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SIGNIFICANCE OF TRANS-EUROPEAN TRANSPORT NETWORKS FOR LOGISTICS CENTRE LOCALIZATION AS EXEMPLIFIED BY THE ŁÓDŹ REGION

Abstract. This work complements and structures knowledge in the field of logistics centres (with focus on the Łódź region). It presents a thorough analysis of strategic documents of the European Union in reference to the functioning of international transport networks. It also provides a detailed description of logistics facilities operations from the theoretical standpoint and definition of relations in points where logistics centres and TEN-T networks overlap. The result of this work is a set of recommendations referring to effective development of logistics centres on the background of transport corridors.

Key words: logistics centres, tran-European transport network, Łódź region.

1. INTRODUCTION

As shown by the historical example of both Europe and the whole world, the course of routes, or transport corridors, to a large extent determined prosperity or stagnation of many civilizations (Tyszkiewicz, 2003). In economic, political and military history road networks play a crucial role, which naturally results from development of settlements and major forms of economic activity, such as trade, transport or industry, along main roads. Initially, transport development took place along river trails and it was only much later that it largely moved to railway lines and then motorways.

The Trans-European Transport Network Executive Agency (TEN-T EA) included aviation apart from the three above-mentioned modes of transport in its project of establishing the single European transport area. The aims, priorities and main plan directions referred to in the Decision of the European

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Parliament and of the Council as of 23rd July 1996 and subsequently in the White Paper, generally focus on increasing the effectiveness, territorial cohesion and compatibility of individual transport systems with special emphasis on the rail network and up-to-date systems of transport infrastructure management. They also stress the importance of transport hubs where individual transport systems may be integrated. Such functional and spatial structures are represented by logistics centres, in particular the multimodal ones. Besides integration of transport systems aimed at increasing the effectiveness of the flow of materials, in practice logistics centres are also a form of integrating many services in one place, taking over part of operations performed by parent companies – customers.

The aim of this work is to analyze the relations which exist where logistics centres and the EU international transport policy meet. In order to achieve this, the work focuses on the localization of logistics centres and intermodal terminals, their characteristics and spatial coverage as well as the course of the Trans-European Transport Network (TEN-T). Furthermore, the above-mentioned analyses are illustrated by the case of the Łódź region situated in the middle of Poland on the intersection of main transport routes with two TEN-T network transport corridors running through its territory and developing logistic clusters (figure 1).

The importance of transport policy is evidenced by the fact that the Nordic countries, including the Barents Region, have vast natural resources, which are attractive to the EU area (critical raw materials for the EU) because of the short and secure supply routes and high reliability and stability of the Scandinavian partners. They may significantly increase the self-sufficiency of raw materials in Europe, which is one of the priorities of the EU. Europe is the largest importer of raw materials and transporting them often from remote locations is costly and raises the price of industrial products, thereby reducing their competitiveness. The longer the route of delivery, the greater the consumption of more expensive fuels and stronger the impact of transport on the environment – mainly by emissions. Given these barriers, it is natural to develop transport corridors providing access to raw materials. It is strategically important in the context of the freight transport system in northern Scandinavia, which includes the Gulf of Bothnia with numerous seaports in Sweden and Finland. It can be extended in all geographical directions, but the greatest development potential is in the southern direction – including the continuation of the Baltic-Adriatic corridor. It is necessary to coordinate the development of infrastructure connecting the ports with the proximal and distal economic environment with investment activities of the management of ports, because they represent a complex relationship between different geographic markets. Traditionally, the logistics process intensification zone developed at the back of the port, as a result of the limited capabilities of the physical transfer of goods to and from the various regions of the world. As a result of more and more

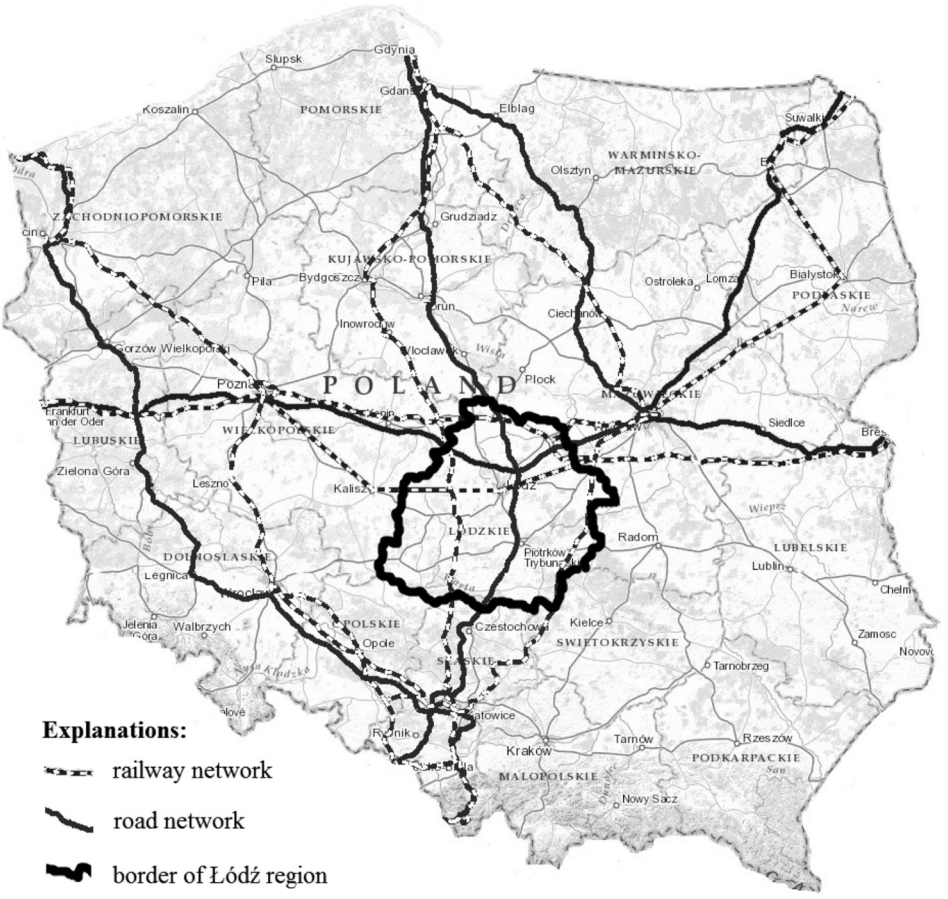

Fig. 1. Localization of the Łódź region against the background of international transport corridors
Source: author's elaboration on the basis of data made available by the General Directorate for National Roads and Motorways (GDDKiA) and TENtec Information System

efficient land transport infrastructure, the physical distance is no longer the only factor in the location of logistics infrastructure. Today, a port's hinterland can be defined as an area that can be reached at lower cost or in a shorter time than from other ports (Wilmsmeier *et al*., 2011). The main aim of this article is to examine the location of logistics centres with particular emphasis on the European transport policy. A detailed analysis was carried out on the example of the Łódź region in 2014. The first part of this work presents the operation of logistics centres both generally and in reference to the Łódź region, with a detailed description of key determinants of their location, in the context of the transport policy of the European Union. Such a diagnosis made it possible to propose universal guidelines for the process of localization of logistics centres.

2. LOCALIZATION OF LOGISTICS CENTRES: THEORETICAL BACKGROUND

As an inherent element of the contemporary world logistics concentrates on the management of movement of goods and/or persons together with activities supporting these processes, both in the functional and cognitive aspect (Fechner, 2006). They are numerous and they are very diverse. They may be material (e.g. delivery dispatch), informational (e.g. delivery scanning) or financial (e.g. bank transfers). The beginnings of logistics are difficult to trace back. Movement of goods, i.e. practical operations being the subject of interest for logistics, has existed since trade began to develop. The difficulty consists then not so much in determining when logistics appeared but from which moment it started to be distinguished as a separate activity. Scientists localise this moment in different periods and places. The term 'logistics' in the meaning close to the contemporary definition was first used in the mid-19th century by French general Henri de Jomini, who defined in this way the activity consisting in transport, accommodation and procurement for military troops. Modern logistics can be traced back to the late 1940s and early 1950s. It first began to develop in North America, and above all in the United States. It was not until much later that it appeared in Europe and on other continents. Logistics developed step-like and was shaped within a number of phases. Due to dynamic development of logistics networks the last (present) phase of development of logistics is referred to as logistics networks or e-logistics.

Logistics centres have the most extensive structure of all facilities comprising the logistics network. They are composed of many facilities collaborating with each other and co-operating logistics operators (economic entities involved in logistics operations) (Gołębska, 2012). In logistics literature there are many logistics centre definitions which are based on attempts to classify their functionality (e.g. logistics and distribution centre, logistics centre of distribution) or are a result of marketing strategies of companies which use the logistics centre name for a warehouse of finished goods or central warehouse. Following Fechner (2010), the logistics centre[1] should refer to a spatial facility

[1] 'This is a designated area within which all operations connected with transport, logistics and distribution of goods are performed by different operators as part of deliveries, both on the national and international level. These operators may be owners of built and situated in the centre: buildings, offices, warehouses, storage yards, parking places, facilities, etc. or use them pursuant to leasing or rental agreements. In order to respect the principles of free competition, the centre must ensure access to all companies involved in activities described above. The logistics centre must be equipped with devices and facilities available to the general public allowing to provide services. Whenever possible it should also ensure public services for the staff and users' equipment. In order to support the development of inter-modal technologies in cargo relocation, the logistics centre should be supported by many branches of transport. It is also necessary that the centre be run by an entity appointed especially for this purpose from the public or private sphere' (Europlatforms – Europejski Związek Centrów Logistycznych).

with characteristic organization infrastructure which enables companies to conduct operations on goods in connection with warehousing and relocating them between the sender and the recipient, including servicing inter-modal shipments and performing activities on resources used to this end. This last property distinguishes logistics centres from warehousing centres. Due to the subject matter of this work, it is also important to define the inter-modal handling terminal which, as the facilities described above, allows different manipulation activities to be performed thanks to appropriate infrastructure. The inter-modal terminal, however, concentrates on handling inter-modal transport units in the form of containers, swap bodies and semi-trailers among different means of transport.

Logistics centres are classified in a number of ways depending on numerous criteria. Considering the operation of facilities in the trans-European transport networks it seems of key importance to account for the division according to the number of transport branches (inter-modal, mono transport) on the basis of which the centre develops and the radius in which the logistics centre provides its services (international, regional, local, branch-specific, centres of logistics services) (Mindur, 2012).

Smooth functioning of the supply chain therefore requires modern infrastructure. The future of freight transport is not only modern vehicles and infrastructure, it is mainly efficient logistics systems interconnected and ensuring the implementation of complete logistics chains. In accordance with definitions found in the literature, intermodal transshipment terminal is a spatial object with the proper organization and infrastructure capacity of intermodal transport units: containers, swap bodies and semi-trailers belonging to different modes of transport and operations on these units in relation to their storage and use. Siding is defined as a way station which is connected to the railway line and is used for loading and unloading of wagons, performing maintenance operations on rail vehicles, stationing rail vehicles and directing the movement of rail vehicles into the railway traffic. Siding also includes railway traffic control devices and other equipment related to the safety of rail traffic, which are located on it. Railport is a broader concept. It refers to both these features and also provides comprehensive services related to the functioning of many supply chains. Railports are entities of strategic importance to the economies of many countries. Their functioning is affected by many components such as proximity of industry, other logistics centres or the impact of economic factors and local transport development strategy of the country.

There are certain general criteria of logistics centre localization which are common to all models of implementation of this investment type. They comprise, above all, the structure of the region's economy by type, the volume of the exchange of goods with other regions and in exports and imports, cargo structure by type, kind, condition and availability of transport infrastructure, availability of land, its legal status and purchase price, the size of the market and its potential, levels

of competition on the market of logistics services, environmental and landscape restrictions, and possibilities of adopting alternative functions on the part of the analyzed area (Fechner, 2006).

From the whole variety of determinants it is necessary to choose, however, one key feature in relation to which others are of secondary importance. Therefore, the significance of the course of transport trails must be stressed as *sine qua non* condition of location of logistics facilities. Other variables may, of course, make the given location more or less attractive, yet without roads, railways or water or air transport the process of localization simply could not take place. The factors mentioned above all condition the course of transport infrastructure which, in turn, determines the centre's location.

General location (macro-spatial) is connected with the choice of a given region and subsequently a place where the logistics centre is to be situated. Hence from the macro-spatial perspective the location of the logistics centre is determined primarily by transport corridors and highly urbanized areas (Skowron-Grabowska, 2010). On the other hand, the detailed location (micro-spatial) concerning the logistics centre investment area comes down to indicating a concrete plot and later elaborating its development plan, including distribution of individual elements of the facility. Relations with other facilities and transport network are also determined. From the micro-spatial perspective the choice of logistics centre location is usually made by entities specializing in this field or entities in charge of the investment. As revealed by business practice, the most important element of micro-spatial location is the purchase of the plot on which the planned logistics centre is going to be built. High prices of land in cities and a deficit of sufficiently large dense territories in urban agglomerations contributed to concentration of centres in suburban areas with convenient connections with road and rail networks (Skowron-Grabowska, 2010).

The task of planning a logistics centre location should be given to institutions having comprehensive knowledge on the topic of locating such facilities nationwide. Determining a location is a result of many elements arising from the state's transport policy, distribution of the existing and planned linear and nodal infrastructure, transport directions, structures and build-up of cargo lines (Mindur, 2012). Configuration of logistics centres on the country's territory also depends, among other things, on the spatial layout of modal points i.e. where cargo movement is accompanied with lowest costs. This layout is dependent on the condition of transport infrastructure which undoubtedly affects transport costs as well as the area's logistics absorptive power defining its preparation to absorb logistic solutions (Walczak, 2008) and measured by transport and logistics infrastructure, such as warehouses, distribution and logistics, ports etc. (Januszkiewicz, 2008). It is also not irrelevant to consider availability costs of the given market and investment area.

Nonetheless, all the above-mentioned elements must be convergent with the international transport policy created by the European Union which remains superior in relation to them.

The logistics centre belongs to one of the aforementioned modal points of logistics network configuration. Allocation of areas for future logistics centres and ensuring their transport services should be done at the time of creating spatial management plans or development plans at each administrative level. Considering future transport difficulties, it is of great importance to go to lengths to ensure that logistics centres are based on rail transport combined with different means of transport (multimodal and intermodal transport). The ideal location of logistics centres includes areas with points in space where there are intersections of four different modes of transport (by road, rail, sea and air). Taking into consideration the specific transport network of the Łódź region, it is impossible to find such a perfect location. It suffices to seek the best location having in mind systems of roads[2] and railways[3] (Bartosiewicz and Wiśniewski, 2011).

Logistics centres require specific road infrastructure. On the one hand, the infrastructure must be resistant to considerable surface pressures (caused by movement of cars with high on-axis pressure). On the other, however, it must provide a link with expressways and motorways allowing heavy goods vehicles to access the centre. It is also necessary for the infrastructure to be characterized by high capacity due to the supply transport of small and medium tonnage catering for senders and recipients gathered around the centre.

In Poland there is a zone which meets the condition of ideal localization in reference to the network of expressways and motorways (both existing ones and those in the process of planning). It is the most attractive place for investors situated in the region of Łódź, Stryków and Piotrków Trybunalski, forming the so-called golden triangle of logistics (figure 2) (Skowron-Grabowska, 2010).

Once the investment location is decided on the next step consists in its construction. In this process different realization models may be distinguished. They were created thanks to an analysis of operating logistics centres and a synthesis of experiences gathered by consortiums in charge of completion of logistics facilities. The logistics centre model in Polish realities can be depicted in two variants. The first one comprises a virtual logistics centre model while the other one represents a form of concentrated logistics centre built according to the

[2] Motorways, expressways, local roads of geometric and resistance parameters allowing for transport of containers between the container terminal and the container sending/receiving point as well as local roads of geometric and resistance parameters allowing for deliveries of goods from storage warehouses in logistics centres to recipients.

[3] Railway lines of technical parameters allowing for deliveries of goods at the operating speed of 120 km/h, railway sidings of technical parameters allowing for access of block trains from the main railway line to the container terminal.

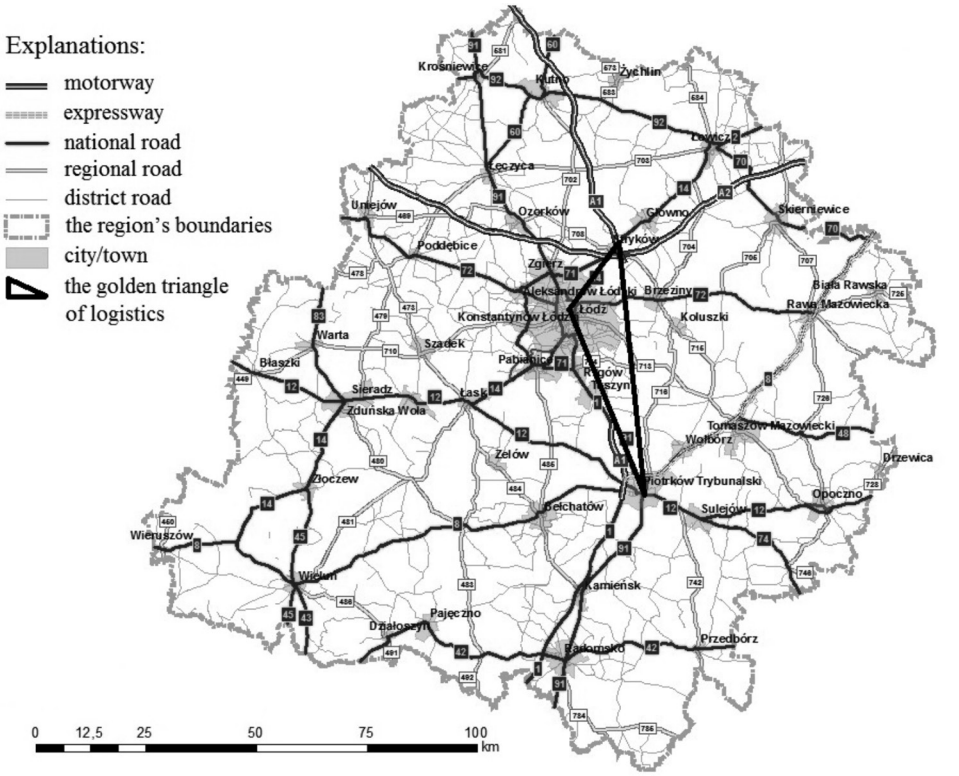

Fig. 2. The location of the golden triangle of logistics against the background of the transport road network of the Łódź region
Source: author's elaboration

principle of public and private partnership. In the first case the logistics centre may come into existence when logistics operators with their own infrastructure appeared earlier on the given territory. Given favourable conditions they may begin to co-operate on the electronic market of logistics services. In the second case it is possible for the logistics centre to arise when the initiator is the public sector. It must, however, create certain initial conditions such as specifying the localization, adopting the local spatial development plan etc. The most important thing in this model is the attitude of the public administration to investors (Fechner, 2004).

As for logistics centres enabling intermodal transport, it is worth stressing that there are prerequisites for intensive development of intermodal transport in Poland due to the country's localization on the intersection of main European transport corridors (with the notable example of the Łódź region), the development of the Polish economy and the standard of living of its society coupled with the European

integration. These factors influence the increase in domestic and international transportation as well as in transit.

Considering the expected surge in trade and transport of goods in the region of the Baltic Sea, efforts aimed at more integrated and sustainable transport must be correlated with spatial planning both on the national and international level. One of such activities refers to development of logistics centre networks which will have a viable impact on the increase in effectiveness of movement of goods. It is also necessary to implement spatial planning which promotes the use of sustainable means of transport (Klapita and Svecova, 2006).

In a situation when the significance of logistics systems as a coherent whole is not perceived with sufficient attention, the strategic aim for new activities in this area should include integration of different transport networks within and among logistics centres so as to improve and develop the quality of logistics networks.

Activities on the part of authorities at the national and European level should focus on integration of connections among logistics centres in a sustainable way on the spatial platform, creating durable and integrated approach to spatial planning of logistics centres and transport infrastructure. Furthermore, it is necessary to remember about the territorial assessment of the influence of logistics investments on the selected transport corridors in which logistics centres are located, which should result in establishment of a common vision of future spatial development along transport corridors to eliminate bottlenecks in connecting the centres with their background area (Kabashkin, 2007).

The need for consistent policy and spatial planning which caters for logistics centres is also justified by a large land surface absorbed by large-format warehousing facilities and technical infrastructure which accompanies them. Social costs connected with intensive road transport should be reduced by shifting cargos to railway or water carriers (Hesse and Rodrigue, 2004). Transport corridors constitute a natural area of eliminating these costs.

O'Connor (2010) draws attention to the town's role in the process of localization of logistics centres. On the one hand, it is a ready market for logistics operators collaborating with the given centre. On the other hand, towns are accompanied by infrastructure of key importance for logistics centres, such as airports or motorway hubs.

Another problem is spatial deconcentration of logistics facilities and distribution centres as well as polarization of logistics operations connected with lack of collaboration and agreement among different local authorities as far as spatial planning and localization of transport and logistics hubs are concerned (Dablanc and Ross, 2012). To decrease the negative impact of goods transport on the town's space it is necessary to consolidate cargos as well as ensure well-thought locations for consolidation centres having in mind requirements and features of individual towns affecting the given centre logistics (Olsson and Woxenius, 2014).

3. THE EUROPEAN UNION TRANSPORT POLICY AND LOCALIZATION OF LOGISTICS CENTRES

The European Union shares competences related to pursuing the transport and trans-European networks policy with the member states (Article 4 of the Treaty on the Functioning of the European Union). Pursuing the policy in the scope of transport and trans-European networks results from the necessity of ensuring free movement of goods, persons, services and capital within the European Union market without any internal borders (Article 3, point 2 of the Treaty on the European Union, Article 26, point 1–2 of the Treaty on the Functioning of the European Union). It also arises from the objective to achieve economic, social and territorial coherence and harmonious development of the whole territory of the European Union (Article 3, point 3 of the Treaty on the European Union, Article 174 of the Treaty on the Functioning of the European Union). It is then logical that the indicated aims of the transport infrastructure and trans-European networks policy are financed from the European Cohesion Fund (Article 177 of the Treaty on the Functioning of the European Union).

Common transport policy of member states of the European Union focuses on establishing principles of functioning of international transport together with conditions of transit through territories of member states and also principles of access of foreign carriers to domestic transport of every member state (Article 91, point 1 of the Treaty on the Functioning of the European Union).

The trans-European networks are established by the European Union not only in transport infrastructure (TEN-T, or the Trans-European Transport Networks) but also in telecommunications infrastructure (eTEN, or the Trans-European Telecommunications Networks) and energy infrastructure (TEN-E, or the Trans-European Energy Networks). The trans-European transport networks involve not only transport infrastructure but also systems of movement management and geographical positioning systems (Napierała *et al.*, 2013a). The transport infrastructure includes road and railway networks, inland shipping networks and ports, motorways of the sea, sea shipping ports and airports.

The EU documentation, complementing the list of nodal elements of transport networks, expressly emphasizes the importance of inter-modal and multi-modal hubs (Article 3, EU, 2010c). They are referred to as integration places of the above-mentioned networks, which admittedly are not directly exemplified in the form of logistics facilities, yet their functional description fully overlaps with literature definitions of logistics centres.

In the scope of trans-European transport networks, the main task of the European Union is to ensure cohesion among central and peripheral regions of the Union through development of transport, telecommunications and energy industry, which forces the Union's bodies to prepare projects of trans-European networks (Article 170 and Article 171, point 1 of the Treaty on the Functioning of the European Union). TEN-T operating

development aims were indicated in the decision of the European Parliament and the Council as of the 7th July 2010 on EU guidelines concerning development of trans-European transport networks (EU, 2010c). They concentrate on the issue of ensuring sustainable movement of goods and persons, with acknowledgement of social aspects, environmental protection, security and transport quality (Napierała *et al*., 2013a).

In the aforementioned document of the European Parliament and of the Council, apart from disclosure of basic issues concerning framework plan of modernization and integration of land, sea and air transport infrastructure, there are references to multimodality of trans-European connections (Article 1, point 1–2, Article 2, point 1, EU, 2010c). They should constitute some kind of general guidelines for the decision about a logistics facility location and the scope of its functionality.

Attachments to the decision of the European Parliament and the Council include a project of the course of TEN-T for every member state, including Poland. Pursuant to the maps attached to the document (EU, 2010a), TEN-T in the Łódź region includes: as far as the road system is concerned A1 and A2 motorways and S8 expressway in the so-called Bełchatów option. As for the railway network (EU, 2010b), the following lines were included in TEN-T: no. 1 with its course close to the south-north orientation, connecting Warsaw with Upper Silesia (Katowice). Within the borders of the Łódź region line no. 1 links Skierniewice and Koluszki, one of the most important railway hubs in Poland. The second line (no. 3) with the course close in turn to the east-west orientation Słubice–Warsaw on the territory of the Łódź region connects Kutno and Łowicz. Line no. 11 (Łowicz–Skierniewice), no. 12 (Skierniewice–Pilawa–Łuków–Biała Podlaska–Terespol) and no. 131 (Tczew–Bydgoszcz–Inowrocław–Zduńska Wola Karsznice–Tarnowskie Góry) were also included in the network.

The contents of the White Paper of the European Commission seem to be of particular importance for logistics centres as they include a plan of establishing a single European transport area, i.e. efforts to achieve competitive and resource-efficient transport system. The provisions of the document expressly stress the necessity of introducing solutions aimed at multi-branch nature of transport. The Book refers to both transport of goods and persons. Considering its guidelines concerning still a high proportion of car transport (especially on short and medium-length distances) with simultaneous gradual overtaking of transport of goods by railways it is necessary to pursue the transport policy in such a way as to eliminate barriers which are present where these two domineering branches of transport meet. A system solution consists in construction of logistics centres since it allows to make multi-modal solutions more attractive and it combines with the furthest possible elimination of infrastructure barriers. Creating a system of hub points coherent with the network of transport corridors would allow for smooth changes of the branch of transport depending on the characteristics of the given section in the supply chain.

The European Commission defines precisely aims concerning establishment of a competitive and resource-efficient transport system. By 2030 almost one third of road transport of goods on distances exceeding 300 km will have been replaced

by railway or water transport. These restrictions will have been extended to half of all long-distance shipments by 2050. 'Hard' solutions will be accompanied by simultaneous attention to high quality of the network of connections and creation of support in the form of suitable information services. All operations aimed at achieving these strategic aims by 2015 are coordinated by the Trans-European Transport Network Executive Agency established pursuant to the resolution of the European Commission as of 26 October 2006 (EC, 2007).

The postulate of creating a community instrument of financing development of trans-European networks, 'Connecting Europe Facility', first appeared in the communication of the European Commission as of 19th October 2011 (COM, 2011a). Its contents of diagnostic character enumerate main areas of underinvestment in transport infrastructure, clearly stressing the low level of its interoperability. This gave rise to passing the regulation of the European Parliament and of the Council establishing the 'Connecting Europe Facility' financial instrument. The emphasis on the regulation contents and the volume of funds allocated for its completion in the period 2014–2020 force to place special attention as for localization of logistics centres. In the course of numerous consultations it was established that the target pace and directions of infrastructure development, particularly programmes of development of trans-European networks, require appreciable financing from the community funds. 'Connecting Europe Facility' is the answer to the above postulates.

The above-mentioned postulate of the European Commission contains preliminary proposals connected with the development of core transport networks. It is of key importance for the Łódź region to see completion of investment in two corridors of the core network: the Baltic-Adriatic Corridor (modernization of the railway line from the coast to Upper Silesia) which runs through the western part of the region as well as the Warsaw–Berlin–Amsterdam/Rotterdam–Felixstowe–Midlands Corridor. The postulate of the European Commission concerning the Directive on interoperability of the railway systems within the EU borders (COM, 2013) seems to be vital here. Transport potential of the Łódź region combined with legal basis on the international level open perspectives of dynamic development of logistics. It is necessary, however, to ensure coordination of investments in this field, which will allow to avoid localization errors.

In February 2012 the European Commission formulated the final version of the proposal to pass a new regulation of the European Parliament and the Council on community guidelines concerning trans-European transport network development (COM, 2011b) in place of the document as of 2010 (EU, 2010a, b, c). The main aim of the proposal is to establish a comprehensive and integrated transport network as well as to provide basis for sustainable, economically optimal development of all transport branches. From the perspective of functioning of the logistics branch, however, the most important are provisions connected with using the potential of multimodal transport, which is to reduce considerable differences among regions in the scope of legal regulations concerning transport interoperability.

This proposal of the European Parliament and of the Council postulates a division of the TEN-T network into comprehensive and core networks. The comprehensive network comprises all existing, modernized and planned elements of the TEN-T network. The core network, in turn, consists of these elements of the comprehensive network which are of strategic importance for completion of TEN-T aims (Napierała *et al.*, 2013b).

In the Łódź region the core TEN-T network includes A1 and A2 motorways and S8 expressway in the so-called Łódź option within the section from Rzgów in the direction of Wrocław. The core section also comprises goods railway lines: the aforementioned lines no. 1 and 131 as well as line no. 4 (Warsaw–Mszczonów–Opoczno–Zawiercie) and line no. 14 (Koluszki–Łódź–Zduńska Wola Karsznice) (figure 3).

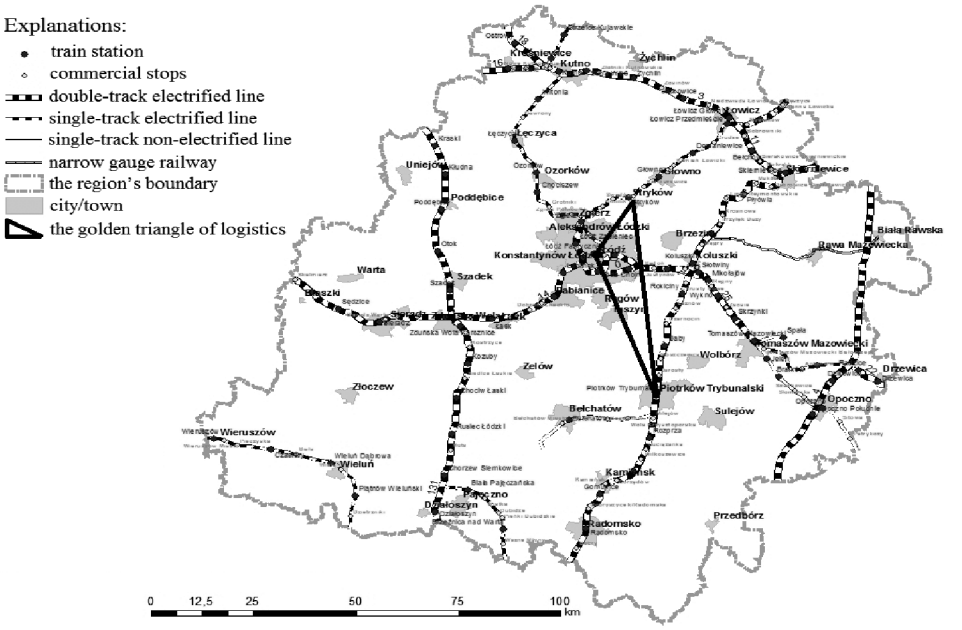

Fig. 3. The location of the golden triangle of logistics against the background of the railway network of the Łódź region
Source: author's elaboration

As for passenger railway lines, the TEN-T core network include: the planned 'Y' high-speed rail (Warsaw–Mszczonów–Łódź–Kalisz–Poznań, Wrocław), the above-mentioned line no. 4 (Warsaw–Mszczonów–Opoczno–Zawiercie), line no. 14 (exclusively on the Łódź–Koluszki section) as well as line no. 25 (exclusively on the Łódź–Opoczno section). The comprehensive TEN-T network also consists of sections of expressways in the Łódź region: S8 from Rzgów and Piotrków

Trybunalski in the direction of Warsaw, S12 (exclusively within the section from Piotrków Trybunalski in the direction of Radom) and S74. The railway line no. 25 (Łódź–Opoczno–Skarżysko Kamienna–Tarnobrzeg–Mielec–Dębica) was classified to the comprehensive TEN-T network of goods railway transport. Łódź was earmarked as localization of road and rail terminal within the core TEN-T network while Stryków as part of the comprehensive network.

As for logistics centres enabling intermodal transport it must be stressed that there are premises for intensified development of intermodal transport in Poland due to its localization on the intersection of main European transport corridors. This factor brings about an increase in domestic and international transport as well as transit services. The Łódź region stands out in this respect as within its boundaries there are over 20 logistics facilities of different sizes and functional character. They form clear concentrations, mainly in the vicinity of Łódź, Stryków and Piotrków Trybunalski. Single facilities are also situated in Kutno or Rawa Mazowiecka.

The greater majority of hub elements of the logistics chain has been located in 'the golden triange of logistics' being part of the course of transport corridors of international importance. Ten of them are situated within the boundaries of Łódź in the part of the city earmarked for warehousing and storage operations, with the vast majority of them on the split of the railway network based on lines no. 14, 17, 458, 540 and 541. Car transport, on the other hand, is based on the regional road no. 713 and the national road no. 1. Among these facilities only Łódź Olechów Container Terminal is based on intermodal transport, whereas other facilities are one-branch companies using only car transport.

The second most numerous logistics facilities are in the Stryków commune where there are four logistics centres. Similarly as in the case of Łódź-based entities these are centralized facilities orientated toward exclusively car transport which in the case of the Stryków commune may take place on A2 motorway, A1 motorway, national roads no. 71 and 14 as well as the regional road no. 708. Possible intermodal solutions could become implemented using the railway line no. 15.

Piotrków Trybunalski is another place with accumulation of logistics infrastructure (two logistics centres) alongside with the communes neighbouring with it (two more logistics centres). These centres function using solely car transport which, like in Stryków, constitutes the most important localization factor for this kind of entities. In Piotrków Trybunalski there is A1 motorway joining S8 expressway (Piotrków Trybunalski – West hub) and the national road no. 8 (Bełchatów hub). The national road no. 91 (joining with S8 Piotrków Trybunalski – North hub), the national road no.12 and the regional road no. 716 also go through the area of Piotrków Trybunalski. Possible intermodal solutions could become implemented using the railway line no. 1.

The terminal in Kutno is a logistics centre which does not form part of 'the golden triangle of logistics' but represents an excellent example of intermodal

solutions in the trans-European transport corridor. The entity functions using the road network of A1 motorway linking the Kutno – East hub with the national road no. 92 as well as the national road no. 60 and the regional road no. 702, thanks to which it may efficiently provide car transport services. The railway line no. 3 and the vicinity of lines no. 16, 18 and 33 ensure adequate access for cargos received or sent further on. The logistics centre in Pabianice is centralized and it operates thanks to car transport mainly on the national roads no. 71 and 14. A very important element of the area's transport network is the existing ring road of Pabianice and the planned western ring road of Łódź in the form of S14 expressway.

Baltic-Adriatic Corridor is potentially the shortest, cheapest and most economically and environmentally efficient north-south route through Poland (Gdynia/Gdańsk and Świnoujście/Szczecin). To make this possible, the Local Government Agreement was initiated for the Baltic-Adriatic Corridor, signed by six local government associations in Poland. Transport policies of a general nature, focused on the competitive position of intermodal transport are often ineffective because they usually do not take into account the private interests of the parties operating in the supply chain. Successful promotion of intermodal transport is the most critical activity in order to achieve sustainable transport, which is one of the main objectives of transport policy in the European Union. For this reason, the European Commission, as part of research projects and financial instruments, supports the policy, design and development of advanced tools to promote intermodal transport (Tsamboulas *et al.*, 2007).

4. THE TEN-T NETWORK AND LOGISTICS OPERATIONS

Both the national and regional logistics system is based on diversified elements of transport infrastructure. It should also be characterized by a high degree of infrastructure standardization. In case of linear elements this is primarily connected with the quality, technical parameters and density of transport and telecommunications infrastructure. In reference to nodal elements, on the other hand, it is availability to the key transport hub that matters. Such availability should be understood, above all, in the context of time and economic distances. Real physical distances (dividing the journey starting point with its potential destination measured according to the course of the road or railway line) are nowadays of secondary importance. Transport availability, irrespective of its definition, has a vital application dimension since it represents an element of diagnosis of difficulties in the movement of goods and persons, giving grounds to pursue appropriate transport policy aimed at territorial cohesion (Rosik, 2012). Transport availability is also considered to be an essential element of space organization

being directly reflected in diversification of attractiveness of individual locations. It is an important factor shaping, for instance, the standard of living or investment attractiveness of the given site. All this is of great significance when logistics centre availability is considered. Its development is connected with its potential influence, the size of the covered area, possibility to recruit employees and win clients, which in turn is directly connected with availability levels of the facility. Transport availability plays an even more important role in case of the whole logistics system on the given area. Only ensuring high levels of transport network availability of all system elements may result in adequately high level of competitiveness of the given area (Guzik, 2011).

Transport network must also enable creation of intermodal transport solutions and effective use of benefits arising from localization of logistics operations within the transport corridor (Fechner, 2010). It is also necessary to consider the course of transport corridors in location analysis because of infrastructure equipment and also due to very positive forecasts related to cargo flows in the future. Although by 2030 the dynamics of surges in traffic will have decreased as a result of limitations of technical (congestion) and economic nature (increase in prices of fuel, employing logistics solutions boosting cargo flow), on some international roads the traffic volume will exceed 20 or even 30 thousand vehicles per 24 hours (Lipińska-Słota, 2010).

Focusing on forecasts concerning directly the Łódź region, it is worth pointing out that the load for corridor II on the section Świecko–Błonie may reach the maximum of 261,334 t, 321,870 t and 382,498 t in 2020, 2025 and 2030 respectively. Cargo flow in corridor VI will reach lower yet still considerable figures. On the section Gdańsk–Łódź cargo traffic may reach as much as 94,837 t, 116,133 t and 137,453 t in the consecutive years in question. Very high values will be achieved also on the section Łódź–Katowice (247,818 t, 303,559 t and 359,365 t).

In recent years rail transportation of goods has been slightly on the increase. The market of rail transportation is gradually opening and it may be expected that by 2030 this upward tendency in cargo transportation will continue. Individual sections of corridor II on the area of the Łódź region may receive traffic flows of 33,019 t in 2020, 34,710 t in 2025 and 36,301 t in 2013. The traffic flow of cargos transported by rail in corridor VI may reach up to 88,865 t, 93,415 t and 97,698 t (Lipińska-Słota, 2010).

The problem of transport corridors is directly connected with the issue of functioning of logistics centres. Transport share in realizing logistic processes is essential. Logistics centres are indispensable for functioning of intermodal transport as they are responsible for completion and preparation of container batches (Nowakowski *et al.*, 2010). It is apparent to see the link between transport corridor, and consequently the number and form of transport infrastructure, with localization of logistics centres built in correlation with the principle of transport intermodality. In the localization aspect, but not only, logistics centres relying on

the transport intermodality principle refer to the course of main transport corridors. Transport corridors understood as stripes of land where at least two means of transport overlap are a natural construction sites of intermodal logistics centres. Moreover, transport corridors centre the traffic flow which in certain proportions tends to the logistics centre due to the necessity of reloading, re-packing and other elements of logistics process service. Transport corridors are also, according to Fechner (2010), a kind of mobile warehouses which become unloaded in hub points, i.e. logistics centres.

The strategic importance of transport corridors in the case of Poland is a direct result of the fact that international trade is based on maritime transport. Ships carry about 80% of containerized cargo. There is a constant trend to larger container exchange reducing the number of ports capable of handling such cargo. Today, there are only a few dozen in the world. This concentration is the lack of a uniform and proportionate network connections. Baltic and Adriatic ports, situated in the area of sonar, prepare for meaningful participation in global trade. It also includes the ports of Gdynia and Gdańsk. Baltic Outlook 2030 forecasts for the ports of Gdynia and Gdańsk largest increase in trade turnover among Baltic ports (Baltic Transport Outlook 2030, 2011). The efficient functioning of the Valley Logistics plays a very important role in rail transport. Currently, it performs only 5% of the flows of goods covered by international trade. However, before this type of transport is a qualitative revolution. In November 2010 entered into force EP and the Council Decision establishing a European network of rail corridors. One of them is corridor no. 5: Gdynia–Bologna–Ravenna/Koper/Trieste. This corridor is expected by the end of 2015., which can have a direct impact on the intensification of development of logistics facilities in the Łódź region. Logistics investments in Poland must be rapidly developed due to the amount of goods transported in the region, which in 2030 will increase by over 40% compared to 2010. (Baltic Transport Outlook 2030, 2011). All Polish ports of key importance for the economy support persistent connections with Scandinavian shipping ports. Their previous biggest problem – poor availability of transport – gradually gives way, thanks to a combination of new investment and this implemented under the Baltic-Adriatic Corridor.

EU for the development of the TEN-T recommend outside actions, aimed at key sections of the transport network integrated approach to transport in urban areas. According to these urban node means the area of the city where the transport infrastructure of the TEN-T, such as ports, including passenger terminals, airports, railway stations, logistic platforms and freight terminals located in urban areas or in their neighbourhood, are connected to the other parts of the infrastructure and facilities for the regional and local traffic. Thus, the location of transport terminals has a major impact on urban and regional logistics. Thus the transport corridors is an idea whose fundamental objective is to strengthen the strategic relations between the states and regions. Intensification of the indicated links is implemented

by improving their mutual availability of transport, the intensification of flows of goods, people and information and promotion of new directions of the movements.

5. CONCLUSIONS

Considering the theoretical assumptions of functioning of logistics centres, the European Union's transport policy and business practice of logistics centres in the Łódź region, it is possible to specify guidelines the implementation of which may contribute to boosting the effectives of functioning of logistics facilities with simultaneous appearance of synergy effects at the meeting point with transport flows realized in the trans-European transport network.

Undoubtedly a great improvement would be a coherent vision of functioning of logistics centres and the course of transport lines at local, regional, national and international level, which is connected with meeting universal analysis and monitoring standards as well as detailed documentation. For this purpose it would be helpful to adopt benchmarks from documents characterized by possibly greatest degree of generality which is displayed by the documents provided by relevant organs of the European Union (Napierała *et al*., 2013b). It is also recommended to elaborate a coherent terminology connected with logistics centres bearing in mind the commonly used typology of facilities due to the functional criterion.

It is necessary to pursue effective information policy aimed at potential stakeholders, concerning possible benefits arising from the planned course of the TEN-T network, which should constitute an essential factor determining the location of new logistics centres. In this scope one must remember about logistics operators whose knowledge of the market of logistics services is considerable and important for the purposes of creating optimal market situation, infrastructure planning or the course of new transport lines.

The process of location of logistics facilities requires constant monitoring of the use of the road and rail network. The process could enable, in the long run, identification of main transport corridors and future optimization of their course, which should be directly connected with supporting location decisions by systematically provided information in the form of micro- and macro-spatial analyses. Such large objects as the logistics centres cannot function in isolation from the policies pursued by the local authorities of the area in which they operate. It is very important that the representatives of each party remain in constant contact. For the sake of both 'players' actions are required – to support the development of the municipality from the centres, while simplifying the operation from the municipality. The fundamental motive to engage local government authorities in the functioning of the centres is the need to regulate the processes and increase space metropolization to boost its competitiveness. Nowadays it is necessary to

continuously strive for current and potential investors, since the relocation of business is becoming easier. When the environment of the company becomes unattractive, the investor moves activities, providing a direct signal to other market participants about the shortcomings of the location. Therefore, local authorities in all their activities relating to the development of logistics centres should consult such studies as the National Development Plan, the National Strategy for Regional Development, the National Spatial Development Concept and National Transport Policy. It is also necessary to take into account the content of the documents that define the regional development strategies and local structures that are geographically or functionally associated with the investment.

The operation of logistics centres should be given special attention by the authorities, which should take active part, carrying out their activities in order to meet the economic needs of the local community. However, to be effective, their policy must be aimed at streamlining and not merely sanctioning changes that occur spontaneously. It is especially difficult, because currently there is no comprehensive policy relating directly to the process of entering large-scale logistics investment.

Local development plan, mentioned above, simplifies the whole procedure significantly. The designer, after seeing the extract from the plan, is only required to make the environmental impact assessment of the proposed investment and can then proceed to comprehensive planning. After a period of about half a year (depending on the complexity of the investment) will be issued a building permit. The situation changes completely when the area is not covered by the LDP. First the investor is obliged to develop EIA. Then the designer applies for planning permission (decision on conditions of up-building). It is necessary to provide in the application the project data, which at this stage are only preliminary and in most cases change in progress. It should also be noted that the zoning procedure for logistics investment is problematic. In the vast majority of cases, the warehousing investment projects are located on yet untapped areas where it is impossible to continue development. While providing technical infrastructure and access to a public road usually does not cause much difficulty, the majority of the proposed large-scale objects are at least partly on agricultural land or forest. Therefore they require exclusion from agricultural and forestry production, which excludes zoning. Of course, the investment may also be in conflict with other regulations (e.g. the Nature Conservation Act), which also disqualifies its location. It can be concluded that in many cases the procedure for issuing a zoning approval is a fiction, but unfortunately, in the absence of effective solutions, it is necessary. Obtaining the decision is often not synonymous with transition to the next phase of the investment process. In many cases, the conditions imposed in the decision force creation of a new version of the EIA (for the updated project). Each of these cycles takes about half a year and, of course, substantial funds. To avoid such situations it is necessary to move the period of EIA creation to the phase of applying for planning permission (decision on conditions of up-

building). It is also necessary to develop a tool alternative to zoning for location of storage or industrial investment. Under current regulations permissions for single-family houses and logistics centre are issued on the same basis.

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