Main Issues in East-West Transport Corridor Identified with the Range Correlation Method

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***Abstract*—Since the global economic crisis and pandemic situation all the states have been suffering from low levels of investment in transport infrastructure. This has held back the modernization of the transport system. Road and rail infrastructure across the states have been degrading because of too little maintenance. The purpose of this paper is to show the main issues in East-West Trasnport corridor using The Range Correlation Method. A group of 10 specialists assigned ranges to 10 indicators to highlight the main issues. After the results of the study, a new strategic solution is proposed.**

Keywords—East-West transport corridor, logistics infrastructure, improvement, export, import

I. INTRODUCTION

Transport is a fundamental sector of economy. It is a strategic sector of the EU economy, which directly affects the daily lives of all EU citizens. Transportation services provide about 11 million jobs. They are a cornerstone of European integration, with fully interconnected and sustainable transport networks being a necessary condition for the completion and proper functioning of the European single market. Efficient transport services and infrastructure are vital to exploiting the economic strengths of all regions of Europe, supporting the internal market and growth, and enabling economic and social cohesion. It is very important to mention the fact that it can influence trade competitiveness, as the availability, price, and quality of transport services have strong implications on production processes and the choice of trading partners. It can be mention that it has a central role in the logistics chain.

Despite the decrease of volume transportation caused by the pandemic situation and microprocessor crises, the East-West Transport Corridor (EWTC) is considered to be the transport corridor with the fastest developing traffic in the East-West direction having more traffic than many other corridors. Even if the volume is high, it is suffering from several obstacles as poor infrastructure, missing effective intermodal transport, low quality of the facilities provided by transport hubs, high volume of emissions, bottlenecks in the rail networks, insufficient motorways, airline, and sea services. From a social perspective, affordability, reliability, and accessibility of transport are missing. However, since the economic crisis of 2008, low investment in transport infrastructure has hampered the modernization of the transport network, with average investment reaching much lower levels than needed. Given the limited availability of public funds, increased private sector investment in strategic transport infrastructure is considered essential.

According to Eurostat's statistics in Europe the volume of goods transported in different ways is as follow (the volumes are represented in thousand tonnes):

Fig 1. Sea transport of goods European Union

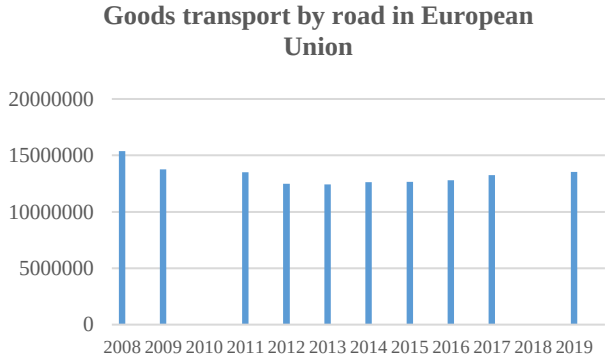

Fig 2. Goods transport by road in European Union

Fig 3. Air transport of goods European Union

In his paper A. Beifert [1] has studied the problem of the development of international transport corridors and F. Günther and others noted the importance of modernizing the transport infrastructure for its development [2]. In his study Liao mentions the urgency of improving the customs escort of goods passing through the corridor [6]. The need to develop international transport corridors and the active participation of the state in creating conditions for their improvement has been repeatedly asserted by researchers [7, 8]. At the same time, considerable attention has traditionally been paid to the problems of modernizing the existing transport and logistics infrastructure [4, 5, 9].

II. METHODS

The methodological basis of the study consists of general scientific methodological approaches, such as Range Correlation Method. The experiment was conducted by choosing factors of influence as the level of infrastructure on the railway on EWTC, level of infrastructure on the motorway on EWTC, level of infrastructure on airline structure on EWTC, affordability, availability of transports, reliability, the volume of emissions

III. RESULTS

Ten specialists were asked to classify the influence factors presented below in the order of their importance. They must award points from 1 to 10 to the factors they consider critical in logistic transport on East-West Transport Corridor and need improvement. The factors noted with Xi were explained as follows:

- X_1 –Affordability

Affordability measures the relative cost that the purchaser is able or not to pay for the transport.

- X_2- Availability of transports
- X_3- IT network development
- X_4 – Volume of emission

Air pollutants are responsible for several adverse environmental effects, such as photochemical smog, acid rain, death of forests, or reduced atmospheric visibility. Emissions of greenhouse gases from the combustion of fossil fuels are associated with the global warming of Earth's climate. Certain air pollutants, including black carbon, not only contribute to global warming but are also suspected of having an immediate effect on regional climates.

- X_5- Level of infrastructure on the railway on EWTC

Rail transport has an important role in raising the level and standards of development of a country, and the railway has been and is generating progress and civilization. The elements that will be evaluated during the railway transport are:

- railways, bridges, tunnels, viaducts;
- geotechnical protection and consolidation works;
- safety and operational management facilities for railway traffic;
- the network triage of the railway and the lands related to them;
- telecommunications installations that ensure the transmission of information for safety and operational management of traffic;

- X_6- Level of infrastructure on airline structure on EWTC

Airfreight is an extremely important component of freight. Air transport of goods is the fastest way to transport but also the most expensive. The elements that will be evaluated consist mainly of aircraft, airports, air traffic control, and safety systems.

- X_7- Level of infrastructure on the motorway on EWTC

The elements that will be evaluated during the motorway transport are:

- road transport network (roads, vehicles);
- aspects related to design, construction, diagnosis and operation of vehicles, road traffic, management.

- X_8 – Reliability
- X_9 – Facilities provided by transport hubs
- X_{10} –Existence of an intermodal transport

Grade 1 is given for the most important factor and grade 10 for the least important factor. The grades were centralized in the primary data table.

Table 1 Questionnaire

Fact. No.	Description	Grade
X1	Affordability	
X2	Availability of transports	
X3	IT network development	
X4	Volume of emission	
X5	Level of infrastructure on the railway on EWTC	
X6	Level of infrastructure on airline structure on EWTC	
X7	Level of infrastructure on the motorway on EWTC	
X8	Reliability	
X9	Facilities provided by transport hubs	
X10	Existence of an intermodal transport	

All responses were centralized in the below table:

Table 2 Primary data table

Specialists	Influence factors										Σaij
	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	
S1	1	4	3	6	5	8	7	2	10	9	55
S2	4	9	5	3	1	7	8	1	6	10	54
S3	10	2	5	1	2	4	10	7	8	6	55
S4	1	1	1	2	1	1	3	3	3	3	19
S5	5	4	7	3	6	10	9	8	1	2	55
S6	7	8	1	5	3	4	9	2	10	6	55
S7	5	3	4	2	1	9	8	7	6	10	55
S8	1	4	7	3	1	5	6	8	10	9	54
S9	8	6	10	4	3	5	9	1	2	7	55
S10	4	8	3	2	1	10	5	9	7	6	55
Σaij	46	45	39	28	18	53	65	40	62	66	512
Θj1	3	6	4	2	1	7	10	5	8	9	

Because, in the questionnaires, some respondents gave the same rank to at least 2 factors of influence, it is necessary to link ranks. For this purpose was browsed the primary table line by line and calculate the corrected rank as the ratio of the sum of the order numbers of places occupied by factors of the same rank and the number of factors of the same rank. With the corrected values, a second table is completed.

Table 3. Secondary data table

Specialists	Influence factors										Σaij
	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	
S1	1	4	3	6	5	8	7	2	10	9	55
S2	4	9	5	3	1.5	7	8	1.5	6	10	55
S3	10	2	5	1	2	4	10	7	8	6	55
S4	3	3	3	6	3	3	9	9	9	8.5	55
S5	5	4	7	3	6	10	9	8	1	2	55
S6	7	8	1	5	3	4	9	2	10	6	55
S7	5	3	4	2	1	9	8	7	6	10	55
S8	1.5	4	7	3	1.5	5	6	8	10	9	55
S9	8	6	10	4	3	5	9	1	2	7	55
S10	4	8	3	2	1	10	5	9	7	6	55
Σaij	49	51	48	35	27	65	80	54	69	74	550
Θj1	4	5	3	2	1	7	10	6	8	9	

The adequacy of the data in the primary table with the data in the secondary table is realized by comparing the hierarchy provided by the primary table Θ1 with that of the secondary table Θ_2, by calculating the correlation coefficient r_s:

$$r_s = 1 - \frac{6\sum_{j=1}^{n}(\theta j1 - \theta j2)^2}{n^3 - n} \quad (1)$$

where n is the number of influence factors (x);

(1) refers to the data in the primary table;

(2) refers to the data in the secondary table

In the case studied, rs =0.66 which shows that data from the primary and secondary tables are in agreement.

Verifying the degree of agreement between the points of view of the specialists is made calculated The consensus coefficient W:

$$W = \frac{10\sum \Delta^2 j}{m^2(n^3 - n) - m\sum Ti} \quad (2)$$

where: m is the number of specialists;

n is the number of influence factors

$$\Delta j = \sum_{i=1}^{m} aij - \frac{1}{n}\sum_{j=1}^{n}\sum_{i=1}^{m} aij \quad (3)$$

$$T_i = \sum_{j=1}^{n}(t^3 j - tj) \quad (4)$$

where tj is the number of identical ranks, of a certain value, assigned by specialist i.

After calculations, the value of the consensus coefficient is w = 0.59. The statistical significance of the coefficient w is estimated using the statistical criterion χ^2, as 10 influence factors (n> 7) were studied. The value of criterion χ^2 is calculated if the relation:

$$\chi^2_{calc} = m(n-1)w \quad (5)$$

The graphical representation of the results was made in the form of a histogram showing on the axis OY the influence factors noted X_1, X_2…., X_{10}. And it also ranks the factors from the most important, which obtained the lowest rank, to the least important, which is the one who obtained the sum of the highest rank.

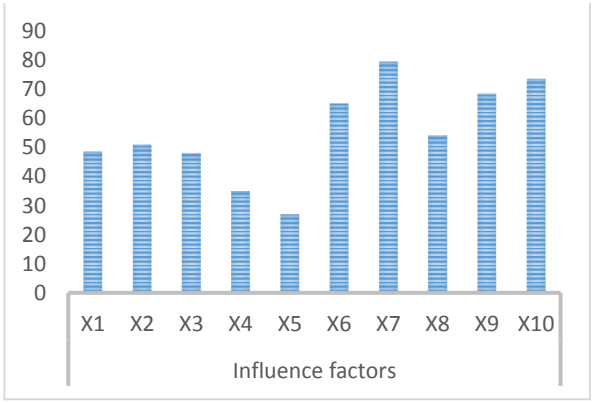

Fig 4. Hierarchy of influencing factors

The data representation was chosen in the form of a histogram (fig. 1), which has the influence factors on the axis Ox, and on the axis Oy, the significance index Is, expressed by the ratio (m / Aij).

According to the specialists' answers, the railway infrastructure, the gas emissions, and the IT network are the main areas that require immediate intervention.

Railways are a climate-smart and efficient way to move people and freight. Railways promote economic growth while cutting greenhouse gas emissions. They are a clean and compact way to move millions of passengers and millions of tons of goods across countries and continents. The environmental benefits include:

- Decreased energy consumption
- Reduced accidents
- Reduced air pollution and emissions
- Reduced land for auto and air facilities
- Intensified and reuse of urban area lands around stations
- Reduced wetland and water resource impact by reuse of existing rail routes.
- A larger volume of goods to transport for long distances

Unfortunately, the railway network is not sufficiently developed to support a larger volume of goods and an increase in speed. Not only the investments in infrastructure but also its maintenance were neglected, which determined, for safety reasons, the permanent reduction of the maximum allowed traffic speed, respectively the increase of the journey time, thus diminishing the attractiveness of the system and the offered services.

To increase the speed Maglev train should be a solution. The operating principle of the system consists in using the forces of attraction or rejection between the poles of permanent magnets, for the transport of goods. The bounce forces between the N-N or S-S magnetic poles determine the propulsion, that is, the displacement in the direction of transport.

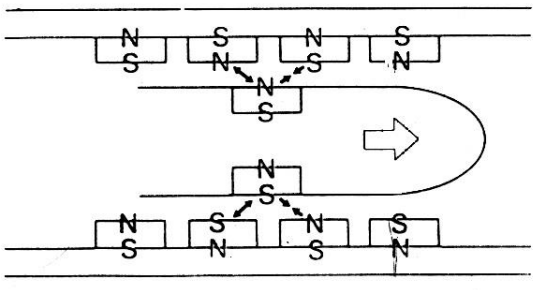

Fig 5. The operating principle of the system

The coils (magnets) are made of superconducting material (niobium-titanium alloy) whose resistance is canceled out at temperatures of -269 ° C (cryogenic domain). Helium is used as a cooling agent to maintain such a temperature. When moving vertically, the variable magnetic field determines the induction of electric current in the coils (magnets) in the path that will act as a vertical suspension. The electromagnets in the path are connected to an electrical circuit. Thus, at a lateral displacement, the variable magnetic field induces in the circuit an electric current resulting in attractive or repulsive lateral forces that will guide the transport unit along the central axis of the path.

The big disadvantage is that these types of trains cannot be used with the existing infrastructure, but must be designed from the beginning and are very expensive.

Increasing the competitiveness of railway transport must be considered the approach with the greatest chances of success in terms of the recovery of railway transport and, implicitly, in terms of the economic and financial recovery of railway companies.

IV. Conclusions

The study shows that according to the specialists' answers, the railway infrastructure, the gas emissions, and the IT network are the main areas that require immediate intervention. It is a clear fact that railways are a climate-smart and efficient way to move goods across countries and continents. The solution proposed with Maglev trains has the advantage that they reach much higher speeds than ordinary trains, have better acceleration, and can climb steeper slopes. Energy efficiency is superior and they are much safer, there is no risk of derailment. Although not as quiet as expected, magnetic trains are much quieter than usual. But Maglev trains also have many disadvantages. They cannot be used with existing infrastructure, and the high cost of building new taxiways is very high.

V. References

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