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SEVENTH FRAMEWORK PROGRAMME
THEME 7
Transport including Aeronautics

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1. Introduction

From the antiquity until today the Trans-Eurasian land bridge networks have contributed to the exchange of goods and ideas, and to the economic growth of Europe and Asia. Today, Asia is one of the world's largest geo-economic hubs and Europe places particular emphasis on trade relationships with it. The New Silk Road, as the Eurasian land bridge is often called, provides a land-based option for moving freight between the Pacific ports of Russian Far East and China, countries of Central Asia like Kazakhstan and European industrial centres. Under certain conditions, use of rail routes may comprise a noteworthy alternative to maritime and air transport. This document examines the current good practices on the Europe – Asia railway corridors, the problems hindering their further growth, and the actions and measures to be taken to improve their performance.

The review of relevant transport policies and strategies indicates that investment in railway infrastructure and efficient Europe-Asia rail operations is of high priority on the political agendas of the European Union, Russia, China and Kazakhstan to mention the most important ones. All countries along the railway corridors have signed bilateral and multilateral agreements on railway transport, providing a legal basis and an operational framework for cooperation. One of the major challenges will therefore be to push forward a legal and operational harmonisation.

To assess the market potential and development strategies, several railway corridors have been examined in the framework of the NEAR^2 Project, including: Western Europe to the Russian Far East and Japan; Western Europe to China via the Trans-Siberian route and its branches, including the Manchurian route, the Trans Kazakh route, and the Mongolian route; Western Europe to China via the TRACECA corridor branches, including the Turkmenbashi and the Aktau route; Western Europe to China via the Central Corridor in Kazakhstan; and Western Europe to India via the Trans-Asian railway route. Several of these routes are currently operational and others are under development with several projects currently underway for the purpose of completing missing links and connecting existing lines.

2. Good practices in Euro-Asian transport

Trade between Europe and Asia is a significant source of income for both regions and hence for several of the countries located therein. Trade volumes increased even during the recession due to the rise of specific economies in Asia, mainly India and China. The majority of trade volume is transported by sea. Several factors, however, including congestion in ports, escalating fuel costs leading to slowing down of ships (slow steaming), as well as security reasons (piracy) are said to have led several companies to search for alternatives. For Chinese ports in particular, it has been reported that the use of their 2012 capacity reached 125% for Shanghai, 120% for Guangzhou and 107% for Qingdao [1]. The rise in fuel price in the past has affected air transport as well, leading to an increase in the already high freight transport prices. Air transport remains an ideal solution for high-value, time-sensitive products, but it is not a good option for larger sized products.

Within this environment railways have become a viable alternative to maritime and air transport, parenthetically taking us back in a way to when the use of railways in the trans-Eurasian area was a very popular solution during the latter part of the 19th century and early to mid-20th century. Several major shippers already use the Trans-Eurasian railway corridors for the provision of their services and transportation of their products. Key factors to opt for the land bridge corridors include the overall cost and travel time, security, reliability of service, comprehensiveness of service and availability of real time information on the location of the freight consignment or container (tracking and tracing). The sections that

follow provide information on existing use of corridors for rail services by service providers and major shippers.

2.1 Service providers in the Trans-Eurasian railway corridors

COSCO Logistics

COSCO Logistics, the largest 3PL in China uses the routes shown in the figure below:

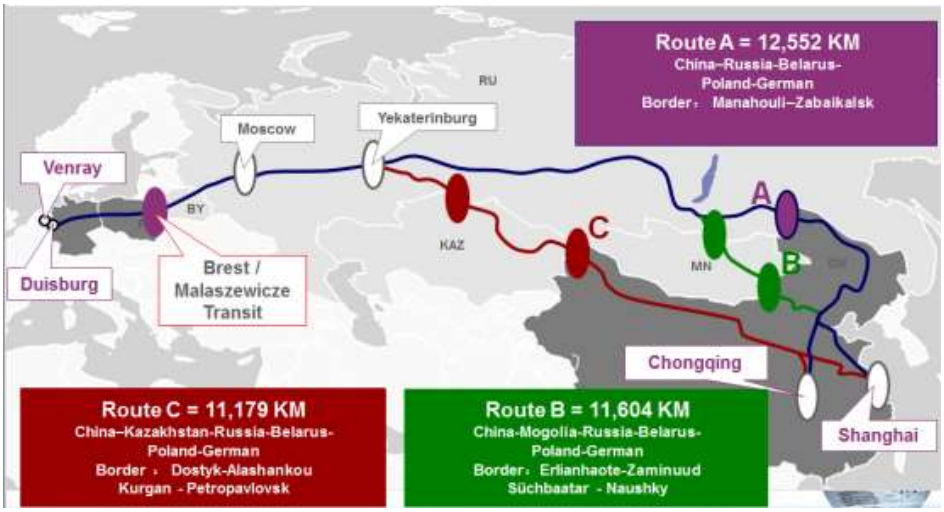

Figure 1: Trans-Eurasian railway corridors used by COSCO Logistics [2]

The commodities transported include equipment, tools and building materials for cement production, electrical power station equipment including capacitor set, capacitor voltage transformer substation, and monitoring system and finally well drilling, logging, and well cementation for Kazakhstan oil fields. Currently, COSCO is examining other options with combination of sea and rail transport for transportation between China and Europe. One of the options is for the cargo to enter Europe through the port of Piraeus in Greece and then be transported by rail to central and northern Europe.

DHL

Since 2011, DHL has been running a daily intermodal service from Shanghai to Moscow via the Trans-Siberian Railway [3]. A weekly express freight train service was launched in 2013 from Chengdu in western China, across Kazakhstan to its cargo port in Poland and then in Russia and Belarus by truck or train [4], with travel time of 12-14 days [5]. The transported products are mainly electronics, machinery, pharmaceuticals and chemicals [6].

In January 2014 the company introduced the first temperature-controlled rail container service between China and Europe on a year-round basis [7]. In March 2014, DHL Global Forwarding announced the development of rail-based forwarding services on the China-Europe route via a new joint venture called United Transport and Logistics Company (UTLC) [8], which plans to operate door-to-door delivery times of 21 days [8].

In April 2014 the first container train with goods from Suzhou arrived in Warsaw in 13 days [9]. In September 2014 a new weekly block train service on this route was announced [10]. The company recognised the challenge of rail freight growth between Asia and Europe

through successful strategic partnerships and through the improvement of rail forwarding services on the China - Europe - China route with one-stop and one-price service [11].

DB Schenker

In 1973 the company started providing rail services through the Eurasian land bridge by running the first container along the Trans-Siberian railway route [12]. In 2008 the first train with goods between Beijing and Hamburg was launched [12] and in the beginning of 2009 a weekly regular service between Shanghai and Beijing with Hamburg, Nuremberg and Duisburg was offered [13]. The products transported are mainly from the automotive industry, chemical industry and manufactures of household goods [13]. In 2009 in cooperation with the Russian Railways (RZD), DB Schenker Logistics established the Trans Eurasia Logistics GmbH.

DB Schenker operates also in the Northern rail route from Shanghai to Moscow and then to Duisburg through the Trans-Siberian line with a transit time of 18-20 days [14]. In September of 2011 a regular train service began to operate for BMW on the route from Leipzig to Shenyang (eastbound) [15]. In November, a daily container train service was launched for this destination exclusively for BMW for automotive components [16]. From 2012 the company offers a weekly service from Chongqing to Duisburg for IT customers. The transport time for a block train to reach its destination in Duisburg is 18 days. Further to this service, in September 2014 the first freight train run from Hamburg to Zhengzhou in China. The duration of the journey is around 17 days and is about 20 days faster than by sea [17].

Samskip Van Dieren Multimodal

Samskip Van Dieren Multimodal, one of the larger multimodal container transport and logistics companies in Europe [18], announced in September 2014 its plan to start a new rail freight service during 2015 to connect the port of Riga in Latvia with China [19]. The plan is to operate 4-6/week with automotive components and IT products [19].

KTZ Express

KTZ Express, established in 2013 [20] and being the national multimodal transport and logistics company of Kazakhstan Railways (KTZ) provides rail freight services that take 16 days through Kazakhstan territory, twice or thrice less compared to sea shipping [21]. The products transported are pharmaceuticals, farm produce and electronics with a focus on electronic companies that have their plants in Chongqing or to their suppliers such as Foxconn Technology for Apple Inc and Acer Inc. [22]. Industries such as Hewlett Packard and Toyota Tsusho already use this rail route [22]. There is also an interest from Europe for dedicated block train services to Asia for products such as fruit and automotive parts [23]. In October 2014, the company plans a new rail freight service from Shenzhen, Guangzhou, Wuhan and Xi'an to Europe, announced by the Governments of China and Kazakhstan [23].

Yuxinou (Chongqing) Logistics Co., Ltd

The Yuxinou (Chongqing) Logistics Co., Ltd. provides freight railway services between Asia and Europe [24]. One of the main services is the Yuxinou train which travels from China via Kazakhstan, Russia, Belarus and Poland to Germany with travel time 16 days. It's one of the weekly services leaving the industrial hub of Chongqing and having as customer electronic companies such as Hewlett-Packard Co., Acer Inc., Apple Inc. and supplier Foxconn Technology Co [25].

The Far East Land Bridge Ltd

The Far East Land Bridge is one of the first logistic companies, which provided railway services between Europe and Asia and has its base in Vienna, Austria. In 2007 they started providing two-way container rail services via the Trans-Siberian Railway route and European

and Chinese rail networks [26]. The main customers of the company are industries such as BMW, Audi, Volkswagen and Samsung [27].

Weiss-Röhlig

Weiss-Röhlig, a logistic operator established by two freight forwarding companies (Röhlig & Co. Holding GmbH & Co. KG and Gebrüder Weiss GmbH) [28] started providing in March 2011 a Trans-Siberian rail service to link the Russian Far East with the economic centres in Europe and in Central Asia. Major customers for this rail service to Europe are electronics companies including Apple Inc., Foxconn Technology Co. and Acer Inc.

2.2 Major Shippers in the Trans-Eurasian railway corridors

Hewlett-Packard Company

Over the last two decades HP increased its supply chains from China, largely through maritime trade to the Netherlands. During the last couple of years a significant number of workers in manufacturing in China moved to the East Coast from the mainland and hence HP has located manufacturing facilities inland and using mainly air transport to the west and rail transport to the east coast ports for maritime transport to Europe. HP is currently using the 'Southern route' from inland China to Kazakhstan, Belarus, and Poland. This was a single-track line, without an existing service. From July 2012 on, after a relevant agreement was signed, a customs zone facilitating trade was established and HP could have a non-stop train in transit. HP requested and obtained government support from China, Russia and Kazakhstan, based on the principle that infrastructure development drives economic growth.

Currently the company operates 2-3 trains per week to Duisburg, Germany and service takes 22 days door-to-door, from manufacturing site to distribution centre or customer (container yard to container yard is reported as 16-18 day). The goal is to move soon to daily service of multi-user block train. Electronic products are mostly moved from China to Europe, whereas, from the EU to China there is interest to move automotive components, finished products (cars), pharmaceuticals, chemicals and food (including frozen foods).

Fujitsu Siemens Computers Company

In 2008, Fujitsu Siemens Computers Company ran, in cooperation with DB Schenker, a block train through the Eurasian land bridge to transport IT products directly from China to Germany. DB Schenker collaborated with Russian Railways RZD and Chinese Railways. The company was the first IT company in the world to transport IT products across the Trans-Eurasian land bridge [29]. The container train started from Xiangtan and after a 17-day journey it arrived in Hamburg. The train is called "the Green IT Train" [30] due to the 95 % percent lower CO2 emissions compared to the same service by air freight.

Automotive industry

In 2008 Mazda Motor Corporation became the first Japanese automaker to use the Trans-Siberian railway route to transport its products directly from Japan to Moscow [31], in order to quickly transport the various car models in to the growing market of Russia. It took the cars 20 days after production to reach Moscow on a block train [31]. BMW, Audi and Volkswagen use rail to transport auto parts produced in Germany east to their assembly plants in China. BMW alone sends 3-7 trains a week from Leipzig to China, transporting car parts for its assembly plant in Shenyang, through Siberia in 18 days [32].

In 2002, an integrated container train service started, operating from the Czech Republic in the direction of Mlada-Boleslav and from Slovakia in the direction of Velka Ida – Kaluga, through Poland and Belarus and finally to Kaluga in the Russian Federation. The service

delivers disassembled VW and SKODA cars to an assembly plant. Finally, 140 Peugeot cars are taken every day from Sochaux and Mulhouse and 60 from Zeebrugge (Belgium) to Vesoul disassembled (a practice known as knocked-down export or KDX). The operations described above, as well as other companies operating in the Trans-Eurasian corridors are shown in Figure 2:

Figure 2: Companies operating in the Trans-Eurasian railway corridors [33]

3. Existing problems, bottlenecks and corresponding solutions

The significant potential of the Trans-Eurasian railway corridors is undisputable; there are however several issues and bottlenecks that need to be addressed in order to make railways a competitive intermodal alternative to air and maritime transport. The information summarized below is based on the 10 Concept Documents that have been formulated within the context of the NEAR^2 project (www.near2-project.eu) and input from experts provided during the three project workshops and the Final Conference. Policy issues, problems related to border crossings, interoperability and missing links, safety and security, operational and environmental issues are examined.

Policy Issues

Currently, most of the railway companies in Europe and Asia are state-owned or state-controlled. Liberalisation of the railways may mean splitting up freight and passenger operations, and infrastructure activities and operations. According to experts, the liberalisation of the railways could lead to simplified general transportation conditions, significant reductions in rail freight rates (between 40-70%), reduced railway transit time periods and operation of cheaper, faster and flexible rail maintenance companies [34].

Regarding regulatory issues, the need to harmonise border-crossings, customs, safety, security and maintenance requirements are noted. These issues need to be resolved, in addition to the ownership related ones, to achieve cost-effective and competitive railway transport in the Trans-Eurasian corridors. The most important advantage deriving from the liberalisation of the railways relates to the attraction of private investments and the reduction of dependency on public funds, which is necessary for the construction of missing links and the achievement of interoperability. Moreover, by going from public to privately owned infrastructure, the tax base increases as this becomes taxable infrastructure, which is a significant revenue stream for municipalities, provinces, etc. In addition, private operations increase the revenue stream from fuel tax. Policy reforms are expected to lead to easier market access, resolution of border crossing issues through simplification and speeding up of processes, improved safety and security.

Border Crossing Issues

Border crossings can be divided in two categories: conventional border crossings, where the bordering network has the same track gauge, and non-conventional border crossings, where different track gauges exist, further complicating the process. Border crossing delays are reported as the key issue impeding the achievement of competitive travel times, whereas they comprise an issue that cannot be improved only through infrastructure improvements.

As main reasons that lead to cargo detention at borders have mentioned the incorrect execution of carriage and commercial documents, untimely provision of cargo consignment by empty rolling stock, technical and commercial errors, problems of customs processing, malfunctions of infrastructure and problems with regulatory documents.

Another problem related to customs, is the fact that different systems (COTIF, SMGS, SMPS) are used, having as a result the increase in bureaucracy and in the number of the necessary documents that need to be exchanged. Given that the international framework of customs and commerce is changing very rapidly, efficient cooperation between the EU and Asian customs is necessary. To implement a new strategy for the customs' unification, the European Commission has identified four fields of action simplification and rationalisation of legislation, improvement of customs controls, ensuring the efficient services provided to companies and improvement in training and overall international cooperation in the field of customs.

Use of new technologies and practices that facilitate the crossing procedures should be considered, taking into account market needs and specifications. Control systems at border crossing stations should be connected with various data sources, such as data bases of local and interstate authorities, so that all the necessary procedures for the identification and cross checking of information are undertaken directly and on time. According to UIC, implementation of the CIM/SMGS consignment notes and paperless transport are essential for the elimination of administrative delays at borders. Custom controls should be undertaken only at the origin and destination points [35]. A common and concerted attempt must be made for the drastic decrease of border time delay and the simplification of procedures. Several solutions have been proposed and technologies have been developed to address the situation. It rests with the countries and national authorities to decide on whether to cooperate and how to proceed.

Interoperability issues and missing links

Adequate capacity needs to be provided along the railway corridors, from origin to destination. Adequate infrastructure means that there are no missing links and that interoperability is achieved to the highest extent possible. Interoperability of rail services refers to the harmonization of specifications for rolling stock, including motive power, command and control; signalling and telecommunications systems; noise emissions; operational rules; maintenance and repair. Interoperability further implies consistent and common documentation, including bills of lading across the entire network; existence of a common track gauge throughout the whole railway line; common axle load and permitted train length; and most importantly, electrification of all lines with common standard pantographs, dc current standards etc., and clearances for double stack containers. An alternative to full electrification would be to have standard run-through diesel electric motive power for the Trans-Eurasian corridors. The adequate maintenance of the network may also contribute to the achievement of maximum permitted speeds throughout the whole line. A set of interoperability issues along the corridors under study is analysed in the report produced by the NEAR^2 Project Working Group 8 on "Infrastructure and Signalling" [36]. A summary of some key such issues includes the following:

- *Maximum axle load:* Significant incompatibility exists not only between countries, but also between rail segments in the same country. This leads to the

composition of block trains of axle-load equal to or less than the minimum permitted axle-load along the whole line.

- *Maximum train length:* Maximum allowable train length also varies between countries and regions. Critical factors to be addressed to increase train length for the same permitted axle-load include the presence of a steep vertical alignment, the insufficiency of the platform length and station alignment.
- *Track gauge:* Track gauge comprises the basic obstacle in achieving physical interoperability along the Eurasian railway corridors. The available solutions would include either the unification of the rail track gauge or the installation and operation of advanced systems for track gauge change.
- *Track capacity:* Saturated track capacity is observed in several sections along the Trans-Eurasian railway corridors, where the routing of additional trains is not feasible. In such cases, increase in track capacity is needed.
- *Rolling stock static and dynamic gauge (clearance):* The civil engineering structures gauge should allow the safe and non-reduced transit speed of the freight trains.
- *Traction system:* A significant percentage of the railway corridors are not electrified and/or have different power supply systems. Change in traction unit may be required in these cases, according to a proper traction management plan. Alternatively, multiple-current electric traction units could be provided.
- *Signalling system:* The rail infrastructure of each country along Tran-Eurasian corridor includes different railway signalling systems.
- *Maintenance:* Different maintenance systems are in use in various countries.

Safety and Security issues

In some countries, and especially in Europe, progress is underway to improve safety while ensuring faster trains. A variety of national signalling systems led to the development of the European Rail Traffic Management System (ERTMS) that consists of control-command, signalling and voice and data communication. Similar steps need to be taken in Asian parts of the corridors, to ensure safety and security. Some of the potential measures that could be taken to increase safety and security include harmonisation of safety requirements, rules and standards, devising Common Safety Methods (CSM) and Common Safety Targets (CSTs) to achieve harmonisation of national rules, interoperability, safety certification and vehicle authorisation and finally, safety and security monitoring taking into consideration the human factor.

Operational issues

One of the major problems in operations currently conducted in the Trans-Eurasian railway corridors is the empty container return, which is due to the trade imbalance between regions. China accounts for more than 90% of the global production of containers, which is the outcome of several factors, particularly its export-oriented economy. Once produced, a new container is moved to a facility for an export activity (factory or distribution centre) [37] upon completion of which it will have to be repositioned empty. It is expected that trade imbalance will decrease in the future with more products moving from EU to Russia, China and other Asian countries. Partial switching of automobile imports from EU to Russia and CIS, for example, is possible. There is also the possibility of involvement of domestic flows of Russia and CIS, as the major cargo flows go east [33]. According to the Deputy General Director of JSC TransContainer (Russia), by combining cargo flows, the unbalanced transit cargo flows between China and EU can be reduced to 12-15 %.

Apart from the empty returns, there are other operational aspects that should be taken into consideration to improve the efficiency of the Trans-Eurasian railway corridors [35]:

- *Transport Time:* Time is the key advantage of rail compared to maritime transport. Priority should be given to reliability/predictability rather than to the decrease of overall travel time by 1 or 2 days.
- *Reliability* is considered as a key factor by shippers and customers as it allows price premiums if time-sensitive or production-critical materials/goods bear high opportunity costs.
- *Target Markets:* Rail generates high benefits in hinterland areas for high-value goods and it should optimize its product offerings for these interfaces (continental consolidation points). More balanced traffic or combining shorter eastbound traffic along the way back to Asia should be considered.
- *Pricing*: Rail can compete with a comprehensive price view; D2D, working capital, lead-time. Working capital savings, time-to-market and built-to-order benefits allow for a price premium, but are highly dependent on fast and reliable transport times. Setting up a stable "through rate" and guaranteeing it for 5-7 years could increase the attractiveness of the corridors.
- Frequency/Flexibility: Unpredictable frequency reduces the attractiveness of rail. The availability of a regular service is considered an entry condition for many customers. Target frequency should be at least 1-2 departures per week, ideally more than 3.

Rolling stock issues

Rolling stock, as the carrier of passengers and goods transport and the basic component of the railway transportation system, is one of the main issues that should be examined in the process of improving the competitiveness and operating efficiency of the Eurasian land corridors. Achieving interoperability of rolling stock is essential for the improvement and growth of the Trans-Eurasian railway networks.

Environmental issues

A modal shift towards railways can contribute to meeting EU targets on climate protection and reducing greenhouse gas emissions. A stronger role for rail would help to achieve real progress towards the 2020 target of a 20% cut in the EU's greenhouse gas emissions [38].

It is essential that railway companies along the corridors take all the necessary steps and measures to sustain this important "asset". Some of these measures are [39] the reduction of polluting agent emissions to the atmosphere from static sources by 20%; the elimination of sewage water dump without purification; the increase up to 40% of the level of usage of wastes as a source of secondary materials and energy resources; the increase of water circulation up to 75%; the use of wooden ties, saturated only with environmentally-friendly preservative substances of hazard class 4; the reduction of noise impact on the environment by laying continuous welded rail, using rail fastenings of new design, rail grinding, forestation, building noise screens; the shore protection activities near railway lines in specially protected natural territories (Black Sea shore, Baykal lake); the environmental control activities using automated management systems (such as Ecologiya) and the environment conservation activities based on the Environment Conservation Centres' activities.

Another very important aspect is the impact of weather conditions. A freight train travelling between Europe and Asia crosses several countries with very different climate conditions. The responsibility of tackling problems caused to the railway network due to severe weather conditions lies with the national authority or company using and managing the specific network. The fact, however, that these problems could cause important increases in the overall travel time, leads to the conclusion that the impacts of weather conditions should be investigated in an integrated manner and for the whole corridor.

General remarks on existing problems and relevant solutions

Most of the noted problems are not unique to the study corridors; the great length of the Euro-Asian rail corridors, the large number of countries involved and other unique elements of these rail networks, however, make the identification of solutions to these problems more demanding. In an attempt to summarize the most important of these problems one could mention the following:

- Regulation, competition and open access to the railway: The opening of the market could attract private investment, supporting in this way the solution of some of the above noted problems;
- Border crossing issues: major delays in railway operations across the trans-Eurasian land bridge occur due to delays at borders.
- Harmonization of freight documents: this comes hand in hand with the previous issue, creating equally significant delays.
- Achievement of interoperability: the seamless running of trains could reduce to a large extent the already competitive travel times of the railways.
- Operational issues having to do with empty runs.

Railway travel time may be affected by various other issues as well, including isolation, adverse climatic conditions, inhospitable terrain, challenging railway conditions and most importantly, ongoing wars and/or disputes between countries. These conditions may lead to disruptions in the network and hence significant increase in travel time and transportation costs.

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