

Inflow of Goods in City

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Delivery of goods significantly affects the sustainable development of the city center. As the population of people gravitating to city centers grows, the challenges of delivering necessary goods in an appropriate manner are increasing. Numerous flows of goods from and within the city center increase the level of congestion in city centers, which are already congested by public transport and cars. High emissions of harmful gases occur due to the rising turnover of goods and due to the fact that conventional trucks equipped with outdated technology are used for transport.

Keywords: city logistics ; delivery flows ; interest groups ; evaluation criteria

1. Overview

The aim of this paper is to define and measure the relevance of the criteria for the evaluation of the inflow of goods in city centers, in order to improve delivery activities within city centers. The development of the city center leads to the grouping of numerous business operators, which results in the increase of the quantity of goods entering the city center, causing additional traffic congestion, higher levels of noise and emissions of harmful gases. In the long term, this leads to major dissatisfaction with the quality of life among city residents. Therefore, the planning of goods delivery must be in line with the sustainable development of city logistics, while at the same time considering the interests of relevant stakeholders. However, in the existing literature the criteria for evaluating delivery flows have not been comprehensively identified or evaluated by the stakeholders of city centers. In order to fill the research gap, the authors have defined four groups of criteria: technical-technological, economic-financial, organizational and social criteria. To determine the relevance of these criteria, it was necessary to use the questionnaire method to collect data from the stakeholder groups defined by the literature review. Regarding the relevant stakeholders (carriers, delivery recipients, residents and urban policy makers), the results have pointed out that the technical-technological and organizational criteria groups are considered the most relevant by the stakeholders regarding the inflow of goods in city centers.

2. Urban Development

Urban development is one of the key issues of the modern age. Every day there is an increase in migration of people from rural to urban areas, most often for economic and social reasons. More than 50% of the global population lives in cities, and by 2050 the percentage is projected to increase to 70% ^[1]. A growing number of inhabitants place a heavy burden on cities, which represent the social and economic backbone, and are also the center of social, economic and cultural activities.

Modern urban development moves in two interrelated directions: the direction of sustainable development that provides a framework for shaping policies and strategies for continuous economic and social progress based on available resources, without (or with minimal) damage to the environment and natural resources relevant to human activities in the future, and the direction for the development of smart cities that focuses on residents who use energy, materials, services and finance to catalyze sustainable development and ensure high quality of life by combining technology, architecture and renewable energy sources. As part of the smart city concept, what can be highlighted is the planning of sustainable cities through more efficient, innovative and safer transport systems, the development of reliable transport networks and the reduction of environmental pollution, and other similar impacts ^[2].

Delivery of goods significantly affects the sustainable development of the city center. As the population of people gravitating to city centers grows, the challenges of delivering necessary goods in an appropriate manner are increasing. Numerous flows of goods from and within the city center increase the level of congestion in city centers, which are already congested by public transport and cars. High emissions of harmful gases occur due to the rising turnover of goods and due to the fact that conventional trucks equipped with outdated technology are used for transport ^[3].

Stakeholders of the city center are interested in making decisions or achieving goals that seek to improve the existing delivery situation ^[4]. Each stakeholder group strives to pursue its interests, but the only correct decision is the one that will consider the opinions of all stakeholders but without explicit policy leadership there is a danger that certain institutional stakeholder priorities will be imposed over others by the most powerful without adequate dialogue ^[5]. Each stakeholder group has its own interests and perception of problems related to delivery activities, which increases the complexity in finding the optimal solution. Therefore, mutual interaction is necessary. Non-compliance with the interests of stakeholders can have major consequences for the sustainability of the urban logistics system ^[6]. The question is how to organize and structure the decision-making process so that all stakeholders contribute to the potential decision ^[7].

Delivery of goods is important for the functioning of the economy within the city center, such as the need to replenish stocks of food and other retail goods in stores, delivery of documents, office supplies, etc. Although delivery of goods plays an important role in the economic development of the city center, it also has a number of negative effects ^[8]:

- traffic congestion: delivery vehicles make up between 5% and 10% of the total flow of vehicles in city centers. However, when parked outside designated delivery points, they obstruct roads and contribute to congestion;
- reduction of air quality: almost all delivery vehicles have a diesel engine which results in the emission of harmful gases that directly affect human health;
- greenhouse gas emissions: delivery vehicles are a significant greenhouse gas generator; although this may be of less interest to city authorities, this issue must be addressed by the European Union directives;
- noise: sleep disturbance of residents, especially in early morning and evening deliveries;
- reduced safety: city authorities consider delivery vehicles to be dangerous for both pedestrians and cyclists because of their size, especially near buildings in the city center where streets are too narrow.

Inefficient distribution leads to additional costs for the carrier and is ultimately borne by the end user. City logistics has the task of developing and implementing measures to achieve an efficient and environmentally friendly urban transport system ^[9]. Customers expect that carriers will provide a better transport service within Just-In-Time delivery ^[10]. For this reason, most carriers have their headquarters near city centers. This results in an inefficient use of delivery vehicles, which use their capacities inadequately, all because of customer satisfaction in terms of speed of delivery ^{[10][11]}. The entry of heavy goods vehicles (HGVs) into city centers disrupts the quality of life of its residents. However, these same vehicles bring the goods the residents need ^[12]. Certainly, the goals of urban transport management include reducing transport costs and setting a higher level of quality of logistics services to make the urban area "cleaner" and "quieter", which would have a positive impact on the quality of life of residents ^[12]. Planning the delivery of goods in the city center without theoretical and scientific support, as well as without practical application of the principles of sustainable and smart development, and without taking into account the interests of city stakeholders, has a negative impact on the sustainable development of the city center. This fact motivated the authors for this research to try to give a framework for improving delivery activities, all for the purpose of sustainable development of the city center. Thus, there is a need to define and evaluate the criteria for the inflow of goods to the city center, with the aim of improving sustainable logistics of the city.

Anand et al. ^[13] provide an overview of the ways of modeling city logistics with regard to its importance and role in society and try to identify the shortcomings of modeling urban transport. They emphasize that the development of the model requires a multidimensional and multidisciplinary approach where all stakeholders who are a part of the city center must be considered. Tamagawi et al. ^[14] developed a model according to which the customer determines the time of the earliest and latest delivery in which the order must be delivered. The results of the model indicate that the ban on trucks entering the city center directly affects the sustainability of the city area, which leads to an acceptable environment for all stakeholder groups, both for residents and the reduction of delivery times. Koster et al. ^[15] emphasize the importance of the organization of postal and parcel services. One of the most relevant criteria is travel time to the end customer. They point out that travel time is very difficult to predict, given that the number of vehicles in traffic differs during the day, i.e., traffic jams are created. They emphasize that all stakeholders, including local residents, carriers, administrators and delivery recipients, must be involved in decision making. Gonzales-Feliu ^[16] emphasizes that stakeholders should have a direct influence on decision-making related to urban logistics. The author recognizes several stakeholder groups, such as public administration, which has both a legislative and technical role, passenger transport, delivery people, locals and users of public transport and delivery services. Neghabadi et al. ^[17] emphasize the importance of urban logistics planning, especially the part related to sustainable development. Such planning requires the interaction between all stakeholders, suppliers, retailers, consumers and local authorities in order to find the optimal solution for the development of urban logistics. Morfoulaki et al. ^[18] point out that the goal of urban logistics is to optimally plan, manage and control cargo

movement within the logistics network in the urban area with regard to integration and coordination between the stakeholders involved. The consequences of such planning are expected to reduce noise pollution, air pollution, congestion and carbon emissions; it also implies measures and methods of assessment. They note that the main interest groups are freight carriers, local authorities and residents (consumers). Munda ^[19] believes that issues related to the sustainability of the city center are characterized by a high degree of possible conflicts between stakeholders. The paper emphasizes the criteria related to sustainability, which are economic, environmental and technological.

Berbe et. al. ^[20] emphasize the importance of proper selection of criteria related to the observed issues. They point out that it is necessary to include defined interest groups in making any decisions. Deluka-Tibljias et al. ^[21] present the issue of decision-making on transport infrastructure. The authors analyze the constraints of decision-making in which several stakeholders participate, indicating the importance of involving stakeholders in decision-making in the planning, design, maintenance and reconstruction of transport infrastructure in urban areas. They emphasized that when choosing the criteria, it is necessary to pay the most attention to the criteria related to the sustainability of the urban area. Jaeger et al. ^[22] present a literature review that identifies green supply chain challenges in multi-tier supply chains. The purpose of the paper is to identify operational bottlenecks in the multi-tier supply chain to guide organizations towards where they should focus their efforts to address their supply chain environmental challenges. The applicability of the model is demonstrated by identifying environmental bottlenecks in a healthcare supply chain that support decisions about which challenges a green supply chain strategy should address. Watrobski et al. ^[4] point out the problems of harmful gas emissions in urban areas and emphasize that the biggest polluters of the city center are HGVs. Given the growing interest in the use of vehicles on alternative fuels, the authors have selected the criteria related to the use of electric vehicles such as speed, capacity, battery charging time, price, etc.

Zanella A. et al. ^[23] provide an overview of the technologies, protocols and architectures provided by Internet of Things technology. They conclude that the new technology will greatly facilitate the planning and organization of the delivery of goods to the city center, but also the lives of the residents of the city center in general. Tijan et al. ^[24] present a comprehensive overview of the current and rising trends in the use of blockchain technology in logistics and supply chain management. They emphasize that this technology can facilitate logistics tasks: It can be used to track orders, order changes and freight documents, and it can help in sharing information about the manufacturing process and delivery. Upadhyay et al. ^[25] explored the challenges and opportunities of adopting blockchain technology from the lens of the technological–organizational–environmental framework (TOE) for operational excellence in the UK automotive industry context. The authors present significant theoretical and managerial implications and deep understanding for companies seeking to understand the challenges and opportunities of blockchain adoption for their operational excellence.

As can be seen from the papers in general, the authors showed the impact of a single/multiple criteria on city centers. None of the papers included a whole range of criteria related to city center delivery activities at once. We also recognized that articles related to new technologies emphasize the possibility of accelerating business processes, i.e. better planning of business activities.

According to the literature review, the authors conclude that numerous stakeholders are involved in the decision-making process. One stakeholder group is always related to public policy (local, regional, national or European level). The other stakeholder groups depend on the research topic (residents, industries, freight forwarders, carriers, etc.) ^{[20][26]}.

Decision makers always strive to decide based on an optimal solution. Unfortunately, the optimal solution exists only in the case of one criterion; in real situations, almost every decision involves conflicts and dissatisfaction ^{[21][27]}. The decision-making process that results in choosing the best solution provides a solution in which positive results outweigh possible losses ^[19]. The goals of the decision-making process are to effectively generate necessary information for decision-making from available data, to efficiently generate solutions, and to understand potential decision-making problems ^[4].

3. Conclusions

City logistics is a recent research area whose purpose is the sustainable development of city centers to the general satisfaction of all stakeholders. Urban population growth, alongside the increasing number of vehicles and the need for delivery services results in the creation of bottlenecks, increased greenhouse gas emissions and delays in goods delivery.

For a successful implementation of delivery of goods within the city center, it was necessary to consider and analyze the relevance of criteria assessed by all stakeholders, so that a decision can be made to the satisfaction of all stakeholders in the city center. The authors have singled out four stakeholder groups relevant to the evaluation of the inflow of goods in

city centers: carriers who transport the goods into the city centers, delivery recipients who receive the said goods, urban policy makers (or regulators/supervisors) and residents.

The authors have then selected the criteria that relate to the general development of the city center such as greenhouse gas emissions, noise levels, investments in new/existing technologies, etc. and criteria that relate to the organization of delivery activities. The defined criteria were divided into four groups for evaluating the inflow of goods in city centers, namely: technical-technological group, economic-financial group, organizational group and social group. A survey questionnaire was used to determine the relevance of the criteria. The evaluation of the criteria was done by the stakeholders belonging to the predefined groups: carriers, delivery recipients, urban policy makers and residents, and the results were analyzed.

The data obtained from the survey questionnaire were analyzed with regard to the average assessment of the criteria relevance from the point of view of all stakeholders and from the point of view of each stakeholder group separately. The results of the research indicate a discrepancy in the assessments of criteria relevance between the stakeholders. For example, delivery recipients assessed traffic congestion as the most relevant, while carriers assessed it as the least relevant criterion. It is interesting that both delivery recipients and carriers rated delivery service satisfaction and carrier satisfaction as the least relevant criteria, while they assessed the criteria from the social and technical-technological group as the most relevant. The authors emphasize that it is desirable to involve all stakeholders when making any decisions related to delivery activities within the city center.

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