A Study of a Logistics Transport Chain in the Transport of Selected Commodity from Eastern Europe to China

Studija logističkog transportnog lanca u prijevozu određene robe iz Istočne Europe u Kinu

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Summary

This article deals with a model of a logistics transport chain, which is the result of research for customers of selected commodities. Mineral water producers use sea transport for transporting their products to China nowadays. The Institute of Technology and Business in České Budějovice and the University of Žilina were asked to propose a new optimized logistics chain employing combined transport consisting of road and railway transport.

KEY WORDS

logistic
transport
transport chain
logistics chain
sea transport
railway transport

Sažetak

Članak se bavi modelom logističkog transportnog lanca, a rezultat je istraživanja za kupce određene robe. Danas se proizvođači mineralne vode koriste pomorskim prometom za prijevoz proizvoda u Kinu. Institut za tehnologiju i poslovanje (České Budějovice) i Sveučilište Žilinu zamoljeni su predložiti novi optimalni logistički lanac u kojem se kombinira cestovni i željeznički promet.

KLJUČNE RIJEČI

logistika
transport
transportni lanac
logistički lanac
pomorski promet
željeznički promet

1. INTRODUCTION / *Uvod*

Transport chains involve more types of transport using various means of transport, particularly globally standardized containers, which are mainly transported by sea on vessels of an average capacity from 500 to 15,000, the so called twenty-foot equivalent units (hereinafter referred to as TEU). One TEU represents one ISO 1C container, two TEUs represent an ISO 1A container. The Maersk Line, one of the largest container shipping companies, put the biggest container vessel that has ever been built into operation in June 2013i it has a capacity of 18,000 TEUs, named Triple-E [1].

The maximum load Triple-E forwarded within a one trip was 17,603 containers in the summer of 2014. All such sea container vessels sail all over the world to harbours (CTTs, Gateways), where containers are unloaded, stored, cleared through customs and then are to be transported on inland railway paths or water paths to the customers. *Figure 1* shows an outline of global sea network and ports [2].

Table 1 provides a summary of world ports with the largest numbers of available TEUs, whether full or empty.

Table 1 Summary of World Ports with the Largest Numbers of Available TEUs

Tablica 1. Pregled svjetskih luka s najvećim brojem raspoloživih TEU

No.	Country/port	2010 in mil. TEUs	2011 in mil. TEUs
1.	China/Shanghai	29.07	31.74
2.	Singapore/Singapore	28.43	29.94
3.	China /Hong Kong	23.70	24.38
4.	China / Shenzhen	22.51	22.57
5.	South Korea/Busan	14.18	16.17
6.	China /Ningbo-Zhoushan	13.14	14.72
7.	China /Guangzhou Harbour	12.55	14.26
8.	China /Qingdao	12.01	13.02
9.	United Aram Emirates/Dubai	11.60	13.01
10.	Netherlands/Rotterdam	11.14	11.88

Source: [1], [2]

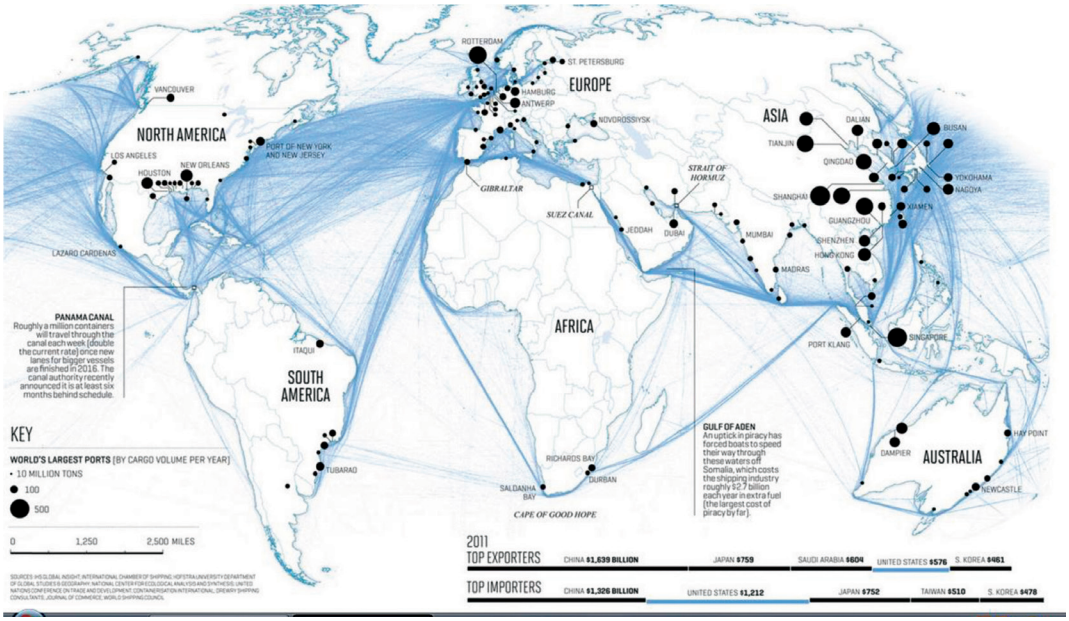

Figure 1 Global network of ports and their sea paths as in 2011
Slika 1 Globalna mreža luka i pomorskih ruta iz 2011.

Source: [2]

1.1. Possible alternatives to existing east-west routes / *Moguće alternative postojećim rutama istok - zapad*

There are alternative opportunities for delivery of goods on the East - West route, which are presented on map in Fig. 2 according to the TRACECA (Transport Corridor EU-Caucasus-Asia) project were given. As shown in Fig. 2 there are three main road routes considered: Trans - Russian route (blue); Trans - Turkish route (brown) and Trans - Caucasian route (red). Rail routes could be identical with road routes, because in theory transport corridor should provide different modes of transport according to commodity paradigm.

Obviously, safety is one of the key factors in the assessment of the attractiveness of the given route. Unfortunately, current situation related to military activities in the Donetsk region, and in general due to the political tensions between Ukraine and Russia do not allow to ensure the safety and attractiveness of traffic on the Trans - Russian routes. Trans - Turkish route in the part which could pass through the territory of Iran is also not sufficiently safe, so investments in infrastructure in this part of the route are practically impossible now.

Figure 2 Alternative possibilities of delivery of goods between East and West by road
Slika 2. Alternativne mogućnosti isporuke robe cestovnim prometom između istoka i zapada

The real alternative that seems possible is the expansion of project of the new rail link between the Caspian Sea and the Black Sea, which will run through the borders of two following countries: Azerbaijan and Georgia. The idea, behind the creation of new infrastructure, is to create an alternative transport network for the Trans-Siberian Railway (TSR) and north and south trans-Asian corridors. Implementation of the initiatives is created under the central segment of TRACECA. Corridor is involved in gradually developing trends of trade and economic development between European and Asian global markets and integration of the corridor into the Trans-European Transport Networks (TEN-T).

The basic characteristics that permitting the evaluation of selected route is the capacity of railway transport as well as utilization of this mode of transport in multimodal transport. In this case, the implementation of port handling operations must be taken into special consideration, performing the function of containers break-bulk points global logistics flows. The most important of these shipping points are: Baku port located on the Caspian Sea and Poti and Batumi ports located on the Black Sea. The container terminal located in Baku handles 15,000 containers annually. APM Terminals in Poti in 2014 handled 384,992 TEU and Batumi's annual throughput is similar: 400,000 TEU; see [16]. The new solution therefore will bring measurable benefits associated with an increased range of services to the client through the delivery of a "door-to-door" relation by a new route which will effectively lower prices of transportation and increasing the quality of customer service.[17]

2. A PROPOSAL OF A MODEL OF A LOGISTICS TRANSPORT CHAIN IN THE TRANSPORT OF SELECTED COMMODITY FROM SLOVAKIA TO CHINA / *Prijedlog modela logističkog transportnog lanca određene robe iz Slovačke u Kinu*

Upon the analysis of the existing transport chains and the commodity flow therein, a logistics transport chain that might provide Slovakia with comparative advantage to succeed in the global competitive environment and increase the Slovakian export is modelled in this article. The logistics transport chain of the selected commodities should be implemented right by the model with two main transport methods with a gauge changeover performed in Dobrá Combined Transport Terminal (CTT) and Zabaykalsk Combined Transport Terminal from the Slovak Republic to China.

Increasing attention has recently been paid to this railway connection because of the possible competition for sea transport of container shipments from Asia to European countries and back. Such a variant is a great challenge not just for Slovakia itself, but also for other European countries (plus Russia, Ukraine, Mongolia, Kazakhstan and China) that might establish a competitive transport chain from east to west and back. *Figure 3* shows the possible transport routes on the railways of the above mentioned countries [3].

The most suitable transport operators for transport from Central Slovakia to China are the operator of Combined Transport Terminal Žilina, Rail Cargo Operator – CSKD s.r.o. (RCO) and the operator of Dobrá, TransContainer, that is a leading Russian intermodal transport operator, that has leased CTT Dobrá from ZSSK CARGO for 15 years and that is able to provide transport on one CIM/SMGS waybill from the Slovak Republic to China.

3. EXPORT COMMODITY SELECTION / *Asortiman robe za izvoz*

Slovakia is rich in mineral waters and springs and is one of the countries that has no lack of drinking water. There are about 1,500 mineral water springs in the Slovak Republic and lots of them are commercially bottled and sold to consumers.

The Natural Mineral Water Act No. 538/2005 Col., which forbids the extraction of underground water in quantities higher than 0.5 litres per second, has to be taken into account. With the elaborated logistics chain for export of mineral waters from the SR and with adequate marketing based on the quality of mineral waters from the SR profitability for all the parties involved in the logistics chain can be expected, even for the government budget because of the rate of 0.20 €/m^3 paid to the Ministry of Healthcare for the really extracted volume of mineral water per month (Decree No. 27/2006 Col.). Four mineral water brands listed in *table 2* (together with their respective places of production) were chosen for the model proposal [4].

Figure 3 The Possible Transport Routes on Railways from the EU to China and Their Gauges.
Slika 3. Moguće željezničke transportne rute iz Europske Unije u Kinu i njihovi kolosijeci

Source [3]

Table 2 List of Selected Producers of Mineral Water for Export
Tablica 2. Popis odabranih proizvođača mineralne vode za izvoz

Producer identification	Producer's seat	Mineral water name
A	Budiš	Budiš
B	Kláštor pod Znievom	Kláštorná
C	Martin	Fatra
D	Rajecká Lesná	Rajec

Source: [4]

Google Maps application (which shows the transport route on roads for the collection of ISO 1A containers herein proposed for transport to the Combined Transport Terminal in Žilina (RCO) and where reloading the containers to Sggmrss 90' railway wagons of the proposed railway forwarder CARGO would be performed) was used for the specification of the selected mineral water producers to the nearest CTT. *Table 3* shows details of the road transport routes together with the distances [5], [6].

Table 3 The Transport Routes and Distances to CTT Žilina (RCO)
Tablica 3. Transportne rute i udaljenosti do Centra za transfer tehnologije Žilina (Željeznički teretni operater)

Transport Route from Forwarders to CTT Žilina (RCO)		Route Distance (km)
A	Budiš - Tur. Teplice - Martin - Žilina	62.2
B	Kláštor pod Znievom - Príbovce - Martin - Žilina	45
C	Martin - Žilina	29.6
D	Rajecká Lesná - Žilina	26

Source: [5]

Situation analysis has shown that all of the above mentioned companies distribute mineral water in 1.5 litre PET bottles. The individual bottles are then packed in transparent foil per 6 pieces, which forms a unit that can be held, which is put on a EUR pallet. Then 505 bottles of 1.5 litres are put on one EUR pallet, which represents 84 manually hand held units (3*7=21*4=84*6=504).

The article proposes the export of 10 ISO A1 containers (*table 4*) from each of the 4 forwarders (*table 2*), which would be 40 ISO A1 containers altogether. The total time for collection of the proposed 40 containers to the CTT in Žilina has to be calculated.

Table 4 The Weight of the Commodity Transported in an ISO 1 A Container
Tablica 4. Težina transportirane robe u ISO 1 A kontejneru

Proposed Load	Weight Calculation
weight of one 1.5 l bottle of mineral water	1.57 kg
504 bottles on 1 EUR pallet	504 bottles x 1.57 kg = 791.28 kg
weight of an empty EUR pallet = 25 kg	791.28 + 25 = 816.28 kg
number of pallets in an ISO 1 A = 24	24 x 816.28 = 19,590.72 kg
tare ISO 1 A = 3,480 kg	19,590.72 + 3,480 = 23,070.72 kg
total weight of one ISO 1A =	23,070.72 kg = 23.07 t

Source: Authors

After finding the weight of one ISO 1A container, we have to verify whether a road container trailer or a special railway wagon can take the weight. The selected road container trailer has a capacity of 39 tons and the proposed Sggmrss 90' wagon has a capacity of 106 tons. Thus the road truck and the railway wagon are able to cope with the weight.

Then we have to examine the capacity of the handling devices in CTT Žilina and CTT Dobrá. A Kalmar fork lift truck that has the capacity to handle 45 tons operated in CTT Žilina in reloading from the trailers to the railway wagons. Two rail portal cranes with a lifting capacity of 50 tons operate in CTT Dobrá. This means that the means of transport (as well as the handling machinery) can cope with the proposed weight of one ISO A1 container [6], [7].

The collection of the containers to ctt žilina by road transport / *Kontejneri u cestovnom prometu do centra za transfer tehnologije Žilina*

It is necessary to determine the time for handling the containers in CTT Žilina, the trip time of the trucks and the time necessary for loading the 24 EUR pallets into a container prepared at a loading platform on the premises of a mineral water manufacturer. The following allocation table (*table 5*) presents the time necessary for the collection of the 40 containers to CTT Žilina [8], [9].

Now we have to calculate the number of road tractors and the number of container trailers (the number of articulated vehicles) necessary for the collection of the 40 containers to CTT Žilina during working hours from 7.00 to 15:30 (T = 8.5 hrs of working hours and T_{tp} = 0.5 hrs of break, α_{pv} = 0.7 and r = 5 %).

Table 5 The Allocation Table
Tablica 5. Tablica raspodjele

Forwarder	Distance in km	Number of containers	Handling time at CTT	Trip time 2x	Handling time at forwarder	Return time	Total time x of 10 containers
A	62.2	10	17 min.	155 min.	30 min	202 min.	33h 36min.
B	45	10	17 min.	112 min.	30 min.	159 min.	26h 30min.
C	29.6	10	17 min.	74 min	30 min.	121 min.	20h 10min.
D	26	10	17 min.	65 min	30 min.	112 min.	18h 40min.

Source: Authors, according to [8], [9]

The following formula (*form. 1*) is applied to calculation of the total number of vehicles [8-10]:

$$n_c = \frac{\Sigma T_{total}}{(T - T_{tp}) * \alpha_{pv}} * \left(1 + \frac{r}{100}\right) \text{[number of vehicles]} \quad (1)$$

where:

n_c – total need of articulated vehicles, actually tractors (units),

ΣT_{total} – total time needed for transport of all containers to all the forwarders per shift (hrs),

T – total daily fund of working hours (hrs.),

T_{tp} – technological breaks (hrs),

α_{pv} – coefficient of operability of the vehicles (tractor, idle time, unevenness in traffic etc.),

r – reserve for regular maintenance and planned repairs of handling machinery (%).

The number of tractors equals the number of trailers. *Table 6* presents the results after filling in the *form. 1*.

Table 6 The Final Number of Trucks and Trailers of the Vehicles
Tablica 6. Konačni broj teretnih vagona i prikolica

Forwarder	Total time T_{total}	Number of Tractors	Number of Trailers
A	33.66 hrs	6.9	6.5
B	26.5 hrs	5.12	5.12
C	20.16 hrs	3.89	3.89
D	18.66 hrs	3.6	3.6
Total number of tractors and trailers		19.11 = 20 tractors	19.11 = 20 trailers

Source: Authors

The calculation according to *form.1*, which includes a 15 % reserve, implies that 20 vehicles are necessary for the collection of the containers to the CTT in Žilina in one working day. A daily schedule of the truck drivers' work presented in *table 7* has been elaborated upon this fact, which takes into account breaks and the service is implemented in all four forwarders per one working day with the saving of seven vehicles, which means saving 35 % of the vehicles calculated from *table 6* [7], [9-11].

Containers have to be stored at the storage area of CTT Žilina (RCO) as it is impossible to reload them directly to a railway wagon because of insufficient rail length or as the CTT may be being used by another forwarder, which is why the minimum storage area for 40 ISO 1A containers has to be calculated according to formula (*form. 2*) [9-11].

$$S_D^{NJKD} = N_{NJKD}^d * s_D^{NJKD} * \quad *t*\beta \ [m^2] \quad (2)$$

where:

S_D^{NJKD} – minimum necessary area for storing loaded containers (m^2)

N_{NJKD}^d – number of stored containers per day

s_D^{NJKD} – area necessary for one container (e.g. 1 TEU = approx. 16.5 m^2)

Φ – container stacking coefficient

t – average time of container storage (days)

β – transport unevenness coefficient (season drops, or increase of transport)

After filling in formula (2) S_D^{NJKD} = 40*35.68*1/3*1*1.5=713.6 m^2. The minimum necessary area for the temporary storage of 40 ISO 1A containers is 713.6 m^2 from the formula.

5. THE COSTS OF THE COLLECTION BY MEANS OF ROAD TRANSPORT / *Troškovi kontejnera u cestovnom prometu*

The transport costs form one of the largest items of the total costs of a container transport system. The costs of the collection of the proposed 40 containers from four forwarders are calculated from the calculation formulas for the calculation of the costs of transport of the ISO 1A containers in road transport.

The collection costs have been extended by the costs of the lease of the 40 ISO 1A containers for a maximum of 20 days, the handling in the CTT, the storage in the CTT, the indirect costs of the collection and the total costs of the road transport [11-14].

The Total Costs of the Road Cargo Transport are shown in following *table 8*.

Table 7 Daily schedule of truck drivers' work on container collection
Tablica 7. Dnevni raspored rada vozača u prijevozu kontejnera

AV / Forwarder	AV 1	AV 2	AV 3	AV 4	AV 5	AV 6	AV 7	AV 8	AV 9	AV 10	AV 11	AV 12	AV 13
A	1					1	1	1			2	2	2
B	1					1	1	1	3	3			
C		2	3	2	3								
D	1	2	1	2	1	1	1	1					
net work. hrs	473 min.	466 min.	475 min.	466 min.	475 min.	473 min.	473 min.	473 min.	477 min.	477 min.	404 min.	404 min.	404 min.

Source: Authors

Legenda: AV – zglobna vozila (tegljač prikolica), A, B, C, D – špediter.

Table 8 The Total Costs of the Road Cargo Transport
Tablica 8. Ukupni troškovi cestovnog prijevoza tereta

Item	Calculation	Sum in Euros
container lease costs	40 ISO 1A * €7/day * 20 days = 5,600	€ 5,600
collection costs from A,B,C & D	1,176+828.5+559.7+491.6 = 3,055.8	€ 3,055.8
CTT handling costs	40 ISO 1A*22 €/1 ISO1A = 880	€ 880
storage costs	713.6 m^2*€0.3/m^2*2days = 428.2	€ 428.2
collection direct costs	3.055.8+880+428.2 = 4,364	€ 4,364
indirect costs	30 % from direct costs	€ 1,309.2
Total costs	5,600 + 4,364 + 1,309.2 = 11,273.2	€ 11,273.2

Source: authors

The total costs of the collection of the 40 ISO 1A containers included in *table* 8 are € 11,273.2. The total trip distance of the vehicles is 3,256 km and the collection costs are € 3,055.80, which is € 0.93 per 1 km.

Railway transportation of the containers through the Slovak Republic / *Željeznički transport kontejnera u Češkoj Republici*

This article also proposes the transport model, where services of the CARO Railway Company a.s. (hereinafter referred to as ZSSK CARGO), which provides the block train service, are employed. A forwarder places a "transport order" where the departure station is mentioned (the Žilina shunting yard) the place of the waggon's location (CTT Žilina), the day, the hour, the identification of the goods (ISO 1A), the weight (33.07 t), the waggon type (Sggmrss 90'), the number of wagons (20), the destination (CTT Dobrá) and the consignor's details. After that, a group block train can be arranged to transport a group of consignments from more consigners (forwarders A, B, C and D) from one station (the Žilina shunting yard) for a single receiver (TransContainer) to one destination station (CTT Dobrá). The block train is at CTT Žilina, to which the road vehicles transport 40 ISO 1A containers, which are consequently loaded on 20 special railway waggons Sggmrss 90' [9], [14], [15].

It is necessary to determine the time of the journey from the shunting yard in Žilina to the CTT in Dobrá and the transport price. *Table 9* presents the distance in kilometres and the time.

Table 9 The Distance in Kilometres and the Journey Time
Tablica 9. Udaljenost u kilometrima i vrijeme putovanja

Location	Tariff distance	Journey time at vp=80km/h
Žilina sh. yard. - CTT Dobrá	332	4 hrs 9 minutes

Source: [15]

The transport price of the proposed 40 ISO 1A containers is calculated from the tariff for the transport of the wagon consignments (hereinafter referred to as TR1) published by Cargo Slovakia. The CARGO Railway Company a.s. prepares the block train from CTT Žilina to the Žilina shunting yard for free within the services provided for CTT Žilina [13-15].

Costs of railway transportation through the Slovak Republic / *Troškovi željezničkog prijevoza kroz Slovačku*

The transport costs of the proposed block train from the Žilina shunting yard to the CTT in Dobrá, including the reloading to wide-gauge waggons of TransContainer are € 41,404.08 according to the CARGO tariff TR1. The operator in the CTT in Dobrá, has been analysed in the following part of the article, will ensure transport to China within its "Block-Trains" service [13-15].

Transportation of the containers from the Slovak Republic to the people's Republic of China / *Prijevoz kontejnera iz Slovačke do Narodne Republike Kine*

The operator TransContainer will arrange for the transport from CTT Dobrá through the transit countries of Ukraine and Russia, to the destination station Dahongment in the Chinese capital of Beijing. Tieyun Logistic Centre is located near the Dahongment Terminal in south Beijing, in the Fengtai District.

TransContainer will arrange for the reloading of the containers in railway terminal Zabaykalsk, where the containers will be reloaded from wide-gauge waggons to waggons of normal gauge and for the engine replacement [13-15].

The transport limitations on the route are given by the maximum ISO 1A content weight 25.5 t (the proposed weight is 23.07 t) and the maximum train capacity of 120 TEU (the proposed capacity is 80 TEUs = 40 ISO 1A containers). The train and the containers are monitored at 37 monitoring points throughout the whole route. So 80 feet flat waggons with maximum load capacity of 70 tons are used in the proposal. The route CTT Dobrá, Čop border crossing (Ukraine) – Kiev – border crossing Suzemka (Russia) – Moscow – Omsk – Novosibirsk – Karimskaya – CTT Zabaykalsk (gauge change 1520mm/1435mm) – border crossing Manzhouli – Harbin – Beijing is 10,324 km long [13-15].

Costs of railway transportation from the Slovak Republic to China / *Troškovi željezničkog prijevoza od Slovačke do Kine*

The transportation cost calculation was based on the International Conference on Railway Transport of goods between Asia and Europe in Prague, where the average price of the container transport between Asia and Europe was presented as USD 0.09 per 1TEU per 1km. After recalculation to 2 TEUs, which represents one ISO 1A container in the article the rate is 0.18 USD per 1 ISO 1A per 1km. After conversion (USD 1 = EUR 0.7617) it is € 0.137 per 1 ISO 1A per 1 km. After filling in the rate the freight cost on the proposed route is € 56,575.50 [13-15].

The additional charges proposed by TransContainer to a customer in writing upon entering into a commission contract have to be added to the freight costs. The price of transport of the containers proposed in the article from CTT Dobrá to China's capital Beijing (together with these charges) is € 74,593.50. With regard to the expiry time of the mineral waters (1 year from bottling) transported to Beijing, the transport time on the proposed route has to be set. If the delivery time is calculated from the delivery times from the SMGS Contract, where the 24-hour dispatch time is determined and further 24 hours per each 200 kilometres, then the delivery time is less than 53 days. In

fact, TransContainer is able to ensure the delivery time from 15 to 17 days on the proposed route, depending on the utilization rate of the Zabaykalsk terminal and preparation time of wagons and an engine of Chinese Railways (hereinafter referred to as KZD) [13-15].

The Total Costs of the Export of the Mineral Water to Beijing / *Ukupni troškovi izvoza mineralne vode u Peking*

The complex results of the cost consists of the cost of purchasing 483,840 1.5 litre bottles of mineral water (504 filled bottles on a pallet) while there are 24 pallets in one container, which means that 40 ISO 1A containers contain 483,840 mineral water bottles from four producers. After the calculation of each of the four mineral water producers proposed in this article exports 120,960 bottles of 1.5 litres in one block train. *Table 10* shows the total cost of acquisition of mineral waters from the four producers [13-15].

Table 10 The Total Cost of the Acquisition of Mineral Water
Tablica 10. Ukupni trošak nabave mineralne vode

Forwarder – m.w. name		Calculation	Sum in €
A	Budiš	120,960 * 0.45 = 54,432	54,432
B	Kláštorná	120,960 * 0.49 = 59,270	59,270
C	Fatra	120,960 * 0.79 = 95,558	99,558
D	Rajec	120,960 * 0.79 = 95,558	99,558
Total		483,840 bottles with mineral water	312,818

Source: authors, according to [4], [13-15]

Then the complex cost includes the cost of the transport chain from the Slovak producers to the consumers in Beijing, which consists of the cost of the collection of 40 ISO A1 containers from the manufacturers to CTT Žilina on the road, then the railway cargo transport to CTT Dobrá, from where the consignment is transported on wide-gauge railway network to Zabaykalsk terminal, where the containers are reloaded on KZD normal gauge wagons and then the consignment is transported to the capital Beijing (Dahongmen Terminal), where the containers are reloaded on articulated road vehicles and transported to a logistic centre (Tieyun) from where the goods will be distributed to the consumers in the capital of Beijing.

In order to prevent damage from accidents occurring during transport, the consignment should be adequately insured. The sense of insurance in international transport is to eliminate the consequences of damage, destruction, loss or theft. There are numerous insurers providing transport insurance upon the situation analysis; the premium is about 10 % of the consignment value.

Table 11 shows the complex transportation cost with insurance of the model of logistics transport chain herein proposed.

Table 11. The Complex Transportation Cost
Tablica 11. Trošak kompleksnog prijevoza

Calculation of the complex costs	Sum in €
Collection of containers on road to CTT Žilina	11,273.20
Railway transport from CTT Žilina to CTT Dobrá	41,404.10
Railway transport from CTT Dobrá to Tieyun logistic centre	74,593.50
Insurance 10 %	31,281.80
Total	158,552.60

Source: authors, according to [13-15]

The payment of customs duty and the value added tax (hereinafter referred to as VAT) represent the substantial cost. The import duty is paid in the import of the goods to China and that calculation is based on the acquisition price of the goods, the transportation cost and insurance. According to the latest information from www.customs.gov.cn, the import duty on mineral water to China in the harmonized nomenclature of goods 22011010 is 0 %, but 17 % VAT is paid. The export duty rate for mineral water exported from Slovakia is 0 % as well, but the 20 % VAT from the acquisition price of the goods intended for transport outside the SR is paid. *Table 12* shows the calculation of the duties and the VAT and their total sum according to [13-15].

Table 12. Total Cost of Customs Duties and VAT
Tablica 12. Ukupni carinski trošak i PDV

Cost item	Sum in €
Import duty on mineral waters imported to China 0 %	0 €
VAT in China of 17 % from 312,818 + 158,552.6 = 471,370.6	80,133 €
Export duty on mineral waters exported from Slovakia 0 %	0 €
VAT in Slovakia 20 % from 312,818	62,563.60 €
Total	142,696.60 €

Source: authors, according to [13], [14], [16]

Because of the lack of experience with the market of the People's Republic of China, the authors propose the employment of services related to legal consulting in business relations with China, together with the translation services and a personal visit to Beijing focused on the negotiation of the international deal, while the costs of the legal services and personal visits to China are estimated to be € 15,000.

Table 13 shows the complex costs of the proposed model of logistics transport chain for selected commodities.

Table 13. Complex Implementation Costs of the Export of Mineral Water to Beijing

Tablica 13. Kompleksna provedba troškova izvoza mineralne vode u Peking

Calculation of the complex costs	Sum in €
Total costs of mineral water acquisition	312,818.00
Total freight and insurance costs	158,552.60
Total costs of customs duties and VAT	142,696.60
Legal services, personal visits, translator and others	15,000.00
Total	629,067.70

Source: authors

The total costs of the implementation of the mineral water export from producers' sites in Slovak Republic to Beijing (China) have been calculated to be € 629,067.70 in the proposed model.

6. CONCLUSION / *Zaključak*

Question of the effectiveness of the costs invested in the logistics chain related to the export of the proposed commodities in comparison to the competitive transport methods remains important. The effectiveness of the proposed logistics chains is now being researched. This research involves a situation analysis of the Chinese market, the potential customers and the competitors.

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