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URBAN LOGISTICS ON THE EXAMPLE OF THE CITY OF CZĘSTOCHOWA IN TERMS OF ECOLOGY AND SAFETY

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Abstract: The paper presents a brief literature overview concerning urban logistics and the analysis of the selected aspects of urban logistics in the area of the city of Częstochowa. There are indicated the concepts assuming the improvement of the processes of urban logistics in the area of the city of Częstochowa and its peripheral areas, and their particularly important aspects are ecology and safety. The propose of realization of the concepts is to increase the level of quality of these areas of urban logistics and the position of the city in Poland, while stimulating its further development along with the development of urban logistics.
Keywords: urban logistics, ecology, safety

1. Introduction

Urban logistics includes the whole of processes and activities directed towards optimization of flows of goods, people, energy and information inside the city system [1]. The development of agglomeration, measured by the spatial development of cities, an increase in population density, the number of located factories or public institutions, requires the application of the principles of logistics management with reference to cities from the local authorities, while considering the needs for safety and development objectives, and also the environmental protection. This influences the city functions and higher needs with the help of its sub-systems (e.g. procurement, production, distribution, storage, transport or utilization). The basic urban functions include satisfying needs for: accommodation, work, rest, municipal services or secure communication. The higher needs in this area remain: sustainable development, ecology or revitalization.

According to S. Zamkowska, in 2020 more than 60% of the world population will live in cities, and the need for mobility will increase by 50% [2]. In highly urbanized cities the movement of people is the basis for their functioning, thus, it burdens infrastructure. Therefore, the goal of the communication policy and logistics of cities ought to be enabling the realization of the desirable secure mobility [3] with simultaneous optimization of possible effects, also the ecological ones. Similarly, there are also emphasized the aspects of ecology and security of the applied solutions of urban logistics, being increasingly less dependent on the advancement of the development of the local community. Certainly, an important argument is also the regulations of the European Commission, according to which in the coming years it will not be possible to obtain funding from the European Union for any purpose – one of the priorities will be supporting the development of ecological branches of transport and security of transport processes [4].

The present paper is devoted to the analysis of the selected fields of urban logistics in the area of the city of Częstochowa. Its main objective is the identification of the concepts assuming the improvement of the processes of urban logistics in the area of the city of Częstochowa and the peripheral areas, referring particularly to the aspects of ecology and security, among others, the purchase of ecological buses, replacement of tramway fleet,

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construction of roads and modernization of junctions to provide smooth movement of vehicles and construction of cycle routes.

2. Literature overview

The term of urban logistics is connected with the dynamic development of the area of logistics whose directions are determined by economic, social or technological changes. The factors affecting these phenomena, among others, include: globalization, transport development, scientific and technical progress, an increase in the significance of the environmental protection [5]. The necessity of changes in urban systems is caused by the needs of inhabitants and an increase in the requirements of (regional and international) competitors.

Theoretical basis of the field of knowledge, which urban logistics is, is still not sufficiently developed and shaped, therefore, it cannot constitute a separate scientific discipline [6]. On the other hand, it went through many definitions while bringing closer the systematization of knowledge in the field of logistics and enabling its application to such a multi-functional organization which the city is. A wide range of the applied solutions and areas of interests leads to lack of unambiguity in defining this term [7].

While taking as a starting point the definition of logistics developed by Council of Logistics Management, urban logistics may be defined as the process of planning, performing and controlling the flows:

- initiated outside and directed to the city or initiated in the city and directed outside,
- passing through the city and the internal ones in the city

and the information flows accompanying them, aiming at satisfying the needs of urban agglomeration in the field of the quality of management, life and development [8].

Urban logistics refers to all the activities which constitute a daily cycle of the city life as the economic, social and cultural space. This constitutes the basic instrument of the effective functioning of life of the contemporary city. Moreover, urban logistics is a tool of solving problems connected with the functioning of communication in highly urbanized areas which urban agglomerations, metropolises and megalopolises are. It assumes such transport organization in the city which aims at optimum use of the loading area of a vehicle [9].

In the city, different entities of economic life perform logistic activities which may be the object of the study of urban logistics. It is possible to list, at this point, the exemplary areas connected with:

- transport of cargo: delivery, transportation and exportation, and also transit traffic or creating transport links of the agglomeration with the logistic system of the micro-region,
- securing and storing goods for the benefit of the city,
- urban and suburban public transport and passenger transit traffic,
- supplying the city,
- waste collection and disposal of litter from the city [9].

Therefore, the objective of urban logistics is integrating the activities of all economic entities and institutions operating in the area of the city to provide the desirable level of the quality of life and management in the city with minimum costs and with the consideration of the requirements of security and ecology [10]. The most important objective of urban

logistics is satisfying needs of urban dwellers whose achievement is possible owing to the following actions [11]:

- providing favorable location of public buildings and institutions,
- improvement in the effectiveness of supply of raw materials and finished goods,
- improvement in the condition of the urban environment,
- reduction in nuisances connected with transport congestion,
- providing secure, effective and efficient functioning of the urban transport system,
- relieving the city transport infrastructure by removing transit to bypasses.

3. The concepts of improvements in the processes of urban logistics in terms of ecology and security on the example of the city of Częstochowa

In accordance with the above literature overview, the objective of urban logistics on the exemplary Polish city of Częstochowa is using the activities of institutions and economic entities functioning in the area of the city, aiming at satisfying the needs of urban agglomeration in the field of the quality of management, the quality of life and development with minimum costs, with the consideration of the requirements of security and ecology [12]. For the city of Częstochowa, with county rights, situated in southern Poland in the Silesian Voivodeship of the total area of 160 km and with a population of 235 thousand people, one of the most important, in terms of ecology and security, are the concepts indicated briefly below, assuming the improvement of the processes of urban logistics in the area of the city and peripheral areas.

3.1. Ecological buses. At the turn of 2012 and 2013 Miejskie Przedsiębiorstwo Komunikacyjne in Częstochowa Sp. z o. o. (Municipal Transport Company) tested modern buses. They were equipped with electric and hybrid (diesel-electric) engine. In case of hybrid vehicles, electric drive enables the recovery of energy lost during braking. Such a technology, coming from Spain, belongs to the most modern in the world. After several days of tests, the company has been interested in the purchase of these vehicles. Such an investment may provide many benefits, e.g.:

- decrease in vehicle operating costs by about 50%,
- increase in the quality of the performed transport services,
- increase in the competitiveness of the company,
- increase in the reputation of the company.

To let such buses in the streets of the city, the carrier wish to obtain funding from the Gazela program of the National Fund for the Environmental Protection and Water Management. This program belongs to the program of *Green Investment Scheme - a low-carbon urban transport*. It objective is to reduce or avoid greenhouse gas emissions into the atmosphere by means of funding projects consisting in lowering the consumption of energy and fuel in the city transport [13].

3.2. Replacement of tramway fleet. The tramways mostly operated by the carriers do not satisfy the basic qualitative criteria, and particularly the modern requirements of passengers. They are frequently repaired, repeatedly they pose a threat to the safety of passengers. Sometimes the cost of their repair is very high. Due to high costs of one tram (about 5-7 million zloty) the carrier is not able to finance such an investment from their

own budget. Therefore, owing to the limited financial resources, it has been investing only in the new bus fleet. The last replacement of the means of rail transport was carried out during the construction of a tram line in the district of Błeszno. The purchase of new tramways needs to be continued since it will allow to stop the outflow of passengers. It will cause that the journey by the modern means of transport in the city will become more popular. Another opportunity for this purchase will appear when the realization of the concept connected with modernization of the tram network starts. The company will wish to get a grant for the purchase of the vehicles along with the realization of the network development. Therefore, in the coming years it is unlikely for modern wagons to drive the existing tracks in Częstochowa. Recently, the local authorities have developed a few concepts of transport development in Częstochowa using the EU funds for the period of 2014-2020. Among them, there is the purchase of 15 low-floor tram sets [14]. In the nearest future it is possible, however, to install surveillance systems in the older tramways. The investment is to be carried out as in the case of buses.

3.3. Modernization of line infrastructure. To make the city traffic flexible, the urban local authorities ought to devote most of funds to the transport line infrastructure. There are the concepts of the previous and contemporary authorities, which make the above assumption. The most important ones include:

1. The construction of two-level junction of Aleja Jana Pawła II and Droga Krajowa nr 1 -National Route 1 (Al. Wojska Polskiego) along with the construction of the bridge on the Warta River;
2. Modernization of the streets: Warszawska and Rędzińska along with the overbridge on Droga Krajowa nr 1.

Both investments are the largest ones from among all carried out so far in the city of Częstochowa. They are co-financed from the EU Operational Program *Infrastructure and Environment* for the period of 2007-2013. These are the concepts which particularly enable faster and more secure movement of the inhabitants between the given areas of the city The development of these projects will bring about many benefits for Częstochowa and its inhabitants, e.g. the city will gain better reputation in the Voivodeship, Poland and Europe; more probably, the inhabitants will be able to avoid retention or slow traffic (traffic jams); the quality of individual transport will increase; therefore, the accessibility of two districts of the city: Wyczerpy and Mirów-Zawodzie will improve.

The construction of the multilevel crossing in the cities situated near the main national arteries most frequently maximizes the level of safety. Droga Krajowa nr 1 (DK-1) is in the TEN-T (trans-European transport network) network. At the crossroads with Aleja Jana Pawła II it connects with DK-46, running in the horizontal transport corridor of Poland. Moreover, in this area there are large shopping centres and investment areas. The existing road infrastructure does not provide appropriate safety and flow of traffic, and the intersection of these roads does not allow the appropriate traffic capacity. The result of such phenomenon are traffic jams and difficulties of pedestrians, connected with the movement in this area among numerous objects. To solve the above problem, the concept assuming the two-level crossing at this point has been started. The project includes [15]:

- complete replacement of pavement structures in the streets: Jana Pawła II, Wojska Polskiego as well as Srebrna and Drogowców,

- bridges and engineering structures, i.e. the road junction at the crossroads of these streets, footbridge on DK-1, bridge on the Warta River.

The objective of the realization of this investment is [15]:

- the improvement in communication accessibility of Poland and interregional connections in the framework of the TEN-T network by means of the development of the road network;
- decongestion of the road network of the city;
- improvement in transport security and improvement in the condition of interregional connections by increasing security and flow of traffic;
- reduction in the duration of transit and in travel time in connections between big cities of the country.

The concept of local authorities for the period of 2014-2020 mentioned above, referring to the planned investments by 2020, assumes the creation of transfer centres. The main transfer node is to be located by the main station. The planners also predict two solutions *park and ride*, mainly to provide service to suburban buses. They may be situated in the north of the city and in the south (by the Raków railway station).

3.4. Construction of bicycle lanes. In spite of the fact that European Cycle Route (Athens - North Cape) runs through Częstochowa, in the city itself, there is not a well-developed network of bicycle lanes. A significant part of the sections has been built on the occasion of larger infrastructural investments in recent years. Nowadays, the plans of Częstochowa City Hall and Miejski Zarząd Dróg i Transportu (the City Road and Transport Administration) do not include larger investments in the field of cycling infrastructure. The assumptions of the Program of Development of Cycle Lanes in Częstochowa of a few year back, assuming the implementation of ecological transport solutions in the city, have not been fully realized. In spite of the above, this concept is still up-to-date. This program assumes the development of cycling network, which is to be 82.87 km long [16]. The surface of roads are to be made, among others, of concrete blocks and asphalt.

Moreover, in October 2012 there was the meeting of the councilors with the representatives of the Nextbike company. It referred to the creation of the system of the bike rent in the area of the entire city. This idea is possible to implement only after obtaining funding from the EU. In accordance with the initial assumptions, the system consisting of 15 stations for 150 bicycles would be optimum [17].

Summing up, concluding the contract between the Nextbike company and the city authorities to install several bike rents should bring about a lot of advantages, which may include reduction in car traffic for the benefit of cyclists. However, this concept will not be effective, also while taking into consideration the financial profits, if there is no dense network of cycle lanes.

4. Summary

In the paper, there is presented a brief literature overview concerning urban logistics. Subsequently, there are analyzed the selected aspects of urban logistics in the area of the city of Częstochowa by indication of the concepts assuming the improvement of the processes of urban logistics in the area of the city and its peripheral areas. The realization of

the concepts presented above is to increase the level of quality of these areas of urban logistics and the position of the city in Poland, while stimulating its further development along with the development of urban logistics. Briefly presented areas of urban logistics in the area of the city of Częstochowa included particularly the aspects of the desirable secure mobility with simultaneous optimization of possible effects, also the ecological ones.

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