THE COST AND NON-COST CONDITIONALITY OF TRANSPORT CORRIDOR LOGISTICS PERFORMANCES AS DETERMINANT OF PORT COMPETITIVENESS

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Abstract

Transport corridor logistics performances are largely influenced by the transportation cost, but at the same time the non-cost elements play a significant role, which sometimes can be crucial. This paper examines the conditionality of logistics performances of transport corridor with cost and non-cost factors related to transport corridor where the port is located, in order to provide measurable basis for assessing the port hinterland as a competitiveness determinant of the port itself and transport route in general. From a methodological point of view, the authors systematize the key cost related factors and qualitatively determine key non-cost related factors as well as the most common ordinal size of their impact intensity. The authors also elaborate on possible models of evaluation and assessment of the impact intensity of cost and non-cost elements that determine transport corridor logistics performances. The authors conclude that the impact intensity of cost and non-cost factors affecting the transport corridor logistics performances is variable in size and largely dependent on political factors and hinterland development. That is a substantial determinant of port competitiveness.

Key words: transportation costs, port competitiveness, logistics performances, transport corridors

1. INTRODUCTION

In today's highly globalized world transport is an increasingly cost integral part of a product. However, overall costs on a corridor have a strong impact on the attractiveness and even "competitiveness" of a single transport corridor. Regarding this relation between transport corridors can be considered as some kind of competitive relation between transport corridors as flows of freight traffic. Logistic performances of a corridor are one of the key determinants of competitiveness. Logistics performances can be observed as a level (intensity) to achieve the desired logistic goals, or achievements. Transport corridor logistics performances are largely influenced by the transportation cost, but at the same time the non-cost elements play also a significant role, which sometimes can be even crucial. In maritime transport it is extremely important to consider the logistics performances of an entire transport corridor, because the sea ports are an important logistical point along the route, and most often are route starting points. For these reasons the development of port systems and the justification and appropriateness of an investment in a port infrastructure is highly dependent on the entire port hinterland and port gravitational area (zone), and especially on the transport corridors logistic performance that extend throughout the port gravitational zone. From aforementioned we can conclude that the seaport competitiveness is largely determined by logistics performances of all correlated systems in the port hinterland, and especially by transport corridor logistics performances observed as an integral unit.

The objective of this paper is to examine and clarify the conditionality of logistics performances of the whole transport corridor with cost and non-cost factors of the infrastructure and transportation service on the corridor where the sea port is located and which directly influence the port competitiveness.

This paper examines the conditionality of transport corridor logistics performances with cost and non-cost factors related to transport corridor where the port is located, in order to provide measurable basis for assessing the port hinterland as a competitiveness determinant of the port itself and transport route in general.

In order to develop a systematic approach for determining the transport corridors logistics performances and their coherence and impact on the competitiveness of a port, the systematized and evaluated assessment methodology of performances and transportation costs on the transport corridor is elaborated and provided in this paper.

In last decades a very prominent EU approach (European Commission, 2015) towards transportation networking system has produced something that is today well known as Trans-European Transport Network (TEN-T). This is a solid foundation for further transport development in the EU but continuous effort needs to be done for its enhancement and strengthening. In this sense the practical relevance of the problem researched in this paper represents the necessity to establish some kind of measurable basis for evaluation of transport corridor logistics performances and their influence on port competitiveness as well as impact on economic development in port's hinterland. Contribution of this paper to the existing knowledge can be found in the integral perspective on logistics performances of the transport corridor as a whole and as a system while identifying and analysing cost and non-cost conditionality of its

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logistics performances that are determinants of competitiveness of a port as a starting/ending point of most of transport corridors.

2. THEORETICAL BACKGROUND

Chow et al. (1994) performed very extensive and important theoretical researches and systematisation of researches performed by other prominent scholars from the field. Also significant part of their research is focused on comparison and evaluation of methodological solutions focused on determination of logistics performances. This paper is following their research approach and is oriented on applicative upgrade. According to Chow et al. (1994) it is possible to define logistics research as a systematic and objective search for, and analysis of, information relevant to the identification and solution of any problem in the field of logistics. They particularly emphasize that majority of logistics research is conducted emphasizing the premises that a relationship exists between a particular course of action and logistics performance. In the literature it is emphasized that logistics performance can be associated with a concept of logistics effectiveness, but this relation between performances and effectiveness is frequently relatively blurry, unclear and ambiguously, and this is particularly emphasized by Chow et al. (1994) arguing that definition of performance is a challenge for researchers in any field of management because organizations have multiple and frequently conflicting goals, so this goals mix can limit the clarification and unification of performance definition. This more because the dynamics of objective changes in present time is growing continuously under the influence of more rapid market and non-market changes in the environment. This largely applies also to institutional changes understood in the broadest sense, which are under strong pressure for changes, particularly in the transition and post-transition economies. Partly it is the impact of the inevitable changes that are brought together with the transition to competition in transition economies and strengthening of market relations in the post-transition economies. On the other hand it is the cause of ever-increasing pressure from the developed market economies in the direction of the needs for institutional harmonization with the aim of establishing integrated logistics chains and transport corridors.

Literature dealing with the area of logistics performances according to Chow et al. (1994) can be divided into six key areas in which there are a number of different directions, but summarising these six rounded approaches are taken into account:
- Conceptual works;
- Performance definition;
- Performance measurement;
- "Leading edge" literature;
- Performance as an outcome variable;
- Mathematical/economic analyses.

From the theoretical perspective it is also important to mention the contribution of Naim et al. (2006) in their conceptual study developing definitions and models for transport flexibility. They have identified twelve definitions and key components of transport flexibility that signify a proactive approach to the consideration of the

subject within the context of a collaborative approach to relationships between carrier, supplier and customer. We can also apply such a collaborative approach in this research aiming to put a more light on the collaboration approach and integration of transport service under door-to-door basis.

Such collaboration and eventually integration movements on transport corridors can be illustrated as it is shown on Figure 1.

Figure 1. Intensity of collaboration and collaboration forms on transport corridors
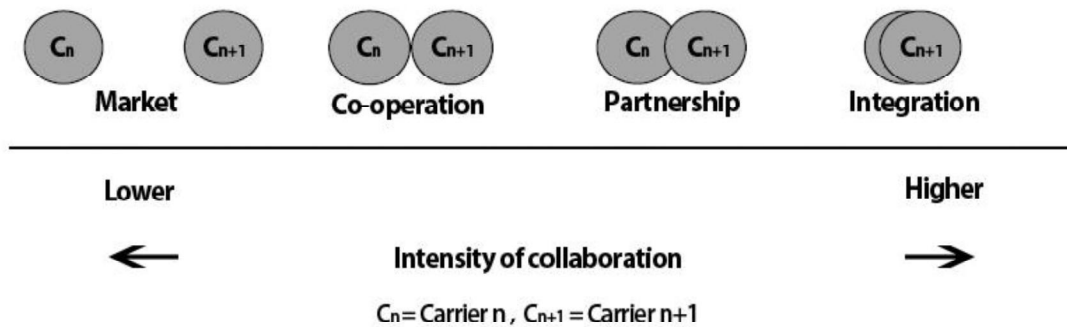
Source: Authors elaboration based on synthesis of Williamson (1979) and Naim et al. (2006).

Rutner & Langley (2000) argue that logistics is an essential function within business emphasizing that it that creates value, so in order to interconnect logistics performance and competitiveness strengthening the generated value is an important cohesion factor that we find necessary to interconnect logistics performances and competiveness generation. They were primary motivated with the premise that the terms value and value added are neither clearly defined nor accurately measured so their primary goal was to clarify these definitions in the context of how value is created by logistics. Their empirical research contributed to better definitions and understanding of value and value added related to the logistics perspectives and practicing managers.

Those researches provided valuable contribution in the framework of logistics performances and their place in the business operations. Following on previous works, in our paper we are providing insight into the cost and non-cost conditioned factors that directly and indirectly affect transport corridor logistics performances and we investigate if they can be perceived as determinants of port competitiveness. To appropriately address those issues it is important to firstly review a methodology.

3. METHODOLOGY

It should be noted that competition among Adriatic ports in container transport is large enough to have excluded all possible forms of monopolistic influence of port operators on service costs. In container transport is much more important the overall price of the transport route, which consists of shipping freight, the Terminal Handling Charges (THC) and inland transport costs. For the shippers this price represents a sort of aggregate transport costs. Costs in container transport can be divided on the cost of the ship and the cost of goods. The fee structure is best illustrated by Figure 2.

Figure 2. Relations between the subjects in the transport process in terms of transportation costs
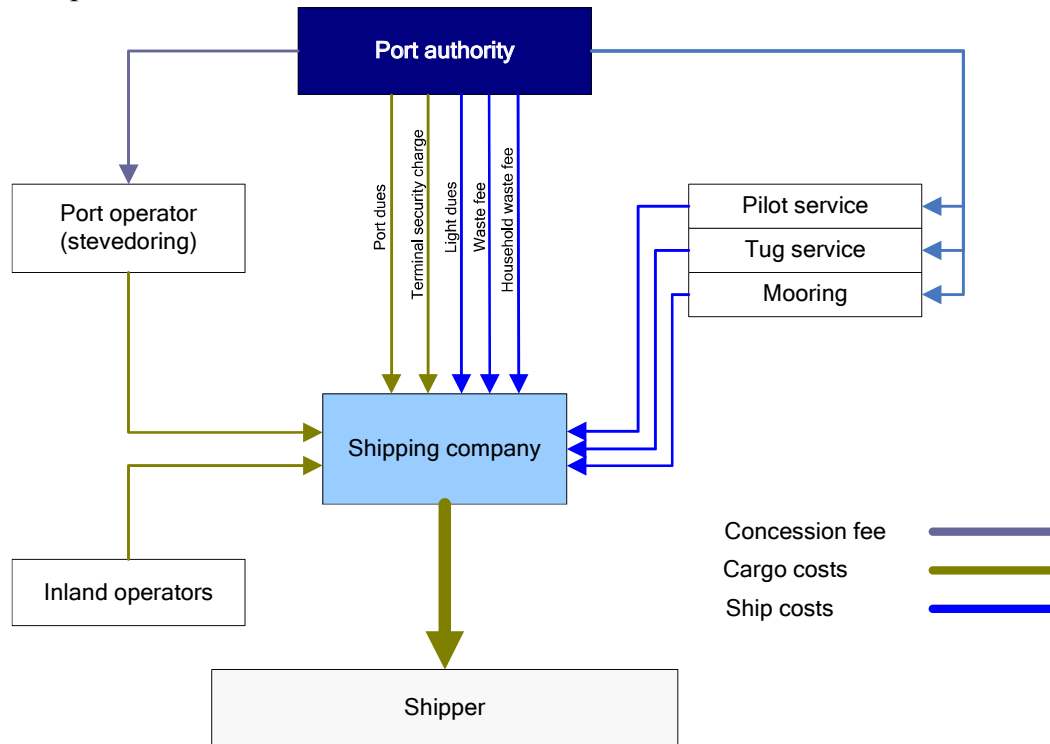
Source: Authors elaboration

One of the important indicators of the port attractiveness in container transport are THC costs. They are the reference indicators of receivables by a shipping company who is entrepreneur of the transport service, to the shipper who provides the goods for transport.

Two main contracting principles exist in container multimodal transport. Those are so-called "port-to-port" principle and "door-to-door" principle.

In "port-to-port" based contracts, goods are carried from the port of origin to the port of destination under so-called merchant haulage clause. That means sea-haulage cost are included in overall transport costs, including sea freight, port dues and cargo handling costs in the port of destination. Transportation of cargo to the final destination is beyond the scope of shipping company. Therefore the costs of inland transport are dispersed on a case by case basis. It should be noted that in that case there is no single transportation entrepreneur who would take over the responsibility for the whole transport route.

On the other hand, "door-to-door" based contracts include the transport services on the whole transport route together with organization and responsibility for the inland haulage. In such a case goods are carried from the port of origin to the port of destination under so-called carrier haulage clause. To make this possible, two important assumptions are important:

- Existence of an entrepreneur in multimodal transport - inland operator who would be responsible for the entire organization and implementation of the inland haulage of transportation to the final destination and who could arrange this type of service with a shipping company,

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- Balanced transport demand where import and export flows of goods have close transport share ratio (eg 60/40 ratio could be considered acceptable). Otherwise, it would generate additional logistics costs due to repositioning, delivery and re "recruitment" of empty containers.

It should be noted that, with excessive deviations in the import-export transport flows, management of empty containers presents special logistic problem. In such cases, additional expenses occur. These costs must be compensated by higher shipping freight or increasing THC. In such situations shipping companies left to forwarders the repositioning and recharging for further container use (re-use of container). These circumstances affect the final cost of inland transportation and the total cost of corridor transportation.

4.MONITORING METHODOLOGY AND INDICATORS ESTABLISHMENT

4.1. Port performance monitoring

A port performance indicator shows the quality of service towards the port users. In intermodal transport that is very important for shipping companies and logistic providers to have exact information of the ability of the particular port or terminal operator to perform its services. Underperforming port or terminal may not be able to compete for significant transport share between other ports, especially in container transport. Therefore, majority of shipping companies will not include that port in their regular service schedule.

Monitoring of port operator activities includes operational and financial indicators as well as standards and evaluation criteria. Continuous monitoring of performances should be required during the concession period. The main performance criteria for port service (The World Bank, 2007) are shown in Table 1.

Table 1. Port performance indicators

Operating performances indicators	*Explanation*
Average ship turnaround time	Total hours vessels stay in port divided by total number of vessel
Average waiting rate	Total hours vessels wait for a berth divided by total time at berth
Gross berth productivity	Number of container moves divided by the vessel's total time at berth
Berth occupancy rate	Total time of vessels at berth divided by total berth hours available
Working time over time at berth	Total time of vessels being serviced at berth
Cargo dwell time	Number of days container cargo stay at the terminal
Ship productivity indicator	Total number of moves handled in a time

TEUs per crane-hour	Total number of TEU handled by one crane in a hour
Financial performances	*Explanation*
Operating surplus per ton handled	Net operating income from port operations divided by total cargo handled
Charge per TEU	Total charges for container
Collected charges	Total collected charges as a percent of accounts billed

Abbreviations:
TEU - twenty-foot equivalent unit represents an inexact but dimensionally comparable unit of cargo capacity used to describe the capacity of container terminals as well as container ships.
Source: The World Bank: Port Regulation Module 6

4.2. Corridor performance monitoring

There are methodologies established for the evaluation of transport corridor performance, which is based on valuable collection and measurement of transport data between two or more network nodes and on some critical points (i.e. ports, intermodal terminals and border crossings). The practical implementation of these methods includes:

1. Filling in travel forms or travel diaries by road carriers. Such questionnaires can be created in order to monitor the quality of service by the port authority and could authorize and oblige forwarders to recollect them from the carrier (the driver). The questionnaire could be created in the form of a check list so data of certain control points on the corridor should be entered.

2. Occasional and periodic interviews with the operational management of shipping and transportation companies. Before that it is necessary to prepare a questionnaire with the required information. The advantage of this method is the ability to obtain information about transport costs and qualitative indicators that are not quantified by current indicators of the transport efficiency. However there is no guarantee that it will gather information about the commercial terms of transportation (price) because such information is protected. Informal form of interviews with freight forwarders / carriers usually gives better results than a formal interview.

3. Calculation of vehicle operating costs - VOC. It is useful to put the transportation costs in relation to the type of transport vehicle. This indicator is usually used as benchmark for measuring the effectiveness of the road or railway (infrastructure). VOC depends on the characteristics of the transport (technological, technical characteristics, speed, resistance ...) and on the infrastructure characteristics (the number of lanes, speed limits, flow, vertical gradient, curves ...). For railways it would be useful to know the VOC for the rail section and for the whole corridor. Railway line with higher rises have a higher VOC, also railway lines that are not electrified have higher VOC. Delays i.e. "Congestion cost" may also be included in the VOC.

4. Measuring of performance at critical points. The most common places are those where bottlenecks or congestion are created (e.g. border crossings).

Measuring indicators refer to the waiting time for border crossing or to the percentage of lost time from the total journey duration.

For quality and comparable performance measurement the selection of appropriate indicators is necessary within the meaning of ordinal as well as cardinal performances comparisons. Selection of the right performance indicators depends on the purpose that must be fulfilled. It can be two-fold: to establish criteria to monitor the competitiveness of the route or impact assessment of the investment project. In the first case it is necessary to consider the wider context in which the entire transport process in the corridor is conducted, while for a specific project should be taken into account more detailed indicators in the narrow space (i.e. Port or border crossing), where the project is implemented and which can measure the success of its implementation.

To measure logistics performance on the corridor there is necessary to establish measurable indicators and methods for their collecting and processing. Therefore we proposed key performance indicators covering port and hinterland area in the Table 2. The indicators are redeveloped according to (Raballand et al., 2008).

Table 2. Transport logistic performance indicators in the port and hinterland area

Corridor performance indicators	*Method for collecting/processing*
Travel flow and duration	
The total duration of transportation between the port and the industrial / logistics center in the hinterland regarding the type of cargo (containers / bulk)	The monitoring system should be developed
Time of intermediate storage / retention of goods in the port (dwell time)	Concessionaires have to report this data to the port authority. Implementation and/or upgrading the PCS system
Status of containers in the port - time required to obtain information about the position of the container	Establish / improve the information system at container terminal and data interchange.
Amount of cargo transported through the port according to the type of cargo and type of container (full / empty)	If necessary unify procedures for collecting statistics data about the cargo
Amount of cargo in import / export and transit which is transported through the port	Unify procedures for collecting and sharing data
Transport time from and to the checkpoints, including arrived	Establishment of geo-referenced information system on corridor level

time, waiting time and departure time at checkpoint.	
Delays	
Time for the border crossing (if possible with specification of causes of delay)	Check lists/questionnaires reports. GPS and/or geo-referenced information systems at the border crossings.
Delays in road transport (in relation to the reference time)	**Reference time should be established for each OD pairs on the transport route.**
Delays in rail transport (in relation to the reference time)	
Operator efficiency	
Productivity / performance	Port authority reports and concessionary reports
The time required for the preparation and dispatch of trains	Concessionary reports (shunting train operators)
Number of formed block trains / daily / weekly / monthly	Concessionaire reports (shunting train operators)
Number of trucks in both directions /daily /weekly /monthly	Porth authority reports
Annual distance per truck	Port authority reports Check list/questionnaires reports
Tariffs	
Prices of transport services in road and rail traffic on the main routes.	Identify the main trip O-D matrix. Make a list of key public and private transportation companies. Periodically conduct interviews (e.g. quarterly) If needed use of external teams services.

Abbreviations:
PCS - Port Community Systems
O-D matrix - Origin–Destination Matrix.
Source: Authors elaboration

5. ANALYSIS OF FACTORS AFFECTING LOGISTICS PERFORMANCES AS DETERMINANTS OF PORT COMPETITIVENESS

Detection and determination of transportation costs on the transport corridor is next important step in the evaluation of performances. A large number of entrepreneurs and intermediaries exist in the container transport on the market. The most common are: legal entities that manage infrastructure, operators in different transport sector, port and terminal operators, service providers in inland transport segment, freight forwarders, logistic companies and more recently so-called system integrators. In such business environment it is very difficult to determine the

mechanisms of pricing the transport services in a way to be standardized and universally applicable.

The commercial transportation costs, by the sources of costs, can be grouped into several key categories:

- Amortization
- Staff costs
- Fuel costs, lubricants costs and others
- Maintenance costs
- Insurance costs
- Toll and other fees
- Third parties services.

The elements that affect the cost of transport services in road and rail transport are shown in Table 3.

Table 3. Types of impact of each factor on the transport price for services in inland transport

Impact factor	*Type of influence in inland transport*
Capital cost of infrastructure	No direct influence on tariffs unless toll payment
Condition of infrastructure, maintenance and availability	Directly affects the duration of the trip, safety, capacity, reliability and operating costs
Capital cost of the device and equipment and efficiency	Directly affects the operating costs; flexibility of equipment, provides higher yield and lower unit costs
Tools and equipment condition	Impact on safety, reliability and consequently on the costs
Fuel costs	Significantly affect the direct costs of road traffic
Relief and vertical slope of the terrain (ascents and descents)	Big ascents and descents reduce speed and safety and increase operational costs
Size and weight of the package	Because of its size large cargo can affect the capacity of the infrastructure
The regularity of service	It is important in rail transport for planning of employment capacity. The absence of regular services (transportation demand) can significantly increase railway tariffs
Balanced cargo flow (transportation demand)	Directly affects the costs. One-way transport almost twice increases transportation costs due to the cost of return travel and / or additional logistics costs (e.g. empty containers)
The long-term transport contracts	Affects the services price, but not crucial, depending on market conditions, it is possible to arrange commercial discounts. In rail transport this element is very important and can significantly reduce the cost of transportation

Cargo amount	No significant cost savings in road transport, but very important for reducing costs in the railway transport. Large amounts of cargo allow better use of resources and lower tariffs.
Destination distance	Direct impact on the road transport costs. In rail transport less impact on tariff.
Commercial speed	In terms of cost it is important to avoid congestion due to which there is an increase of costs
Turnaround time and duration of the trip	Directly affects the costs.
Delays at border crossings	Major cost factor.
Service "door-to-door"	Essential because of the additional costs to final destinations
Cargo tracking and implementation of ITS	Affects logistics costs
The service "just-in-time"	An integral part of the regular services in road transport; very difficult applicable in railways due to inflexibility.

Abbreviations:
ITS - Intelligent Transportation System
Source: Authors elaboration

As it is illustrated in the Table 3 each of the detected main impact factors plays a significant role in transport corridor logistics performances which can be observed as significant determinant of port competiveness. Disturbance in any of the factors has direct impact on attractiveness and cost efficiency of the corridor as a system and in the same time has indirect impact on port competitiveness.

Part of the factors are highly cost conditioned mainly because their implementation and improvement requires significant financial resources:
- Capital cost of infrastructure,
- Condition of infrastructure, maintenance and availability,
- Capital cost of the device and equipment and efficiency,
- Tools and equipment condition,
- Fuel costs,
- Relief and vertical slope of the terrain (ascents and descents),
- Size and weight of the package,
- Turnaround time and duration of the trip.

On the other hand part of the factors are mainly non-cost oriented and are primarily a result of "soft" incentives and organisational issues with high level of know-how required for their implementation and improvement:
- The regularity of service − various fluctuations in the level of transport demand can have significant negative economic results in rail transport as it requires a high level of engagement of fixed assets, so special management attention needs to be focused on quality planning,
- Balanced cargo flow (transportation demand) − in rail transport it is especially important to strive to achievement of two-way transport,

respectively the full capacity in both directions, as this directly influence transportation and logistics costs,

- The long-term transport contracts – management needs to be oriented towards conclusion of a long-terms contracts because this is important as a solid foundation for middle and long-term capacity planning, and this can be positively influenced by quality of service, speed, competitive price and other competitive aspects of business,

- Cargo amount – large amount and time balance of cargo can significantly reduce costs in the railway transport as it allows better use of resources so management can offer lower price, so it is important for management to pay special attention to volume and time balance of cargo in the process of contracting,

- Destination distance – as directly connected with resource utilization destination distance affects costs so management needs to be continuously focused on a effort of extension of the route and can stimulate such arrangements with clients

- Commercial speed – speed of cargo flows is one of the main factors that is evaluated when choosing the corridor so in order to be competitive management needs to put special attention to all time consuming risks that can potentially slow down the cargo flows, so in this area the organisational aspects on the whole corridor have a prominent role,

- Delays at border crossings – following the previous factor, the delays at border crossing as well as clearance procedures are of special importance for achievement of fast and harmonised traffic flow and in this processes the cross-border agreements play an important role.

- Service "door-to-door" – represents a way of transport integration into one service from the perspective of customer and can be a potential for reducing agency costs as well as other transportation costs,

- Cargo tracking and implementation of ITS – implementation of intelligent transportation systems represent a significant possible boost of competitiveness of the corridor because it speeds up transport due to multiple aspects and processing of documents is one of them that is of special importance for modern transportation, but it is important to be implemented and compatible alongside the corridor as much as possible,

- The service "just-in-time" - Just-in-Time logistics channel and service, applicable mainly to road transport, has to be focused on arrival of cargo at its destination right before it is needed and that lowers inventory, storage and other operational costs.

Although the cost conditioned factors are very important for corridor attractiveness and logistics performances, the non-cost oriented factors are of essential significance for competitive position improvements of the port as well as transport corridor as a whole. The non-cost factors are those that require more know-how and as such are primarily value added generators and multiplicators of the port competiveness and transport corridor logistic performances.

One of the important questions, on which we would like to especially thank to the reviewers, is a meter of a procedure targeted to aggregate all the impact factors to

a single assessment. Such a procedure would need to incorporate multiple dimensions and perspectives of each of the detected impact factors, but there is still remaining a problem of variables comparability. In other words such a system should be able to develop an objectively verifiable aggregation procedure which is hard to be accomplished without significant level of arbitrary. We would like to emphasize the importance of usage of ordinal measures instead of cardinal ones in order to minimise arbitrary decisions.

6. CONCLUSION

In this paper are systematized the key cost factors and are qualitatively determined key non-cost factors as well as the most common ordinal intensity of their influence. The paper also elaborates possible models of evaluation and assessment of the impact intensity of cost and non-cost elements that determine transport corridor logistics performances.

It is particularly important the question of a port tariffs and fees. If there are published tariffs for commercial transport, they may significantly differ from the actual price offered to the client. It is common practice that for larger amounts, more frequent shipments, or for strategically important partners the discounts are granted through a long-term contracts that are difficult to identify and support with the available documentation.

Through the analysis it is evident that the economies of scale issue is very prominent, especially reviewing a transport corridor as an integral system. This particularly because the transport throughput of a corridor depends largely on the most significant bottleneck in this corridor, and just overcoming a technical (physical) bottlenecks does not necessary bring competitive improvement, but implementation of "soft" solutions is simultaneously required in order to overcome and remove non-physical barriers and through that to improve logistics performances and to raise competitiveness level of an entire corridor. Here largely comes to the forefront the question of vertical and horizontal integration of transport companies. From the perspective of a shipping companies and port / port authority unification and integration of transport services through the system integrator could help determine the transport corridor costs, raise logistics performances level and improve competitiveness of a supply chain. Simply stated, through this approach the inland transport component would be more transparent and more reliable in terms of performances and costs. In in such a case shipping companies would negotiate transport conditions on a door-to-door basis with one entrepreneur.

We conclude that the impact intensity of cost and non-cost factors affecting the transport corridor logistics performances is variable in size and largely dependent on political factors and hinterland development which is also a substantial determinant of port competitiveness in general.

This paper opens new research directions for future research opportunities in a way of demonstrating the importance of non-cost factors that affect logistics performances of the whole transport corridor and are largely dependent on social factors emphasizing the political factors. This represents a solid basis for further

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research aiming to develop a research platform that thoroughly systematize and distinguish all aspects of key social factors as well as provide measurable basis for ordinal comparison of the intensity of their influence.

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