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Kiba-Janiak, Maja; Marcinkowski, Jakub; Witkowski, Jarosław; van Duin, Ron

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Sustainable last-mile delivery from the supply side – perspective of various stakeholders

Maja Kiba-Janiak*, Wrocław University of Economics and Business, Poland, maja.kiba-janiak@ue.wroc.pl

Jakub Marcinkowski, Wrocław University of Economics and Business, Poland, Jakub.marcinkowski@ue.wroc.pl

Tomasz Kołakowski, Wrocław University of Economics and Business, Poland, Tomasz.kolakowski@ue.wroc.pl

Jarosław Witkowski, Wrocław University of Economics and Business, Poland, jaroslaw.witkowski@ue.wroc.pl

J.H.R. van Duin, Rotterdam University of Applied Sciences, Delft University of Technology, The Netherlands, j.h.r.van.duin@hr.nl/j.h.r.vanduin@tudelft.nl

*Maja Kiba-Janiak

1. Purpose

The e-commerce growth has posed severe challenges in transporting the ordered goods to customers (van Loon et al. 2015, Allen et al., 2018). On the one hand, there are increasing legal requirements connected with reducing CO₂ emissions by 90% in transport by 2050 as stipulated by the Green Deal (European Commission 2019). That is an ambitious goal, which would require a 55% reduction of emissions from cars by 2030, a 50% reduction of emissions from vans by 2030, and a 0% emission from new cars by 2035. The increasing number of delivery vans also contributes to social and environmental externalities in urban areas, such as congestion, noise, habitat loss, degradation of infrastructure, or locking lanes and sidewalks (Kiba-Janiak et al. 2021). On the other hand, there are increasing amounts of goods to be delivered as the number of online retail purchases increases steadily. So does the number of parcels distributed worldwide, both domestically and internationally (Statista 2020). Furthermore, last-mile delivery is costly (Gevaers Van de Voorde and Vanelslander 2014); it has been estimated that in 2018 it accounted for 41% of total supply costs worldwide (Statista 2020).

Last-mile delivery can be viewed from three perspectives represented by various stakeholders: from the demand side (demand for goods purchased online, represented by individual customers and companies, institutions), supply (delivery of goods purchased online, represented by mostly courier, express and parcel companies – CEP and ecommerce services, producers and online shops) and its physical environment regulated by local government (Bandeira, D’Agosto, Ribeiro, Bandeira, & Goes, 2018).

In the literature an interest in city logistics in terms of last mile delivery on the e-commerce market has been increasing for several years, however, many publication typically refer to the supply side in the last-mile delivery, especially related to e-customer preferences (Markowska and Marcinkowski, 2022; Caspersen et al., 2021; Kapsler & Abdelrahman, 2020) and their opinions on alternative solutions for the shipments purchased via Internet in relation to the home deliveries (Iwan, Kijewska, & Lemke, 2016; Lemke, Iwan, & Korczak, 2016; de Oliveira, Morganti, Dablanc, & de Oliveira, 2017; Vakulenko, Hellström, & Hjort, 2018; Kiba-Janiak et al., 2022). What is lacking, however, is comprehensive research on the supply side of last-mile delivery and its physical environment regulated by local government, including an analysis

of the factors that could drive courier companies, e-shops, e-platforms and local governments towards sustainable last-mile delivery.

This article aims to identify the actions taken by courier companies, e-shops, e-platforms and local authorities in terms of last-mile delivery and the factors that could push them to deliver in a more sustainable way.

This article formulates the following research questions:

What eco-friendly solutions for last-mile delivery are currently being used by e-shops, e-platforms and courier companies, and what factors can motivate these companies to introduce more sustainable delivery?

What last-mile delivery measures are being taken by local authorities, and what factors could lead local authorities to take action towards sustainable urban freight transport?

Which stakeholders have the greatest influence on the implementation of sustainable last mile delivery solutions in the city and to what extent are they interested in doing so?

2. Research Approach

In the paper qualitative methods have been applied, such as in-depth interview and expert panel. The study design consists of four stages. A research tool was developed in the first stage based on critical literature analysis. As a result of Stage one, four survey questionnaires were developed. In the second stage, interviews with representatives of four groups of stakeholders (local authorities, courier companies, e-retailers and e-platforms) were conducted. So far, ten representatives of local authorities have been interviewed, four from courier companies and seven from e-retailers and e-platforms. The following stage included an expert panel organized on January 20, 2023. The expert panel was attended by 25 experts - representing ten national and international universities and academic institutions, courier companies, logistics companies, local authorities, and a Polish e-platform. As a result of expert panels, problems related to sustainable last-mile delivery solutions' implementations and activities that could resolve these problems were identified. Within the expert panel, matrices for stakeholder analysis were developed to assess each stakeholder group in terms of their influence and interest in implementing various groups of solutions for last-mile delivery.

In the last research stage, the conclusions and recommendations for each group of stakeholders were developed.

3. Findings and Originality

Local authority

The research shows that the measures taken by local authorities to introduce sustainable urban freight transport include, above all, legal regulations on entry restrictions into the city centre. The most important factors motivating local authorities to take sustainable urban freight transport measures include EU funds, national funds, and EU regulations. Slightly less critical are factors related to environmental aspects, such as noise and air pollution and social aspects,

such as accidents or congestion. Additionally, local authorities do not want to be passive observers with no specific preferences in last-mile delivery within the city centre.

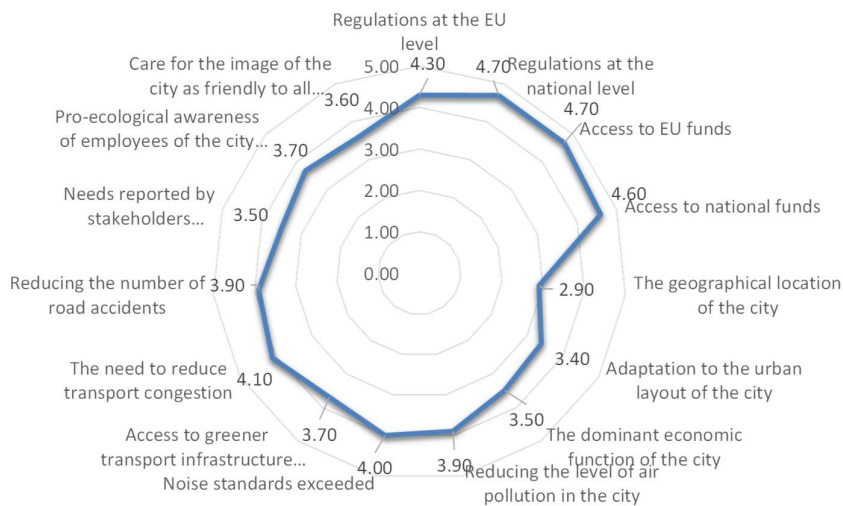


Figure 1. Factors encouraging local authorities to introduce sustainable freight transport in a city

E-shops/e-platforms and courier companies

In the case of courier companies, among the pro-environmental solutions for last mile deliveries, the following were most frequently mentioned: consolidation of deliveries through distribution centres or micro-hubs, optimisation of transit routes, cooperation with sub-suppliers who use pro-environmental solutions and use of ecological packaging and ecological vehicles. In turn, e-shops and e-platforms among the measures for green last-mile deliveries most frequently singled out ecological packaging and fillers, cooperation with bicycle couriers and consolidation to one parcel of an order delivered to one customer. For both courier companies and e-shops and e-platforms, the most important factors that could motivate them to implement sustainable last-mile delivery solutions include customer requirements for further cooperation, local authority's ban, orders and improvement of the company's financial results (cost reduction). For courier companies, laws-penalties for activities harmful to the environment are also relevant. For e-shops and e-platforms, on the other hand, the pro-ecological trend in the sector is significant. Somewhat surprisingly, for courier companies as well as for e-shops and e-platform, government support for pro-environmental initiatives is not a motivating factor for implementing sustainable last-mile delivery solutions.

Table 1. Factors, which encourage e-shops/e-platforms and courier companies to introduce sustainable solutions in last-mile deliveries

E-shops & e-platforms	Courier companies
Customer requirements for further cooperation	
Requirements of local authorities (city) ban, orders	
Improvement of your company's financial results (cost reduction)	
The pro-ecological trend in the sector (sustainable supplies are becoming the standard)	Laws - penalties for activities harmful to the environment
Pro-ecological activities of the market leader	
Increasing the importance of pro-ecological activities in the development strategy of your company	
Impact on the market image proven in consumer research	-
Pro-ecological activities of the biggest competitor	-
The ecological trend in the sector (sustainable supplies become the standard)	-
Government support for pro-environmental initiatives (subsidies, tax exemptions, etc.)	
-	Impact on the market image proven in consumer research
-	Pro-ecological activities of the biggest competitor
-	Local amenities - infrastructure for green vehicles, facilitating applications

Legend:

Highest rate

Moderate rate

Lowest rate

Stakeholders analysis with the use of Influence and Interest Matrix

The authors identified six main groups of solutions affecting sustainable last-mile delivery based on the critical literature on the subject and their own research. These include infrastructural, managerial and ICT solutions, transport modes, legal regulations, education and changing e-customers' preferences. Expert research shows that local government has the most significant influence on implementing four groups of solutions: legal regulations, transportation modes, infrastructure and ICT systems. Courier companies, on the other hand, have the greatest influence on the implementation of solutions related to management and organisation. In the case of solutions related to education and changing e-customers' preferences, according to experts, courier companies and e-platforms and e-stores have the most significant influence on the successful implementation of these solutions. Selected matrices of stakeholder analyses are shown in the figures below.



Figure 2. Selected matrices of stakeholders analyses

4. Research Impact

In the course of the study, tools were developed to explore the preferences of different groups of stakeholders in last-mile supply and to identify the factors that motivate them to pursue (offer) this delivery in a more sustainable manner. An impact and interest matrix was also used to analyse last-mile delivery stakeholders in the context of implementing sustainable last mile delivery solutions.

5. Practical Impact

The study results provide essential knowledge for local governments, courier companies, e-platforms and e-stores. By knowing the expectations of different stakeholder groups and the factors motivating them to implement sustainable delivery, local governments can take action

to accelerate the implementation of these solutions. An impact and interest matrix for stakeholders analysis can provide valuable information for companies implementing sustainable last-mile delivery. Based on it, individual solutions for sustainable last-mile delivery can be implemented more efficiently by knowing which stakeholders have the most influence on the implementation of a solution and which stakeholders are most interested in a solution.

6. Discussion Questions

Are there solutions for sustainable last-mile delivery that can constitute a compromise between various groups of stakeholders?

What are the barriers to the implementation of sustainable last-mile delivery solutions?

How would you assess stakeholders in your countries regarding their influence and interest in implementing sustainable last-mile delivery solutions?

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