



CHALLENGES FOR ORGANISATION OF CONTAINER TRAINS BETWEEN CHINA AND EUROPEAN UNION

Borna Abramović, Kristijan Šugić

University of Zagreb, Faculty of Transport and Traffic Sciences, Croatia

Abstract

In the last few years, maritime transport between China and European Union has experienced huge capacity limitations and enormous delays. An alternative has emerged in railway transport. Currently, railway transport is less time consuming but is more expensive. So, there are optimisation challenges in organising transport of goods between China and European Union. Naturally, only goods in containers are transferred to railway transport as they will probably be able to bear the more expensive transport costs considering the reduction in transport time. Since 2013, China has been implementing the Belt and Road Initiative strategic plan to create a single market. One part of the plan also refers to establishing land connections, mainly by railway, between China and the European Union. There are currently four main corridors: (1) Northern, (2) Mongolian, (3) Southern, and (4) the New Silk Road. The most significant challenges can be divided into technical and organisational. The main technical challenge is the different track gauges that cause loading limits and loading gauge issues. The main organisational challenge is different customs procedures, operational rules, and administration tasks. This paper analyses the corridors used for railway transport of containers between Asia and European Union. We tackle issues regarding the technical and organisational obstacles. We have analysed container equipment, transloading equipment, railway vehicles, and terminals on the technical side. After that, we collected and analysed statistical data regarding traffic flows. We made a detailed analysis of the organisational process. According to our analysis, we have proposed organisational improvements that facilitate the overall transport of containers between China and European Union.

Keywords: Belt and Road Initiative, Asia, Europe, transport, containers, railway, organisation

1 Introduction

Last 50 years, the most important transport mode between Asia and Europe has been maritime transport. The overall trade growth has pushed maritime transport to the limits, especially between China and the European Union. So, in the last few years, maritime transport has experienced huge capacity limitations and enormous delays. There was a necessity to find adequate transport mode substitution. A very logical solution with all advantages and disadvantages was railway transport.

Historically the most famous land trip was made by Marco Polo between 1271 and 1295. Marco Polo was born in 1254 in Korčula, in thus years was part of the Republic of Venice and today in Croatia, and he passed away 1324 in Venice. In the 19 century, this route was named the Silk Route. In addition to the trade between East and West, cultures and diplomatic relations were exchanged. His travel experience was notable because his roommate from a prison cell, Rustichello da Pisa, wrote: "The Travels of Marco Polo", in the Italian language

title of the book was *Il Milione*. The book's central idea probably was to create a handbook for merchants, essentially a guidebook on weights, measures, and distances [1].

Imports into Europe from China have been steadily increasing in recent years. China is now the EU's largest supplier of manufactured goods, making it the EU's leading trading partner. In 2019, imports from China amounted to €362 billion (around €1 billion per day), and exports to €198 billion.

The freight transport between Asia and Europe takes place through several modes of transport, namely: (1) maritime, (2) air and (3) railway. Maritime transport plays the most significant role due to its robustness and the ability to transport massive quantities of goods. Air transport offers the speed of transport service as the only advantage. Railway transport has been receiving increasing attention in the last decade. Railway transport offers a service that is faster, safer and more environmentally friendly compared to maritime transport, and on the other hand, it offers a service that is cheaper than air transport.

The ports of the European Union are therefore of crucial importance to the economy of the member countries since they are the gateways to the territory for 74 % of imported goods. Today there are more than 1.200 commercial seaports on the European Union coasts and around 4 billion tonnes of goods pass through them every year.

Despite this large number of ports, only a few are recognised as major ones, forming the basis of a high-performance network that handles 96 % of maritime traffic in European Union. Indeed, only these main ports can accommodate the largest container ships (up to 18.000 TEU) [2].

2 Belt and road initiative

The Belt and Road Initiative (BRI), formerly known as One Belt One Road (OBOR), is a global infrastructure development strategy adopted by the Chinese government in 2013 to invest in nearly 70 countries and international organisations. This initiative refers to the proposed overland routes for road and rail transport through landlocked Central Asia. In the frame of Belt and Road Initiative infrastructure investments include ports, skyscrapers, railways, roads, bridges, airports, dams, coal-fired power stations, and other big infrastructure projects. This initiative is a huge “generator” worldwide [3]. Thru different invest, it is present in nearly 70 countries. Investments are in land and maritime transport so that the reliability of connection between China and Europe is stable. Also, there are different routes thru different countries for the same reasons. The overall goal is to build a unique wholesale market. The current plan is that all projects within the BRI will be finished by 2049 [4].

3 Railway routes in belt and road initiative

The routes for trains between Europe and China have a certain degree of flexibility depending on the availability of empty slots, traffic conditions, and mutual agreement by BRI participant countries. The route choice is on the rail operators or/and consigner, so some routes are more utilised than others [5]. Also, it is important to follow everyday politics when choosing the route. There are currently four main railway corridors: (1) Northern, (2) Mongolian, (3) Southern, and (4) the New Silk Road. The northern corridor uses the Russian Trans-Siberian Railway line, which is a direct connection between China and Russia. Passing through the Russian mainland, the Northern Corridor past thru Belarus reaches Poland as a gate to Europe. This corridor is fully operational. It also crosses through the least number of countries, hence involving the least number of border crossings, amongst the three alternatives. The Mongolian corridor connects China and the Russian Trans-Siberian Railway line thru Mongolia. This is a shorter route than the northern corridor. In the current situation, this variant seems to be predominant. The southern corridor connects China and the Russian Trans-Sibe-

rian Railway line thru Kazakhstan. This corridor is shorter than the northern and Mongolian corridors. Also, this corridor bypasses bottlenecks in Siberia and Mongolia. The New Silk Road connects China with Kazakhstan and passes through Turkmenistan, Kyrgyzstan, and Tajikistan to Iran. Through Iran, it reaches Turkey and then finally connects with Europe. The main disadvantages of this corridor are the high number of border crossings and the political situation in the region. A quite important advantage is that it connects China with southeast Europe and passes through Iran and Turkey, which traditionally have good relations with European countries. In the current situation, this corridor does not have track bottlenecks. The main railway routes are shown in Figure 1. It is interesting to look at the statistical data from 2014 until 2018. In 2014, only 308 trains carried around 25, 000 TEU and in 2018 was 4, 400 trains carried around 345, 000 TEU. So, the annual average growth for a number of trains is 94.41 %, and TEU is 92.74 %. Detailed statistics with calculated chain indices are present in table 1.

Table 1 Statistical data [6]

Year	Trains	Chain indices	Containers (TEU)	Chain indices
2014	308	-	25, 000	-
2015	815	264.61	65, 000	260.00
2016	1, 777	218.04	145, 000	223.08
2017	3, 700	208.21	279, 000	192.41
2018	4, 400	118.92	345, 000	123.66



Figure 1 Main railway routes between China and European Union [7]

There is no doubt that the significant potential of the future use of railway routes between China and the European Union exists. This especially is connected with prolonging the trains routes from/to Korea and Japan. However, several challenges need to be addressed for the railway to become maximally competitive with air and maritime transport. The challenges are (1) policy, (2) border crossings, (3) interoperability, (4) missing links, (5) safety and security, (6) operational rules and (7) environmental [8].

Currently, most railway infrastructure managers (IM) in Europe and Asia are state-owned and the majority of railway undertakings (RM) are state-controlled. The liberalisation of railways services could lead to simplified general transport conditions, significantly reducing rail freight tariffs (40-70 %), shortening railway transit, and cheaper operation costs. The most important regulatory challenges are harmonising border crossings, customs, safety and se-

curity, and maintenance. The biggest advantage of railway liberalisation is attracting private investment and reducing dependence on public funds. Policy reforms are expected to lead to an overall better railway system.

Delays are mostly happening on the border stations. There are two types of border stations: (1) track gauge is the same and (2) track gauge is different. In both cases, there is a need for a lot of border station tracks for doing necessary procedures. The issue of different gauges will be discussed later.

The most important procedure at the border station is custom. Custom is very complicated because every country on the route has different customs standards, so there is a direct loss of time at each border station. Customs officials often find some irregularities in documents, so the whole custom process becomes timeless. For sure, there is a need for introducing Electronic Data Interchange (EDI) for communication with all custom officials on the whole route. EDI does not allow wrong inputs and there is a control protocol behind each entered data so this can speed up the entire process. Also, there is a technical solution for controlling passing goods thru border stations such as: cameras, infrared cameras, X-ray devices, automatic weight devices and e.g. European Commission has identified four areas in order to implement the new strategy for the unification of customs: (1) simplification and streamlining of legislation, (2) improving customs controls, (3) ensuring efficient services provided to companies, and (4) improving training and international cooperation.

Another bureaucracy challenge is consignment notes. There are currently two different standards for consignment notes: Uniform Rules concerning the Contract of International Carriage of Goods by Rail (CIM) and Agreement on International Goods Transport by Rail (SMGS). Each of the consignment notes has a historical background of using them in different countries. There is a working group between the International Union of Railways (UIC) and the Organization for Cooperation of Railways (OSJD) for improving two consignment notes in one universal CIM/SMGS consignment note. This solution needs to find larger uses on the whole route [9]. Interoperability means the ability of the railway system to ensure the safe and uninterrupted movement of trains which accomplish the required levels of railway lines performance. This ability depends on the legal, technical and operational conditions which have to be provided to meet the essential requirements [10]. The most important interoperability question is different track gauges on the routes from Asia to European Union. So, China and European Union used Stephenson gauge (1435 mm) and former states of the Soviet Union used broad gauge (1520 mm). The difference in track gauges means completely different standards in terms of infrastructure and vehicles. So, on each connecting point, usually border station, there is a need for double gauge facilities and most important huge places for transloading goods. Also, there is a huge difference between train weights in Asia that is 10, 000 tons and in European Union is 2,000 tons. So, this results in a huge difference in the number of trains and the number of wagons. For example, containers on the broad gauge can be stacked doubled on each wagon, so there is a difference of 10 times between numbers of wagons. All these issues need to be solved at the border station. There is a very feasible solution for transloading between standard and broad gauge in the dry port Khorgos on the border between China and Kazakhstan. The solution is shown in Figure 2. Border stations is usually a bottleneck for technical and organisational issues. So, in the future, there is a need to increase the border station's physical area, introduce a new technological solution for transloading goods, and use Electronic Data Interchange (EDI) for customs and consignment notes.

One of the most challenging operation issues is the return of empty containers. The main reason for this issue is the huge disbalance of goods flows between China and European Union. Currently, 80 % of eastbound containers are empty, while 89 % of westbound containers are fully loaded. In the case of expansion of transport services to Korea and Japan and greater involvement of the regions through which the corridor passes can reduce the imbalance of goods flows.

It is interesting to compare cost and transit time depending on the used transport mode. The railway is more expensive than maritime transport but cheaper than air transport. Regarding the fastest time is air transport, then railway and slowest is maritime transport. It can be concluded that the railway is in the golden mean concerning the price and time of transport. Transport goods by railway are perfect for high-value industrial products such as vehicles, electronics and computer equipment, as well as promotional equipment that must reach their final destination as quickly as possible. Table 2 shows different transit times when using the railway.

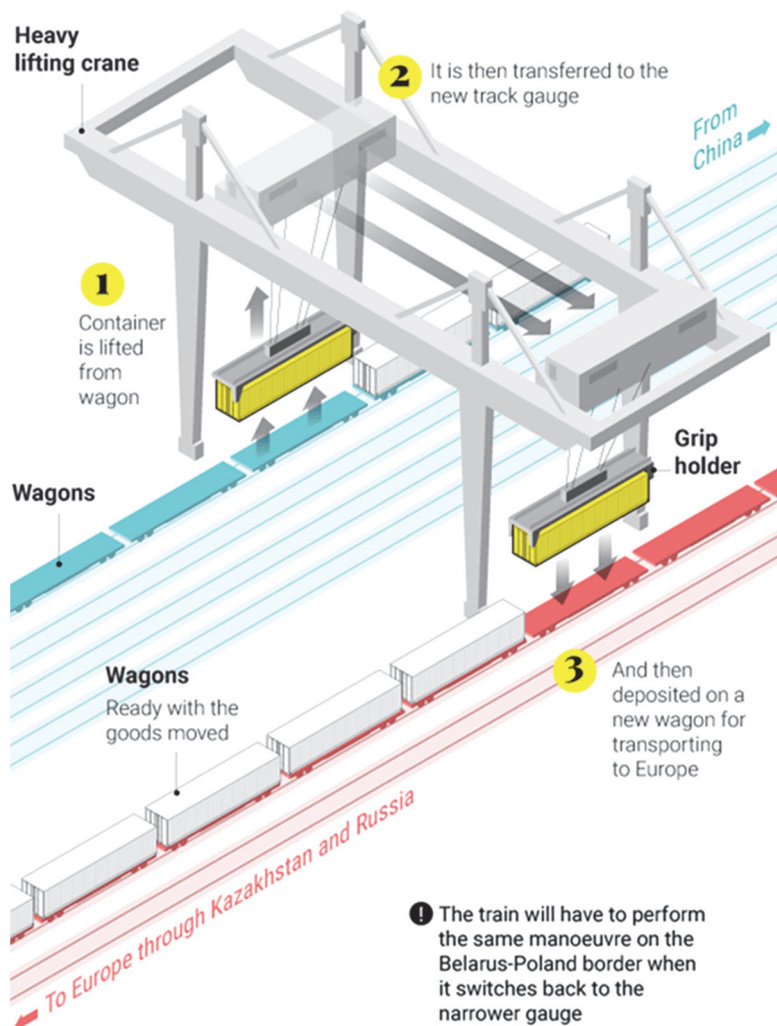


Figure 2 Transloading equipment in dry port Khorgos [11]

China Railway Express is an emerging freight transport mode between China and Europe, which provides a new option in addition to air and maritime transport. At the initial stage of development, due to the higher freight costs compared to maritime transport, the Chinese government subsidy provided for the China Railway Express operator plays a significant role in the process of market cultivation. The original intention of the government subsidy was to

promote the rapid and sustainable development of China Railway Express and the further subsidy scheme should encourage China Railway Express operators to act towards the expected goal of the local government. Interestingly, the optimal subsidy amount is between 2000 and 2500 USD per Forty-Foot Equivalent Unit (FEU) on the route between Wuhan and Hamburg [12]. For sure, the railway transport is sustainable and China Railway Express is a quite successful way to promote sustainable transport between China and the European Union. Of course, all subsidies need to be carefully monitored and rethink this model feasible for the future.

Table 2 Transit times

City (Country)	Transit time [days]
London (UK)	18 - 20
Lyon (France)	14 - 17
Brussels (Belgium)	12 - 14
Hamburg (Germany)	14
Warsaw (Poland)	12

4 Conclusion

With the implementation of the Belt and Road Initiative, the People’s Republic of China once decided to strengthen its economy further and provide an opportunity to develop less developed provinces. Belt and Road Initiative is providing an opportunity for further development to other participating countries. The main goal of Belt and Road Initiative is to upgrade and build the new infrastructure, but as the results will benefit efficient and effective transport between China and the European Union. Key transport mode of present and future is railway. Railway has following advantages: (1) reduction of transit time, (2) reduction of transport costs vs. air transport, (3) reduction of CO2 emissions, and (4) option for full and less than container services. With the further development of economic centers in European Union and China, there is a growing demand for transport services due to the increased need for trade, railway transport with all its advantages has become a very good alternative to maritime transport because it offers faster transport service. It can be concluded that it is located between air and maritime transport because it is cheaper than air and faster than maritime transport. An analysis of the number of transported containers and the number of trains running between the European Union and China shows an increase in the transport of goods. The increase in the transport of containers by railway means that the service offered by railway operators is of high quality and financially acceptable. Of course, there are some future challenges to optimise the whole transport chain. Most important are technical and organisational obstacles. These challenges can be tackled at different levels. Technical challenges can resolve using an innovative technology solution that solves interoperability issues. Organisational challenges can be solved by introducing Electronic Data Interchange (EDI) to communicate with all custom officials on the whole route and using CIM/SMGS consignment notes. For sure, with the increasing of transport goods, it will be introduced a new feasible solution that will cope with technical and organisational challenges.

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