

Determining Factors of Logistics Centres Development in Poland

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This study aims to evaluate the possibility of development of logistics centres (LCs) in Poland. Currently in Poland (2015) there are 4 LCs which meet European requirements and standards. The supply of warehouse space in Poland is catered mainly by developers building numerous storage facilities. Very often, however, they are incorrectly called "logistic centres". The paper presents the most significant differences between LCs and storage centres. The authors assessed the potential location of LCs in Poland using a grading point method. Three groups of location have been thoroughly characterized and identified where, from the location and economics point of view, is the best to develop an LC.

Keywords: logistics centre, warehouse centre, logistic infrastructure, bonitation.

1. INTRODUCTION

Logistics centres (LCs), characterized by the highest level of complexity of all the National Logistic Network (NLN) nodes, are some of the most important elements of the logistics industry's nodal infrastructure. They provide the widest array of services and allow for access to the multi-branched infrastructure. Other than seaports, they are objects with a dominant role in intermodal transfer-based international transport organization.

Currently (2015) in Poland, there are 4 active LCs conforming to the European standards. The demand for storage space in Poland is mainly created by developers constructing numerous storage facilities. They are, however, often mistakenly referred to as "logistics centres".

The contradictions in naming individual NLS nodes make it worth to organize the knowledge about these facilities. In order to do that, the essence of logistics centres and their approximate classification will be described. The role of an LC and the factors influencing these facilities' location have been presented. The main goal of the article is to present the results of research related to the potential and optimal location of future logistics centres in Poland from the economic and spatial perspective.

2. METHODOLOGY

The research, the results of which have been included in the following article, was conducted in 2014. The selection of facilities was deliberate, based on analysis of professional literature and scientific articles touching upon the issues of logistics centres' location [1, 2, 3, 4, 5, 6, 7].

On the basis of information found therein, a list of 19 areas was composed (fig. 1), which the researchers deemed to be attractive location-wise for a potential creation of a logistics centre. It was reduced by four locations where real logistics centres already exist, i.e. Poznan, Konin, Gliwice and Slawkow. The selection of factors impacting the LC location, based on which the research was conducted, was done by means of reviewing the literature, scientific publications and articles. Ultimately, the research sample consists of the following locations: Braniewo, Bydgoszcz, Gdansk, Gdynia, Krakow, Bydgoszcz, Łososna, Lodz, Malaszewicze, Rzeszow, Suwalki, Szczecin, Warsaw, Wroclaw, Zurawica-Medyka.

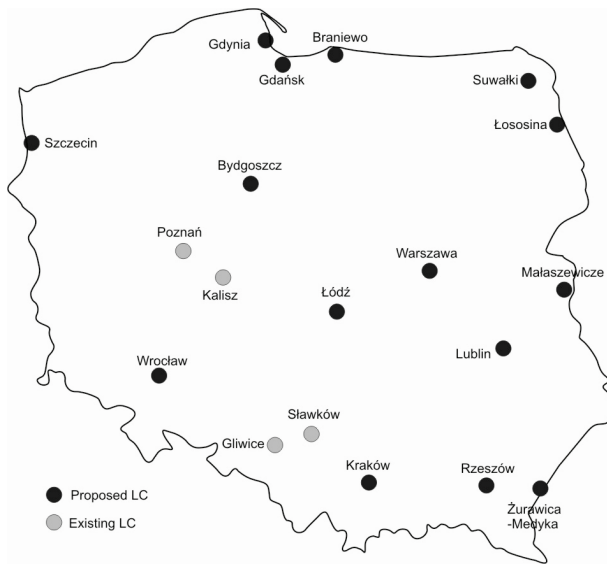


Fig. 1. Potential locations of logistics centres selected for research.

Source: own elaboration

The method used for the assessment was point evaluation. Due to the diversification of individual locational factors' significance, they were given values (tab. 1) by use of the Delphi method. After value-based calculation of points, the results were summed up. Point evaluation allowed for a synthetic assessment of a given area against the other locations.

Table 1. Weights and scoring system implemented for research.

		Point scale	Weight
Pan-European transport corridor		0/1/2/3	0.05
Intermodal container terminal		0/1	0.1
Agglomerations 50 km*	> 1 million**	0/1	0.07
	0.5-1 million	0/1	0.05
	0.1-0.5 million	0/1	0.03
Special Economic Zones		0/1	0.06
Industrial zones		0/1	0.05
Roads in use	Highways	0/1/2	0.05
	Express ways	0/1/2/3	0.03
Planned roads	Highways	0/1/2	0.04
	Express ways	0/1/2/3	0.02
Railways	AGC and AGTC	0/1	0.07
	others	0/1	0.02
Sea harbours		0/1	0.15
Air-cargo terminals		0/1/2	0.01
Land border crossing points	road	0/1	0.07
	rail	0/1	0.07

*location of LC up to 50km away from agglomeration

**number of inhabitants of agglomeration

Source: own elaboration based on Delphi method

3. THE CONCEPT OF LOGISTICS CENTRES

A logistics centre is one of the components of the National Logistics Network (NLS). Its operation distinguishes between logistics network nodes which are the point elements of logistics infrastructure, i.e.: seaports, airports, inland ports, inland marinas, storage centres, storage facilities, loading terminals and package sorting facilities [8]. The literature [9, 10, 11, 12] gives each of the above-listed objects their own definitions and distinguishable features assigned to a particular infrastructure point, as well as the ones that make them stand out from the others. And so, a logistics centre is a spatial object with its own organization and infrastructure which allow independent enterprises to perform actions on goods in relation to their storage and transportation between the sender and the recipient, including support for intermodal transport and actions on resources consumed to that end, LC is a complex facility. Its framework encompasses the functioning of logistics infrastructure elements (storage buildings, loading platforms, the intermodal transshipment terminal), as well as service facilities performing no logistic functions (office premises and facilities, the customs post, petrol stations, car washes, hotels, models, catering facilities and vehicle maintenance points) [13].

The second plane relates to the scope of functions performed by individual objects, resulting from the possessed logistics infrastructure. The framework of a LC distinguishes between three types of functions [6]:

- logistic - cargo handling in the intermodal container terminal, transport, storage, inventory management, freight forwarding, completion, packaging;
- supporting - customs services, rental of pallets, containers and transport packages, insurance, rotation of reusable packages, IT services, promotions and marketing;
- additional - telecommunications, hotel, banking, accounting and catering services, repair of broken transport packages (e.g. containers), sale of fuel, car accessories, oils and lubricants, vehicle maintenance, car kit parking.

Tables 2 and 3 present the differences between logistics centres and other storage facilities in National Logistics Network (NLN).

Table 2. Infrastructure as a factor of NLN division.

Infrastructure elements	Logistics Centres	Warehousing Centres	Warehouses
Warehouse building	+	+	+
Dock lever	+	+	+
Intermodal dock leveller	+		
Offices	+	+	+
Office building	+		
Customs station	+		
Cat service facility	+		
Petrol station	+		
Car wash	+		
Catering facility	+		
Accommodation facility	+		

Source: own elaboration

Table 3. Services as a factor of NLN division.

Services	Logistics Centres	Warehousing Centres	Warehouses
Warehouse building	+	+	+
Supplies management	+	+	+
Cross docking	+	+	+
Package sorting	+	+	+
Intermodal transshipment	+		
Shipping	+	+	+
Custom service	+	+	+
Telecommunication services	+	+	
Financial services	+		
Packages rental	+		
Cleaning and package service	+		
Fuel sales	+		
Car service	+		
Catering	+		
Accommodation	+		

Source: own elaboration

The basic differentiator of a logistics centre is its intermodality, whereby a facility can provide cargo handling services for intermodal container units. Moreover, its framework should include operation of many independent enterprises conducting business in the area of logistics, but not limited to it. It should include financial, service or customs companies.

There are many facilities mistakenly referred to as logistics centres in Poland today. They are, in fact, objects of a single economic entity, with the access to a single mode of transport. The differences also concern the functionality of

individual facilities. LC offers the most extensive array of provided services from among all the nodes of the national logistics system. European research, e.g. in Spain, also confirms the erroneous naming [14].

4. TRENDS IN SELECTION OF LOGISTICS CENTRES' LOCATIONS AND THEIR RELATIONS TO THE CONDITIONS IN POLAND

The European experiences in terms of planned and existing LCs' locations are characterized by dominant trends related to the macro-spatial distribution of these facilities. The first one are locational factors. In the case of the private sector, the most important aspects are the economic and technical conditions of a given location, which include: the value of the logistics market, investment attractiveness for potential clients, availability of a multi-branched logistics and communications infrastructure, availability and price of land, availability of trained personnel, low labour costs, availability of outlet markets, tax rates, existence of special economic zones (SEZ). Additionally, the important aspects for private entrepreneurs include an opportunity to participate in government and regional programs which support the development of transport and logistics infrastructure, the current level of transport infrastructure's development, as well as its development plans, ability to use non-commercial sources of financing, ability to cooperate with the administration and local government units, ecological and environmental factors, legal and financial factors. It is interesting to know that the legal factors of a location, which to an extent regulate the actions of enterprises in the transport and logistics industry (ecology, congestion regulations, untapped potential in the rail transport), have no significance to private investors [6], as long as they do not go hand in hand with financial factors. The most important factors, as indicated by the literature and research, to the public sectors are the socio-political ones [4]. By means of initiating, creating conditions for investment, planning and involvement in the construction of logistics centres, the government or local governments implement the postulates of the social or economic policy: implementation of the regional development strategy, combating unemployment, mitigation of uncontrolled urban development's adverse effects, implementation of the environmental policy, realization of sustainable

transport policy objectives, prevention of traffic overloads and jams.

The above-listed factors indicate the dominant trends related to the macro-spatial distribution of these facilities. The first one is location within the Pan-European Transport Corridors area [4, 6, 15]. Due to the focus on intermodal solutions, the transport corridors seem to be a natural spot for an LC location.

Slovakia, Ukraine and West Asia. The location of an LC within the boundaries of the transport corridors would allow for free and economic flow of goods with the above-listed areas. The factor closely related to the course of the transport corridors is access to the linear transport infrastructure: roads and railway lines. The development level of the motor transport infrastructure is dependent on the availability of

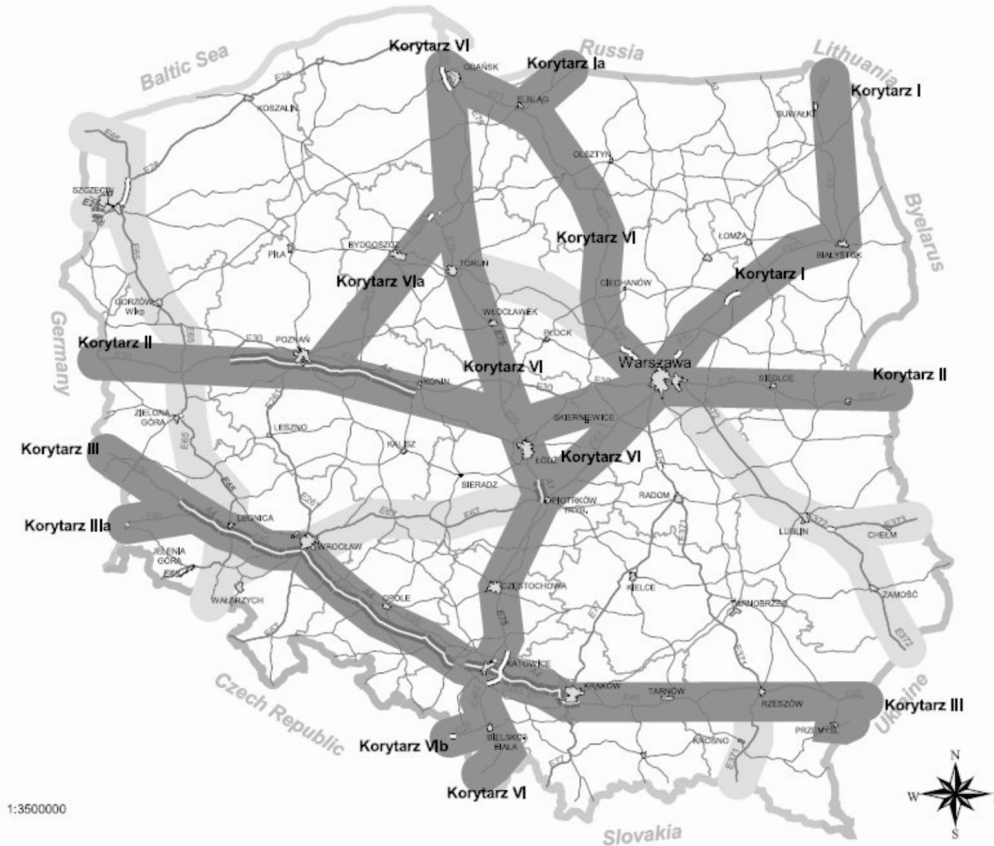


Fig. 2. Pan-European transport corridors through Poland
Source: gddkia.gov.pl

Moreover, the location within their boundaries allows for logistic support for transport streams (storage, cargo handling, packaging, etc.). In particular, the places of corridor intersections contribute to the creation of LC. The following map shows the Pan-European Transport Corridors going through Poland (fig.3). A network of auxiliary corridors has been isolated, it connects individual regions with the main routes of the network (fig.4).

Based on figures 3 and 4, one can indicate regions in Poland connected with via the Pan-European network. The Baltic countries should be noted here first, Germany, the Czech Republic,

highways: motorways and expressways. While considering the location of an LC, both the existing road network and planned investments should be taken into account.

5. RESEARCH RESULTS

Based on the results of point evaluation (tab.4), four area groups were designated:

- I (0.60-1.00 pts) - the most attractive areas from the perspective of a potential logistics centre location;
- II (0.40-0.59 pts) - moderately attractive from the perspective of a potential logistics centre location;

- III (0.00-0.39 pts) – the least attractive areas from the perspective of a potential logistics centre location;

Group I included mainly seaports (Gdansk, Gdynia, Szczecin) and the surrounding areas of the second most populated agglomeration in Poland - Warsaw. In the case of seaports, the reason is access to the multi-modal transport infrastructure and having intermodal transshipment terminals on their own ground. It is worth noting that the facilities scored in nearly all categories of location factors.

Malaszewicze and Zurawica-Medyka. They are located in the immediate vicinity of railway and road border crossings, and have modern intermodal transshipment terminals.

The remaining locations were included in group III, they are the least-attractive areas, mainly due to the lack of transshipment terminals and poorly developed linear infrastructure.

Table 4. Scoring table for best location of LCs in Poland.

Location factors	Locations of logistic centres														
	Branie-wo	Bydgoszcz	Gdańsk	Gdynia	Kraków	Lublin	Łosóń	Łódź	Malaszewicze	Rzeszów	Suwałki	Szczecin	Warszawa	Wrocław	Żurawica-Medyka
Pan-European transport corridor	0,05	0,05	0,1	0,1	0,05	0	0	0,05	0,05	0,05	0,05	0	0,15	0,05	0,05
Intermodal transshipment	0	0	0,1	0,1	0,1	0	0	0,1	0,1	0	0	0,1	0,1	0,1	0,1
Agglomeration *	>1 mln	0	0	0	0,07	0	0	0,07	0	0	0	0	0,07	0	0
	0,5-1 mln	0	0,05	0,05	0,05	0	0	0	0	0	0	0,05	0	0,05	0
	< 0,5 mln	0,03	0	0	0	0	0,03	0	0	0	0,03	0	0	0	0
Special Economic Zone	0	0,06	0,06	0,06	0,06	0,06	0	0,06	0	0,06	0,06	0,06	0,06	0,06	0
Industrial Zones	0	0,05	0,05	0,05	0,05	0	0	0,05	0	0,05	0	0,05	0,05	0,05	0
Existing roads	highways	0	0,05	0,05	0,05	0,05	0	0	0,1	0	0,05	0	0,05	0,05	0,05
	expressways	0,03	0	0	0	0	0	0,03	0,03	0	0	0,03	0,03	0,03	0
Roads in plan	highways	0	0	0	0	0	0	0,04	0	0	0	0	0	0	0
	expressways	0,02	0,04	0,04	0,04	0,02	0,06	0,02	0	0,02	0,04	0,02	0,04	0,02	0,02
Railways	AGC & AGTC	0	0,07	0,07	0,07	0,07	0	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07
	others	0,02	0	0	0	0	0,02	0	0	0	0	0	0	0	0
Sea harbours	0	0	0,15	0,15	0	0	0	0	0	0	0	0,15	0	0	0
Air-cargo terminals	0	0,01	0,02	0,02	0,01	0,01	0	0,01	0	0,01	0	0,01	0,02	0,01	0
Land border crossing points	road	0,07	0	0	0	0	0	0,07	0	0,07	0	0	0	0	0,07
	rail	0,07	0	0	0	0	0	0,07	0	0,07	0	0	0	0	0,07
TOTAL	0,29	0,38	0,69	0,69	0,48	0,23	0,21	0,58	0,38	0,36	0,2	0,61	0,62	0,49	0,43
Group	I	I	I	I	II	III	III	II	III	III	III	I	I	II	II

* number of inhabitants

Source: own elaboration

The areas of Warsaw are an attractive area for an investment in construction of a logistics centre, chiefly due to its location. The capital of Poland is located at the crossing of the Pan-European transport network corridors and has a well-developed linear and nodal infrastructure network. The access to nearly 3 million inhabitants of the urban agglomeration also has a significant impact.¹

Group II includes the remaining biggest cities in Poland. Lodz, Wrocław and Krakow are attractive locations for creation of LCs mainly due to their access to absorptive output markets and a well-developed road infrastructure. The group is supplemented by two locations in eastern Poland:

6. CHARACTERISTICS OF THE GROUP I AREAS

Gdansk and Gdynia scored the most points in classification of individual areas for construction of logistics centres. They scored the same amount of points in all categories. It is related to the fact that these two cities are located in a very close proximity to each other, about 25 km. It makes all the factors related to availability of widely understood logistics infrastructure the same for both these locations.

Gdansk and Gdynia are situated along two Pan-European transport corridors: VI, connecting the Baltic region to the central and southern part of Poland, with the biggest two agglomerations in Poland, Silesian and Warsaw, in its route. The

¹ according to CSO data 1.XII.2014

corridor ends in Slovakia (Zilina) and the Czech Republic (Ostrava, Brno). The seaports in Gdansk and Gdynia are therefore attractive business partners for those countries, especially due to their lack of immediate access to the sea. Another one is the offshoot of corridor I connecting Polish ports with Latvia, Estonia and Russia via the Kaliningrad District.

While discussing the location of seaports in Gdansk and Gdynia, one should also analyse the availability of linear transport infrastructure. The most important is the A1 motorway with a meridional course, along the international E75 route which connects the Scandinavian countries with the Balkan peninsula [16]. Routes S6 and S7 are to go through the area of Tri-City in the future. Railway lines E65 and C-E65 have their beginning in Gdynia. These routes are included in the international AGC and AGTC agreements and constitute connections of the Polish port cities, through central Poland and the Upper Silesian region, with the southern Polish border, and then with countries located on the Adriatic Sea and in the Balkans. Gdansk and Gdynia constitute the fifth most populated agglomeration in Poland, with nearly 1 million inhabitants. They both lie within the Pomeranian Special Economic Zone and the Gdansk Industrial District. The Gdansk Rebiechowo airport is also located in their area.

All of these factors positively influence the potential interest of investors related to potential construction of a logistics centre in the area. Still, the most important factor with an impact on the attractiveness of the above-described locations are the seaports with container terminals. DCT Gdansk and BCT in Gdynia - the Baltic Container Terminal and GCT - the Gdynia Container Terminal. There are also additional seven terminals there for transshipment of grain, general cargo, bulk cargo or liquid gas.

The third place among group I areas was taken by Warsaw. The main factor contributing to it is its location along three Pan-European transport corridors (I, II and VI). They make Warsaw attractive for potential investors. The intersection of international Tallinn - Warsaw, Berlin - Moscow (Nizhny Novgorod) and Gdansk - Zilina/Brno routes creates perfect conditions for the functioning of LC. Due to its location in the centre of Poland, it is the crossing point of the main land routes. The motor routes include the A2 motorway running along the international E30 (Ireland - Russia) route, and the extension of the German A12 motorway, the expressway S8, S17,

S7. The city is the intersection point of main rail routes listed in agreements AGC and AGTC: E-65 and C-E65, E20 and C-E20, E75 and C-E75. There are two container terminals functioning in the area of Warsaw. The Warsaw agglomeration also constitutes an enormous consumer market which has to be served by logistics companies. Its location in the area of the Lodz Special Economic Zone and the Warsaw Industrial District, with many active companies from the food, chemical and energy industry, has a positive impact on the area of Warsaw being perceived as a place for investment. It is also where Cargo Terminal, the largest cargo airport in Poland, is located.

The last, final position in group I was taken by Szczecin. Its main asset is the Szczecin-Swinoujscie group of ports. 15 shippers provide their services there. The most important terminal from the perspective of possible creation of an LC in Szczecin is the DB Port Szczecin container terminal, with handling capacity of 120 000 TEU. The facility's advantage is its location - it is the closes port to the five European capitals: Berlin, Vienna, Prague, Bratislava and Budapest. The port in Szczecin is the main spot servicing the eastern parts of Germany. Another factor is its access to developed linear infrastructure. The main route is the A6 motorway. It is a section of the E28 international route going through Germany, Poland, Russia, Lithuania and Belarus. The A6 motorway links with the German A11 motorway and creates the Berlin-Szczecin connection. The S3 expressway is an important route here. It goes along the western border of Poland and connects the Swinoujscie-Szczecin group of ports with the Czech border in the south of Poland. An S6 route connecting Szczecin with Gdansk is also to be constructed in the future.

The railways of international significance going through Szczecin are E59 and C-E59, they ensure the most beneficial connection of Scandinavia with Central and Eastern Europe. The remaining factors influencing the attractiveness of this location is its position in the Kostrzyn Special Economic Zone, the Szczecin Industrial District and its ability to service over 600 thousand inhabitants of the urban agglomeration.

7. CHARACTERISTICS OF THE GROUP II AND III AREAS

The areas found in group two are divided into two subgroups. The first one consists of large voivodship cities with intermodal transshipment

terminals. These factors are the main determinants of attractiveness of Lodz, Wroclaw and Krakow. Those cities are situated within industrial districts and special economic zones, which, in combination with access to large consumer markets, additionally strengthens their position in the ranking. Their location on communication routes is also important. Lodz acquired the most points resulting from its access to linear infrastructure. The city lies along the VI Pan-European transport corridor, in the section between Gdansk and Katowice. Two motorways intersect in the area of Lodz: A1 with a meridional course, and A2 with a latitudinal course. Moreover, the S8 expressway goes through the area, granting communication with Wroclaw. A railway of international significance (C-65) also goes through the city.

In the case of Wroclaw, located on the borders of the III transport corridor, the state of access to roadways is equally attractive. The main route going through the city's area is the A4 motorway. It is the Polish section of the international E40 route, starting in France and then going through Belgium, Germany, Poland, Ukraine, Russia and Kazakhstan. It grants connection to large voivodship cities, i.e. Katowice, Krakow and Rzeszow. Good communication with Lodz, Warsaw and Bialystok is, in turn, granted by the S8 expressway. Construction of an additional S5 route towards Poznan and the Bydgoszcz-Torun agglomeration is also planned in the area of Wroclaw. Wroclaw has railway connections resulting from its location on international routes CE-30, E-30, CE-59 and E-59. The last of the large cities in this group, Krakow (III Pan-European corridor), lies along the A4 motorway (as above). An S7 route towards Warsaw and Gdansk is to be created here. Railways included in the AGC and AGTC agreements also go through Krakow. The second subgroup consists of two locations in the east of Poland. Malaszewicze is a large transshipment terminal located near the border with Belarus, through which runs one of the most important trade routes with Russia. Two road border crossings and one rail border crossing are located near the terminal. Malaszewicze is situated in the area of the II Pan-European transport corridor, along the international E30 roadway (the national road no 2). A section of the A2 motorway and an S19 expressway is to be constructed in the area in the future. The CE-20 (E-20) railway goes through the town.

The second of the two towns is Zurawica-Medyka, located at the border with Ukraine. As in

the case of Malaszewicze, there is a container terminal there, as well as rail and road border crossings. The facility supports trade between the EU and Ukraine and Russia. The III transport corridor, the A4 motorway and the international CE-30 and E-30 railway all run through here.

The third group, i.e. the least attractive locations, comprises of the remaining voivodship cities (Bydgoszcz, Lublin, Rzeszow) and two border towns (Braniewo, Lososna, Suwalki). What these areas have in common is the lack of an intermodal container terminal. In the case of most locations (apart from Bydgoszcz and Rzeszow), the very poorly developed road infrastructure network is also important.

8. CONCLUSIONS

The national logistics network in Poland does not currently have a sufficient number of LCs. There are initiatives to build more facilities, but they are at a very early stage. The research results indicate that seaports are the most attractive areas for the construction of new LCs. It is mainly due to their role, i.e. integration of the marine, road and rail transport modes. All the more because the location of LCs in Poland is closely related to the functioning of existing intermodal terminals. From all the areas selected for the study, the ones with access to such a facility were put in group I or II. It concerns seaports, large urban agglomerations, and border areas, so-called dry ports. It has been confirmed that access to a demand/output market in a given region has a considerable impact on the creation of an LC.

Private LC investors with the interest of their clients in mind built storage centres with access solely to the road infrastructure. From the operation of the national logistics system's perspective, those investments were uncoordinated, and their location could be considered accidental. Due to storage centres being built according to old projects, their role being limited to storage and management of supplies, and the previously described single means of transportation, these facilities stand little chance to be transformed into modern LCs. The developers' approach is also important, as they wrongly perceive LCs solely as structural objects.

Due to the market being increasingly saturated with storage space in the area of Warsaw, Lodz, Poznan, Wroclaw, and Upper Silesia and Little Poland, the creation of LCs in this region comes with significant investment risk because of the

market competition. Therefore, the most attractive locations seem to be the seaports in Gdansk, Gdynia and Szczecin, as well as the eastern border areas in the towns of Zurawica-Medyka and Malaszewicze.

As the demand for LCs in Poland is still growing, the next part of this research should be selection of the locations for building new LCs (not expanding the existing warehouse areas) with respect to the criteria from this paper.

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