22nd Cambridge International Manufacturing Symposium
University of Cambridge, 27 – 28 September 2018

Development of Asian Landbridge from Finland: Current State and Future Prospects

Olli-Pekka Hilmola [a], Ville Henttu [b] and Yulia Panova [c]

[a] Lappeenranta University of Technology, Kouvola Unit, Prikaatintie 9, FIN-45100 Kouvola, Finland, Fax: +358 5 344 4009, E-mail: olli-pekka.hilmola@lut.fi
[b] South-Eastern Finland University of Applied Sciences, Pääskysentie 1, FIN-48220 Kotka, Finland, E-mail: ville.henttu@xamk.fi
[c] Department of E-Commerce, Luoyang Normal University, 6 Jiqing Rd., Yi Bin District, Luoyang City, Henan Province, China, E-mail: panovayulia87@gmail.com

Abstract

Purpose

Finland has decades long history in railway transports using the Russian Trans-Siberian Railway (TSR). In 2004, Asian landbridge volumes increased to 124,000 TEUs per annum, and container balance was rather good in both directions. This favourable situation changed drastically in a short amount of time with Russian tariff increases, and volumes nearly completely disappeared. The situation was nearly such until China, in collaboration with Kazakhstan, started to implement ambitious "One Belt and One Road Initiative" (in 2015-2016).

Design/methodology/approach

Research combines qualitative and quantitative data, and it is case based (Ellram, 1996; Voss et al., 2002; Eisenhardt & Graebner, 2007). However, it has some action research features due to the background of the authors (being part of development programs, committees and research works).

Findings

Based on the initial experiences, the new route through Kazakhstan (instead of going through the entire TSR/Russia) to China provides shorter lead time, a better catchment area of consumers in China, and also supply chain cost advantage. There are currently higher cargo volumes from Finland to China than to the opposite direction (actually, there are trains leaving Finland full of forest industry products, and returning nearly empty back). Furthermore, connecting other North European countries is a great challenge, since reaching Sweden, Denmark and Norway would require short sea shipping and road transports, and eventually leading to some sort of cost disadvantage. However, these other North European countries are currently out of belt and road connection, but have significant trade volumes with China.

Research limitations/implications

Empirical examination is based on the experience of authors, and material gathered during the years. It is of course limited to Northern Europe, and Finland. Another important direction for railway landbridge development has been that of connecting Poland/Germany (and UK) with China. This alternative has developed significantly in the recent years, but our study does not concern this progress.

Practical implications
Eurasian economies are connected nowadays in trade by sea (long lead time with low cost) and air (short lead time with high cost) transportation modes. However, land based modes are available and developing rapidly (both moderate lead time and cost). This has implications to future supply chains as the distance from Northern Europe to eastern end of Kazakhstan is nearly the same as to the southern end of Spain. These new connections do not only offer lead time advantage (inventory holding and price erosion lower), but show cost efficiency and quality too.

Social implications
Eurasia has huge opportunity to develop as a more integrated single market, and this will impact the lives and prosperity of the numerous people in the region. For Europe, this means more growth opportunities in a trade with Asia, and particularly emerging areas of China.

Original/value
Research is one of the seminal works after the implementation of Belt and Road Initiative in Northern Europe. It is also one of the initial works analysing direct railway connection to China from Northern Europe, instead of using only TSR/entire Russia connection (and sea ports as well as third countries such as South Korea).

Keywords: Landbridge, railways, Asia, China, Finland, Kazakhstan

1. Introduction

In Europe, all seashore-owning countries are keen to develop their sea port infrastructure, and add more capacity to serve internal EU-trade, but also continental trade needs. Sea transport together with inland waterways accounts for more than one third of intra-EU trade, and three fourths of external EU-trade (European Commission, 2017). Even smaller North European countries have numerous sea ports. For example, in both Sweden (Trafa, 2017) and Finland (Finnish Transport Agency, 2017) the total amount of sea ports is approx. 45-50, and at least half of these are open around the year. However, both of these countries have also hinterland access using roads and railways to reach destinations in short, medium and long range. Due to historical reasons, politics and policies, higher costs, different technological standards (making barriers in product flow) and lack of multinational railway companies, Europe has not been that well connected to Asia using hinterland connection. Actually, just looking Eurasian map, it would be natural to transport by using railway landbridge products between Europe and Asia. However, this is still marginal phenomenon. Continental trade is dominated by sea transports as in 2017 it was estimated that 23.1 mill. TEU containers were transported by deep-sea option (United Nations, 2017), while transit transports of Trans-Siberian Railway in 2016 was at the level of a little bit over 0.1 mill. TEU (overall international container volumes at TSR in year 2016 were somewhat below 0.8 mill. TEU; Coordinating Council on Trans-Siberian Transportation, 2018). For the entire logistics branch, it is difficult to think that this modus operandi is properly challenged or even changed (forthcoming global sulphur regulation at seas in 2020 will be one potential catalyst; Hilmola, 2019). Situation is, however, different in North

America. Quite a significant part of the East coast transport volume from Asia is transported by road or rail (U.S. Department of Transport, 2017). If Eurasia is more economically integrated, peaceful, and cost competitive in hinterland transports, particularly using railways, development can resemble that of North America. Sea transport is still needed in this new situation, and sea ports do hold relevance, but the overall configuration shall change a lot, and volumes will concentrate more on certain points and corridors. In this regard, Northern Europe holds importance as reaching e.g. China is shorter and technically more convenient (e.g. railway system shares similarities due to old Soviet and Russian standards). It is so that Finland (Hilletofth et al., 2007; Panova et al., 2017) and all Baltic States (Bulis & Skapars, 2013 & 2014; Hilmola & Henttu, 2015) can act in the future as important access-points to China. Of course, it is natural that Central Europe has its own access-points too (Verny & Grigentin, 2009; Rodemann & Templar, 2014; Moon et al., 2015). Currently this northern point is just concept and opportunity, but could turn as a reality within a short amount of time. It is notable that Baltic States, Kazakhstan and other former Soviet era railway countries do have accustomed to serve transit traffic, however, reforms in railway sector in these countries remains as slowly progressing (Pittman, 2013).

Research problem of this work is related to railway transports use in Eurasian continent, and particularly in respect of Finland (Northern Europe) and Asia. Although, North European population is not significant and consumer market is limited, the distance e.g. from Finland to Asia is rather competitive as comparing the alternative of Central Europe. Situation is similar in the airline industry, where Finnish Finnair has been enjoying in recent years surge of Chinese customers due to the most lead time competitive routes to/from China. Following questions are tried to be answered: “How and by whom railway landbridge has been used?”, “Why railway landbridge routes have changed over the years?”, and “What are the likely development trends in the future?”.

This research is structured as follows: In Section 2 we present research methodology of this study. Thereafter, in Section 3 is reported empirical findings of belt and road initiative between Finland and Asia – some comparison is made to an earlier Trans-Siberian era. Finally, Section 4 concludes and discusses completed work, and suggests avenues for further research.

2. Research Methodology

Asian landbridge has been on the use and under development for decades, and it was extensively used by Finnish export industries and logistics service sector in the early 2000s, until the demand collapse of year 2006. Thereafter, its relevance has only year by year increased, as developing nations, headed by China, have become the factory of the world. In logistics sense, developing countries already dominate the statistics (like container and raw material handling). Most of the population in the world lives in Eurasia, and from future economic growth, most of the wealth creation is completed in this geographical area.

Research subject, Asian landbridge, is mostly being examined from second-hand statistics, public documentation, and annual report perspective. Analysis concerns here merely "one belt and one road" initiative era. Authors of this research work have been part of development programs, committees and research works concerning Asian landbridge (in Finland and Russia). However, in order to provide an unbiased perspective, we have used numerous public records (magazine and newspaper articles, together with annual reports), and second-hand statistics to report the development during the years. Research combines qualitative and quantitative data, and it is case based (Ellram, 1996; Voss et al., 2002; Eisenhardt & Graebner, 2007). However, it has some action research features due to the mentioned background of authors. Research work is a single case study. Documentation and statistics of this work has been gathered during the years, and this research work is merely a compilation of all the data and knowledge regarding this matter. We are focusing on the following only to belt and road initiative era, but some comparison is made to earlier Trans-Siberian high volume era.

Table 1 Three main routes reaching Asia from Finland (Kouvola) using railway landbridge.

Route	**Length (km)**	**Lead Time**	**Main Markets**
1. Trans-Siberian Railway (TSR) to Nakhodka / Vladivostok	9960 km	21 days	• Japan • South Korea • North of China
2. Combining TSR and Kazakhstan railways to reach Xi'an, China	8473 km	12-16 days	• Western, Central and East of China
3. Combining TSR and Mongolian railways to reach Tianjin, China	8417 km	16 days	• North and North-East of China

There are, of course, number of hinterland railway transport options to reach Asia from Northern Europe, and Table 1 compiles three of them regarding the interests of our study, railway landbridge starting from Finland. For longest and still highest volume usage (at peak somewhat above 124,000 TEU in 2004), landbridge implemented through the entire Russia and Trans-Siberian Railway (TSR) connection is the first option in Table 1. Most of this high volume was being transit originating from South Korea to Finland; electronics shipments simply arrived to Finland to be further processed, delivered and custom registered to Russia (Tsuji, 2007; Finnish Railways, 2005).

First route was used in the late 1990's and early 2000 to connect Northern Europe with such economies as Japan, and South Korea. Length to reach Nakhodka (or Vladivostok) is nearly

10,000 km, and it is not the end in this journey as final connectivity to Japan or South Korea requires sea transportation. Therefore, in lead time terms classical TSR connection is not particularly good – it will lose as intermodality becomes to the picture, and its performance in the end is dependent on the interface between the railway and sea transport. Two other options on Table 1 are railway only – reaching cities in China. Length of these alternative landbridge routes is shorter, on railway distance around 1500 km (or 15 %), however, if sea transportation of classical TSR is included in the route length of the first option, then difference is around 2500 km (or two latter options are 23 % shorter). What is a weakness in these shorter options, is the need to transship containers at the border of China. Railway gauge width in China is standard gauge of 1435 mm as in Russia and former Soviet Union countries it is 1520 mm. Gauge width in Finland follows Soviet standard, but it is somewhat different (1524 mm), however, this does not lead to any transshipment needs, and trains can continue without any technical interruptions between Finland and Russia. Direct options to China offer lead time performance, what is clearly better than the first option, and over performs e.g. against sea transports of containers.

Earlier Japan was the growth engine of Asia, and it developed through production and export based country as a high-end consumption place. Of course, currently it is well known that Japanese economic growth is having significant problems as population is shrinking, and ageing. In addition, export-based model does not work so well any longer as salaries and costs have increased as compared to other competing countries. Situation is not so bleak in South Korea, but in the size of the economy, it is smaller country, and has limitations in GDP growth as population base is much smaller as compared to Japan or China. Therefore, it could be concluded that classical TSR route and connections to Japan and South Korea are less significant today than what they were in the 90's. In addition, the importance of direct connectivity to China via railways have increased as population base is huge, GDP is still growing and GDP is already 76 % higher (year 2016 data in USD terms) than what is combined GDP of Japan and South Korea.

3. Empirical Case: Asian Landbridge Development from Finnish Perspective

Rail freight transportation between Europe and Asia is not a new invention as has been described in the earlier research (Hilletofth et al., 2007; Panova et al., 2017). The current era between EU and Asia started in 2011, when the first rail freight connection was established between Germany (Duisburg) and China (Chongqing) (Seo et al., 2017). The volume of international rail freight transportation between Europe and China has increased in general during the last years after the first train connection trial. According to KTZ Express JSC (2017), around 100,000 TEU were transported through Kazakhstan as a transit between Europe and China during the year 2016. However, if the total transportation between Europe and China is examined, it is estimated that there were around 310 trains transporting freight between Europe and China during the year 2014, 820 in 2015 and approximately 1,700 in 2017 (Khorgos

Gateway, 2018; OSJD, 2016; Think Railways, 2017). Same source estimates that the volume could rise up to one million TEU in year 2020.

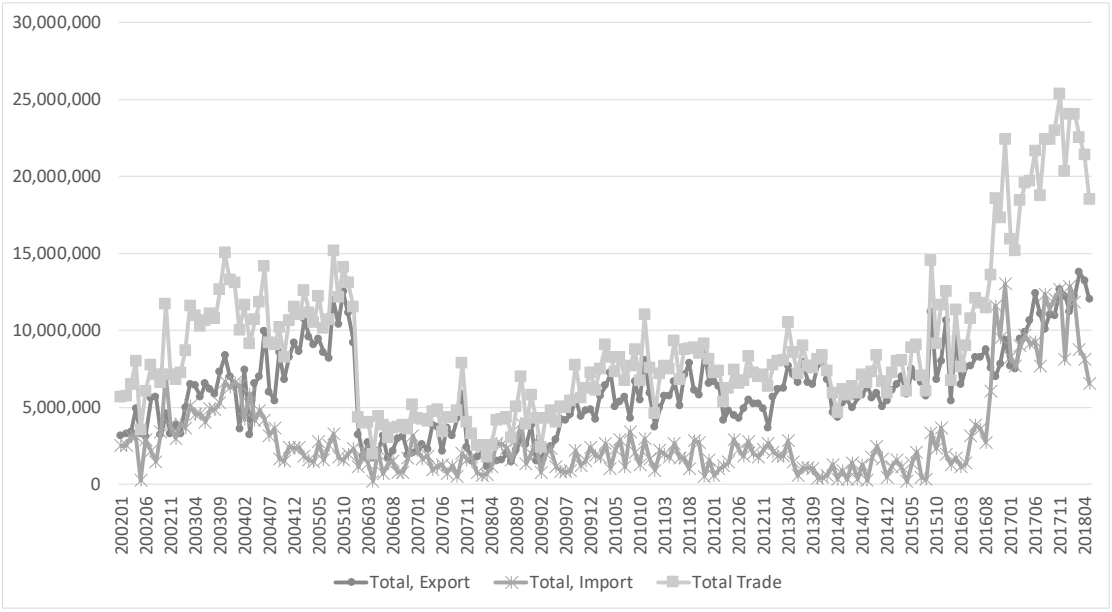

Figure 1 Monthly container based international (all countries in total) railway transport to and from Finland during period of Jan.2002 to May.2018 (excludes transit; y-axis in kg). Source: Finnish Customs (2018)

The international Finnish import and export rail freight transportation (do note that transit is excluded) has developed rather positively after the worst years (2006-2008) as can be seen from Figure 1. Total volume of the international railway freight transport has already exceeded the earlier record years of 2003-2005. Majority of the international rail freight transport takes place between Finland and Russia, and the main export group consists of chemicals and related products, whereas the main import group consists of crude materials excluding fuels. The main export group to China is crude materials (excluding fuels), which includes pulp products. The main import groups are machinery, transport equipment and not classified finished products. However, the export plays at rails significantly larger role between Finland and China, since the volume of railway container based import to Finland has been almost 70-80 times less than the export. Export containers by railway from Finland to China already equals container-based export using railways to Russia. (Finnish Customs, 2018)

One promising export cargo type from Finland by rail transport and containers is pulp, which has increased both its production and export volume in Finland during the time window of 2009-2017. The total chemical pulp production was circa 7.5 million tons in Finland in 2016, and around 3.2 million tons were exported from Finland. Furthermore, China is the main pulp export country for Finland with approximately 33 % market share during the year of 2016 (Germany is second with about 18 % market share). In addition to sea transport, the pulp has

also been transported by rail from Finland to China. (Finnish Forest Industries, 2018; Lundén, 2017)

3.1. China-Finland Trans-Kazakhstan rail freight corridor development before the first actual train

The authors of this article have followed the development of the rail freight corridors closely. They have also influenced in the development of the Finland-China rail freight connection through various academic and professional statements, meetings, visits etc. The Finnish-Chinese freight train connection is using the Trans-Kazakhstan railway route, i.e. the route, which aligns through Russia and Kazakhstan.

The first freight train between Kouvola, Finland and Xi'an, China started its journey in November of 2017. However, planning and development of the train connection started already during 2013. Connection has been mainly planned, developed and established in Finland by Kouvola Innovation (a City of Kouvola owned regional development company) and City of Kouvola. The process was started by contacting suitable companies, which could have freight export or import with China, i.e. the demand for the corridor was first estimated. The demand seemed to be in place, and thus the planning was decided to proceed further. Next step was to have meetings with suitable geographical locations along the possible route. As soon as the suitable locations were found and contacted multiple times, letters of intent were signed with the high level representatives from the selected locations, which were Kaluga near of Moscow in Russia, Khorgos in Kazakhstan side near the Kazakhstan-China border and both Zhengzhou and Xi'an in China. The multinational route was seen both as challenging due to multiple border-crossings and bureaucracy along with that, but also beneficial, since multiple countries are involved, which decreases the risk of excessive decision-making power of one country. During the years bureaucracy eased as Eurasian Union was implemented, and customs formalities were present only in Finnish-Russian border and Kazakhstan-Chinese border.

3.2. One Belt and One Road (OBOR) Initiative and Trans-European Transport Networks (TEN-T)

The Finnish-Chinese route is part of the OBOR initiative (China – Central Asia – Russia – Europe leg to be more specific). The new plan is to invest approximately 900 billion dollars (makes total of 1.8 trillion USD with old programme) to different investment projects around the world to improve the connectivity between China and the rest of the world (Phillips, 2017). The benefit for the end-user is the fact that the initiative subsidizes transportation costs for the whole transportation leg (not only for the transportation on the Chinese soil). Furthermore, being part of the OBOR strengthens the possibility of the route to increase its volume and investments in the future.

Furthermore, City of Kouvola, Finland is part of one of the core corridors of the Trans-European Transport Networks (TEN-T). Kouvola is the only inland terminal location (Rail Road Terminal, RRT), which is marked on the core network corridor (Scandinavian-Mediterranean) in Finland. It is also only access-point in TEN-T network map to east, Russia and eventually China (Poland of course has development area access to Belorussia). EU has directed part of its investment funds towards the core network corridors, which in turn strengthens the logistical position of this location. It is also able to apply for funding, which is explicitly directed towards the core network corridors. (European Commission, 2018a) Some funds were received during the implementation period for development and engineering of logistics area (European Commission, 2018b).

3.3. Current state and possible future prospects of the Finland-China landbridge

KTZ Express JSC takes the main responsibility of organizing the transportation between Finland and China. The frequency of the train connection was approximately one train per month in both directions during the last two months of 2017. In addition to the preliminarily agreed freight trains in 2017, an additional freight train full of timber products was exported from Kouvola to China during December of 2017. This sawn wood export train used Mongolian route (instead of Kazakh) to reach its destination, Ganzhou (located in the South-East of China). Most probably these sawn wood deliveries will continue in the future. Thereafter, the frequency of primary connection of Kouvola and Xi'an has been increased first to circa two trains a month in both directions from the start of 2018. There were plans to increase the frequency further to one train per week in both directions during April 2018. Local logistics company has been in charge of the operational processes of the rail connection (in the beginning there were number of companies, but now only one). One train can transport up to 80-100 TEU containers. After April, container train volumes have developed so that there is a weekly train from Finland to China, while to other direction, there have been difficulties to find a cargo, and train has been weekly or bi-weekly.

If the weekly freight train in both directions would have been realized as planned, it would have resulted to about 9,000 TEUs transported during 2018 (now total amount will be somewhat below). The long-term goal is to improve the frequency higher. If there are four weekly trains in both directions for the first six months of 2019, and eight weekly trains in both directions during the last six months of the same year, it would result in about 62,000 TEUs transported during that year. The capacity of the current intermodal terminal in Kouvola is estimated to be around 50,000-60,000 TEU a year (same terminal served TSR traffic at its height in year 2004 as sea port of Hamina was needed to handle rest of the volume; see e.g. Ristimäki, 2004).

During the project execution process have been identified several strengths of the current Finnish location to serve growing Chinese railway landbridge. One of them is that Kouvola region still has competence for material handling and logistics information management of long-distance Asian trains (documents and practices of customs, international railway transport

documentation, and all the related procedures). As this North European connection is being compared to Central Europe, one apparent strength is the better technical connectivity – rail gauge changes only at the Kazakhstan-China border within Khorgos transshipment facilities. At the time of writing this research (and also during the entire 2017), railway connection between China and Central Europe has been greatly congested, because of additional transshipment needed at Polish-Belarussian border (as gauges change) and occurred volume growth. Finally, as major strength remains lead time and price factors. First trial container trains have shown impressive lead time performance of a little bit above 10 days to 15 days. Later on lead time performance has been consistent for trains operating out of Finland to China, while on the other direction some major difficulties have been faced (reported to be related on container handling in China as well as on demand issues from China to Finland). Overall, this lead time performance is much better than what sea transportation can offer from north: It takes from 35 to 45 days to reach China from Finland. It is important to acknowledge that price level is also very competitive currently. Due to Chinese OBOR subsidies along the whole route, the cost of the rail freight transportation is competitive with sea transportation. OBOR subsidizes will be in the force for the forthcoming two or three years, according to the current knowledge. This support is only for the shipments between Finland and China (deliveries to Russia and/or Kazakhstan do not receive any support from this programme).

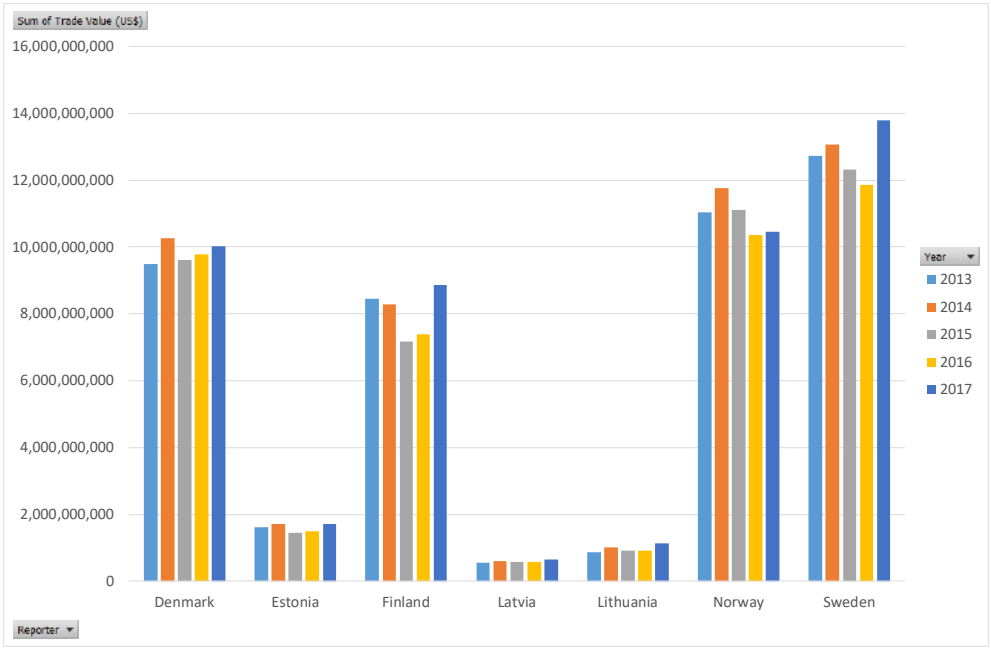

Figure 2 Total trade with China of different North European countries during 2013-2017 (y-axis in USD). Source: Comtrade (2018)

One good opportunity to gain more volume and form weekly trains (particularly from China to Finland) is to develop current connection increasingly to serve the needs of Sweden, Denmark and Norway. As compared to German trade with China, all countries and their total trade in Figure 2 is around 22 % from German-Chinese trade volume. However, these three mentioned

countries (Sweden, Denmark, and Norway) each hold more than 10 bill. USD trade with China. Most potential could be seen in Sweden and Norway from where there has been sustaining interest to utilize new direct connection to China. In Swedish case, transportation would merely be imports of machinery, parts used in metal industry assembly and car products (finished or semi-finished). In Norwegian situation, interest has so far been on fish exports, which is growing volume group to China, yet demanding transport item to be forwarded (due to temperature and quality issues, but also harmful political constraints due to Russian sanctions on food items, even on transit to a third country). Food export is not only constrained in Norwegian situation, but also Finnish companies are still unable to use landbridge e.g. for meat exports (like pork), and they still use long duration deep-sea transports. Until today, also transportation costs within Europe have been so high that Swedish or Norwegian volumes have not found their way to this new route. New environmental demands at Baltic Sea (sulphur and forthcoming nitrogen) and increasing price of oil have not eased these cost pressures.

4. Conclusions

Media and professional magazines are absorbing in large-scale “one belt and one road” project, and its possibilities. It is evident that it will change transportation volumes between Europe and Asia, particularly in direction of China. This will mean more hinterland transport options, instead of using only deep-sea. Progress in recent years regarding to Central Europe, but also in Trans-Siberian Railway and its international container volumes have been positive, and increasing. International volumes at TSR are of course fluctuating annually, and in recent years growth has not been that much present, however, it has been the case in ten and fifteen years perspective.

From the findings of this research work we may state that transportation volume development and evolution between Finland and Asian countries has been turbulent, and having its clear ups and downs. From research work is arising finding, that railways at Eurasian landbridge are functional, and interesting for customers. Previous studies from Moon et al. (2015) also underline that routes utilizing maritime transport alone or in combination with railway, are less competitive than routes, which are fully provided by single transportation mode, railways. However, railways are higher cost transportation mode (Perminova, 2016). As Finnish volumes in the years of 2004-2005 were booming, they were doing so mostly due to the increasing functionality of this route, but also due to the competitive level of railway tariffs (as Russia did not increase tariffs of international transit that greatly, until the year 2006).

Same lower tariff scheme is one major reason, why direct railway traffic from Finland to China has arisen recently. Now it is so that China shall offer the attraction point for costs. However, this is not entirely the case as trains full of forest industry products from Finland were transported without Chinese financial support in years 2015-2016. Volumes have also been increasing all the time, before the year end of 2017, and arrival of financial support. So, there

is a basic need for trade and logistics, which is now only aided further with competitive tariff level.

In earlier boom, it was South Korean transit, which was the reason for the volumes, and they disappeared rather rapidly when the price level changed, and Russia was simultaneously able to offer competitive infrastructure for logistics (warehousing). In this new situation, it could be presumed that volume base is much sustainable as it is arising from population rich country, and basically its hunger for raw materials (forest industry products). Volume growth cannot be assumed to be so steep as in the previous growth wave (years 2000-2005), but it will most probably sustain changes and time much better. Earlier landbridge contained also an intermodal component as sea transportation was needed in the Asian side. This is not anymore the case as the entire transportation task is completed within landbridge by railways.

The use of the railways that connect China with Finland via Central Asia-Russia became preferable in terms of customs and time (Yang and McCarthy, 2013). The current study also showed that the routes that lay via Russia and further through Kazakhstan or Mongolia are competitive due to short lead times. The classical route via Russia (with the use of Trans-Siberian Railway alone) implies longer distance and the necessity to transship cargo at the sea ports that sometimes entails longer lead time than in the direct routes. However, the weakness of the shorter options (with the use Trans-Kazakhstan and Trans-Mongolia Railways) is the break of gauge problem. That is the need to transship cargo at the border with China, because of the different railway gauge in transiting countries (1435 vs. 1520). Despite this fact, both options are favourable for transport goods sensitive to time.

As a further research in the Eurasian landbridge, it would be vital to examine from Finnish perspective the potential of imported items from China to Northern Europe. In this research, it was identified that return journeys of containers are still somewhat challenging in railway container statistics, and also based on initial experiences of Xi'an container trains. China is developing all the time, and especially the urban areas and the manufacturing sector in the middle of China and west are on the agenda. Understanding the dynamics of these is vital for not only volume growth out of the European direction of containers, but also due to the new opportunities for North European products to be delivered for the need of these growing regions.

References

Bulis, A. & Skapars, R. (2013). Development of international freight transit in Latvia. *Procedia – Social and Behavioural Science*, Vol. 99, pp. 57-64.

Bulis, A. & Skapars, R. (2014). Development of "New Silk Road" Northern branch through sea port of Riga in Latvia. *Procedia – Social and Behavioural Science*, Vol. 150. pp. 1222-1229.

Comtrade (2018). UN Comtrade Database. United Nations. Available at URL: https://comtrade.un.org/ Retrieved: 6.July.2018

Coordinating Council on Trans-Siberian Transportation (2018). Statistics. Available at URL: http://icctt.com/mezhdunarodnoe-znachenie Retrieved 18.01.2018.

Eisenhardt, K.M. & M.E. Graebner (2007). Theory building from cases: opportunities and challenges. *Academy of Management Journal*, 50:1, pp. 25-32.

Ellram, L.M. (1996). The use of case study method in logistics research. *Journal of Business Logistics*, 17:2, pp. 93-138.

European Commission (2017). *EU Transport in Figures 2017*. Publications Office of the European Union, Belgium.

European Commission (2018a). Mobility and Transport: Infrastructure - TEN-T - Connecting Europe - Trans-European Transport Network homepage. Available at URL: https://ec.europa.eu/transport/themes/infrastructure_en Retrieved 08.Feb.2018.

European Commission (2018b). INEA – Development of open access and intermodality in the Kouvola rail-road terminal. Available at URL: https://ec.europa.eu/inea/en/connecting-europe-facility/cef-transport/2015-fi-tm-0029-s Retrieved: 2.August.2018

Finnish Customs (2018). ULJAS - Foreign Trade Statistics. Available at URL: http://uljas.tulli.fi/ Retrieved: 31.July.2018

Finnish Forest Industries (2018). Pulp and paper industry. Available at URL: https://www.forestindustries.fi/statistics/pulp-and-paper-industry/ Retrieved 12.Feb.2018.

Finnish Railways (2005). *Annual Report 2004* (in Finnish). Helsinki, Finland.

Finnish Transport Agency (2017). *Statistics on International Shipping*. Statistics from the Finnish Transport Agency 3/2017. Helsinki, Finland.

Hilletofth, P., Lorentz, H, Savolainen, V.V, Hilmola, O.P., and Ivanova, O. (2007). Using Eurasian Landbridge in Logistics Operations: Building knowledge through case studies. *World Review of Intermodal Transportation Research*, 1:2, pp. 183-201.

Hilmola, Olli-Pekka (2019). *The Sulphur Cap in Maritime Supply Chains: Environmental Regulations in European Logistics*. Palgrave Macmillan, Pivot Series. UK.

Hilmola, O-P. & Henttu, V. (2015). Border-crossing constraints, railways and transit transports in Estonia. *Research in Transportation Business & Management*, Vol. 14, pp. 72-79.

Khorgos Gateway (2018). Khorgos Gateway homepage. Available at URL: http://khorgosgateway.com/ Retrieved 8.Feb.2018.

KTZ Express JSC (2017). Development of Continental Transit and Container Service. Available at URL: https://www.kinno.fi/sites/default/files/eng_ktz_express_finland_march_2017_09.03.2017-3.pdf Retrieved 8.Feb.2018.

Lundén, K. (2017). 50 konttia Uimaharjun sellua lähti aamujunassa Kiinaan. Rahtihinta nelinkertainen? (in Finnish, free translation to English: “50 containers of Uimaharju’s pulp were send by freight train to China. Freight price is quadruple?”). *Maaseudun Tulevaisuus*, Finnish newspaper, 22.Nov.2017. Available at URL: http://www.maaseuduntulevaisuus.fi/talous/artikkeli-1.214473 Retrieved 12.Feb.2018.

Moon, D. S., Kim, D. J., and Lee, E. K. (2015). A Study on Competitiveness of Sea Transport by Comparing International Transport Routes between Korea and EU. *The Asian Journal of Shipping and Logistics*, 31:1, pp. 1-20.

OSJD (2016). OSJD and China-Europe Rail Container Transport. Available at URL: http://fiata.com/fileadmin/user_upload/documents/recent_views/Working_Group_UIC_FIATA/UIC-FIATA_Shenzen_12-13_May_2016_Presentation_Dong_Jianmin.pdf Retrieved 8.Feb.2018.

Panova, Y., Korovyakovsky, E. Semerkin, A., Henttu, V., Li, W. & Hilmola, O-P. (2017). Russian Railways on the Eurasian Market: Issue of Sustainability. *European Business Review*, 29:6, pp. 664-679.

Perminova, A.A. (2016). Прогнозирование спроса и оценка конкурентоспособности контейнерных перевозок на железных дорогах России (in Russian, free translation to English: "Forecasting demand and assessing the competitiveness of container transportation on railways of Russia"). Dissertation for the degree of candidate of economic sciences, Moscow, Russia.

Pittman (2013). The freight railways of the former Soviet Union, twenty years on: Reforms lose steam. *Research in Transportation Business & Management*, vol. 6, pp. 99-115.

Rodemann, H., and Templar, S. (2014). The enablers and inhibitors of intermodal rail freight between Asia and Europe. *Journal of Rail Transport Planning & Managemen*t, 4:3, pp. 70-86.

Ristimäki, M. (2004). Elektroniikkaa virtaa idästä ja itään (in Finnish, free translation to English: "*Electronics flows from east to east"*). *Taloussanomat*, 19.April. 2004.

Seo, Y.J., Chen, F. & Roh, S.Y. (2017). Multimodal Transportation: The Case of Laptop from Chongqing in China to Rotterdam in Europe. *The Asian Journal of Shipping and Logistics*, 33:3, pp. 155-165.

Phillips, T. (2017). The $900bn question: What is the Belt and Road initiative? *The Guardian*, 12.May.2017. Available at URL: https://www.theguardian.com/world/2017/may/12/the-900bn-question-what-is-the-belt-and-road-initiative Retrieved: 10.Feb.2018

Think Railways (2017). First China – UK direct rail freight service launched. Available at URL: http://www.think-railways.com/first-china-uk-direct-rail-freight-service-launched/ Retrieved 8.Feb.2018.

Trafa (2017). *Shipping Goods 2016*. Trafik analysis, Statistik 2017:19. Stockholm, Sweden.

Tsuji, H. (2007). International container transport on the Trans-Siberian Railway in 2005-2006: The end of Finland transit and expectations regarding Japanese use. *Erina Report*, vol. 73, pp. 20-30.

United Nations (2017). *Review of Maritime Transport*. Unctad, United Nations. Geneva.

U.S. Department of Transport (2017). *Freight Facts and Figures 2017*. Bureau of Transportation Statistics. USA.

Verny, J., and Grigentin, C. (2009). Container shipping on the Northern Sea Route. *International Journal of Production Economics*, 122:1, pp. 107-117.

Voss, C., Tsikriktsis, N. & Frohlich, M. (2002). Case research in operations management. *International Journal of Operations & Production Management*, 22:2, pp. 195-219.

Yang, J., and McCarthy, P. (2013). Multi-modal transportation investment in Kazakhstan: Planning for trade and economic development in a post-soviet country. *Procedia-social and Behavioral Sciences*, 96:6, pp. 2105-2114.