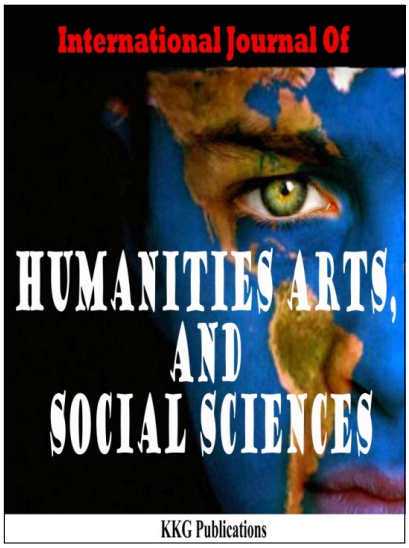

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Opportunities and Threats for Goods' Flow Concept Development

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OPPORTUNITIES AND THREATS FOR GOODS FLOW CONCEPT DEVELOPMENT

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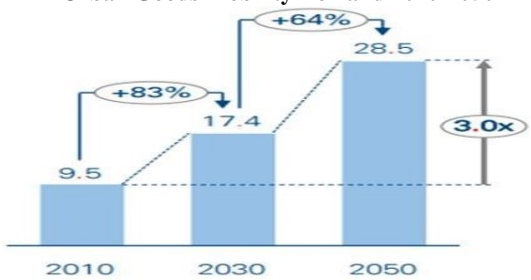
Abstract. Urban logistics seem to be a quite difficult issue, as it contains several levels of complexity. It consists of planning, coordination and controlling of logistic processes, and resources' flows within the urban areas. Besides, what is also very important, city logistics involve various stakeholders. Among them can be listed authorities, transportation operators, and retailers. Often these stakeholders have different aims and priorities. Local authorities are mostly interested in reducing pollution, noise or congestion, transport operators' aims focus on minimising costs while maintaining service levels. This may lead to enforcement of partial interest solutions concerning urban flow strategies. The possibility of success for an appropriate city logistics strategy depends on the specific city features and its characteristics and needs. The objectives of the article are: to systematize methods rationalizing goods' flows within the cities, to show the practical solutions for improving urban delivery of goods within the city logistics and indicate the best potential freight logistics measures that could be applied in Tri-city area (Poland). The methodological approach: the research is mostly based on the analysis of practical solutions in the field of city logistics in European urban areas, documents of the European Commission, and the publications prepared by industry association. Moreover, studies were carried out on the basis of investigating city board representatives and public road administrators in looking for the best solutions in freight logistics within the city area. The theoretical part of the paper is based on the existing materials from public resources and author's research experience. The results of the paper are: the analysis of effectiveness of the applied solutions in city delivery of goods, which shows the way of considering the right set of regulations and successfully implementing the most appropriate urban logistic strategy.

INTRODUCTION

Statement of the Problems

City logistics is essential to the functioning of modern urban economies. "Urban areas are places of frequent deliveries of retail goods, express deliveries to business, and home deliveries. City logistics tend to be an important part of economic development of the urban areas" (Law, 2013). The world's population is concentrated in cities and large metropolitan areas, and as a result, their size is increasing. Currently, about 52% of the world's population live in cities, though it is estimated that by 2050, this level will reach 67%. The same happens with transport taking place within the city areas. Now 67% of passenger transport is taking place in urban areas. By 2050, the number of kilometres travelled in urban areas is going to be tripled. Similar trends can be observed in freight transport. By 2050, the number of tones of goods transported in urban areas is going to be tripled (Figure 1) (Fum, 2015).

FIGURE 1
Urban Goods Mobility Demand 2010-2050



Source: (Fum 2015)

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Because of the high rate of urbanization in Europe, the importance of city logistics is still growing. The urban environment may be characterized by congested roads, limitation of space, deficiency of access, restriction of efficiency, and well-prepared city logistics operations. (Hesse & Rodrigue, 2004). Transport operators' activities lose due to various inconveniences within the city areas. City logistics is as well increasingly perceived as disturbing activity for passengers and the people's quality of life. Urban transport is not only essential for economic growth but also for better quality of life within the cities. Logistic activities within the cities or especially city centres sometimes generate air pollution, traffic congestion or noise and accidents. Therefore, balancing smart economic growth is strongly needed. (Dimitriou & Gakenheimer, 2011).

These complicated problems require appropriate solutions. There is a strong need to improve the quality of life within the cities. That is why local authorities around the world are looking for the best solutions in urban logistics strategies in order to improve logistics operators' activities with, at the same time, reducing the negative impacts of it. Various city logistics' solutions are implemented but with different levels of success (Behrends, 2016). City logistics measures have, in fact, their weaknesses and strengths. It is rather difficult to find optimal solution, because it's difficult to take into account the complexity and diversity of urban logistics while keeping all sides engaged.

REVIEW OF THE LITERATURE

Organization of Freight Transport

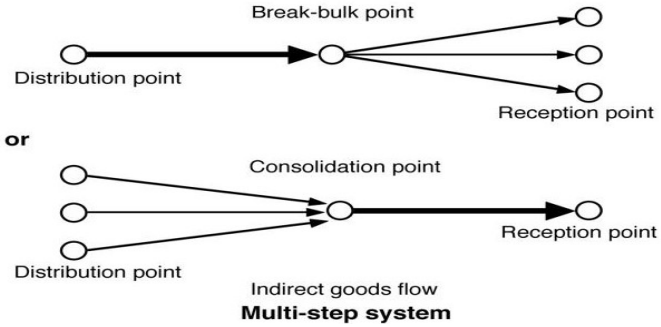
Urban freight transport is very unique. Mostly it is because of its features like special restriction, traffic infrastructure, and environmental concerns and sensitives. Its organization is much more complicated when taking place within the city areas. In cities, serving as hubs for national and international trade, urban freight is essential for wholesaling, distribution, logistics, and international operations (Taniguchi & Thompson, 2015). Its influence on external environment depends on the level of transport operators' organization. That's why there is a strong need to optimize the way of goods' flow. Stakeholders have different possibilities. The easiest way is single-step system (Figure 2), when the goods flow directly from the supply point to the receipt point.

The most complicated are: multi-step system (Figure 3) and combined system (Figure 4), where during the transfer from supply point to the receipt point, more operators are engaged.

FIGURE 2
Single-Step System in Organization of the Goods' Flow

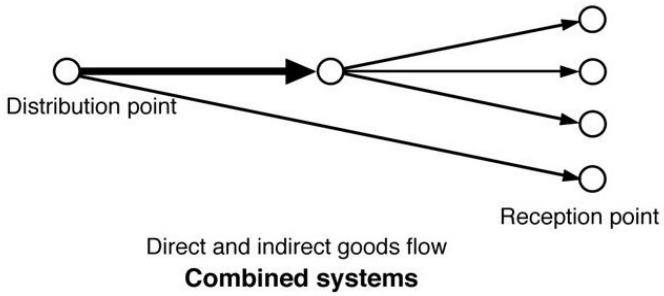
Source: (Inner Urban Freight Transport and City Logistics, 2013)

FIGURE 3
Multi-Step System in Organization of the Goods' Flow



Source: (Inner Urban Freight Transport and City Logistics, 2013)

FIGURE 4
Combined System in Organization of the Goods' Flow



Source: (Inner Urban Freight Transport and City Logistics, 2013)

So, the more complicated the level of the transport chain, the greater the negative impact on the external environment. Hence, there is strong need for the optimization of the goods' flow within the cities, and continuous looking for the best solution in this area. So far, stakeholders have different possibilities in the city delivery system (Inner Urban Freight Transport, 2013):

- individual forms of organization:
  receivers without self-coordinated delivery logistics;
  receivers with distribution company-coordinated delivery logistics;
  receivers with self-coordinated logistics;
- superordinated forms of public organization: goods distribution centres;
  freight villages.

Comprehensive Urban Logistics Strategy

For improving the quality of life in cities, there is a need to implement comprehensive urban logistics strategy (Komninos, 2008). A simple definition of urban logistics states that it regards to planning and implementing of economic efficiency of people, cargo, and information flows in urban areas, in order to improve the quality of citizens' lives. The most precise definition says it is "the process for total optimization of logistics and transport activities by private companies with the support of advanced information systems in urban areas considering traffic environment, traffic congestion, traffic safety, and energy savings within the framework of market economy" (Intan, 2016; Taniguchi, 2014).

The system of urban logistics should be understood as a "deliberately organized set of elements, such as: stakeholders, infrastructure, regulatory standards and tariffs, and relationships between them, which are involved in the process pertaining to the flows of people, cargo, and relevant information in urban areas" (Macharis & Melo, 2011).

Thus, the most important aspects of city logistics are its actors and stakeholders, which identify with different objectives and scopes. The key stakeholders are (Ehmke, 2012):

- shippers and receivers;
- carriers;
- local authorities.

They do not have the direct business relations, but they share the same physical space and, therefore, interact.

Shippers and receivers are the main actors in the transport market. An important condition of their positions is the accessibility of goods to the facilities where their activities take place. The shippers' decision on supply chain determines the transport demand in terms of shipment size, frequency, delivery precision, and flexibility. Shippers' and receivers' high accessibility to their suppliers and customers maximizes their level of service in terms of costs (Kaszubowski, 2014).

Carriers are operators whose role is providing the transport services for the shippers and receivers. They are also often providers of the logistics services. They aim at minimizing their costs by maximizing the efficiency of the services provided by them. The carriers can be own account or third party providers (Behrends, 2016).

Local and regional authorities should design environment, which highly influences the way urban logistics are carried out. Administrators should resolve conflicts between other stakeholders who try to achieve their own goals. Most of local authorities' main aim regards to the attractiveness of their city, and from that point of view, urban transport, in this condition, is responsible for contributing pollution and nuisance. Their main measures to improve urban environment are (Gonzalez-Feliu, Semet & Routhier, 2014):

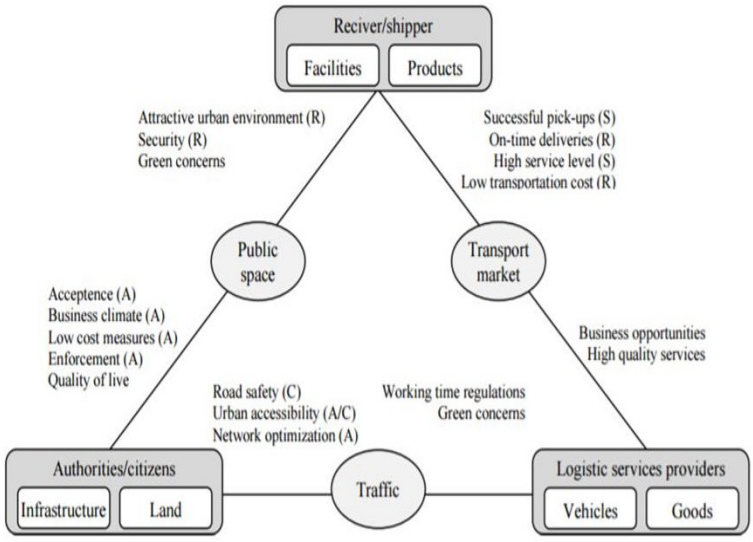
- using land-use and traffic planning;
- providing land for economic facilities and transport infrastructure;

Authorities have two goals (Brebbia, 2009):

- reducing impacts of freight traffic to improve citizens' quality of life;
- high accessibility to their city-region.

Figure 5 presents stakeholders, their fields of interaction, and objectives (Macharis & Verlinde, 2012).

FIGURE 5
Urban Freight Stakeholders and their Objectives



Source: Result from analyzed data of surveyed questionnaire

Urban Freight Logistics Measures The success of city logistics solutions depends strongly on local authorities' and policy makers' knowledge and their consciousness about parties' involved preferences. "Limited knowledge often results in coarse and undifferentiated policy that can backfire when reliable forecasts of policy effects for the various stakeholders' impacts are not available" (Givoni, 2014).

The only successful way to implement proper city logistics strategy and taking into account all stakeholders is preparing consensus-based strategies. Urban policies for urban logistics are investigated by a number of public initiatives. All the urban logistics concepts aim at the improvement of urban freight transportation by integrated analysis of transportation infrastructure, transportation resources, and political and economic environment (Azkuna, 2012).

The potential initiatives can be classified into six main categories, within each of them detailed measures can be listed. Those categories can be divided into (Civitas Wiki, 2015). Within each category, detailed measures can be listed (Fum, 2015):

- Stakeholders' engagement (freight quality partnership, freight advisory boards, city logistics manager);
- regulatory measures (restriction on vehicles, exclusivity zones, environmental restrictions);
- market-based measures (pricing, permits and mobility credits, incentives, and subsidies and taxes);
- infrastructure (nearby delivery areas, collecting points, centers for consolidation of goods);
- eco-logistics (eco-driving, greener trucks, alternative transportation means);
- new technologies (real-time information system and traffic control systems).

RESEARCH

Introduction to the Research - Urban Freight Logistics Measures as an Answer to Comprehensive Urban Logistics Strategy

Planning and implementing the complex strategy must be an answer to reconciling the interests of all parties involved. A comprehensive urban logistics strategy can "typically contribute to several objectives, where each can be influenced by different factors. Some of these objectives may even be in conflict. Therefore, prioritisation is needed" (Fum, 2015):

- "urban congestion reduction - influenced by distance traveled, vehicle capacity, and length and ease of coming to a halt;
- reduction of number of trucks in the city - influenced by vehicle capacity, vehicle filling ratio, and congestion level;

- pollution reduction and energy conservation- influenced by vehicle type, distance traveled, and congestion level
- noise reduction - influenced by vehicle type, distance traveled, and congestion level;
- development of local retail, influenced by solution costs, which are defined by service quality (speed, delivery time slots, flexibility/reactivity, etc.)" (Blecker, Kersten & Ringle, 2014).

Within each scope of comprehensive urban strategy, different urban logistics measures can be applied (Table 1).

TABLE 1
The Best Urban Freight Logistics Measures as an Answer to Urban Logistics Strategy Scopes

Urban Strategy Scope	Urban Congestion Reduction	Reduction of Number of Trucks	Pollution Reduction and Energy Conservation	Noise Reduction	Development of Local Retail
Urban Freight Logistics Measures					
Freight Quality Partnership		X			
Freight Advisory Boards	X				
City Logistics Manager					X
Time Access Restrictions	X			X	
Parking Regulations	X				
Size and Load Restrictions	X	X			
Tradable Permits and Mobility Credits		X			
Pricing			X		
Taxation and Tax Allowance			X		
Freight-Traffic Flow Management	X	X			
Traffic Control	X	X			
Urban Consolidation Centres		X			X
Nearby Delivery Areas		X		X	
Collect Points	X	X			

METHODOLOGY

Different methods were used to reach the research purpose of the paper. The theoretical part of the paper is based on the existing materials from public resources and author's research experience. The practical aspect of research is mostly based on the analysis of practical solutions in the field of city logistics in European urban areas, documents of the European Commission, and the publications prepared by industry association. Moreover, studies were carried out on the basis of investigating city board representatives and public road administrators in looking for the best solutions in freight logistics within the city area. Theoretical analysis and examining numerous case studies of applied urban freight logistics measures indicate the lack of universal solutions for particular cases. All measures have to be applied with respect to the policy and city considered. Below, as a consequence of the investigation, the best measures of urban freight logistics were presented, with the application example, and as an answer to achieving comprehensive logistics strategy aims.

The Best Urban Freight Logistics Measures for Achieving Comprehensive Logistics Strategy Goals-Research Results

As the answer to aiming urban congestion reduction goal, different practical solutions can be distinguished. Most of them are applied in European countries. The detailed solution involves:

- time access restrictions;
- size or load access restrictions.

However, the most popular solution within this area is parking regulations. Main types of parking regulations are:

- loading restrictions;
- parking restrictions;
- parking space reservation system;
- peak-hour clearways.

All the solutions have their pros and cons. There are following strengths: Reducing congestion, enhancing safety, and increasing throughput. Within weaknesses, we can include requiring enforcement, private as well as public sector acceptance, and requiring additional parking space due to high demand.

The example of this instrument is the Freilot project in Bilbao.

It is based on the existing road parking system that allows its users to book loading space via the Internet or in real time. Each vehicle can book the space at most for 30 minutes. The information if the slot is free or busy comes from the red or green light on the street.

The objectives of the project are to:

- "increase the number of stops in delivery areas and to optimize delivery times;
- improve traffic flow and reduce congestion;
- avoid double parking and avoid searching for delivery space" (Fum, 2015).

Important aim for improving city logistics system is the reduction of number of trucks within this area. Solutions that help achieve this goal are:

- urban consolidation centres;
- organizing nearby delivery areas;
- traffic control systems;
- freight-traffic flow management.

Adapting on-street loading zones tends to be the most effective one. The measures focus on designing special kerb space well-prepared for parking and loading activities. "Parking places and loading-zone-related strategies focus on designating and enforcing kerbside parking, reallocating kerb space, and identifying potential freight traffic parking locations" (Fum, 2015). What are the most important pros of these measures? They mostly focus on:

- enhancing environmental sustainability;
- reducing congestion;
- improving operational efficiency;
- low probability of unintended consequences.

There are also weaknesses that mostly regard to high capital investment cost, updating of existing development regulations, and requiring available space for off-street loading.

Practical example of this measure is kerbside loading system in London. Kerbside system had required appropriate physical infrastructure and special traffic regulation, but strongly improved traffic flow within the city area. Moreover, in Kentish Town, special project was implemented, with the main scope focused on simplifying parking controls and, where possible, both increasing short-stay parking provisions and introducing additional loading bays.

The deficiency of parking and loading facilities aimed at using of nearby delivery areas. Such a system was established in 2003, in Bordeaux, to simplify the delivery of goods in the city centre area. "ELP (Espace de livraison de proximite - ELP) is an area of street space that has been dedicated to goods vehicles for the loading and unloading of goods delivered to nearby shops." (Civitas Wiki, 2015). ELP space is controlled by up to two members of staff who help vehicle drivers to unload their vehicle and deliver their goods to the shops using trolleys. The ELP is big enough to accommodate 3 to 5 delivery vehicles at a time.

Noise reduction, as an aim, finds the solution mostly in the access restriction measures. The intent of this instrument is to reduce traffic during peak hours in city centre areas. The main types of time access restrictions are the following:

- daytime delivery restrictions or bans;
- nighttime delivery restrictions or ban.

Main strengths of this measure are: improving reliability, improving parking availability, increasing throughput, enhancing environmental sustainability, and safety.

There are following weaknesses: high probability of unintended consequences, high degree of coordination required, increasing daytime congestion, increasing operational cost, and reducing operational capacity.

The practical example of applying one of above solutions is the urban project of Barcelona - Civitas Miracle 2002-2006. The Municipality of Barcelona, in cooperation with two supermarket operators: Mercadona and Condis, applied nighttime deliveries using adopted trucks and quiet unloading methods. The pilot project showed the initiative achieved its objectives (Civitas Wiki, 2015):

- reduced delivery time;
- lower transport operating costs;
- lower congestion;
- reduced emission;
- last mile delivery system.

Environmental restrictions are the most effective way to achieve pollution reduction and energy conservation aim of comprehensive urban logistics strategy. These kinds of instrument help in preserving the quality of life in city centres by reducing the negative externalities produced by freight vehicles, in terms of emissions and noise. Such strategies have two positive effects: "on one hand, they reduce the environmental impact of freight traffic, while on the other hand, they foster the use of clean technologies by promoting the use of electric or low-emission vehicles for urban deliveries" (Flamig & Wolff, 2016).

The main environmental restriction measures are:

- low emission zones;
- emissions standards;
- noise regulations.

Besides, in this area, incentives and subsidies are also applied. Their practical application can be observed in Madrid (within

the frames of the Air Quality Plan 2011-2015). It is focused on the development of a long-termed framework for the promotion of electric vehicles, by implementing following instruments:

- unlimited free parking for electric and plug-in electric hybrid vehicles;
- reduction in municipal tax on motor vehicles;
- free recharge of the electric vehicles at 24 street points;
- a discount on the annual fee for freight operations for hybrids.

Another measure, promoting ecological transport has been applied in Graz. The Municipality of Graz grants subsidies for cargo bike investments. "The city defines eligible purposes and limits the number of grants to one bike per institution or company. The eligibility criteria for this subsidy have been compiled and elaborated within the EU project CycleLogistics. The subsidies are granted for cargo bikes with 2 or 3 wheels and the city recommends purchasing the bikes at specialist shops" (Civitas Wiki, 2015).

Last mile delivery of goods is a difficult issue to apprehend, as it involves several levels of complexity. That is why in preparing the comprehensive strategy, the local retailers must be taken into account. The answer to the development of local retail scope is making the distribution systems within the city centres easier.

Urban consolidation centres contribute to the reduction of freight traffic circulating within a target area by promoting the consolidation of cargo shipments at one or more urban terminals. Besides a large number of strengths such as load factors' improving, congestion reduction, environmental sustainability enhancing and kerbside occupation time reduction, this solution also has its cons. The most important are:

- increasing operational cost;
- high capital investment;
- large space for the centre.

The applied example is Cityporto in Padova. It is a logistics consolidation and distribution center that is based on a voluntary subscription. If freight transport operators choose to join the model, they can benefit from easier access to the city centre. Cityporto vehicles are allowed to:

- use reserved public transport lanes;
- enter the city 24 hours a day;
- use dedicated loading bays.

CONCLUSION

Planning of urban freight activities remains a challenge for the most municipalities all over the world. City logistics or goods transportation within the urban areas should be considered as a complex system involving many stakeholders, objectives and scopes, constraints, and different conditions. Urban logistics is essential for the vitality of a city but it is associated with many obstacles and problems, which do not match up with the needs of the stakeholders. For several years, various experiments have been carried out in order to reduce these nuisances. Research efforts are focused on achieving sustainable development and more responsible supply chain management. That is why planning and implementing of the proper urban freight logistics strategy is such a complicated process. It is appropriate to underline that the results of a strategy are going to be successful only with respect to the policy and city considered. So, it also has to be taken into account various conditions various conditions of a city area with, and at the same time, reconciling the interests of the parties involved. In Polish conditions, where the externalities of transport in urban areas are still increasing, it is extremely important to implement urban freight logistics strategy with paying attention to its most important scopes. So, the first step in preparing Polish metropolitan freight logistics strategy, may be, within so called 'good practices', observation and examining of the European city logistics measures and only then implementing them in Polish conditions.

The research results indicate the best in the city authorities' and public road operators' opinions solutions that could be successfully adopted in Tri-city area:

- parking regulations, as an answer to urban congestion reduction;
- adapting on-street zones, helping in reduction of number of trucks within the city areas;
- time access restrictions, helping in noise reduction;
- environmental restrictions achieving pollution reduction aim;
- organising urban consolidation centres helping in development of local retail.

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