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The Importance of Logistics Distribution Centers as Nodes in Logistics Networks

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ABSTRACT

The emergence of logistics distribution centers has in the past few decades become a mass phenomenon that has emerged as a result of global economic processes. As part of logistics networks, logistics distribution centers are the key link between production and the market, i.e. end users, and function as nodes that facilitate international business activities. For this reason, the aim of this paper is to analyze the characteristics of logistics distribution centers on the example of logistics distribution centers of the selected Western and Central European Union countries and examine the prospects for the development of logistics distribution centers in Croatia. The research results indicate that the Republic of Croatia is less competitive in comparison with Western and Central European countries, although it has a number of logistics distribution centers due to insufficient utilization and renewal of transport infrastructure. Logistics distribution centers are an important center of logistics networks, and the countries will have to devote more attention to their development to attract foreign investment and achieve economic development, because their significance will continue to grow in the future.

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1 Introduction

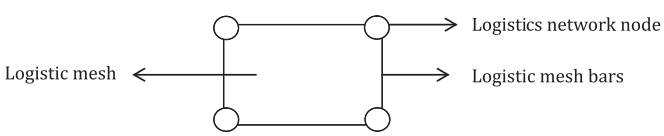
The increase in the flow of goods and globalization has made logistics services more important and their quality may be one of the key factors of company success. Development of logistics and distribution centers started around the 1980s. At that time, Western Europe, which is considered the developed part of Europe, recorded increased demand for logistics services, especially in distribution and transport. Numerous companies are looking for ways to reduce the costs associated with supply, storage, distribution, and further processing of goods, which results in their cooperation with logistics distribution centers. Growing significance of logistics in the modern society has enabled logistics distribution centers to become an essential component of logistics networks. The proximity of major European or state roads, the proximity of sea ports, river ports and airports, and accessible railways are crucial for smooth provision of logistics services and the management of logistics distribution centers.

The aim of this paper is to analyze the characteristics of logistics distribution centers and, on the basis of the examples of logistics distribution centers of the European Union member states, explore the prospects for the development of logistics distribution centers in the Republic of Croatia.

This paper consists of five connected parts. After the Introduction presenting the aim of the research and paper structure follows the second part that presents previous research on logistics distribution centers and their role. Logistics distribution centers in the Republic of Croatia are analyzed in the third part, while the fourth part presents the analysis of logistics distribution centers in Western and Central Europe. The fifth part, the conclusion, is the synthesis of the entire paper and provides concluding remarks.

2 Theoretical framework of logistics distribution centers

Logistics activities have expanded beyond traditional transport and storage activities that include packaging, labeling, assembly, procurement, distribution, etc. Modern logistics activities, often referred to as "low end" and "high end" logistics service values, add value to products and generate revenue for distribution centers and storage facilities [3]. Logistics distribution centers are one of the most important elements of each country's economy. They are an important factor in economic development that influences the flow of goods and contributes to increasing the efficiency of the logistics channel, and may also have an influence on the development of cities or regions in which they are located. A logistics distribution center is a part of a logistics network, a logistics system is a strategic link between the production itself and the market, i.e. the end users [5]. Each logistics network has its essential elements shown in the following scheme.



Scheme 1 Logistics Network Elements

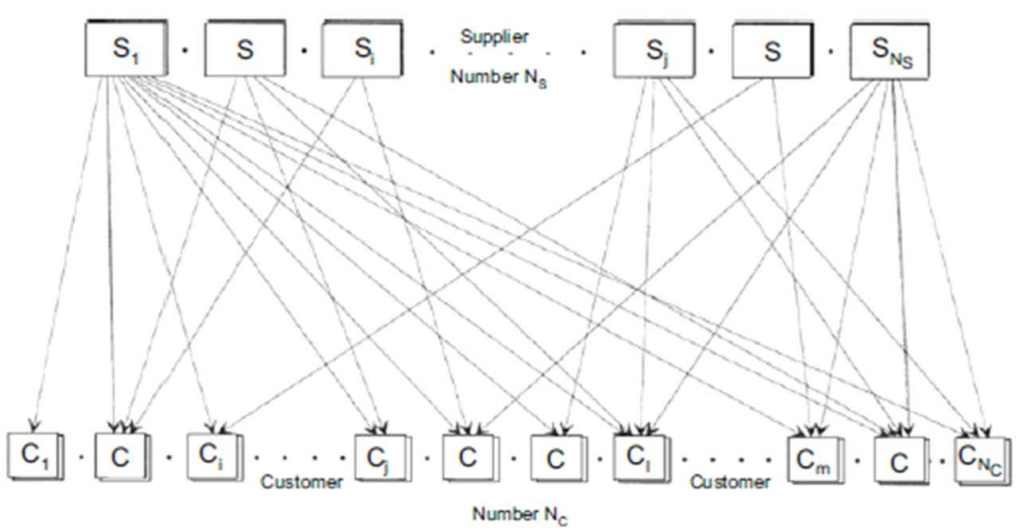
Source: [26]

The scheme clearly shows that the key elements of each logistics network are logistic mesh, logistics network nodes, and logistic mesh bars. Nodes, which are part of the logistics network, represent logistic centers, logistic mesh bars include roads, railways, shiplines, etc., and bars represent a transportation network. Logistics distribution centers consist of infrastructure, suprastructure, human resources, and technology [8]. If logistics distribution centers are observed in the narrow sense, they can also exist within a company for its own purposes. Logistics distribution centers may also be defined as "modern facilities in which goods for further distribution to customers are selected, stored, upgraded, and prepared" [10].

Logistics distribution centers are part of a more complex structured logistics network. Namely, logistics networks may be structured very simply, as shown in Scheme 1 and such a logistics network directly connects suppliers with end users.

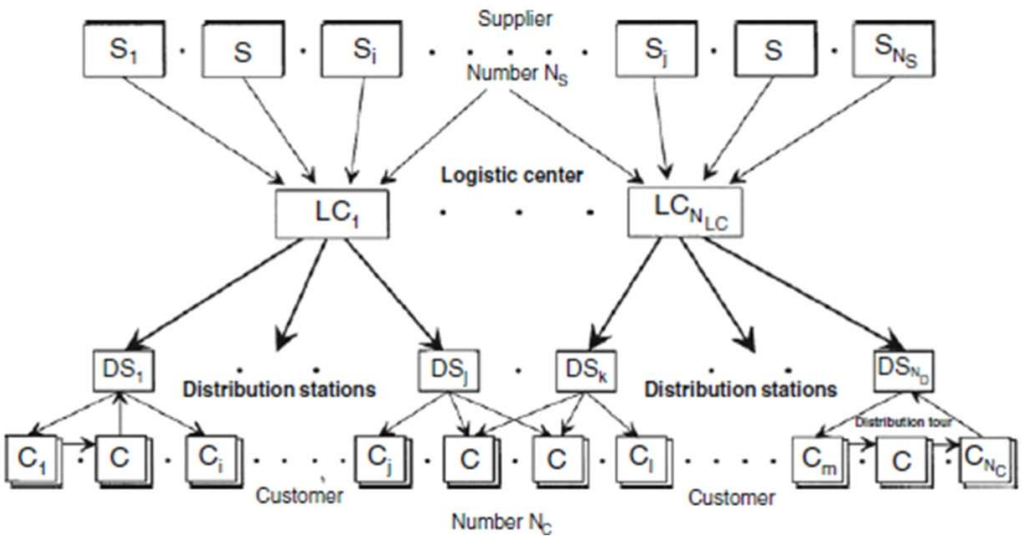
When a logistics network has a more complex structure and multiple levels, suppliers and end users are divided with at least one intermediate point and this structure is shown in Scheme 2.

This intermediate point may be a point, i.e. a transhipment location, a shop or a logistics center [6]. In this case, logistics centers are an important link in the whole process, because they provide continuous delivery. They represent macrocomplexes of specialized and universal warehouses and terminals, customs zones, freight transport, freight distribution, and retail trade centers. Notteboom points out that the choice between different types of distribution, i.e. distribution centers, depends, *inter alia*, on the product type and delivery frequency [15].



Scheme 2 Single-Level Logistics Network

Source: [6]



Scheme 3 Three-Level Logistics Network with a Logistic Center

Source: [6]

3 Logistics distribution centers in the Republic of Croatia

There are large regional logistics distribution centers whose purpose is to supply a wider international area, and there are also national and regional logistics distribution centers and those that can supply larger urban areas. They are mostly located in ports where they have a connection with the customs and freight forwarding offices and are well-connected in terms of transportation [14]. The Republic of Croatia has a few logistics distribution centers covering the national territory, and they are mostly owned by foreign companies. These centers are located near major roads and large cities in Croatia, by which they can provide services to more inhabitants and companies.

3.1 The need for the establishment of logistics distribution centers in the Republic of Croatia

The favorable geo-traffic location of Croatia was recognized back in 1997 at the Pan-European Transport Conference in Helsinki. Longitudinal and transverse traffic routes that pass through the territory of the Republic of Croatia are shown on Map 3. Corridor X and branches of corridor V – Vb and Vc are important corridor routes passing through Croatia. Taking into consideration larger branches, it is fair to say that four corridor routes actually pass through the territory of the Republic of Croatia. In addition to the three aforementioned routes, the fourth is the Danube River that is a part of corridor VII [25]. This indicates the favorable geo-traffic location that enables Croatia to build and manage the operations of logistics distribution centers in the best and optimal way.

There are several functional logistics distribution centers in Croatia. They are mostly located around larger cities; most of them in the vicinity of the City of Zagreb. One of the largest logistics distribution centers is the Immopark Zagreb located in Jastrebarsko, 24 km away from Zagreb [14]. Thanks to its optimal geo-traffic location, logistics distribution centers such as the one in Jastrebarsko near Zagreb make their owners competitive and foster the development of the region and development of the infrastructure. Namely, their construction facilitates the expansion of the railway network to enable better and faster services, and this is supported by the proximity of roads and access to the airport. These advantages of Croatia's location clearly show that there is a need for the establishment of such types of centers and that they are necessary for Croatia to be and remain part of the European logistics network.

3.2 Characteristics of logistics distribution centers in the Republic of Croatia

In the aforementioned logistics distribution center Immopark Zagreb in Jastrebarsko, there is a logistics distribution center of a large retail chain, Lidl. The entire LDC Immopark is located near the Jastrebarsko exit on the A1 highway, 24 kilometers away from Zagreb, and has access to the entire network of highways through the Lučko intersection. The planned expansion of the railway lines will contribute to the existing attractiveness of the location [7]. In addition to Immopark in Jastrebarsko where Lidl is located, there are several more LDCs in other parts of Croatia. The most important ones are the logistics distribution center of Ralu logistika in Rugvica, Konzum's LDC in Zagreb and Dugopolje, and another logistics distribu-

Map 1 Distribution Networks of Konzum and Lidl

Source: [23]

tion center of the Lidl retail chain located in Perušić in the Lika-Senj County.

Ralu logistika has a logistics distribution center in Rugvica near the capital of Zagreb, in Dragošićka business area. It expands on 11.500m^2 and has state-of-the-art own infrastructure in order to provide top-quality logistics services [24]. In their logistics distribution center, they strive to achieve workflow optimization and efficiency, and devote great attention to automation and technology development. They opened regional logistics centers in Dalmatia, Kvarner, and Slavonia and have also established their own national distribution network [21]. Konzum and Lidl retail chains' LDCs have two different, but very similar distribution networks presented on the Map 1.

There are two approaches to distribution networks of both companies. The first approach denotes the market potential that is directly linked to the available population, while the second approach shows how trucks make deliveries using highways. Therefore, the optimal solution for both approaches is to have two logistics distribution centers – one for the northern part of the state, and the other for the southern part of the state. The top three reasons for choosing such locations are the number of inhabitants in the given area, delivery time and the average distance to the end users. Konzum's LDC in Zagreb supplies Osijek, Rijeka, and Poreč, while the LDC in Dugopolje supplies the cities of Zadar, Korčula, and Dubrovnik. Lidl's LDC in Jastrebarsko supplies the region around the City of Zagreb and Slavonia, while the LDC in Perušić supplies Istria, Kvarner, Gorski Kotar, Lika, and Dalmatia [23]. It is very important to maintain the level of frequency of logistics distribution services. They have an impact on the number of distribution centers that will supply a particular supply chain. If the frequency of services is reduced, there is a need for fewer distribution centers, and if the frequency level is higher, it requires the establishment of a larger number of distribution centers. Also, if the number of distribution centers is limited, it is implied that there is greater distance for empty return, which can be very expensive.

3.3 The impact of transport infrastructure on the development of Croatian logistics distribution centers

In addition to the growing influence of globalization and changeability of market characteristics and consumers' desires and tastes, it is necessary to keep track of the trends and provide state-of-the-art technology and services. The development of transport infrastructure and the construction of larger logistics networks have become a necessity ever since Croatia accessed the European Union. Such investments are primarily long-term and require great capital; they should, however, be implemented gradually and involve the collaboration of domestic economic entities at all stages of their development. They are also necessary for Croatia and its companies to become more competitive in comparison with other EU countries.

In terms of transport infrastructure, the Republic of Croatia has 26.985,5 km of roads (including highways, state roads, county, and local roads), 2.722 km of total length of railway lines, three cargo ports in Rijeka, Split and Ploče and airports in Zagreb, Dubrovnik, Split, Zadar, Pula, Rijeka, and Osijek [13]. In the period from 2006 to 2016, transportation of goods by rail was decreased by almost 43%. The reason for this situation is that there is a delay in the overhaul of about 1000 km of the railway lines, which is, in fact, one third of the total railway network in Croatia [11]. The delay in the railway overhaul in Croatia is still ongoing. If the situation were resolved, there would be a greater flow of goods through rail transport. The opportunities for the develop-

ment of Croatian railways are great and can be achieved by improving the infrastructure through intermodal terminals, modernization of the fleet, integration with other types of transport, and improvement of services. Such a disadvantage and lag behind other Europan countries also affects logistics distribution centers. The purpose of logistics distribution centers is to receive the goods, upgrade them if necessary, and ship them to the next destination. It is crucial that these functions are performed quickly and rationally; if this is not the case and if there is any interference, there will be a waste of time and cost increase, which ultimately creates dissatisfaction of the end users of goods and services and potential loss of the target market. The situation with road and maritime transport is relatively good; however, for the development of logistics distribution centers, it is necessary to modernize and also invest in other forms of transport, such as air transport and, of course, railway transport, in order to keep the Republic of Croatia competitive in the European logistics network.

4 Logistics distribution centers in Europe

In the European context, there are several locations that are considered ideal for the location of logistics distribution centers called the "blue banana". These are the locations that have the optimal infrastructure and market accessibility and are shown on the Map 2.

As shown on Map 2, the area covered by the "blue banana" mainly includes highly developed European countries and cities with a large population located in the very economic center of Europe. Ports such as Antwerp, Rotterdam, and Hamburg are some of the most desirable locations for logistics distribution centers, because they can reach more markets and more people in a shorter period than, for example, Sofia or Kiev. The Netherlands, Belgium, and Germany have well-developed infrastructure, large ports and airports, which gives them advantage and the possibility to supply and provide high-level logistics services for the rest of Europe in a short time.

According to the research conducted by Capgemini, most logistics distribution centers are located in developed European countries, the optimal location for LDCs [1]. Depending on the concentration, Map 3 shows the locations of the majority of logistics distribution centers marked with smaller or larger red circles.

This map also shows that more developed European countries have a more desirable location for logistics distribution centers, unlike transition countries. The same applies to the concentration of logistics distribution centers. Western and Central European countries have a higher share of LDCs. Specifically, the Netherlands, France, the United Kingdom, Germany, Spain, and Belgium have the highest shares.

Map 2 The „Blue Banana" Zone

Source: [4]

Map 3 The Concentration of Logistics Distribution Centers in Europe

Source: [1]

4.1 Key characteristics of logistics distribution centers in Europe

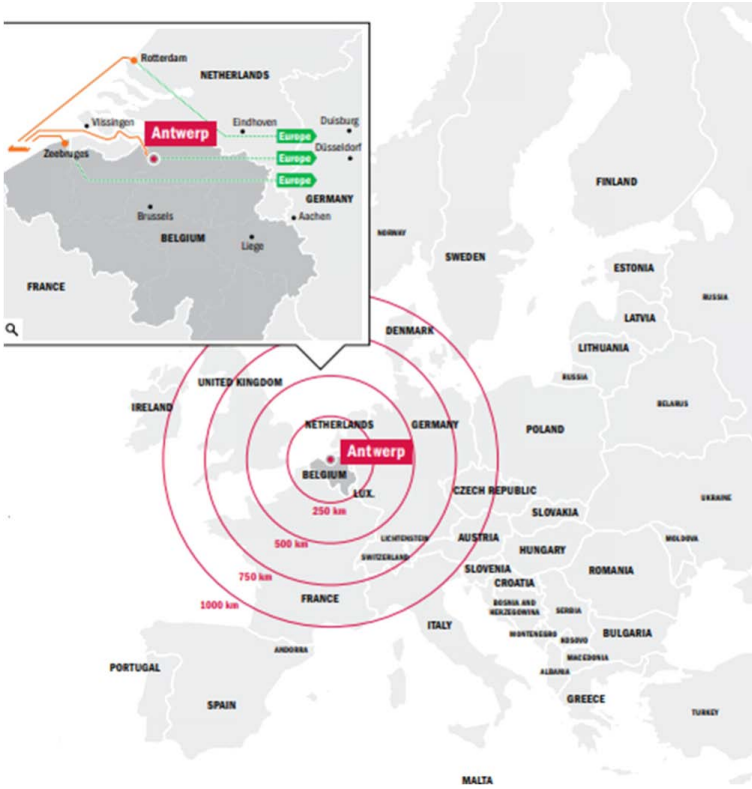
European logistics distribution centers are located near one of the largest European ports and they supply larger regions, i.e. several states. They use multimodal transport and choose the most convenient and efficient mode of transportation.

It is important for many European countries to have access to major European airports and sea ports in the area. This is why cities like Antwerp, Rotterdam, Amsterdam, Hamburg, etc. have almost the greatest turnover in their logistics distribution centers [4]. In terms of distribution-related activities, cost is usually considered one of the main determinants in the process of selecting the location of logistics distribution centers. Thus, ideal locations for LDCs would be in Eastern European countries, where the cost of employees is lower. However, Western Europe has a long industrial history and a well-developed infrastructure system; for this reason, in Eastern European countries, more attention is devoted to production than to other accompanying activities related to logistics distribution centers [4]. Due to its favorable geographical location, Western and Central European countries have a great strategic advantage of placing logistics distribution centers near major sea ports, because they are thus well-connected with overseas countries, allowing them to deliver goods from different parts of the world. Disadvantages of the logistics distribution centers in these countries are reflected in crowds and road traffic jams, especially on the roads leading to ports and logistics distribution centers.

4.2 Logistics distribution centers of Western Europe

Belgium and the Netherlands are considered the most desirable locations for logistics distribution centers. This is also due to the fact that they have well-developed transportation and technology infrastructure, they are near large European cities, and have excellent quality of logistics services. The Port of Antwerp and its logistics distribution centers are located in the area of 12.068 hectares [18] and offer a range of services such as consulting or business management for current and future projects. Given that logistics distribution centers make a node in which goods are received, upgraded, and shipped, it is considered in the Port of Antwerp that each product has its own means of transportation and its packaging method. This is also one of its key success factors. The Belgian port of Antwerp is located in the north of the country, in the County of Flanders, and it is the second largest European port[1]. The Port of Antwerp is an important logistics network node, i.e. an important logistics distribution center, because it offers sustainable access, smooth traffic flow, good roads, and mobility. The port authority has adopted an approach that will make the port more accessible by improving the infrastructure, while maintaining the sustainability and efficiency of cargo transportation [17]. The location of the port of Antwerp is shown on Map 4.

[1] The largest European port is Rotterdam in the Netherlands, the second Antwerp in Belgium, and the third Hamburg in Germany, according to data on the Port of Rotterdam website and https://www.worldatlas.com/articles/the-busiest-cargo-ports-in-europe.html (4/6/2018)



Map 4 The Location of the Port of Antwerp

Source: [17]

The optimal location is the foundation for the success of the Port of Antwerp and the operations of logistics distribution centers. It is fair to say that it is located in the center of European production and customer base. As much as 60% of European production and purchasing power is in the 500 km radius from Antwerp as shown in the picture [17] In addition to Antwerp, the port of Rotterdam in the Netherlands is very important for logistics distribution centers. Apart from being the largest European port, Rotterdam is also considered to be the most important freight hub on the European land [2]. With its inland waterways and well-developed rail and road infrastructure, it is connected to almost all of Europe due to the Rhine – Main – Danube Canal, which connects it to the Black Sea [9]. Rotterdam has the largest concentration of logistics distribution centers in the Netherlands although the port zone extends 40 km from the city to the coast of the North Sea, most of which are located in a narrow, quite closed area. The most significant such space consists of three so-called *Distriparks* located along the A15 highway that have been specially developed to enable logistics distribution activities [2].

Furthermore, it should be noted that not all logistics distribution activities are exclusively related to the port. In the "Noord-West" industrial zone there are several distribution centers with a regional focus that rely solely on road traffic [2].

The Port of Rotterdam points out that they offer a range of services, such as storage, repackaging, packaging, labeling, assembling goods, mixing, and repairing goods. They intend to strengthen the position of the port as the largest logistics distribution center in Europe. They collaborate with different partners to further improve the accessibility and access to the port and have created the project of container transfer in Alblasserdam to facilitate traffic on A15 highway and reduce the emissions of gases and particles [20].

4.3 Logistics distribution centers of Central Europe

As a Central European country, Germany has the best logistics performance in Europe. Germany has a very well-developed transport infrastucture, road, rail, and maritime transport, which makes it a desirable location for logistics distribution centers. Düsseldorf, a city in the German state of North Rhine – Westphalia and a city that is part of the German Ruhr conurbation, is a very successful business center in Central Europe. The city offers optimal accessibility due to its transport infrastructure, the international airport, as many as four transport ports on the Rhine River, and several highways and railway stations. Düsseldorf also has an optimal position in Europe, because it is part of the above-mentioned "blue banana", and therefore has a desirable location for logistics distribution centers and attracts

foreign direct investment. In the past few years, the city has become an important European center for cooperation with Japan [22].

The entire North Rhine – Westphalia region has become attractive due to its performance of logistics distribution activities. Large global companies like Amazon have their own logistics distribution centers in this particular area. This is also supported by the fact that the region is located near Belgium and the Netherlands with direct connections to their ports, roads and railways, as well as six airports connecting the region with the entire world [16]. Another important German logistics distribution center is definitely the northern port of Hamburg. The Port of Hamburg is one of the largest container ports in the world and Europe and the largest port in Germany. Its characteristics are flexibility and high performance. In addition to high speed and quality of cargo handling, the Port of Hamburg is also known for its diverse range of logistics distribution activities and services. They include importing and exporting of all types of cargo, and processing, if necessary, at any time – day or night [19].

Logistics distribution centers are mostly located outside the city centers, near major urban centers and next to major roads. However, in recent years, a new trend has been recorded in Germany; logistics distribution centers keep getting closer to the centers of larger cities. The fast growth of online stores associated with ever-increasing customer demands further increases the significance of logistics in central Germany. The current trend includes delivery of goods on the same day and in the same hour the order was received. In response to such trends, the companies have been optimizing their delivery processes to deliver goods to their customers faster. Therefore, the Amazon company launched its new fast delivery service called "Prime Now" in Berlin and Munich, for which they had to establish smaller distribution centers in city centers [12].

All of the aforementioned characteristics of individual countries and regions in which large logistics distribution centers are located provide an insight into how modern logistics processes and well-developed infrastructure, that enables and facilitates these processes, are an important component of business operations of companies and logistics distribution centers, how they increase attractiveness of the location and attract foreign investment, which ultimately has an impact on the development of the region, the state, and general prosperity of the society.

5 Conclusion

The impact of globalization and the latest trends in consumer preferences and company business operations have enabled logistics distribution centers to become an increasingly important link of logistics networks, performance of logistics and distribution activities, and logistics in general. Western and Central European countries are more successful in carrying out logistics activities than the Republic of Croatia, mostly due to its outdated infrastructure, especially railway, weaker connectivity, and insufficient investment in modernization of technology. It is important to point out that the Republic of Croatia has an optimal location in Europe for the accommodation of logistics distribution centers due to transport corridors passing through its territory. Examples of an excellent location and exploitation of this advantage can be found in the Western and Central European countries. Large European ports such as Antwerp, Rotterdam, or Hamburg are at the top of the world ranking lists in terms of performance of logistics services and the size of logistics distribution centers. Therefore, their regions achieve economic development, they attract foreign investment and generate prosperity for the countries and their population. For this reason, logistics distribution centers are an important center of logistics networks, and if these business trends and market demands continue, their significance will keep growing in the future. This is why the Croatian transport policy and the economic policy should be directed towards modernization, investment and creation of favorable conditions for the development of logistics distribution centers in the Republic of Croatia.

Acknowledgement

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References

[1] Capgemini 2006, *Distribution Center Study*, available at: https://www.capgemini.com/de-de/m/de/tl/Distribution_Center_Study.pdf

[2] CBRE 2011, *Understanding logistics in the Netherlands*, available at: http://www.cbre.eu/portal/pls/portal/res_rep.show_report?report_id=261

[3] Chen, L, Notteboom, T. 2012, 'Determinants For Assigning Value-added Logistics Services To Logistics Centers Within A Supply Chain Configuration', *Journal of International Logistics and Trade,* 10(1), pp. 3-41.

[4] Colliers International 2013, *Top European Logistic Hubs*, available at: http://www.portofantwerp.com/sites/portofantwerp/files/Colliers%20Top%20European%20Logistics%20Hubs%202Q13.pdf

[5] Dunković, D. 2010, 'Logističke mreže i suvremene logističke usluge', *Suvremena trgovina,* No. 4, pp. 1-12, available at: https://bib.irb.hr/datoteka/479365.Dunkovi_Dario_Suvremena_trgovina_4_2010_Logistike_mree_i_suvremene_logistike_usluge.pdf

[6] Gudehus T., Kotzab, H. 2009, *Comprehensive logistics*, first edition, Springer-Verlag Berlin Heidelberg, Berlin.

[7] Immopark Zagreb n.d., *Lokacija*, available at: http://www.immopark.hr/hr/Lokacija

[8] Ivaković, Č., Stanković, R., Šafran, M. 2010, *Špedicija i logistički procesi*, Faculty of Transport and Traffic Sciences of the University of Zagreb, Zagreb.

[9] Janjatović, S., Matijević, M. 2008, 'Europske regije i luke', *Pomorski zbornik*, 45 (1), pp. 137-152.

[10] Kesić, B., Jugović, A., Perko, N. 2004, 'Potrebe i mogućnosti organizacije logističko distribucijskog centra u riječkoj regiji', Pomorski zbornik 42, pp. 187-208, available at: https://hrcak.srce.hr/file/80102

[11] Kreč, S., Hozjan, T., Golubić, J. 2012, 'Razvojne mogućnosti željeznice u Hrvatskoj', *Znanstveni skup Ocjena dosadašnjeg prometnog razvitka Hrvatske i osnovne smjernice daljnjeg razvoja*, Proceedings, Zagreb, pp. 135-149, available at: https://www.bib.irb.hr/598003

[12] Kunz P. 2016, *Colliers International: Logistics companies move warehousing into German city centers*, available at: http://www.colliers.com/-/media/files/emea/germany/germany_news/city_logistik-germany-colliers-160905.pdf?la=en-gb

[13] Ministry of the Sea, Transport and Infrastructure, n. d., *Prometna infrastruktura – Republika Hrvatska raspolaže sa sljedećom osnovnom mrežom prometne infrastrukture*, available at: http://www.mppi.hr/default.aspx?id=3113

[14] Nadilo, B. 2012, 'Logističko – distribucijski centar u Jastrebarskom', *Građevinar*, No. 1, pp. 47-52, available at: http://www.casopis-gradjevinar.hr/assets/Uploads/2012-01-prilog-1-gradilista.pdf

[15] Notteboom, T. 2009, An economic analysis of the European seaport system: report for the European Sea Ports Organization (ESPO). Antwerp: ITMMA – University of Antwerp, available at: https://www.espo.be/media/espopublications/ITMMAEconomicAnalysisoftheEuropeanPortSystem2009.pdf

[16] NRW.INVEST GmbH 2017, *Logistics at its best, North Rhine-Westphalia*, available at: https://www.nrwinvest.com/fileadmin/user_upload/downloads/EN-Broschueren/Brochure_Logistics.pdf

[17] Port of Antwerp 2016, *Antwerp, your reliable supply chain partner*, available at: http://www.portofantwerp.com/sites/portofantwerp/files/Brochure_Supply_chain_LR_UK.pdf

[18] Port of Antwerp 2017, *Facts and figures*, available at: https://www.portofantwerp.com/en/publications/brochures-maps/facts-figures-2017

[19] Port of Hamburg n. d., *Statistics*, available at: https://www.hafen-hamburg.de/en/portofhamburg

[20] Port of Rotterdam n. d., *An Accessible port*, available at: https://www.portofrotterdam.com/en/our-port/our-themes/an-accessible-port/an-accessible-port

[21] Poslovni dnevnik 2013, *Razvoj tržišta logističkih kompanija tek se očekuje,* available at: http://www.poslovni.hr/domace-kompanije/razvoj-trzista-logistickih-kompanija-tek-se-ocekuje-246338

[22] Prologis 2017, *Dusseldorf, Successful Business Center in the Heart of Europe*, available at: https://www.prologisgermany.de/en/industrial-logistics-warehouse-space/europe/germany/dusseldorf-successful-business-center-heart

[23] Pupavac, D., Baburić, M., Baković, I. 2014, 'Logistic distribution centres – business success factor of trading companies', Business Logistics in Modern Management, 14. International Scientific Conference, Osijek, pp. 49-53, available at: http://blmm-conference.com/paper/logistic-distribution-centres-business-success-factor-trading-companies/

[24] Ralu logistika 2015, *RALU Logistika otvorenjem novog logističko-distributivnog centra obilježila 25 godina poslovanja*, available at: http://www.ralulogistics.com/press-centar/objave/ralu-logistika-otvorenjem-novog-logisticko-distrib

[25] Sić, M. 2012, 'Paneuropski prometni koridori i razvoj Osječke regije' *Hrvatski geografski glasnik*, 74. (2.), p. 53-67, available at: https://doi.org/10.21861/HGG.2012.74.02.03

[26] Zelenika, R. and Pavlić, H. 2004, 'Multimodalne logističke mreže', *Pomorski zbornik,* 42 (1), pp. 159-174.