. The "door to door fixed costs" are quoted from the website of the China Railway Container Transport Corp., and the "door to station" drayage costs are calculated by 400 yuan/TEU. 2. The the freight costs of container trucks are calculated by 6 yuan/TEU·km.

Table 6 shows that for different regions and different lines in China, railway container freight costs are significantly different. On the whole, in the Northeast and East China, the unit rates are relatively low; the longer the transport distance, the lower the unit rates; for distance between 300 to 500 km, rail and road freight rates are almost on a par, but for distance over 500 km, the railway freight costs have apparent comparative advantages.

2. Energy efficiency

According to statistics, one hundred km of transport generally consumes a container truck 50 liters of diesel; if a truck carries 2 TEUs, road container transport consumes 0.25 liters of fuel per TEU·km. Then how about the rail transport? Take the Dongfeng 8B heavy-duty locomotive (specially designed to raise the railway speed) as a reference object. The locomotive consumes 208 grams of diesel per kilowatt-hour. By a constant-power speed of 90 km/h, the entire freight train consumes about 800 liters over one hundred km; by 80 TEUs on the train, fuel consumption per TEU·km is 0.1 liters, only 40% of the road transport.

For a container train with 40 wagons, if it has one deck, its loading capacity equals to 40 trucks; if the train is double-decked, its loading capacity is the equivalent of 80 trucks. So the rail container transport has a significant scale effect. By the unit fuel consumption mentioned above, the CO_2 that rail container transport emits is 0.4 kg per TEU·km less than road transport. For a container port with a throughput of 10 million TEUs and an average of 200 km hinterland accessibility, if 1% of the throughput are aggregated and segregated by rail instead of road, carbon emissions of 8,000 tons will be reduced.

As China continues to improve the electrification of major railway lines, extensively uses electric locomotive traction, and actively develops the double-deck container transport, rail container transport will have more apparent advantages over road transport in reducing fuel consumption and saving energy.

C. Development potential of RWICT in China

As mentioned before, China's port container transport divides into transport serving foreign trade and transport serving domestic trade. Transport of domestic trade containers serves the domestic trade, and thus, refers to transport within China. Transport of foreign trade containers before customs declaration and sealing and after customs clearance and unsealing in China is generally taken as transport of domestic trade containers. The report’s analysis of the development potential of China’s RWICT refers to this classification of foreign trade container transport and domestic trade container transport.

1. Forecasting methodology

For a country, its railway involvement in aggregating and segregating containers in the hinterland depends on various factors, such as the maturity of different transport modes, the market competition environment and the preference of customers. This is especially true with China, as its RWICT is in the development stage. So the report estimates the volume of RWICT by referring to several factors, as is demonstrated in equation (6):

$$Y = \sum_{i=1}^{n} Q_i \times (1 + k4) \times k5_i \quad (6)$$

Where,

Y: volume of the rail-waterway intermodal foreign and domestic trade container transport in China (10,000 TEUs)

Q_i: transport demand of the rail-waterway intermodal foreign and domestic trade containers in a certain area (10,000 TEUs)

K4: ratio of empty containers to laden containers (%)

$K5_i$: railway involvement in aggregating and segregating containers in the hinterland for a certain region(%)

2. Freight volume forecast for RWICT in foreign trade

Given the distribution of container transport demand, places where import and export of containers concentrate, and the fact that the volume of empty container transport is much larger than the empty container freight volume, the adoption of railway to collect and distribute containers for different areas has different degrees of comparative advantage: area between inland and coastal ports has obvious advantages; area between offshore zones and coastal ports have certain advantages; and area between the coastal zone and coastal ports has comparative advantages in certain conditions and environment. Based on this analysis, this paper sets two groups of k5 value (representing the conservative vision and optimistic vision) which reflect the railway involvement in container transport in hinterland. (see Table 7) This table is also for examining the volume that China's rail-waterway intermodal foreign trade container transport that might achieve in the future.

K5 figure	Conservative figure		Optimistic figure	
	2015	2020	2015	2020
Coastal area	2%	5%	4%	8%
Offshore area	10%	20%	20%	35%
Inland area	40%	60%	55%	75%

Table 7 Railway involvement in foreign trade container transport in hinterland

Bring the above figures into equation 0 and we get the estimated volume of the rail-waterway intermodal foreign trade container transport in 2015 and 2020. (see Table 8)

Year		Conservative figure			Optimistic figure		
		Total	Railway involvement in container collection	Railway involvement in container distribution	Total	Railway involvement in container collection	Railway involvement in container distribution
2015	China	393	212	182	693	372	321
	Coastal area	195	103	92	389	205	184
	Offshore area	48	26	23	97	51	45
	Inland area	150	84	67	207	115	92
2020	China	1030	566	464	1,554	851	703
	Coastal area	583	313	269	932	502	431
	Offshore area	125	68	57	219	119	100
	Inland area	322	184	138	403	230	173

Table 8 Estimated volume of China's rail-waterway intermodal foreign trade container transport

Applying the same methodology, the paper also calculates the estimated transport volume for rail-waterway intermodal domestic trade containers. (see Table 9)

Unit: 10,000 TEUs

	Conservative figure	Optimistic figure

	2015	2020	2015	2020
China	146	334	454	877
Northeast/North China	86	171	285	570
South China	33	84	75	149
East China/west of the Taiwan Straight	26	79	95	158

Table 9 Estimated volume of rail-waterway intermodal domestic trade container transport at port

3. Forecast for the total RWICT volume in 2015 and 2020

Based on the volume forecasts for rail-waterway intermodal foreign and domestic container transport, the total container throughput of ports and the total volume of RWICT in 2015 and 2020 are estimated. (see Table 10)

Unit: 10, 000 TEUs

	Container throughput of ports				Volume of the rail-waterway intermodal container transport						Ratio	
					Conservative figure			Optimistic figure				
	Total	International line	Feeder line	Domestic line	Total	Foreign trade container	Domestic trade container	Total	Foreign trade container	Domestic trade container	Conservative figure	Optimistic figure
2015	20,468	10,595	2,283	7,589	539	393	146	1,027	693	334	2.63%	5.02%
2020	28,322	12,814	3,533	11,976	1,484	1,030	454	2,463	1,554	909	5.24%	8.70%
Average growth rate between 2011 and 2015	9.0%	5.7%	13.8%	13.4%	27.7%	Nil	Nil	42.2%	Nil	Nil	Nil	Nil
Average growth rate between 2016 and 2020	6.7%	3.9%	9.1%	9.6%	22.5%	Nil	Nil	19.1%	Nil	Nil	Nil	Nil

Table 10 The container throughput of ports and the volume of RWICT in 2015 and 2020

Notes: 1. In 2009, the combined container throughput of China's ports were 122.40m TEUs (75.95m for international lines, 10.51 for feeder lines and 35.61m for domestic lines); the container carrying capacity of China's port stations were 1.243m TEUs. 2. Based on the 2009 data, the average growth rate of the container throughput of ports and of the RWICT volume from 2011 to 2015 and from 2016 to 2020 are calculated. 3. The ratio represents the ratio of the RWICT volume to the container throughput of ports.

As the above table shows, between 2016 and 2020, the average growth rate of container throughput of ports and volume of RWICT are forecast to be 6.7% and 22.5% (conservative figure). Though lower than the growth rate between 2011 and 2015, the figures are still very promising, representing huge potential in developing RWICT in China. If the potential can be fully tapped into and the New Eurasia Land Bridge fully taken advantage of, energy efficiency will be effectively maximized and logistic costs for supply chain trade greatly reduced.

III. RECOMMENDATIONS

In section one, key challenges confronting China's development of RWICT have been analyzed and gaps between China and developed countries presented. In the final analysis, recommendations for China to take these challenges shall be an integral part. The recommendations are mainly for the Chinese government, as ultimately the government's attempt to improve China's RWICT votes to the preference of RWICT in the Asia-Pacific region, especially the RWICT corridor via the trans-China railway. In this section, some general recommendations are also provided by resorting to previous studies and good practices of promoting RWICT in individual APEC economies and non-APEC countries.

A. Recommendations for China

> Revising relevant regulations

Relevant regulations promulgated before need be reviewed against new development trends and way of thinking, inappropriate clauses removed, those crying for improvement modified, and new clauses added. This job is not only for the Ministry of Transport and Railways, but for governments at all levels who have promulgated regulations in relation to RWICT.

> Establishing the coordination mechanism for RWICT

The Ministry of Transport and Railways should coordinate for making unified plans, standards, policies and operation rules, so that the RWICT can have a sustained development. Shipping companies, port enterprises and railway bureaus should establish and strengthen an equal and mutually beneficial cooperation relationship, conduct dialogue regularly, and negotiate to resolve problems encountered in the RWICT.

> Accelerating the infrastructure construction for the RWICT

Relevant parties need make scientific planning for the construction of RWICT routes, bearing in mind the overall layout while choosing port hubs, railway lines and stations. "Integration between railway lines and ports" should be further promoted, and large container terminals built with railway handling lines through which block trains can drive in and out of the terminals.

More efforts should be made to build railway container stations along major RWICT routes and to renovate and expand the infrastructure, for example, investing more in handling machinery and working yards and improving the operational capacity of FEUs. Private capital should be encouraged to participate in the building of railway container yards and the purchasing of specialized equipment.

> Improving the operation efficiency of the RWICT

Container block trains should be greatly promoted, especially non-stop block trains and "small block trains" which features smal-scale mashalling, non-unmarshalling and high-intensity. To support the RWICT in China, the railway sector should prioritize acceptance for carriage, allocating transport capacity, and relocation of empty containers; ports should prioritize shipping confirmation, dispatching and packaging of goods.

The management of container transport should promote single window system, so as to improve the operation efficiency and service quality. "Point to point" non-stop container block trains should should operate according to "fixed departure time and transit time"; if the transport capacity runs shortage, block trains are allowed to operate below the maximal axle load. Empty trains should be arranged in a balanced manner; a whole empty train may well be collected at the marshalling station and then sent back to the departure station.

> Increasing the information application for the RWICT

Relevant ministries should work to raise the information availability for the RWICT, linking up the information systems of shipping companies, ports, railways, customs, inspections departments, etc. and building a real-time and open information platform for sharing. The information transparency for various links of the RWICT should also be raised, so that customers can have access to timely and accurate information, such as the transport timing, freight rates, transport capacity availability, container condition, etc.

> Increasing the information sharing level between port and shipping enterprises and the railway sector

At present, China's major container ports and shipping enterprises have established rather mature business information systems and advanced EDI systems for international container transport; and the railway sector has basically established the TMIS system. As the two sectors enter the information era, they need promote information connectivity and exchange from the following aspects: First, RWICT hubs should have access to information in the railway TMIS system, such as information about containers, railway wagons and block trains; Second, credible and competitive third-party service providers should be allowed to build an e-commerce platform and provide integrated "port-to-door" information services. In the process, ports should be taken as the node.

> Launching demonstration projects

With the preliminary ideas of building more effective RWICT hubs in place, demonstration projects should be launched to explore how to put the ideas in practice. The Yantian Port in Shenzhen province may be taken as a pilot: First, the layout of the port should be redesigned to make railway container handling within the container terminal possible; Second, port and shipping enterprises and the railway sector should work together to build the "port to door" freight rate mechanism for RWICT; Third, an information sharing platform for international container businesses should be built between port and shipping enterprises and the railway sector. If conditions permit and ports have the intention, one or two more demonstration projects will be better. Ports like Dalian, Tianjin, Lianyungang and Shanghai can be chosen for conducting such projects.

> Promoting the use of unified RWICT documents

The interimodal transport contract is a legal document that stakeholders in RWICT must follow; and as proof of the contract, an uniform RWICT document must be used among shippers, carriers, ports, the railway sector, etc. to identify the rights, obligations and responsibilities of each entity. What's more, using an uniform document is the best way to meet the need of RWICT. The thing to note here is that this "uniform document" means the preparation and use of the document must also be in unity.

> Improving the management system for RWICT

Referring to international standards, relevant parties should produce an unified catalog of dangerous goods applicable to waterway, railway and highway; unify the container weight limit for rail and sea transport; unify the cargo restrictions for container transport.

Railway freight rates should be adjusted: to guide customers to adopt rail container transport by setting different freight rates for open wagon, covered wagon, common platform wagon and platform wagon for the exclusive use of containers; to encourage railway administrations to support containerization by setting specific performance valuation standards.

Railways, ports and shipping companies should disclose the freight rates and all kind of miscellaneous fees to cargo owners, so that extra charges and arbitrary charges can be avoided. The "port-to-port fixed charges" should have a range for adjustment, so as to make the price more flexible.

The practice of telling laden containers from empty ones simply by marks on the container door should be changed; instead, containers should be charged based on how much they weigh. For containers arriving at railway container stations, the free storage period should extend from the current two days to seven days.

Port and inland customs should simplify the clearance procedure, making it possible for unboxing, inspection and quarantine only once.

> Deepening the cooperation between ports and shipping enterprises and the railway sector

The international rail-water intermodal container transport is, in essence, the combination of water and rail transport. At present, the water transport industry has been open to the market, but the railway sector is still subject to the Ministry of Railways. Therefore, to promote RWICT, cooperation between port and shipping enterprises and the railway sector represented by the China Railway Container Transport Company need be strengthened from the following aspects:

First, RWICT hub construction. Port enterprises should take the lead and work with China Railway Container Transport Company or railway administrations to build joint venture hubs for RWICT, so that the two parties will be bound by the capital and common interests for developing RWICT.

Second, container transport operation. In China, container block trains fall into two types: one type operates across administration of railway bureaus and one type within the authority of one specific railway bureau; the former type is operated by the China Railway Container Transport Company and the latter type by corresponding railway bureaus. So ports and shipping enterprises should both work with the China Railway Container Transport Company in operating medium-and-long-distance container transport, and work with local railway bureaus in operating short-and-medium-distance container transport.

Third, railway container yard construction. Port and shipping companies need to actively participate in the construction of railway container yards, and propose transformation of the yards to make them more appropriate for rail-water container transport; or they can work with the China Railway Container Transport Company and railway bureaus in building new container yards.

B. Some general recommendations

In an attempt to improve the efficiency of the New Eurasia Land Bridge, Ksenia K A Novikova and Otieno Robert Kennedy conducted a quantified study in 2012, giving insight into the efficiency characteristics of the New Eurasia Land Bridge, examining aspects of the infrastructure, and establishing dimensions of efficiency and inefficiencies. In the study, they categorized the efficiency characteristics into five aspects, namely, organization of railway corporation, information factors, railway cross-border logistics process, policies and legal issues, and socioeconomic and political factors, and described the attributes of efficiency, as is seen in Table 11.

	Attributes of Efficiency		Label
Organization of Railway Corporation	1.	Standardized performance measures	RC1
	2.	Safety and security issues along the Land Bridge	RC2
	3.	Efficient utilization of human resource	RC3
	4.	Improved capability of railway workers	RC4
Information Factors	5.	Level and nature of data collection	IF1
	6.	Level of development of decision support systems for operations and congestion reduction	IF2
	7.	Enhancing wayside and on-board detection systems	IF3
	8.	Improved visibility of goods in transit	IF4
	9.	Data accuracy and timeliness	IF5
Railway Cross-border Logistics Process	10.	Transit speed and gauge characteristics	LP1
	11.	Efficiency of scheduling for trains, crew and car assignment	LP2
	12.	Ability to improve railway hardware management systems	LP3
	13.	Reliability of railway physical infrastructure	LP4
	14.	Energy efficiency and reliability of trains and infrastructure	LP5
	15.	Ability to develop strategies to increase throughput	LP6
	16.	Compliant railway transport planning system	LP7
	17.	Ability to develop computer-based train driving systems	LP8
	18.	Strategies to reduce locomotive idling	LP9
Policies and Legal Issues	19.	Flexibility and effectiveness of regulatory revisions	LI1
	20.	Objective evaluation of safety regulations	LI2
	21.	Ability to develop risk-based safety standards	LI3
	22.	Ability to automate track inspections	LI4
	23.	Acceptable tariffs and border crossing procedures	LI5
	24.	Level of compliance with cross-border	LI6

		regulations	
Socio-economic and political Factors	25.	Strategies to reduce fuel cost	SF1
	26.	Political and social stability of countries involved	SF2
	27.	Level of regional integration	SF3
	28.	Greater cooperation of countries involved	SF4

Table 11 Efficiency characteristics

What's more, the authors have quantified the above efficiency attributes by describing their regression weights respectively. (see Table 12)

Attributes of Efficiency		Round 2		Round 3		Round 3
		Median	Inter-quartile Range	Median	Inter-quartile Range	One Sample z-stat
1.	Standardized performance measures	5.0	1.00	5.0	0	4.102
2.	Safety and security issues along the Land Bridge	5.0	1.00	5.0	0	3.992
3.	Efficient utilization of human resource	5.0	0.75	5.0	0.75	3.123
4.	Improved capability of railway workers	4.0	1.50	4.0	1.00	1.762
5.	Level and nature of data collection	3.5	1.00	4.0	0.75	2.993
6.	Level of development of decision support systems for operations and congestion reduction	4.5	0.50	5.0	0.10	3.015
7.	Enhancing wayside and on-board detection systems	4.0	0.75	4.0	0.70	2.345
8.	Improved visibility of goods in transit	5.0	0.50	5.0	0.25	2.876
9.	Data accuracy and timeliness	5.0	0.25	5.0	0	3.991
10.	Transit speed	5.0	0	5.0	0	3.971
11.	Efficiency of scheduling for trains, crew and car assignment	5.0	0	5.0	0	3.567
12.	Ability to improve railway hardware	5.0	0.25	5.0	0.25	2.889

	management systems					
13.	Reliability of railway physical infrastructure	5.0	0.25	5.0	0	4.012
14.	Energy efficiency and reliability of trains and infrastructure	4.0	0.50	5.0	0.20	3.214
15.	Ability to develop strategies to increase throughput	3.0	1.00	4.0	0.75	1.544
16.	Compliant railway transport planning system	4.0	0.50	5.0	0.75	1.750
17.	Ability to develop computer-based train driving systems	4.0	0.50	4.0	0.50	2.872
18.	Strategies to reduce locomotive idling	5.0	0.25	5.0	0.10	3.561
19.	Flexibility and effectiveness of regulatory revisions	4.0	1.00	4.0	0.60	3.110
20.	Objective evaluation of safety regulations	3.0	0.75	3.0	0.80	2.625
21.	Ability to develop risk-based safety standards	4.0	0.80	4.0	0.50	2.750
22.	Acceptable tariffs and border crossing procedures	4.0	1.00	3.0	1.00	1.961
23.	Acceptable tariffs and border crossing procedures	5.0	0.40	5.0	0.30	1.977
24.	Level of compliance with cross-border regulations	3.0	0.20	3.0	0.30	1.812
25.	Strategies to reduce fuel cost	4.0	0.50	4.0	0.25	1.625
26.	Political and social stability of countries involved	4.0	1.00	4.0	0.25	1.735
27.	Level of regional integration	4.0	0.70	4.0	0.50	2.671
28.	Greater cooperation of countries involved	4.0	0.40	4.0	0.20	1.345

Table 12 Round 2 and 3 results of expert interview

These two tables present not only factors that need to be addressed in improving the efficiency of the New Eurasian Land Bridge, but the priority in addressing these factors. Along with these two tables, the authors have come up with some implications. According to them, socioeconomic and political factors prove to be of priority, second after railway corporation factors; as factors like strategies to reduce fuel costs, political and social stability and greater cooperation between countries involved are key to investor confidence, political stability should be sought for; the efficiency of infrastructure is of great significance and should be improved by every means; stakeholders should improve information systems and the organizational structure of railway corporations (which has the highest regression weight in the final model) to ensure efficiency; issues of security and safety are rated highly by the expert respondents, and thus strongly correlated with efficiency; acceptable tariffs and border crossing procedures and improved visibility of goods in transit also have impacts on firm profitability and service; efficiency characteristics about cross-border logistics processes like efficient scheduling of trains, crew and car assignment, and strategies to reduce locomotive idling could help reroute shipments, expedite delayed shipments and coordinate intermodal transport.

The implications mentioned above can be of great help to experts in railway transportation sector, business communities in countries along the New Eurasian Land Bridge, governments and economic unions in Eurasia for improving efficiency of the Bridge, which can in return help firms and governments respond to ever increasing uncertainties and dynamism in global business environment, especially Euro-Asian business.

Apart from the qualified and comprehensive analysis and implications provided by Ksenia and Otieno, good practices in some individual countries can be very useful references. Take Kazakhstan as an example. At the workshop, as the Kazakhstan speaker presented, Kazakhstan has put in place the «KTZ Express» (order of the President of Kazakhstan Nursultan Nazarbayev at the republican forum of agricultural workers on November 11, 2011). According to the speaker, the «KTZ Express» integrates rail, sea, air and road transport, port, airport infrastructure, as well as a network of terminals and logistic centers, and presents key principles of logistics for improving the efficiency and attractiveness of routes, namely, high speed and stable terms passing the entire route, high level of service, reducing the cost of services by lowering the overhead, and ensuring the safety of goods by including the possibility of tracking the cargo throughout the journey. Meanwhile, as is suggested by the speaker, equally important are integration of all infrastructure elements of transport logistics system, roads, customs stations, and ports along the route of cargo, integration of all transport modes used to implement the transportation route, integration of information systems used throughout the journey of goods, predictability of tariff for the entire route for long term and delivery of a whole range of services based on "one window". One thing emphasized by the speaker is that stability is the key parameter for route attractiveness for customers and for ensuring the transport efficiency of cargoes.

IV. INSTRUCTION MANUAL

Based on the development status of RWICT in China, this chapter provides instructive information for shippers or their agents who may consider adopting RWICT, or for governments and investors who may consider investing in RWICT.

A. Introduction of major corridors for RWICT in China

In China, the rail-waterway intermodal transport demand for foreign trade containers concentrates in the coastal area, offshore area and inland area in the east-west direction, and the transport demand for domestic containers in northeast China/north China, east China/west of the Taiwan Strait, and south China in the north-south direction. Currently, the corridors for RWICT built in China serve as the mainstay for the RWICT network, and more importantly, these corridors are consistent with the distribution of demand for RWICT. In the following table, major corridors, which are categorized based on the demand distribution, are briefly described in terms of the railway lines they are built on, their ports and inland points, and their future development.

Corridor	Major rail lines that the corridor is built on	At the port point	At the inland point	Future development	
				Initiative	Traffic volume forecast
In northeast China	Shenyang-Dalian, Beijing-Ha'erbin (Shenyang-Ha'erbing section)	Dalian container freight station and container terminal in Dayaowan port area of Dalian port, and Bayuquan port station and container terminal in Bayuquan port area of Yingkou port	42 railway container freight stations in Liaoning, Jilin and Heilongjiang which can handle TEUs (25 of the stations can handle FEUs)	Express corridors for passenger transport will be built along railway lines of Shenyang-Dalian, Beijing-Ha'erbin, Changji-Duntu, Ha'erbin-Manzhouli, and Ha'erbin-Suifenhe. As these lines match the corridors for RWICT in northeast China, the freight capacity of the RWICT corridors will be further improved by the time the express passenger transport corridors are finished.	The freight volume in the area will reach 0.89m TEUs (conservative figure) and 2.57m (optimistic figure) by 2015; and 2.57m TEUs (conservative figure) and 7.85m TEUs (optimistic figure) by 2020.
In north China	Fengtai-Shacheng, Beijing-Baotou, Beijing-Yuanping, Shijiazhuang-Dezhou, Shijiazhuang-Taiyuan	Xingang railway station and container terminal in Tianjin port	45 railway container freight stations in Beijing, Hebei, Shanxi, etc. which can handle TEUs (29 of the stations can handle FEUs)	Express corridors for passenger transport will be built along railway lines of Beijing-Shanghai, Beijing-Guangzhou, Tianjin-Shanhaiguan, Shijiazhuang-Dezhou, and Shijiazhuang-Taiyuan. As these lines match the corridors for RWICT in north China, the freight capacity of the RWICT corridors will be significantly improved by the time the express passenger	The freight volume in the area will reach 0.96m TEUs (conservative figure) and 2.88m (optimistic figure) by 2015; and 3.15m TEUs (conservative figure) and 9.23m TEUs (optimistic figure) by 2020.

				transport corridors are finished.	
In east China	Jiaozhou-Huangdao and Qingdao-Jinan, Lanzhou-Lianyungang and Shanghai-Kunming	Huangdao (in Qingdao) container freight station and container terminal in the Huangdao port area, Lianyungang container freight station and container terminal at Lianyungang port, Luchao (in Shanghai) container freight station and Yangshan container terminal at Shanghai port, and Beilun (in Ningbo) container freight station and container terminal in Beilun port area	103 railway container freight stations in Shandong, Jiangsu, Zhejiang, Fujian, etc. which can handle TEUs (88 of the stations can handle FEUs)	Express corridors for passenger transport will be built along railway lines of Beijing-Shanghai, Beijing-Guangzhou, Tianjin-Shanhaiguan, Shijiazhuang-Dezhou, and Shijiazhuang-Taiyuan. As these lines match the corridors for RWICT in north China, the freight capacity of the RWICT corridors will be significantly improved by the time the express passenger transport corridors are finished.	The freight volume in the area will reach 0.65m TEUs (conservative figure) and 1.89m (optimistic figure) by 2015; and 2.65m TEUs (conservative figure) and 5.67m TEUs (optimistic figure) by 2020.
In south China	Beijng-Guangzhou	Container freight station at the new port of Huangpu and	55 railway container freight stations in	The construction of the high-speed railway line of Wuhan-Guangzhou has greatly improved the freight capacity of	Nil

		container terminal in the Shagang port area of Guangzhou, container freight station and container terminal at Shekou port in Shenzhen, and container freight station and container terminal at Yantian port in Shenzhen	Guangdong, Hunan, Hubei, etc. which can handle TEUs (45 of the stations can handle FEUs)	the RWICT corridor in south China, as this railway line matches the line of Beijing-Guangzhou.	
In northwest China	Lanzhou-Lianyungang, Baotou-Lanzhou and Lanzhou-Urumqi	Alashankou and Khorgos as inland railway ports	31 railway container freight stations in Shanxi, Gansu, Ningxia, Qinghai, etc. which can handle TEUs (25 of the stations can handle FEUs)	Express corridors for passenger transport will be built along railway lines of Lanzhou-Lianyungang and Lanzhou-Urumqi. As these lines match part of the corridors for RWICT in northwest China, the freight capacity of the RWICT corridors will be further improved by the time the express passenger transport corridors are finished.	The freight volume in the area will reach 1.35m TEUs (conservative figure) and 1.57m (optimistic figure) by 2015; and 2.82m TEUs (conservative figure) and 3.63m TEUs (optimistic figure) by 2020.
In southwest China	Nanning-Fangcheng, Litang-Qinzhou and Qinzhou-Beihai, and	Fangcheng container freight station and container terminal	43 railway container freight stations in Guangxi,	The freight capacity of the existing railway lines in southwest China will get improved by being transformed to	Nil

	Litang-Zhanjiang	at Fangcheng port, Beihai container freight station and container terminal at Beihai port, and Zhanjiang container freight station and container terminal at Zhanjiang port	Yunnan, Guizhou, etc. which can handle TEUs (32 of the stations can handle FEUs)	double-track and electrified ones.	

Table 13 Major corridors for RWICT in China

B. Instruction on the operation of RWICT within China

Suppose you are a shipper from Japan. You intend to consign your cargo to a RWICT operator and have your cargo transported by sea first to China and then by trans-China railway to Central Asia. In the process, your cargo actually is first imported to China and then exported out of China. You may want to get yourself familiar with the import and export flow for your containers in the rail-waterway intermodal transport within China. (see Table 14 for the import flow and Table 15 for the export flow)

No	Process flow	Document	Note
1.	Shipping agent submits Manifest to Customs, CIQ, wharf and tally service provider.	Import Manifest	Some cargo are subject to commodity examination before Customs declaration, and others are not. Usually, commodity examination takes one to two working days, and Customs declaration half to one working day.
2.	Discharging of imports: shipper registers with port operator details like B/L No., name of vessel, voyage No., container No., container profile, port of departure and destination, and name of cargo and shipping agent.	Nil	Nil
3.	Shipping agent exchanges B/L for Delivery Order.	B/L, Delivery Order	Nil
4.	With customs transit application or not? No Customs declaration and commodity examination Yes Customs and CIO release	Nil	Nil
5.	Freight forwarder advises shipping agent on container release.	Nil	Nil
6.	"Monthly" transport plan is reported by freight forwarder for approval.	Nil	There are two types of "plan" that need be reported to railway station if you intend to transport cargo by railway, namely, "monthly plan" and "daily plan". "Monthly plan" means you have

			to report your transport plan for next month before the 10th day this month. But sometimes even your "monthly plan" has been approved, it does not necessarily mean you can get the transport capacity on time.
7.	Freight forwarder applies to RA for railway capacity a day ahead. ("daily plan")	Nil	"Daily plan" means the day before your cargo is delivered, you have to report the transport plan again.
8.	Application of the "daily plan" is approved.	Nil	Nil
9.	Port freight forwarder applies to port station for train entry.	Nil	
10.	RA sends Empty to designated yard.	Nil	Nil
11.	Port station reports marshalling of the railway company to port station.	Nil	
12.	By referring to freight forwarder's application and RA approval, port station makes loading arrangement.	Nil	Nil
13.	Port station loads wagons and delivers Loading Report to railway company, RA and freight forwarder.	Loading Report	Nil
14.	RA delivers Rail Waybill to port station and freight forwarder.	Rail Waybill	Nil
15.	RA updates consist information of the train to freight forwarder and port station.	Nil	Nil
16.	RA updates real-time information of goods in transit.	Nil	Nil
17.	RA updates real-time information of wagon	Nil	Nil

	entering inland depot.		
18.	RA delivers Unloading Report.	Unloading Report	Nil

Table 14 Import flow for containers in rail-waterway intermodal transport

No	Process flow	Document	Notes
1.	Inland agent applies for commodity examination and Customs declaration.	Customs declaration form for export, verification form of export payment of exchange, packing list, cargo invoice, shipping order, letter of authorization for customs declaration, trade contract, certificate of origin and other documents (if required)	Some cargo are subject to commodity examination before Customs declaration, and others are not. Usually, commodity examination takes one to two working days, and Customs declaration half to one working day.
2.	Customs and CIO release cargo.	Nil	Nil
3.	Inland agent advises railway station on transport plan a month ahead.	Nil	There are two types of "plan" that need be reported to railway station if you intend to transport cargo by railway, namely, "monthly plan" and "daily plan". "Monthly plan" means you have to report your transport plan for next month before the 10th day this month; and "daily plan" means the day before your cargo is delivered, you have to report the transport plan again. But sometimes even your "monthly plan" has been approved, it does not necessarily mean you can get the transport capacity on time.
4.	Inland agent applies to RA for railway capacity a day ahead.	Nil	In China, the railway transport capacity is still subject to government administration, which falls into three levels

			(National Railway Administration of PRC, local Railway Administrations and local depots).
5.	RA approves the application for allocating railway capacity.	Nil	Nil
6.	Inland agent applies to inland depot for train entry.	Nil	Nil
7.	RA sends Empty to the designated inland depot.	Nil	Nil
8.	By referring to the agent's advice and RA approval, inland depot makes loading arrangement.	Nil	Nil
9.	RA updates rail waybill.		
10.	Inland depot loads the wagon and delivers the Loading List.	Loading List	Nil
11.	RA updates consist information of the train.	Nil	
12.	RA updates real-time information of goods in transit.	Nil	Nil
13.	Port freight forwarder reserves shipping space.	Nil	Nil
14.	Port freight forwarder applies to port station for unloading.	Nil	Nil
15.	Rail station in the port updates details on port entry.	Nil	Nil
16.	Port station updates details on marshalling and yard entry.	Nil	Nil

17.	Port station makes unloading and cargo congregation plan.	Nil	Nil
18.	Port station unloads wagons and delivers Unloading Report.	Unloading Report	Nil
19.	Shipping waybill is delivered and Customs seal is made.		Nil
20.	Shipping agent delivers Advance Manifest.	Advance Manifest	Nil
21.	With or without customs transit application? No Customs declaration and commodity examination Yes Customs seal verification	Nil	Nil
22.	Automatic approval is given.	Nil	Nil
23.	Containers are congregated at the port.	Nil	Nil
24.	Containers are loaded onto the ship.	Nil	Nil
25.	Container terminal delivers the Loading Report.	Loading Report	Nil

Table 15 Export flow for containers in rail-waterway intermodal transport

Note: legend (import and export flow):

> CIO—China Inspection and Quarantine

> B/L—Bill of Lading

> RA—Railway Administration

Apart from the import and export flow of RWICT in China, you may need to know who are the major players in in the process. Table 16 and 17 present some key ports, local railway administrations, and enterprises that have been involved in the operation of RWICT in China. In addition, Table 18 and 19 present the container freight rate for typical railway lines, giving a big picture of China's railway freight rate.

Key entities engaged in container transport in China		Notes
Port	Shanghai, Shenzhen, Qingdao, Ningbo, Guangzhou, Tianjin, Xiamen, Dalian, Lianyungang, Suzhou, etc.	In China, there are 107 ports, including 61 along the coast and 46 along inland rivers.
Local Railway Administrations	Beijing, Shenyang, Shanghai, Nanchang, Chengdu, Zhengzhou, Wuhan, Xi'an, Taiyuan, Jinan, Nanning, Kunming, Lanzhou, Ha'erbin, Hohhot, Urumqi, Guangzhou Railway (Group) Corporation, and Qinghai-Tibet Railway Company	Rail Administration is unique to China. China's railway system comprises of three levels, namely, National Railway Administration of PRC, local railway administrations and deports (from higher to lower).

Table 16 Key ports and railway administrations in China

Enterprises	General description	Major businesses	Link
SINOTRANS&CSC (in Chinese: 中国外运长航集团有限公司)	The company has over 12 million m^2 of warehouse and yard, 47 special rail lines, 90 self-owned docks, 300 berths, and various ships of over 13 million tons in deadweight.	Freight forwarding by water, land and air, shipping agency, supply chain logistics, express delivery, warehousing & terminal, trucking transportation, etc.; dry bulk transport, oil tanker service, container transport, roll-on/roll-off transport, fuel trade, etc.	http://www.sinotrans-csc.com/col/col199/index.html
China Shipping	By late 2012, the company owns 500 ships	Transportation of containers, oils, bulk cargo,	http://www.cnshipping.c

(Group) Company (in Chinese: 中国海运（集团）总公司)	with a total deadweight of 30 million tons; its 3 core fleets of container ships, tankers and bulk carriers lead the world in size; its annual freight traffic average 460 million tons and 11 million containers.	passengers, cars and special objects; terminal management, comprehensive logistics, shipping agency, global air transport, ship repairing, container manufacturing, crewing, etc.	om/en/
COSCO Container Lines Co., Ltd. (COSCON) (in Chinese: 中远集装箱运输有限公司)	One of the world's leading providers of integrated container shipping service: By late 2012, **COSCON** has 174 container carries with a carrying capacity of up to 756,979 TEUs; connects more than 162 principal ports in over 49 countries and regions worldwide, and operates over 84 international shipping routes, 23 international feeder routes, 23 coastal routes in China and 79 routes in the Zhujiang River Delta and the Chang Jiang River.	Container shipping	http://www.coscon.com/changeLanguage.do?language=en
China railway container transport co., LTD (CRCT) (in Chinese: 中铁集装箱运输有限责任公司)	The company has 6 Container Freight Stations, 173,000 TEUs of various kinds (collapsible container, flat rack container, tank container, solid bulk container, etc.), 9130 container flat cars and 350,000 tarpaulins for rail use.	Rail transport of international and domestic containers, intermodal container transport, international rail intermodal transport; logistics services like warehousing, handling, packing and delivery; freight forwarding; management and leasing of container, container car, container facility, etc.	http://www.crct.com/portal/index.jsp
Yantian International Container Terminals (YICT) (in Chinese:	A natural deep-water port and leading gateway serving import and export container traffic: the company has a total of 16 berths and a	Intermodal services, import and reefer, liner services, etc.	http://www.yict.com.cn/index.html?locale=en_US

盐田国际集装箱码头有限公司)	yard area of 373 hectares, and an extensive cargo base which attracts about 40 major shipping lines.		
Ningbo Port Group Co., Ltd. (in Chinese: 宁波港口股份有限公司)	A multi-functional and comprehensive modern deep-water port: the port has 309 productive berths, including 60 10,000-dwt deep-water berths, a 250,000-dwt crude oil terminal, 200,000-dwt ore stevedoring terminal, and the 6th-generation specialized international container berth.	stevedoring, storage and transfer of imported iron ores, domestic and foreign trade containers, crude oil, liquid chemical products, coal and other bulk cargoes	http://www.nbport.com.cn/portal/wps/portal/en
Dalian Port Group (in Chinese: 大连港集团)	The port has a 300,000-dwt crude oil berth, a container terminal which can handle 14,100 TEUs, a highly efficient ore terminal, a specialized car terminal, a general cargo wharf and a bulk grain terminal.	Stevedoring, transport, storage, warehousing, transfer, and intermodal transport of containers	http://www.portdalian.com/home/index.html
Lianyungang Port Group Co., Ltd. (in Chinese: 连云港港口集团有限公司)	The port has specialized berths of various kinds with a designed annual handling capacity of over 100 million tons, about 60 liner routes for container, general cargo and passenger, comprehensive aggregation and segregation system (non-stop train for bulk cargo and grain, domestic and cross-border container block train, and over 10 dry ports), and one-stop service center.	Terminal handling, modern logistics, port construction, harbor industry, and comprehensive services	http://www.lygport.com.cn/html/index.aspx

Table 17 Key enterprises operating container transport

		Base price 1				Base price 2			
		Unit	Standard			Unit	Standard		
			2012.5	2013.2	2014.2		2012.5	2013.2	2014.2
Container	TEU	Yuan/ container	337.5	387.5	449	Yuan/ container ·km	1.4	1.7325	1.98
	FEU	Yuan/ container	459	527	610	Yuan/ container ·km	1.904	2.3562	2.7

Table 18 Average railway freight rate (container)

Note: In the table, the base price is for full loaded containers transported along typical railway routes.

In recent years, the railway freight rate for containers has been raised three times respectively on May 20, 2012, February 20, 2013 and February 15, 2014.

Unit: Yuan

Departure station	Destination	Mileage	Freight rate					
			TEU			FEU		
			2012.5.20	2013.2.20	2014.2.15	2012.5.20	2013.2.20	2014.2.15
Shenyang	Dalian port	422	1,803	1,993	2,159	2,932	2,932	2,932
Changchun	Dalian port	738	2,251	2,547	2,791	4,337	4,337	4,337
Ha'erbin	Dalian port	944	2,719	3,083	3,378	5,271	5,271	5,271

Taiyuan	Tianjin port	703	2,208	2,492	2,727	4,251	4,251	4,251
Xi'an	Tianjin port	1,290	3,480	3,959	4,340	6,784	6,784	6,784
Zhengzhou	Tianjin port	862	2,596	2,932	3,207	5,029	5,029	5,029
Xi'an	Lianyungang port	1,099	3,072	3,487	3,821	5,969	5,969	5,969
Lanzhou	Lianyungang port	1,876	4,824	5,498	6,024	9,465	9,465	9,465
Alashankou	Lianyungang port	4,131	9,685	11,109	12,193	19,163	19,163	19,163
Shangrao	Beilun port	553	1,866	2,100	2,298	3,625	3,625	3,625
Yingtan	Beilun port	671	2,129	2,403	2,630	4,150	4,150	4,150
Jinhua	Beilun port	356	1,753	1,753	1,753	2,765	2,765	2,765
Zhengzhou	Qingdao port	873	3,119	3,119	3,119	4,827	4,827	4,827
Xi'an	Qingdao port	1,366	4,515	4,515	4,515	7,041	7,041	7,041
Urumqi	Qingdao port	3,566	11,299	11,299	11,299	18,105	18,105	18,105
Changsha	Shenzhen port	837	3,929	3,929	3,929	5,982	5,982	5,982
Chongqing	Shenzhen port	1,876	6,861	6,861	6,861	10,630	10,630	10,630
Nanchang	Shenzhen port	920	3,941	3,941	3,941	6,124	6,124	6,124

Table 19 Freight rates for typical railway lines

C. Informative regulations adopted by China

This part summarizes a series of helpful policies in relation to China's RWICT, which are promulgated by the Ministry of Transport, the Ministry of Railways and other agencies. All these policies have been adopted by the Chinese government in an attempt to improve and standardize its RWICT both in hardware (infrastructure) and software (operating environment). The railway sector, ports, customs, commodity inspection departments, animal and plant quarantine departments, health quarantine departments, shippers, carriers, etc. all would find these regulations of great help, as they may resort to specific regulations among what are listed below for specific information.

1. Relevant provisions of the Ministry of Transport

China's Ministry of Transport is in charge of waterway container transport, and has formulated a number of relevant provisions to meet the management needs of the waterway transport industry. The provisions are summarized as follows:

> *Regulations for Domestic Waterway Container Cargo Transport*

The *Regulations for Domestic Waterway Container Cargo Transport* unveiled by the Ministry of Transport apply to any for-profit container cargo transport on China's navigable waters and loading/unloading business at ports or yards. The regulations specified requirements for port operation contract, transloading and task allocation, container loading/unloading contract, water-waterway intermodal container transport, transport of special-type containers, container management and maintenance, transportation statistics, etc.

> *Management Approaches for Electronic Data Interchange in Maritime International Container Transport*

The *Management Approaches for Electronic Data Interchange in Maritime International Container Transport* and three other related documents unveiled by the Ministry of Transport specify requirements for electronic data interchange (EDI) in maritime international container transport, and apply to all entities engaging in maritime international container transport.

> *Regulations on International Maritime Transport of the People's Republic of China*

In the *Regulations on International Maritime Transport of the People's Republic of China* promulgated the State Council, it is clearly stated that China will regulate its international maritime transport activities, promote fair competition, keep the international maritime transport market in order, and protect the legitimate rights of the parties to the international maritime transport. The Regulations apply to all for-profit activities and subsidiary activities in relation to international maritime transport. The subsidiary activities are defined as services related to international shipping agency, international ship management, international maritime cargo handling, international maritime cargo warehousing, international shipping container stations and depots, etc.

> Charging regulations for waterway container transport

Regulations on Port Charges (Foreign Trade), *Port Charging Measures for Domestic Waterway Containers*, and *Regulations on Port Charges (Domestic Trade)* are all about port charges for containers. Due to the growing competition on China’s waterway transport market, waterway container freight rates are completely determined by the market, and port charges of domestic trade containers have also been liberalized; but port charges of foreign trade still have to follow the *Regulations on Port Charges (Foreign Trade)*.

2. Relevant provisions of the Ministry of Railways

China’s Ministry of Railways is in charge of railway container transport, and has formulated a number of relevant provisions to meet the management needs of the railway sector. The provisions are summarized as follows:

> *Railway Container Transport Regulations*

The *Railway Container Transport Regulations* specify rules that the railway container transport must follow, including rules in relation to basic transport conditions, consignment, acceptance for carriage and delivery, and shippers, carriers and consignees.

The Regulations divide containers into railway containers and self-owned containers. Railway containers are provided by railway carriers and self-owned containers belong to shippers or are rented. Currently, railway containers are not allowed for purposes other than rail transport, therefore, in the international container transport, containers used are self-owned ones. The Regulations have specified requirements for the transport of self-owned containers. For example, shippers must present waybills separately for different batches of containers, and railway containers and self-owned ones cannot be handled as the same batch.

> *Railway Container Transport Management Regulations*

The *Railway Container Transport Management Regulations* specify rules the management of rail container transport should follow, including rules related to transport management, transport organization, management of railway container quality, safety management, information and statistics, etc. The Regulations apply to the railway sector nationwide, but within the sector instead of as a basis for dividing rights, obligations and responsibilities among shippers, consignees and carriers.

Under the Regulations, the railway container transport is under unified management, aided by specially-assigned persons from railway administrations and railway container transport companies. The Regulations also propose to establish an entirely unified transport management information system, where unified bills, statistical reports and electronic documents are used, where dynamic management of container transport and real-time information inquiry are possible, and where electronic data exchange is finally possible. Container freight stations should use the entirely unified transport management information system, so that information, such as container carriage and container handing will be entered timely and accurately.

> *Management Regulations for Liner Trains*

According to the *Management Regulations for Liner Trains*, liner trains can carry truckload cargo, container cargo and less-than-truckload cargo (only for nonstop lines), but not cargoes that are involved in water-highway intermodal transport, or defined as of military nature and qualify for later payment, or off-gauge, or transported within a certain range of speed, or kept fresh by adding water, ice or edible in transit. If quite a number of rail wagons are loaded with a single shipper's cargo, the shipper will get a certain percent of discount. And a shipper's permanent use of one specific liner train gives him the privilege to rent some or all the rail wagons.

> Charging rules for railway container transport

Charging in railway container transport is performed in accordance with the *Railway Freight Rates Rules* promulgated by the Ministry of Railways. The Rules apply to cargo transport on China national running rail lines, but not water-highway intermodal transport, international through railway transit transport. The freight cost of container cargo should be calculated based on the size and number of the containers as well as the prescribed freight rate. The charges for handling container cargo should conform to the *Notification of Simplifying Container Cargo Handling and Adopting Integrated Operation Rates*; handling charges at the departure station and the terminal station both should be collected in full by the departure station from the shipper. In addition, the container transport charges include some other fees, for example, the railway electrification surcharge.

The "fixed cost" for railway container transport is also a quite prevalent charging method. The "fixed cost" covers all costs in the entire transport process (from containers' entry of the departure station's freight yard to containers' exit of the terminal station's freight yard), and the "fixed cost" is settled in a lump sum. It comprises the three parts of transport related fees, series of fees collected at the departure station and series of fees collected at the terminal station.

3. Other relevant regulations

> Pilot Management Scheme About Cross-border International Container Transport on the Eurasia Land Bridge

The *Pilot Management Scheme About Cross-border International Container Transport on the Eurasia Land Bridge* which was jointly unveiled by seven ministries defines the ports and omnidistance operators that can handle cross-border containers. It also provides that when cross-border containers are transported by railway, costs incurred will be paid up in US dollars; if the costs exceed the prescribed base figure, the excess must be compensated for, and if the cost is below the prescribed base figure, the excess can be kept. This charging approach also applies to terminal handling, cargo storage, truck loading/unloading, etc.

> *Regulatory Measures for Transit Transport of the People's Republic of China*

In November 1992, the General Administration of Customs unveiled the *Regulatory Measures for Transit Transport of the People's Republic of China*, specifying the basic requirements and the operating procedure for transit transport of inbound and outbound cargo.

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