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DETERMINANTS OF THE IMPLEMENTATION OF URBAN LOGISTICS SOLUTIONS – PRACTICAL APPROACH

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ABSTRACT

The world's population concentrated in cities is increasing all the time. By 2050, it is going to reach 67% of the world's population. That is why it is so important to implement various urban logistics measures within the city centers, mainly to avoid air pollution, traffic congestion, noise and crashes. These complicated problems require appropriate solutions. A number of urban logistics measures have been implemented in cities throughout the world. Additionally, modelling techniques have been developed for planning and evaluating the measures of the urban logistics policy. However, all the solutions designed to achieve the objectives must take into account various criteria, and the need to balance the interests of all the stakeholders. The most efficient practical solutions within this system applied in Europe relate to the following aspects:

- land use planning;
- infrastructure;
- market-based instruments;
- new technologies.

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INTRODUCTION

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 lives in cities, though it is estimated that by 2050 this level will reach 67%.

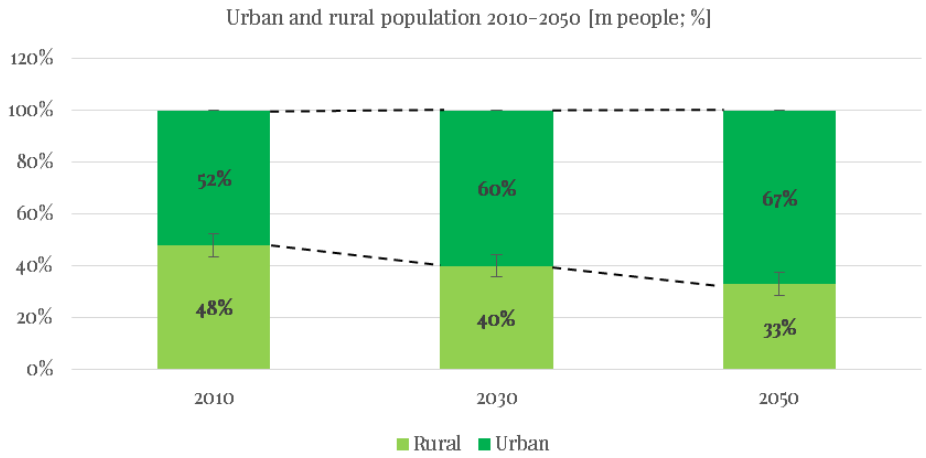

Figure 1. Urban and rural population, 2010-2050
Source: Urban Logistics. How to unlock value from last mile delivery for cities, transporters and retailers, Arthur D. Little, FUM, May 2015

The same happens with freight transport taking place within urban areas. Nowadays, 67% of passenger transport is taking place in urban areas and the number of kilometers travelled in urban areas is expected to triple by 2050.

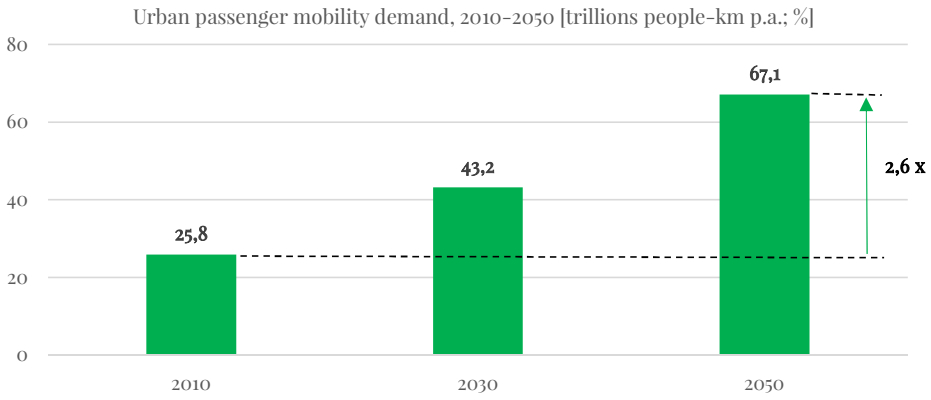

Figure 1. Urban passenger mobility demand, 2010-2050
Source: Urban Logistics. How to unlock value from last mile delivery for cities, transporters and retailers, Arthur D. Little FUM, May 2015

The same trends can be observed in freight transport.

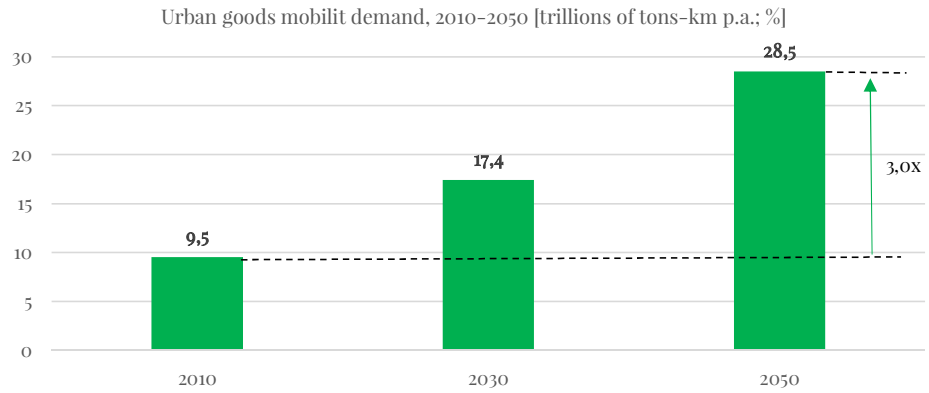

Figure 1. Urban goods mobility demand, 2010–2050
Source: Urban Logistics. How to unlock value from last mile delivery for cities, transporters and retailers, Arthur D. Little, FUM, May 2015

Under such demographic conditions urban transport issues have become more and more important for supporting better life for people as well as a better environment in urban areas (Markowski & Marszał 2006).

Urban transport is not only essential for economic growth but also for better urban environment. Logistic activities within the cities, or especially city centers, sometimes generate air pollution, traffic congestion, noise and crashes. Therefore, balancing smart economic growth and cleaner, quitter and safer communities are needed (Dimitrou & Gakenheimer 2011).

These complicated problems require appropriate solutions. A number of urban logistics measures have been implemented in cities throughout the world. Additionally, modelling techniques have been developed for planning and evaluating the measures of the urban logistics policy. However, all the solutions designed to achieve the objectives must take into account various criteria, and the need to balance the interests of all the stakeholders (Gonzales-Feliu, Semet & Routhier 2014).

URBAN LOGISTICS – MAIN CHARACTERISTICS

It is difficult to find a common definition of urban logistics in expert literature (Szołtysek 2007). Various terms are used to refer to the general concept of transportation of goods, people and waste in urban areas: "urban goods movement", "urban logistics", "urban freight transport" or "urban passengers transport". The exact definitions of these terms differ slightly as to what is and what is not included (Low 2013).

A simple definition of urban logistics states that it is planning, implementation and monitoring of economic efficiency and effectiveness of people, cargo and relevant information flows in urban areas in order to improve the quality of citizens' life. 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." (Taniguchi 2014).

The system of urban logistics should be understood as a deliberately organized set of elements, such as: stakeholders, infrastructure, regulatory standards, tariffs and relationships between them, which are involved in the process pertaining to the flows of people, cargo and relevant information in urban areas. Providers of urban logistics services are expected to be one of the most important elements of the whole system, and they should offer high quality, reasonable prices of their delivery services in the environment of congested urban areas (Ehmke 2012).

MAIN STAKEHOLDERS IN URBAN LOGISTICS

There are a number of stakeholders in urban logistics. The main reason for this is the fact that it takes place in cities – the central location where all the flows and various activities intersect (Urban Logistics 2015). However, two main groups of stakeholders are distinguished. Firstly, there are the supply chain actors responsible for sending, carrying or transporting goods and people. Finally, there is a group of entities who are affected by urban transport and logistics (Ehmke 2012).

The first group is represented by (*Goods Distribution and City Logistics* 2013):

- shippers;
- freight carriers;
- public transport operators;
- receivers.

Shippers are manufacturers, wholesalers and retailers. They send goods to other companies or institutions, and they are often located in the cities or their very centers. They usually do not feel responsible for urban transport issues and their main objective is growth in terms of profit. It can be achieved by minimizing transportation costs and maximizing the amount of sales (Brebbia 2009).

Freight carriers usually care for minimizing their costs by maximizing the efficiency of their pick-up and delivery tours. They are expected to provide the highest level of their services at low cost. Freight carriers are a kind of stakeholders who are urban transport operators, but in most cases they are restricted by limitations set by others. And finally, freight carriers are active in larger areas than just the city (Jonson & Tengstrom 2006).

Public transport operators aim at the providing punctual and frequent public transport and growth in the number of customers. They should care for the improvement of the quality of their services by minimizing delay time of public transport and maximizing consumers' satisfaction.

Receivers are shopkeepers and offices located in urban areas forming the endpoint of logistics chains. In fact, receivers are not responsible for urban transport, but they should realize they can influence it. However, as the receivers are often the only logistics chain actors, they can better identify local issues than freight operators or shippers who usually operate across a larger area than just the city (Civitas Wiki 2015).

The second group of stakeholders of urban logistics is represented by the residents and city administrators. Residents are the people who live, work and shop in the city. They suffer from nuisances resulting from urban freight movements near their residential and retail areas. However, residents also benefit from efficient and reliable delivery (Civitas Wiki 2015).

City administrators should resolve conflicts between other stakeholders who try to achieve their own goals. Most of local authorities focus on the attractiveness of their city, and from that perspective, urban transport can be considered as a main contributor to nuisance and pollution. However, securing city accessibility and having an effective and efficient transport system is also one of the aims pursued by the local authorities. What is the best solution to achieve all the goals and to reconcile the stakeholders' interests? As the stakeholders have different objectives and different perspectives on urban transport, coordination amongst the stakeholders is required to make progress towards more sustainable and liveable cities. The local authorities' main task is consideration of the urban transportation system as a whole.

MAIN MEASURES FOR MAKING URBAN LOGISTICS MORE SUSTAINABLE

The need for efficient and environmentally acceptable urban transportation system is conjoined by the idea of urban logistics. Urban logistics concepts facilitate integrated solutions for the fundamental problem of urban transportation: on the one hand, urban transportation is important to serve industrial and trade activities in urban areas, on the other hand, however, negative impact of city transportation should be limited (Urban Logistics 2015).

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. Practical solutions applied in the European countries may relate to the following areas (Civitas Wiki 2015):

- land use planning;
- infrastructure;
- market-based solutions;
- new technologies.

Within the scope of land use planning measures, various practical solutions can be distinguished. Most of them are applied in European countries. They can refer to (Civitas Wiki 2015):

- access restrictions;
- adapting on-street loading zones;
- nearby delivery areas.

The access restrictions refer to freight transportation. The intention is to reduce freight traffic during rush hours in urban areas. The main types of access restrictions can be divided into: daytime delivery restrictions, daytime delivery bans, night-time delivery bans and silent deliveries.

Practical examples of applying one of the above solutions are Barcelona's urban projects – Civitas Miracle 2002-2006. The Municipality of Barcelona in the cooperation with two supermarket operators – Mercadona and Condis – applied night-time deliveries using adapted trucks and quiet unloading methods. The pilot project showed that the initiative achieved its objectives (Civitas Wiki 2015):

- reduced delivery times;
- lower transport operating costs;
- lower congestion;
- reduced emissions;
- last mile delivery systems.

The example of the second instrument – adapting on-street loading zones – is the Freilot project in Bilabo. The solution is based on the existing road parking scheme and it allows users to book three types of loading bays: via the Internet or in real time. Each vehicle can book slots of 30 minutes, with a maximum of two consecutive slots. Special lights on the road indicate if the slot is free (green light) or booked (red light).

The system enables the driver to book a delivery slot before he arrives at his delivery point. The objectives of the project are to (Urban Logistics 2015):

- 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.

The lack of parking and loading areas is aimed at using of nearby delivery areas. Such a system was established in Bordeaux in 2003 to facilitate the delivery of goods in the city center. ELP (Espace de livraison de proximité - ELP) is an area of street space that has been dedicated to goods vehicles for the loading and unloading of goods delivered for nearby shops. This space is reserved and controlled by up to two members of staff who can also help goods vehicle drivers to deliver their goods to the shops using trolleys. The ELP approach comprises the installation of an urban transshipment platform on which dedicated personnel provides assistance for the dispatching of consignments for the last mile (inner city). Goods are unloaded from incoming vehicles, and then can be loaded onto trolleys, carts, electric vehicles and bicycles for the final distribution leg. The space can accommodate 3 to 5 delivery vehicles at once (Civitas Wiki 2015).

A more proactive approach is to incorporate freight planning into proper management and to create infrastructure by identifying areas of conflict between freight activities and other land uses. The initiative that needs proper infrastructure is called collection points. It promotes the use of specific locations for pick-up and deliveries, such as on-street automated locker systems, parcel shops and post offices as well as mini-depots. In this solution trucks deliver to collection points and customers travel to these pick-up areas to get their goods. The practical example of that scheme is the Berlin bentobox.

Bentobox is a locker system or pack-station with removable trolleys. It was first tested in the CITYLOG project in Berlin in 2012. It is based on a flexible container system, which consists of two elements (Civitas Wiki 2015):

- a fixed docking station with a user interface and control unit; and
- a chassis divided into six modules in which multi-owned, moveable and transportable trolleys can be locked.

The next solution within this group is a consolidation center. This measure contributes to the reduction of freight traffic circulating within a target area by promoting and consolidating cargo shipments at one or more urban terminals.

The applied example is the Cityporto in Padova. It is a logistics scheme for urban freight consolidation and distribution. The Cityporto model is based on a voluntary subscription: freight transport operators can choose to join the initiative and thus benefit from easier access to the city center for freight deliveries, rather than continuing to access the city according to general time-slots. Cityporto vehicles are allowed to:

- enter the city 24 hours a day;
- use reserved public transport lanes;
- use dedicated loading bays for their loading and unloading operations.

The next group of measures is based on market solutions. They are the most common option adopted by local authorities to reduce externalities of road transport. They can be divided into:

- pricing solutions (road pricing, congestion charging or parking charges);
- incentives and subsidies.

The pricing solutions are quite common. One of the most interesting is the system established in Genoa. The mobility credits system called "Mercurio" was the first test-case ever of this approach, both at the European and global level. It consists in making the access of freight vehicles to a target area subject to a self-adapting charging scheme based on credits (virtual money). Each economic operator settled in the historical center has the right to have a predetermined amount of credits (Civitas Wiki 2015):

- transporters have their own virtual account too, which starts from zero; each access to the area is charged (in credits), and for each freight delivered they receive credits transferred from the operators;
- the target area boundaries are equipped with automatic number plate recognition gates, which are able to register vehicles entering the area;
- when their starting budget has been fully used, the economic operators are able to buy additional credits from the municipality.

Between market-based measures some incentives or subsidies can be also found. Their practical application can be observed in Madrid (through its Air Quality Plan 2011-2015). It is focused on the development of a strategic framework for the promotion of electric vehicles through such promotion instruments as:

- exemption from the municipal street parking regulation (unlimited free parking is available for electric and plug-in electric hybrid vehicles);
- free recharge at 24 street points;

- 75% reduction in municipal tax on motor vehicles (during the first 6 years for hybrids and permanent for electric and plug-in hybrid electric vehicles);
- a discount on the annual fee for freight operations for hybrids (free for electric and plug-in electric vehicles).

Another measure, promoting ecological transport has been applied in Graz. The City of Graz grants subsidies for cargo bike investments with 50% of the investment costs up to 1,000 euros. The city defines eligible purposes and limits the number of grants to one bike per institution or company. The eligibility criteria for this subsidy were compiled and elaborated within the EU project CycleLogistics. Subsidies are granted for cargo bikes with 2 or 3 wheels and the city recommends purchasing the bikes at specialist shops.

A well-known solution to making mobility of goods in urban areas more sustainable is based on new technologies. The role of new technologies in the optimization of urban logistics can be very diverse. Intelligent Transport Services (ITS) can be exploited to allow freight vehicle drivers to opt for alternative routes in response to information about urban road network conditions. Dynamic routing systems are used by public authorities to enhance safety and prevent violations of access regulations. Truck routing and the decision support system are based on Intelligent Transportation Systems; they require high-quality real-time traffic data, information on the road network and land use in the area (Sladkowski & Pamula 2015). ILOS (Intelligent Freight Logistics in Urban Areas) is a project of Freight Routing Optimization in Vienna with two main objectives: to develop and define possible indicators to show the potential time and/or distance savings based on information of traffic flows; i.e. delivery routes are optimized with the help of traffic data. The first stage of the project has achieved a 60% reduction in travelling time, a 15% reduction in distance, a 20% reduction in fuel and a 30% reduction in cost (Civitas Wiki 2015).

Real-Time Information Systems are a set of technologies and strategies that can help monitor and manage traffic based on real-time traffic information in terms of:

- road safety;
- reduced congestion;
- regulatory compliance;
- supply chain information.

Within the SUGAR project, the city of Barcelona has developed VMS displaying real-time access regulations on multi-use lanes for freight vehicles. Today, seven multi-use lanes with VMS technology exist in Barcelona. Through better regulation of traffic and parking on major boulevards, the intended objectives of this measure are (Civitas Wiki 2015):

- to reduce travel times and search times for delivery parking spaces;
- to optimize the use of the street space;
- to suppress double parking.

The main result has been a reduction of between 12-15% in travel time and more fluid traffic.

CONCLUSION

Freight logistics has an urban dimension. Distribution within city areas requires efficient interfaces between long-haul transport and short distance transportation to the final destination. All negative impacts of long distance freight transport passing through city centers should be reduced mostly by planning and implementing various technical measures.

Urban freight optimization clearly offers a large number of various technical or organizational applications. This paper has presented the concept of urban logistics with different practical solutions within this area. The most efficient practical solutions within this system applied in Europe relate to the following aspects:

- land use planning;
- infrastructure;
- market-based instruments;
- new technologies.

The paper presents only the most interesting examples of solutions within the urban freight logistics. Many more could be easily listed. A lot of cities still keep on improving their freight transport policy. But as multiple stakeholders are involved in urban transport, and they have various objectives, coordinating all the logistics chain actors is required to make progress in the development of the efficient urban transport system.

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