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DEVELOPMENT OF REGIONAL TRANSPORT LOGISTICS TERMINAL - TRANSPORT LOGISTICS APPROACH

ABSTRACT

Reaching decisions in the process of establishment and operation of a regional transport logistics terminal performing intermodal transport and related activities should be based on the results of preliminary analysis. The selection of the appropriate location for the regional transport logistics terminal is of crucial importance as it affects directly and/or indirectly the initial financial investment, environmental and spatial issues as well as terminal operating costs and commercial sustainability. In the decision-making process regarding the location of intermodal terminals or with regard to building of a new regional intermodal terminal at a specific location a thorough transport logistics analysis should be performed. The paper presents the methodology developed for transport logistics analysis of regional intermodal transport logistics terminals, based on the sets of parameters, criteria and indicators which enable the determination of the overall performance index for a particular terminal location.

KEY WORDS

intermodal transport, intermodal logistic terminal, transport logistics analysis, regional terminal development

1. INTRODUCTION

Intermodal transport is defined as the movement of goods in one and the same loading unit or road vehicle, which uses successively two or more modes of transport without handling the goods themselves in changing modes. [1]

By extension, the term intermodality has been used to describe a system of transport whereby two or more modes of transport are used to transport the same loading unit or truck in a integrated manner, without loading or unloading, in a (door-to-door) transport chain.

Intermodality represents a quality indicator of the level of integration between different modes, more intermodality meaning more integration and complementarity between modes, which provides scope for more efficient use of the transport system. The integration between modes needs to take place in several fields – infrastructure, equipment, operations, services and regulatory conditions. [2]

Intermodal transport represents one of the approaches at the EU level to solve the present and expected problems in freight transport and it is also an important EU political issue. The 2001 White Paper on EU transport policy contained plans to establish multimodal corridors giving priority to freight throughout Europe.

Setting up a network of intermodal terminals or nodes linked to multimodal corridors, while taking into account the complexity of establishing an efficient Europe-wide system, requires a lot of research. [3]

Research should mainly be based on the development planning and design tools in order to develop and integrate terminals into the network. Identification and analysis of obstacles encountered by freight transport intermodality should help in defining the guidelines and recommendations for practitioners as well as politicians. [2]

2. DEFINING REGIONAL INTERMODAL TRANSPORT LOGISTICS TERMINAL

An intermodal terminal is a place equipped for the transhipment and storage of intermodal transport units (containers, swap bodies and semi-trailers suitable for intermodal transport) [1].

Terminals can be defined as nodes in a shipper/carrier system and perform various functions to facilitate the movement of freight. Since all modes of transport use terminals in one context or another, a terminal can be any point within a transport chain where the movement of cargo is stopped or paused for

a modal interchange, added value services, or both. Terminals can also be identified as nodes, interchange or articulation points, where different transport links meet. [4]

The intermodal transport logistics terminal (TLT) must be treated as an individual element within the logistics (supply/distribution) chain. Thus it can be said that the terminal is a business unit that must serve the basic purpose for which it was built and at the same time it must be commercially attractive for the investors or operators. It must operate in accordance with the legislative and social norms and at the same time enable sustainable regional/local development.

Intermodal TLTs have a broad economic and social meaning. As such, they can be treated from different viewpoints:

- from the viewpoint of location – here we consider the point of intersection of the transport routes/corridors and the area of the economic centre with powerful industrial and market hinterland where there are strong freight flows,
- from the viewpoint of concentration of freight – around such a location there is a concentration of warehouse facilities and business areas, infrastructure and handling facilities, safety/security and maintenance services,
- from the viewpoint of rationalization – with the concentration of freight and thus the concentration of all the activities in one place the rationalization of the whole transport increases,
- from the viewpoint of sustainable development – building and operation of the intermodal terminals/nodes have an important role in the development of sustainable freight transport technologies and an increase in share of intermodal transport.

As by its definition, intermodal transport should consist of the major part of the transport performed by rail and the railway intermodal terminals are preferred. Two main types of intermodal railway terminals can be distinguished:

- inland terminals (located in freight villages, transport and logistic centres, shunting stations, inland ports), and
- port terminals (located in maritime and inland waterway ports).

For intermodal transport to be efficient, coherent networks of intermodal TLTs are required. Some of the terminals can become regional/local centres of economic activity, integrating regional/local supply and demand into the logistics structures for long-distance transport.

Regional intermodal TLTs are usually small and medium-sized terminals. A particular regional intermodal terminal can acquire three main operational functions. It can operate as:

a) Regional/local distribution centre (serving regional/local area – urban and industrial areas and to a lesser extent (transit) flows passing through the site):

The location of the terminal is very important for the development of the regional/local, distribution centre. For a terminal to be classified as a regional/local distribution centre the following conditions have to be fulfilled:

- there needs to be an efficient existent physical (infrastructure) connection between the terminal and the city/urban centre, and
- a substantial share of the terminal activities must be connected with the city freight distribution (which in most cases is not true although the terminal is located in the direct vicinity of the city).

The operators of these terminals are usually enterprises with mixed ownership (private and public capital) and in the initial phase the public co-funding is assured. The private enterprises decide to manage the platforms mostly on the basis of comparison between the required investments and the expected profit.

b) Terminal – platform with transit function (serving mainly (inter)national (transit) freight flows passing through the terminal and to a lesser extent terminal catchment/regional/local area):

Usually, when setting up terminals – freight platforms regional/local authorities have great expectations, often overestimated. Consequently, the platforms are often not planned optimally to meet the needs and demand of a certain region which leads to commercially unsustainable operation and financial losses for all stakeholders. Such mistakes often appear as consequence of the following factors:

- the analysis of the existent freight flows in the catchment (city/urban) area was not performed properly (underestimated and overestimated transport flows - quantity of freight),
- underestimated or overestimated needs for logistics services,
- indistinctly placed goals (of regional/local authorities),
- giving priority to specialised platforms,
- preference to larger platforms instead of implementing the specialized networks of smaller platforms.

The platforms should be set up and implemented in accordance with the regional demands and taking into consideration all of the important influential factors and their mutual interactions. For this, the following needs to be performed:

- calculation of the potential terminal throughput,
- defining the optimal type of platform,
- defining the optimal location,

- integrating the existent non-connected platforms into the functional network,
- calculation of the transportation effect of the platforms,
- analysis of the transportation effects,
- determining environmental effects, and
- determining the possibilities for operation and further development of platforms.

The analysis of the regional needs for a freight platform is of utmost importance and represents the basis for reaching all subsequent decisions. The platforms are frequently not planned in accordance with this, so that in the future phases unsuitable capacities are disocvered and consequently the platforms ineffective. In the preliminary phase, when analysing the potential terminal throughput there needs to be a close examination of:

- the structure (type) of the goods and the volume of the freight in the platform catchment area,
- the platform area available for the transhipment/ /manipulation operations,
- the existent modes of transport and type of technologies,
- the quality of the connections with the local and national (transport) infrastructure,
- the distances from the clients and other destinations.

Most of these factors that have influence on the terminal throughput are dependent on the sole parameters of the platform; nevertheless, the regional freight flows and the goods structure have the biggest influence. The structure of the goods is an important factor because not all of the freight is equally convenient for transhipment and other manipulation on freight platforms.

The competition and effectiveness of the freight platforms can increase with the establishment of a network of collaborative platforms. In this way the competition of the railway and indirectly intermodal transport also increases. Rail is competitive only under conditions in which the transshipment times are minimal when the direct and regular trains are used. Terminals connected effectively affect positively not only the volume of freight and the extent of economic success of individual platforms but of the whole network. The connections can be at European, national and regional levels.

At smaller city terminals, where there are relatively small quantities of freight to be transported to numerous different destinations we cannot speak of effective direct connections with large city platforms. However, smaller platforms can also be integrated into the European network of terminals/freight centres by railway (e.g., by a direct train).

c) Hinterland terminal/inland port (serving mainly neighbouring ports and to a lesser extent freight flows passing through the site and terminal catchment/regional/local area):

For the development of intermodal transport a sufficiently large concentration of freight is needed in one place. Typical are the maritime ports, which are often not suitable for performing value added services and freight distribution. In cases where ports are surrounded by the city centre and their expansion is not possible, a hinterland terminal or inland port is built.

The port hinterland terminal must be located next to national railways that are connected to the European transport corridors (trans-European transport network axes and pan-European transport corridors). Hinterland terminals require better services than usually offered today by the railway companies as well as proper reduction of their prices because here the railway transport will encounter strong competition with the road transport. The development of the hinterland terminal requires innovative solutions so as to shift the freight to the railway, good railway services and the introduction of block trains.

How the individual regional terminals or platforms will be incorporated into the European network of intermodal terminals depends on the speed of construction or modernization of the existent capacities, on the location where the terminal is located and on the road and railway infrastructure in this region that has to be as much in accord as possible with the planned European transport corridors.

3. DEVELOPMENT OF REGIONAL INTERMODAL TRANSPORT LOGISTICS TERMINAL

The development of regional intermodal transport logistics terminal requires a multidisciplinary approach consisting of three essential parts: transport logistics analysis, spatial-environmental evaluation and business-financial analysis.

Transport logistics analysis represents the first step, in the preliminary phase, where terminal key sustainability/viability factors are considered: freight flows, location, infrastructure, terminal capacity/ /equipment and operation, etc. The influence of administrative and transport policy measures needs to be taken into consideration as well.

Freight volume

The volume of freight handled that can be realistically expected at an individual terminal is very important for the development of the regional terminal. This depends on the function developed by the terminal, the terminal catchment area and of course on the

attractiveness of the individual location. The recommendations concerning volume – TEU (Twenty-foot equivalent unit) throughput, are as follows:

- for the development of small terminals the limit is 5,000 TEU/year,
- for the development of medium terminals from 5,000 to 20,000 TEU/year,
- for the development of large terminals from 20,000 to 40,000 TEU/year,
- for the development of super large terminals the limit is more than 40,000/TEU year.

The minimum freight flows in the terminal catchment area for the development of an intermodal terminal should be 4 million tons/year, which enables the formation of 1 block train daily.

The share of the seasonal goods (influence of seasonality) at the terminal has to be considered as well as the possibility to replace the loss of freight during the dead season. Smooth distribution of freight volume enables the most efficient use of terminal capacities (space and equipment), thus minimizing the costs. An uneven freight volume distribution over a time period (a month or a year), due to seasonality in particular, can have a significant impact on the level of required terminal capacities and their utilization. In order to keep the terminal operating costs (and by this also the intermodal supply/distribution chain cost as a whole) optimal, the freight flow oscillation or the seasonality effect have to be kept to a minimum, which is often very difficult, if not impossible to achieve.

Terminal location

Although freight flows represent the key terminal viability factor the location of the terminal is of utmost importance when reaching decisions on the establishment of an intermodal TLT. Appropriate terminal location affects significantly the success of its operation and further development.

The process of development or building an intermodal terminal should also be discussed from the viewpoint of the three stakeholders (users of the terminal, investors/terminal operators and the community). According to Macharis [5] the aims and goals of the actors involved should determine all the relevant criteria to be taken into account when analysing intermodal terminal location:

- *terminal users (transport operators, forwarders, consignors and consignees)*: Their aims and goals can be conflicting. In the first place they want minimization of the transport cost consisting of the cost of transport service and the value of the transportation time. In some cases the reliability and the frequency of the service are even more important than the transportation time. The services offered by the terminal and the connection with other transport modes are two additional criteria for the user;
- *terminal owners/operators*: They are more concerned with the terminal financial viability. Terminal possibility to expand and infrastructure capacity are important decision factors;
- *community as a whole*: is concerned primarily with the effects of the developing/building of an intermodal terminal on the environment, congestion and employment.

Transport infrastructure

When developing the intermodal terminal the existent infrastructure at the location where the terminal would develop and its vicinity is very important. It is reasonable to develop the intermodal terminal where road and especially railway infrastructure already exist. Intermodal terminals are often built nearby or in the immediate vicinity of railway freight stations as the share of the railway infrastructure in the initial investment is very high.

It is also recommended that the regional intermodal terminal develops near the main transport corridors.

Political conditions

Besides technical and technological conditions in affecting justification of development and operation efficiency of the intermodal terminal, the implementation of administrative and transport policy measures, which affect differently different types of intermodal transport, also have considerable influence. The dependence on favourable political conditions is a significant feature particularly for intermodal transport of road vehicles (accompanied combined transport), while unaccompanied combined transport is to a greater extent affected by direct improvements in intermodal transport.

For the development of intermodal transport on a national/regional level the political and administrative steps that are of government and ministerial competence are also necessary. Such steps are also attended by the EU countries; mostly they refer to different incentives for the development of the intermodal transport:

- favourable financial conditions for investment in the development of intermodal transport,
- direct deposit of designated resources in infrastructure and equipment for terminals and handling facilities,
- tax and customs relief for the acquisition of transport means and handling facilities for intermodal transport,
- restrictions in permissions in the international road transport,
- stricter regulations on maximum permissible vehicle mass in road transport and reduction of routes where permits are not necessary.

Equal arrangement of the position and conditions of operation for road and railway operators can contribute to the development of intermodal transport and show all the economic and environmental advantages of this transport. This requires political arrangements:

- modelling framework conditions to allow for the advantages of intermodal transport in comparison with conventional (unimodal) transport,
- increase the efficiency and advantages of intermodal transport by investing in technical and organizational structure.

The stimulation to use intermodal transport can be obtained with financial support and its promotion on all levels. For the new EU countries and accession countries urgent steps can assist in their catching up with the developed system of intermodal transport in Europe and at the same time increase the competitive position on the transportation market.

4. METHODOLOGY

In the decision-making process regarding the location of the regional intermodal terminal at a specific location a thorough transport logistics analysis should be performed. The acquired results should be evaluated and compared to reference values. The methodology that should be applied in the transport logistics analysis of the terminal location is presented here.

The methodology has been developed based on the results of the research of intermodal freight transport system development in Slovenia. Due to the characteristics of Slovenia regarding geostrategic, economic and political conditions (location, area, structure and intensity of freight transport, new EU member state, etc.), the applied approach and methodology developed are appropriate for application to other similar countries or comparable regions.

The methodology is based on a multi-criteria analysis. Determination of a set of parameters, each of them consisting of several criteria which also consist of various identified indicators is performed. In the grading specification procedure the criteria and indicators are appointed measurable values or characteristics (in case of descriptive criteria and indicators). The indicators are then graded (1 to 5) and each criterion is properly weighted so that weights of all criteria together make up 100% of the parameter. The parameters are also weighted so that all of them make up 100%.

In order to implement the methodology the following steps of the evaluation model should be adopted:

- identification of parameter and criteria weights,
- specification of grading for each criterion,
- grading of each criterion,
- calculation of the overall performance index.

a) Identification of parameters and parameter weights:

The most important factors – parameters, which are the crucial viability drivers in the process of establishment and later operation of the regional TLT are: freight flows, location, infrastructure (particularly railway infrastructure) and terminal equipment and operation. Parameters and adopted weights are presented in Table 1.

Table 1 - Identified parameters with adopted weights

Parameter	Weight
Freight flows	30%
Location	20%
Infrastructure – general	20%
Infrastructure – railway network	20%
Terminal equipment and operation	10%
Total	100%

b) Identification of criteria and criterion weights for each parameter:

The key parameters consist of several criteria that are appropriately graded depending on the requirements arising from the terminal function and status - upgraded existing terminal, planned new terminal (Table 2).

Weight selection: When analysing the *Location* parameter three sets of weights are available (1*, 2* and 3*). The set of weights should be selected and applied according to the type/function of a particular regional intermodal TLT: inland terminal - applied set of weights number 1, transport logistics platform - applied set of weights number 2, regional/local distribution centre - applied set of weights number 3.

c) Identification of indicators and specification of grading for each criterion:

For the identification of a grade of each indicator, a 5-scale grading range is defined (Table 3). The specification of grading for each criterion of a particular parameter is presented in Tables 4 to 8 as follows:

- freight flows (Table 4),
- location (Table 5),
- infrastructure – general (Table 6),
- infrastructure – railway network (Table 7),
- terminal equipment and operation (Table 8).

Qualitative criteria are evaluated based on the indicators which provide the relevant level of criterion satisfaction. The particular criterion grade is defined as:

$$b_N = (\sum c) / d \quad (1)$$

b_N – particular criterion grade,

c – sum of indicators grades of a particular criterion,

Table 2 - Identification of criteria and criterion weights for each parameter

Parameter	Criterion	Weight		
Freight flows	Existing freight flows in terminal catchment/hinterland area	50%		
	Potential freight flows in terminal catchment/hinterland area (road/rail ratio)	20%		
	Economic sector in terminal catchment/hinterland area	20%		
	Seasonality	10%		
Location		1*	2*	3*
	Distance from major industrial zones (km)	10%	50%	15%
	Distance from ports (km)	75%	20%	5%
	Distance from airports (km)	0%	5%	5%
	Distance from transport and transhipment companies (km)	5%	10%	10%
	Distance from urban and commercial centres (km)	5%	10%	55%
	Distance from agricultural centres (km)	5%	5%	10%
Infrastructure - general	Connection to international motorway network	20%		
	Connection to national motorway network	15%		
	Connection to international railway network	20%		
	Connection to national railway network	20%		
	Connection to maritime terminals	20%		
	Connection to hub-airports	5%		
Infrastructure – railway network	Railway infrastructure	50%		
	Railway connection to other terminals / terminal network	30%		
	Bottlenecks	20%		
Terminal equipment and operation	Terminal operation (general issues)	50%		
	Terminal layout and equipment	50%		

Table 3 - Identification of a grade for each indicator

Grade	Performance
5	Very good - as regards the specific criterion and indicator
4	Good - as regards the specific criterion and indicator
3	Average - as regards the specific criterion and indicator
2	Bad - as regards the specific criterion and indicator
1	Unacceptable - as regards the specific criterion and indicator

d – number of indicators of a particular criterion.

Based on the qualitative criteria grades and weights the particular parameter grade is defined:

$$y = \sum a_N * b_N \quad (2)$$

y – particular parameter grade,

a_N – particular criterion weight (e.g. 35 % = 0.35),

b_N – particular criterion grade.

d) Intermodal TLT overall performance index:

The results of the transport logistics analysis should be evaluated and compared to the recommended/reference values. In this way the evaluation of location appropriateness and development and operational feasibility of regional intermodal TLT, from the transport logistics point of view is obtained.

Minimum grades that individual terminal location should get in the parameter evaluation process (y) have been defined (Table 9). The most important factors to be considered are freight flows in the terminal catchment/hinterland area and built railway infrastructure; therefore, they have higher grades compared to others.

Table 4 - Specification of grading for each criterion of the Freight flows parameter

Criterion 1	Existing freight flows in the terminal catchment area				
Indicators	Grading				
	1	2	3	4	5
Flows (long haulage and/or distribution) generated in the terminal catchment/hinterland area (tons per year)	< 180,000	< 350,000	< 550,000	< 700,000	700,000 <
International freight flows passing through the site/terminal (tons per year)	< 500,000	< 850,000	< 1,200,000	< 1,550,000	1,550,000 <
Ratio of total rail/road freight flows	Road prevailing (20 / 80)	Road substantial (40 / 60)	Balanced (50 / 50)	Rail substantial (60 / 40)	Rail prevailing (80 / 20)
Total intermodal freight flows share (%)	<10%	10 – 20%	20 – 35%	35 – 50%	50% <
Criterion 2	Potential freight flows in terminal catchment/hinterland area				
Indicators	Grading				
	1	2	3	4	5
Intermodal freight flows (tons per year)	<100,000	<150,000	<200,000	<300,000	300,000 <
Ratio of total rail / road freight flows	Road prevailing (20 / 80)	Road substantial (40 / 60)	Balanced (50 / 50)	Rail substantial (60 / 40)	Rail prevailing (80 / 20)
Total intermodal freight flows share (%)	<15%	15 – 30%	30 – 40%	40 – 50%	50% <
Criterion 3	Economic sector in terminal catchment/hinterland area				
Indicators	Grading				
	1	2	3	4	5
Business zones (BZ) in the terminal catchment area	There are no BZ, Not planned	There are no BZ, Planned	BZ Exist, No railway connection	BZ Exist, Railway connection	BZ Exist, Substantial influence on terminal, Direct railway connection to terminal
Planning security (BZ) – property status / availability (public or private, one or more owners, and feasibility of implementation)	Doubtful property status	Numerous properties, with difficulties in joining them (expropriation required)	Numerous properties. May be joined only through expropriation	Public land	Public land with possible interest by owner to be granted by owner
Planning security (BZ) – planning (whether it is approved for implementation, and in accordance with national and regional planning)	Not compatible with land used planning	Land use planning under development (major reactions exist)	Land use planning under development (neutral acceptance for terminal development)	Land use planning under development (positive acceptance for terminal development)	Established land use
Complementary activities (on the existing / potential terminal location)	No complement-tary activities	Some commercial / industrial activities	Some commercial / industrial / transportation activities	Important commercial / industrial / transportation activities, even adjacent	Important commercial / industrial / transportation / 3PL activities, even adjacent
Criterion 4	Seasonality				
Indicators	Grading				
	1	2	3	4	5
Share of seasonal freight flows (%)	80 – 100%	50 – 80%	35 – 50%	15 – 35%	<15%
Compensated share of lost seasonal freight flows (%)	<15%	15 – 35%	35 – 65%	65 – 80%	80 - 100%

Table 5 - Specification of grading for each criterion of the Location parameter

Criterion	Grading				
	1	2	3	4	5
Distance from major industrial zones (km)	> 25	10 - 25	5 – 10	2 – 5	< 2
Distance from ports (km)	> 25	10 - 25	5 – 10	2 – 5	< 2
Distance from airports (km)	> 25	10 - 25	5 – 10	2 – 5	< 2
Distance from transport and transhipment companies (km)	> 25	10 - 25	5 – 10	2 – 5	< 2
Distance from urban and commercial centres (km)	> 25	10 - 25	5 – 10	2 – 5	< 2
Distance from agricultural centres (km)	> 25	10 - 25	5 – 10	2 – 5	< 2

Table 6 - Specification of grading for each criterion of the Infrastructure – general parameter

Criterion	Grading				
	1	2	3	4	5
Connection to international motorway network	Not scheduled until 2010 (TLT cannot realize the connection)	Not scheduled until 2010 (TLT may realize the connection)	Indirect connection via national network or direct connection with congestion problems	Direct, good connection	Direct, very good connection
Connection to national motorway network	Not scheduled until 2010 (TLT cannot realize the connection)	Not scheduled until 2010 (TLT may realize the connection)	Indirect connection via local network or direct connection with congestion problems	Direct, good connection	Direct, very good connection
Connection to international railway network	Future connection, problematic with technical and financial problems	Not scheduled until 2008 (TLT cannot realize it)	Not scheduled until 2008 (TLT may realize it)	Indirect but efficient connection	Direct, very good connection
Connection to national railway network	Future connection, problematic with technical and financial problems	Not scheduled until 2008 (TLT cannot realize it)	Not scheduled until 2008 (TLT may realize it)	Indirect but efficient connection	Direct, very good connection
Connection to maritime terminals	Future connection, problematic with technical and financial problems	Not scheduled until 2008 (TLT cannot realize it)	Not scheduled until 2008 (TLT may realize it)	Indirect but efficient connection	Direct, very good connection
Connection to hub-airports	Future connection, problematic with technical and financial problems	Not scheduled until 2008 (TLT cannot realize it)	Not scheduled until 2008 (TLT may realize it)	Indirect but efficient connection	Direct, very good connection

Table 7 - Specification of grading for each criterion of the Infrastructure – Railway network parameter

Criterion 1	Railway infrastructure				
Indicators	Grading				
	1	2	3	4	5
Number of tracks /permitted axle load (t) / track load (t/m)	1-2 / 16,0 t	1-2 / 18,0 t	2 / 20,0 t	2 / 22,5 t / 7,2 t/m	2 / 22,5 t / 8,0 t/m
Nominal speed (km/h)	< 60km/h	< 80km/h	< 100km/h	< 12 km/h	120km/h <
Loading gauge	UIC GA	-	UIC GB	-	UIC GC
Number of tracks in the TLT	1	2	3	4	4 <
Interoperability issues	Track gauge and / or permitted axle load	Signalling system and voltage of electrified lines	Signalling system or voltage of electrified lines	Legal requirements in terms of working practices / Administrative issues	No barriers / issues
Financing sources for construction of planned railway infrastructure (rail lines, other infrastructure)	Financial sources not defined	Private founding	Public – private partnership PPP	Financing (private or PPP) is of national importance	Financing (private or PPP) is of international / EU importance
Criterion 2	Railway connection to other terminals / terminal network				
Indicators	Grading				
	1	2	3	4	5
Connection to national TLT network	Not scheduled until 2010 (TLT cannot realize the connection)	Not scheduled until 2010 (TLT may realize the connection)	Indirect connection via national network or direct connection with congestion problems	Direct, good connection	Direct, very good connection
Connection to neighbouring country / crossborder TLT network	Not scheduled until 2010 (TLT cannot realize the connection)	Not scheduled until 2010 (TLT may realize the connection)	Indirect connection via national network or direct connection with congestion problems	Direct, good connection	Direct, very good connection
Criterion 3	Bottlenecks				
Indicators	Grading				
	1	2	3	4	5
Infrastructure related - terminal connection to TEN corridors	Not scheduled until 2010 (TLT cannot realize the connection)	Not scheduled until 2010 (TLT may realize the connection)	Indirect connection via national network or direct connection with congestion problems	No bottlenecks - direct, good connection	No bottlenecks - direct, very good connection
Dwelling time (DT) – transhipment / waiting time	Maximum train DT at rail and/or maritime terminal more than 60 min	Maximum truck DT at rail and/or maritime terminal more than 30 min	Maximum truck DT at rail and/or maritime terminal less than 30 min	Maximum train DT at rail or maritime (inland water way) terminal less than 60 min	Maximum train DT at rail and maritime (inland water way) terminal less than 60 min
Border crossing delay	45min <	30 - 45min	15 - 30min	10 - 15min	< 10min
Terminal related delay (cause)	Institutional barriers (legal, customs procedure, etc.)	Terminal equipment capacity	Lack of information technology (IT) support	Working hours	No particularities

Table 8 - Specification of grading for each criterion of the Terminal equipment and operation parameter

Criterion 1	Terminal operation (general issues)				
Indicators	Grading				
	1	2	3	4	5
Conditions for introducing present/new safety/security measures	Bad (no basic pre-conditions	Introduction possible in near future	Good (introduction possible in short time)	Very good (introduction possible in very short time)	Conditions for immediate introduction fulfilled
Terminal operation information technology (IT) support	None	Minimum (only few applications)	Variety of applications (system applications not connected)	Good (various applications - systems connected) Commercial services offered	Existing full (required) IT support
Criterion 2	Terminal layout and equipment				
Indicators	Grading				
	1	2	3	4	5
Warehouse / storage and manipulation area	Not existing	Existing, Does not meet present demand	Existing, Meets present demand, Extension not possible	Existing, Meets present demand, Extension possible	Existing, Meets anticipated demand in next 5 years Extension possible
Terminal enlargement / capacity increase	Not possible (terminal area enlargement not possible, cargo handling equipment capacity increase limited – capacity optimum already reached)	Possible (terminal area enlargement not possible, cargo handling equipment capacity increase possible – capacity optimum not reached)	Possible (terminal area enlargement possible up to 50%, cargo handling equipment capacity increase possible)	Possible (terminal area enlargement possible 50% - 100%, cargo handling equipment capacity increase possible)	Possible (terminal area enlargement possible >100%, cargo handling equipment capacity increase possible)
Cargo handling equipment	Not existing	Existing, Does not meet present requirements in view of capacity	Existing, Obsolete equipment, Meets present requirements	Existing, Contemporary equipment, Meets present requirements	Existing, Contemporary equipment, Meets anticipated demand in next 5 years

Table 9 - Minimum terminal location parameter grades

Parameter	Minimum grade (y)
Freight flows	2.5
Location	1.8
Infrastructure – general	1.8
Infrastructure – railway network	2.5
Terminal equipment and operation	1.4
Total	10.0

The final grade of the evaluated terminal location (Y) is defined as:

$$Y = \sum y_N * g_N \quad (3)$$

Y – terminal location final evaluation grade,

y_N – particular parameter grade,

g_N – particular parameter weight.

Final grade is then compared to general recommendations regarding the feasibility for the development of regional intermodal TLT (Table 10).

Table 10 - Terminal location final evaluation grade

Final grade Y	Feasibility of development of regional intermodal terminal (TLT)
< 2.5	Not acceptable (basic criteria are not fulfilled - insufficient freight flows and non-existent railway infrastructure)
2.5 – 5.0	Not recommendable (one of the basic criteria is not fulfilled – insufficient freight flows or non-existent railway infrastructure; substantial initial investment required)
5.0 – 7.5	Acceptable (basic criteria are partially fulfilled)
7.5 – 10.0	Good (basic criteria are fulfilled)
10.0 <	Very good (all criteria are fulfilled)

5. CONCLUSION

In order to assure the productivity and competitiveness of a newly built regional intermodal TLT or to increase productivity and competitiveness of the already existing (and enlarged) regional intermodal TLT several improvements can be made. Prior to the planning of the introduction of the improvements the status and situation of each terminal needs to be analysed carefully, taking into account regional (and/or local) operational conditions.

A thorough transport logistics analysis has to be carried out in the preliminary phase. Amongst the parameters to be taken into consideration the freight flows are the most important, followed by the terminal location and transport infrastructure (railway infrastructure in particular). Investments in terminal infrastructure, equipment, facilities and technology have to be made in accordance with the terminal present status and planned requirements and possibilities in the future.

Transport logistics analysis of terminal location requires identification and application of key transport logistics parameters with different sets of indicators and criteria, based on the terminal current status and future plans to provide the basis for terminal evaluation in view of location appropriateness and operational viability.

The methodology presented in the paper, based on identified key parameters and their reference values can serve the specialists in transport planning and spatial development and interested stakeholders in particular as tools to support strategic decisions about regional intermodal terminal development and the related investments.

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POVZETEK

RAZVOJ REGIONALNEGA TRANSPORTNO LOGISTIČNEGA TERMINALA – TRANSPORTNO LOGISTIČNI VIDIK

Sprejemanje odločitev v procesu razvoja in obratovanja regionalnega transportno logističnega terminala, na katerem se izvajajo intermodalni transport in spremljajoče aktivnosti, mora temeljiti na rezultatih predhodnih raziskav. Izbira ustrezne lokacije regionalnega transportno logističnega terminala je pri tem ključnega pomena zaradi neposrednega in/ali posrednega vpliva, ki ga ima le-ta na začetne investicije, okoljsko in prostorsko problematiko, kakor tudi na stroške obratovanja in uspešnost poslovanja terminala. V procesu odločanja glede lokacije v primeru obstoječega ali graditve novega intermodalnega terminala, mora biti opravljena temeljita transportno logistična analiza. V referatu je predstavljena oblikovana metodologija za izvedbo transportno logistične analize regionalnega intermodalnega transportno logističnega terminala. Ta temelji na nizu identificiranih parametrov, kriterijev in indikatorjev, ki omogočajo določitev celotnega kazalnika učinkovitosti posamezne lokacije terminala.

KLJUČNE BESEDE

intermodalni transport, intermodalni logistični terminal, transportno logistična analiza, razvoj regionalnega terminala

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