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Measuring Stakeholder Relations in Green Last-Mile Deliveries in the E-commerce Market in Cities

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Abstract

Aim: This research aimed to investigate the intricate relations among stakeholders involved in urban green last-mile deliveries (GLMD) within the e-commerce market, with a focus on network relation features such as strength, reciprocity, and proximity.

Methodology: A literature review identified measurable components of network relation features, followed by an expert study. The study assessed the weights of identified components within the network relation features – strength, reciprocity, and proximity.

Results: The findings revealed that strength is the most critical network relation feature, followed by proximity and reciprocity. Within the strength component, commitment and trust were identified as crucial. Trust is the most critical factor within reciprocity components, whereas within proximity organizational and social dimensions gain prominence.

Implications and recommendations: The research provided practical insights for shaping relations among urban green last-mile delivery stakeholders. Local governments and courier company managers can leverage the findings to consciously shape stakeholder relations, facilitating environmental and quality-of-life objectives.

Originality/value: The research addressed a gap in the literature by focusing on the network dynamics of stakeholders in green last-mile delivery, acknowledging their critical role in environmental sustainability.

Keywords: last-mile delivery (LMD), stakeholders, network, e-commerce, city

1. Introduction

Last-mile delivery (LMD), described as "all logistics activities associated with the delivery of shipments to private customer households in urban areas" (Boysen et al., 2021), serves as a pivotal conduit bridging online-based customer shopping and the final delivery of products to the customer's doorstep (Esper et al., 2003). The exponential growth of e-commerce has introduced formidable challenges in efficiently delivering purchased goods to customers, exacerbated significantly by the pandemic--induced lockdown (Suguna et al., 2022). Despite the economic challenges and high inflation, the same number of customers as last year, namely 75%, affirmed their continued online purchasing, with 30% reducing their buying frequency and 18% indicating an increase in online shopping compared to the previous year (Gemius, 2023). The proliferation of delivery vans, however, contributes to social and environmental externalities in urban settings, manifested in the form of congestion, noise pollution, habitat loss, infrastructure degradation, and obstruction of lanes and sidewalks (Bachofner et al., 2022; Cheba, & Saniuk, 2016; Mucowska, 2021; World Economic Forum, 2020).

In recent years, European legislation has incorporated various documents, directives, and projects with the explicit aim of mitigating the environmental impacts associated with freight transport (Kiba-Janiak, 2017). The most recent addition to this legislative framework is the European Green Deal (European Commission, 2019), which stands out as the most ambitious set of targets to date. A crucial component of the Green Deal is the "Fit for 55" package, encompassing proposals to revise and update EU legislation to align it with the climate goals established by the Council and the EU Parliament (European Parliament, 2022). The adopted document sets a target of reducing 95% of transport emissions by 2050. A 50% reduction in emissions from vans by 2030 and a complete elimination of emissions from new cars by 2035 were stipulated to achieve this objective.

The challenge of reducing CO2 emissions from vans poses a significant obstacle for e-commerce last--mile deliveries in urban areas. At the same time, various environmental stressors are adversely affecting the quality of life in cities. A comprehensive review of relevant literature on green e-commerce last-mile deliveries in cities revealed a plethora of studies focused on analysing specific solutions available for last-mile delivery, and provided valuable insights into the implications of these solutions for reducing environmental impact (Buldeo Rai et al., 2021; Iwan et al., 2016).

However, only a limited number of studies focused specifically on the environmental aspects of last--mile delivery in urban settings (Mangiaracina et al., 2015; Mucowska, 2021; Viu-Roig & Alvarez-Palau, 2020). Moreover, only recent publications recognise the stakeholder perspective in addressing environmental issues and underscore the necessity of stakeholder collaboration (Bachofner et al., 2022; Bjørgen et al., 2021; Kiba-Janiak et al., 2021; Rita & Ramos, 2022; Rześny-Cieplińska & Szmelter--Jarosz, 2021). Urban freight transport stakeholders have received considerable attention, with researchers categorising them based on various functions and groups (Cui et al., 2015; Iwan, 2013; Katsela & Browne, 2019; Kiba-Janiak, 2019; Taniguchi et al., 2012). Noteworthy among these efforts is the comprehensive classification proposed by Kiba-Janiak (2019), who adopted a holistic perspective and distinguished stakeholders into public and private organizations, non-governmental organizations, and societal entities.

A significant impediment to implementing urban green last-mile delivery (GLMD) solutions is the dearth of cooperation among stakeholders (Bachofner et al., 2022; Behrends et al., 2008). Overcoming this barrier and fostering effective management of these relations (Katsela & Browne, 2019; Rześny--Cieplińska et al., 2021) hinges on comprehending stakeholder roles and relations. Yet, there remains a notable gap in the literature concerning the examination of such relations and their management within the context of green last-mile delivery (GLMD). The innovative contribution of this paper lies in its exploration of the structural dynamics of network relations among GLMD stakeholders. By gaining insights into these relational dynamics, the study aimed to provide more effective shaping and management, thus fostering improved cooperation among stakeholders. Consequently, such insight into GLMD stakeholder relations stands as a cornerstone for the effective implementation of green last-mile delivery strategies.

Recognising the critical role of successful cooperation and coordination among urban GLMD stakeholders as a decisive factor for city logistics solutions (Rześny-Cieplińska & Szmelter-Jarosz, 2021), this study examined the strength, reciprocity, and proximity of urban GLMD stakeholders' relations, in order to gather insight into the intensity of network relations features, thereby facilitating the implementation of green last-mile delivery solutions. By investigating these relational dynamics, the research contributes valuable knowledge essential for fostering sustainable and coordinated last-mile delivery practices in urban areas.

2. Literature Review

2.1. The Relations of Urban Green Last Mile Delivery Stakeholders in the E-commerce Market

The implementation of green last-mile delivery in the urban e-commerce market involves diverse stakeholders forming an inter-organisational network. This network includes companies in the logistics industry, e-commerce vendors, local government bodies, associations, community activists committed to emission reduction, and consumers (Kiba-Janiak et al., 2021).

In outlining urban GLMD stakeholder relations within the e-commerce market through network perspectives, it is imperative to elucidate their key attributes, namely exchange, commitment, and reciprocity (Czakon, 2007). Transactions between stakeholders, such as sales platforms or e-commerce stores and customers, as well as logistics companies, are characterised by the continual exchange of material (e.g. goods traded for funds), information (involving order details and shipment tracking shared among transactional parties and shipping companies), and energy (evident in the interpersonal dynamics, or 'chemistry' between managers from different companies (Kawa, 2017), and the demands articulated by NGOs and researchers advocating green practices in last-mile delivery within the urban e-commerce market.

The implementation of any projects aimed at reducing the negative environmental impact of last-mile delivery in the urban e-commerce market requires the commitment of many stakeholders, primarily city authorities, customers, and logistics service providers.

Reciprocity, as defined in legal terms by the fulfilment of civil law contracts (Czakon, 2005), assumes multifaceted dimensions within stakeholder relations. This is manifested as a power-based dynamic, as stated by Holmlund and Törnroos (1997), reflecting the pursuit of dominance by one partner. Simultaneously, it embodies a relation grounded in commonality, following Oliver's (1990) conceptualisation, where network relations are aligned with shared goals or objectives of companies in collaboration with other network partners.

In the context of implementing environmentally conscious last-mile deliveries from urban e-commerce markets, reciprocity in the relations is two-fold. Firstly, it is rooted in dominance, where the controlling stakeholder, such as the city government, establishes parameters such as delivery time windows to alleviate congestion. Secondly, it is founded on the realisation of common goals, for example the joint pursuit of pollution reduction – a shared objective of both residents/customers and the city government.

The analysis of the literature reveals a shortage of empirical research on inter-organisational relations among companies in the logistics industry (Kawa, 2017; Klimas & Twaróg, 2015) and green last-mile delivery is primarily conducted by entities within this industry. Moreover, the literature also indicated that the network approach holds significant potential for logistics research and will expedite its development (Klimas, 2015). Therefore, this paper attempted to address the research gap on stakeholder relations in green last-mile delivery in the urban e-commerce market using a network approach.

3. Methodology and Results

The research process unfolded in two distinct stages. Firstly, a thorough literature review was conducted to identify and delineate the measurable components inherent in network relations features. This preliminary phase aimed to establish a foundational understanding of the key elements relevant to the research inquiry. The second stage involved an expert study to determine the weights assigned to specific network relations features and their components. These weightings were identified with the intention of their later application in city-specific research.

Table 1. Summary of findings related to the conceptualisation of network relations features of the urban GLMD stakeholders on the e-commerce market

Network relation features	Feature components	Variable	Reference
Strength	Commitment	Efforts to develop a stable relation	(Chomiak-Orsa, 2016; Morgan & Hunt, 1994)
		Duration of a relation	(Kawa & Pierański, 2015; Lambert et al., 1996; Smolska, 2016)
		Willingness to sacrifice	(Kawa, 2017; Łukasiński, 2015; Morgan & Hunt, 1994)
		Number of joint projects/transactions	(Kawa, 2017; Lambert et al., 1996; Smolska, 2016)
		Added value (synergies)	(Cygler, 2013; Morgan & Hunt, 1994; Ratajczak--Mrozek, 2009a)
	Trust	Absence of opportunistic behaviour	(Chiles & McMackin, 1996; Morgan & Hunt, 1994)
		Open communication	(Morgan & Hunt, 1994; Nonaka, 1994)
	Knowledge exchange	Open knowledge sharing	(Borgatti & Foster, 2003; Rokita, 2009)
		Tacit knowledge sharing	(Collins & Hitt, 2006)
Reciprocity	Degree of reciprocity	Symmetry	(Kawa, 2017; Knoben & Oerlemans, 2006; Lambert et al., 1996; Ratajczak-Mrozek, 2009b)
		Power	(Pillai, 2006; Ratajczak-Mrozek, 2009b)
		Resource dependence – sharing	(Cygler, 2013; Pillai, 2006; Ratajczak-Mrozek, 2009b)
		Resource dependence – using	(Borgatti, & Foster, 2003; Cygler, 2013; Knoben, & Oerlemans, 2006; Pillai, 2006; Ratajczak-Mrozek, 2009b)
	Exchange of information	Jointly coordinated actions (development plans)	(Borgatti & Foster, 2003; Czakon, 2007, 2010; Lambert et al., 1996)
	Contacts	Formalisation	(Lambert et al., 1996; Ratajczak-Mrozek, 2009b)
		Negotiation	(Ring & van de Ven, 1992)
		Commitment to the provisions of the contract	(Ring & van de Ven, 1992)
		Satisfaction with the performance of the contract by the relation's partners	(Ring & van de Ven, 1992; Smolska, 2016)
Proximity	Cognitive proximity	Similar technologies and quality standards	(Klimas, 2015)
		Similar knowledge and experience	(Borgatti & Foster, 2003; Boschma, 2005; Knoben & Oerlemans, 2006)
	Organisational proximity	The similarity of organisational cultures	(Klimas, 2012; Knoben & Oerlemans, 2006; Lambert et al., 1996)
		Similarity of specialists	(Klimas, 2012; Lambert et al., 1996)
		Strategic orientation	(Klimas, 2012; Lambert et al., 1996)
		Common jargon	(Klimas, 2012)
	Social proximity	Formal and informal communication channels	(Klimas, 2014; Lambert et al., 1996)
		Similar values and standards	(Klimas, 2014; Morgan & Hunt, 1994)
		Social contacts (relations of friendship, liking, family ties) occurrence	(Czakon, 2007; Klimas, 2014)
	Institutional proximity	Related institutional environment	(Klimas, 2014)
		Lack of conflicts and cultural differences	(Klimas, 2014)
	Geographical proximity	Distance	(Boschma, 2005; Knoben & Oerlemans, 2006; Lambert et al., 1996)

Source: own elaboration.

Following a literature analysis, it was determined that examining inter-organisational ties among urban green last-mile delivery stakeholders in the e-commerce market involves assessing the structure of the relation, considering its strength, reciprocity, and proximity, as conceptualised by Czakon (2005). The summary of the literature analysis regarding the network relation features and their components is presented in Table 1.

This paper explored strength as the initial structural characteristic of relations. The benefits derived from a relation depend on its intensity (Rokita, 2009) and duration (Holmlund & Törnroos, 1997). The process of establishing and fortifying ties occurs in three stages (Kwiecień & Żak, 2013). In the initial stage, partners acquaint themselves, and ties remain loosely formed; while progressing into the second stage of medium intensity, value is added, and ties between organisations are established. In the subsequent stage, interdependencies are created between organisations, fostering innovation, and increasing added value by leveraging ties among the network participants.

The strength of the ties is influenced by the commitment of its partners (Czakon & Rogalski, 2014) and their mutual trust (Castaldo, 2007) built through joint activities within the network. These elements are crucial for a fruitful and robust relation (Serrano Hernandez et al., 2018). Trust instils confidence that a partner will not engage in opportunistic behaviour and will ensure a fair distribution of profits in the future (Barringer & Harrison, 2000). In the absence of trust, sustaining any long-term relation is implausible, and a high level of trust contributes to a competitive advantage. What is more, an elevated level of trust facilitates the exchange of both explicit and non-explicit knowledge, with the latter requiring even greater trust (Collins & Hitt, 2006).

Network relations hinge on reciprocity, a critical element in assessing bonds that influence the establishment, modification, or their dissolution. The evaluation of the bond is a product of three key elements: the commitment of the parties, the negotiation of the contract, and its execution through the involved parties (Czakon, 2005). Commitment, apart from reinforcing the relation, serves as a fundamental component of reciprocity, inherently anticipated by the parties engaged in it.

The ultimate structural element of inter-organisational relations is proximity (Klimas, 2013), succinctly defined as the similarity of an organisation's attributes (Klimas, 2011). Proximity also signifies the extent to which an entity is influenced by other measures or externally sourced knowledge (Messeni Petruzzelli et al., 2009). In examining the concept of inter-organisational proximity, the prevalent categorisation in the literature involves five dimensions: cognitive, organisational, social, institutional, and geographic (Boschma, 2005; Klimas & Twaróg, 2015; Menzel, 2015). While there have been suggestions to condense the number of proximity dimensions, as proposed by Knoben and Oerlemans (2006) following an extensive literature review, arguing that only three dimensions – geographic, organisational, and cognitive – are pertinent from a management science perspective, this study maintained the more comprehensive perspective of five dimensions of inter-organisational proximity, namely cognitive, organisational, social, institutional, and geographic (Czakon, 2010; Klimas, 2014). Kawa (2017) stated that the attributes of these dimensions of organisational proximity can be applied to network relations. In the context of green last-mile delivery in the urban e-commerce market, the establishment of parcel vending machines accessible to multiple logistics service providers and e-tailers, known as "white label" parcel lockers (Prandtstetter et al., 2021), relies on a network of positive relations among actors. Klimas (2013) claimed that proximity enhances the benefits of interaction by increasing network and network member efficiency, promoting more effective knowledge creation, and enhancing tie effectiveness. Additionally, proximity mitigates the risks associated with network cooperation, such as opportunistic behaviour and communication barriers (Czakon, 2010).

The quantity of network relations is connected to one of the structural characteristics of the network, namely density. However, in this study, the focus was deliberately not placed so much on the structure of relations among stakeholders in green last-mile supply in the urban e-commerce market, but instead

on their dynamics. Therefore, considerations of network size, the number of nodes, network density, or the position of individual nodes, were not analysed here.

In the second stage, a questionnaire was distributed to thirteen distinguished academics specialising in city logistics, e-commerce, last-mile deliveries, and environmental protection. They were requested to assess the weights of each network relation feature and its components. Due to variations in the experts' decisions, their research consisted of two rounds.

In the first step of the expert study, the weight of each network relation feature was established (Figure 1). The experts collectively determined that the strength of stakeholder relations was the most critical factor concerning urban green last-mile delivery in the e-commerce market. The weight assigned to strength amounted to 42% of the overall network relation. Next, proximity was valued at 32%, while reciprocity emerged as the least essential network relation feature among green last-mile delivery stakeholders in the e-commerce market in cities, with a result of 26%.

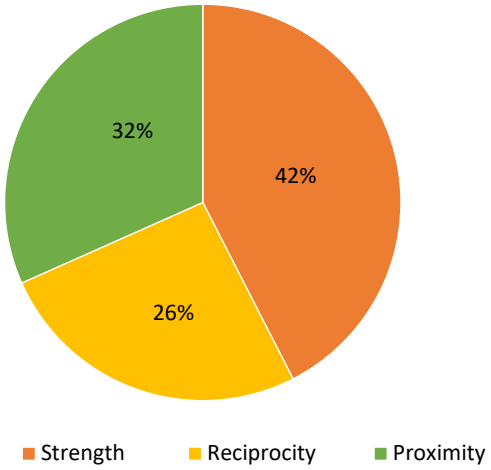

Figure 1. The weight of network relation features among urban GLMD stakeholders in the e-commerce market

Source: own elaboration.

In the second step, the experts were asked to assess the weight of each identified component within the network relation features. Concerning the strength of the relation, the analysis revealed that commitment and trust were the most crucial components of this network relation feature among green last-mile delivery (GLMD) stakeholders in the e-commerce market in cities (Figure 2). Both of these components were assigned a value of 36% of the overall relation, whilst the exchange of knowledge was deemed less important, reaching a value of 28% according to expert assessments.

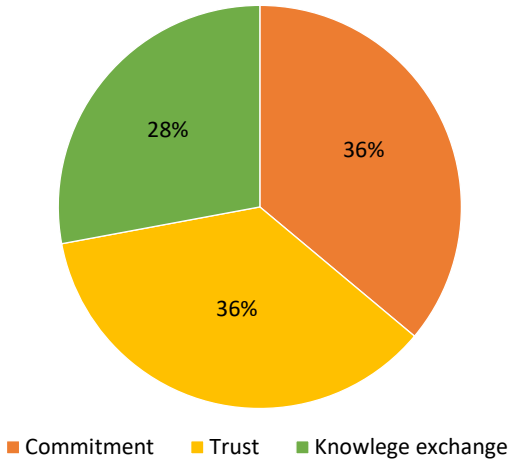

Figure 2. The weight of strength components in urban GLMD stakeholders' relation in the e-commerce market

Source: own elaboration.

Regarding reciprocity, the unequivocally most critical factor was trust (Figure 3). The experts rated exchange of information as constituting 43% of the overall reciprocity component. The degree of reciprocity was identified as responsible for 31% of the reciprocity network relation feature, whereas the contacts only achieved a score of 26%.

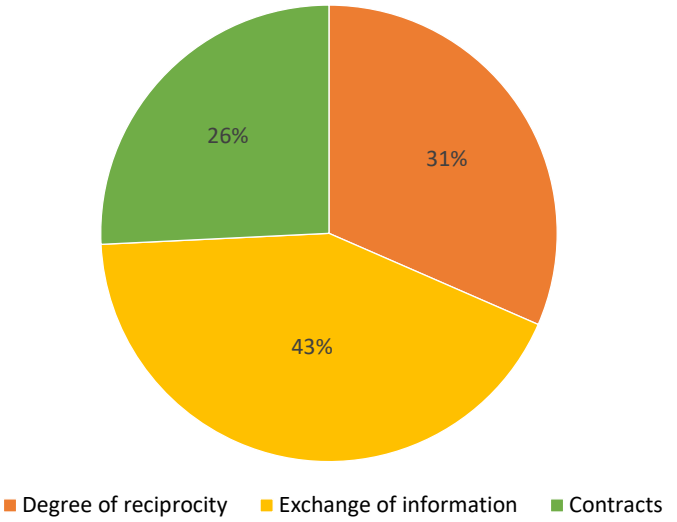

Figure 3. The weight of reciprocity components in urban GLMD stakeholders' relation in the e-commerce market

Source: own elaboration.

The issue of proximity proved to be the most complex, with a considerable variation in expert opinions when assessing the particular components of proximity among the stakeholders of urban GLMD in the e-commerce market. The research revealed that two dimensions of proximity seem to be the most important in the stakeholder relations of urban GLMD in the e-commerce market, namely organisational proximity, and social proximity (both with a score of 23%). The remaining dimensions were assessed as almost equally significant, with institutional proximity reaching 19%, cognitive proximity at 18%, and geographical proximity at only 17% of the total value of proximity.

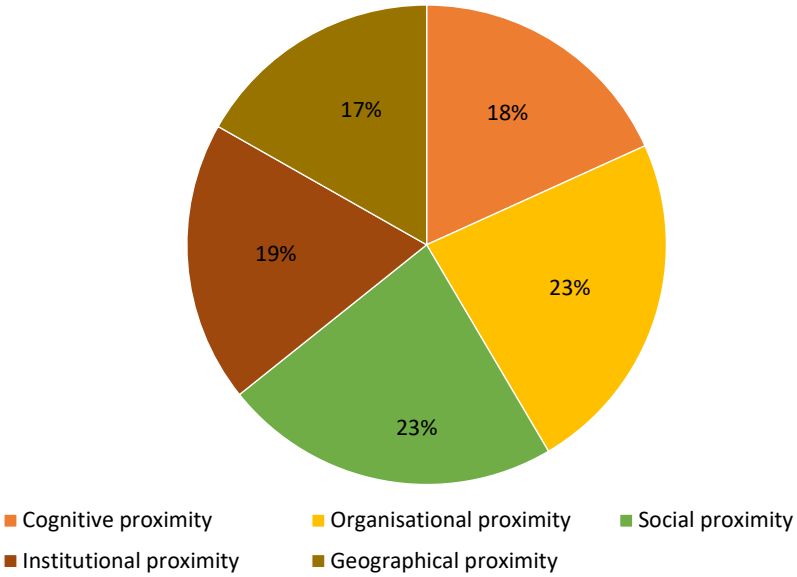

Figure 4. The weight of proximity components in urban GLMD stakeholders' relation in the e-commerce market

Source: own elaboration.

4. Discussion and Conclusions

In conclusion, this research offered a comprehensive exploration of stakeholder relations in the context of green last-mile deliveries (GLMD) within the e-commerce market. The study focused on the pivotal network relation features of strength, reciprocity, and proximity (Czakon, 2005) among stake-holders involved in urban GLMD, recognising the escalating challenges posed by the growth of e-commerce.

The research addressed the gap in the literature by focusing on the network dynamics of stakeholders in green last-mile delivery, acknowledging their critical role in fostering environmental sustainability. By employing a methodological triangulation approach, the study integrated a literature review and an expert study.

The literature review enabled the identification of measurable components of network relations features among green last-mile delivery stakeholders in the e-commerce market. Along with the identified weightings, these are intended for application in city-specific research. The depth of insights obtained from combining literature review and expert evaluations ensures a thorough understanding of network relations features, contributing to the successful implementation of green last-mile delivery solutions.

The obtained results offer practical implications for shaping relations among urban green last-mile delivery stakeholders. Notably, the predominant attribute within network relations, constituting nearly half of the total relation weight, was strength. Therefore, it becomes imperative for stakeholders committed to implementing green last-mile delivery solutions within the e-commerce market to prioritise the cultivation of trust, fostering commitment, and facilitating knowledge exchange, as these elements collectively form the foundation of strong relations. Additionally, the next significant factor influencing relation creation was proximity, with social and organizational proximity emerging as the most crucial dimensions. Lastly, reciprocity was shown to play a pivotal role in GLMD stakeholder networks, with the exchange of information being the most vital element within this feature. These insights can serve as valuable guidance for local governments within a given city striving to align with Green Deal objectives, who may utilise the research findings to consciously shape stakeholder relations in the city, facilitating the achievement of environmental and quality-of-life objectives.

One of the ways of such cooperation is Freight Quality Partnership (Iwan, 2013; Kiba-Janiak et al., 2021; Viu-Roig & Alvarez-Palau, 2020). Lindolm and Brown (2013) conducted an analysis of six cases of operational partnerships in European cities and concluded that while there is no universal model for

such collaboration, it is essential to involve representatives from both the public and private sectors Furthermore, partnerships offer various benefits to stakeholders by improving the urban distribution of goods and emphasising long-term cooperation. For instance, managers within courier companies mandated to implement clean transport services can glean valuable insights into establishing relationships that promote environmental sustainability. In Poland, such a partnership has been established in Szczecin (Kijewska, 2017; Kijewska & Jedliński, 2018).

In essence, this study provides a valuable foundation for guiding stakeholders involved in green last--mile deliveries within the e-commerce market in cities, fostering sustainable and coordinated practices in urban areas. Moreover, understanding the dynamics of relations among stakeholders in green last-mile delivery (GLMD) networks presents further research opportunities for establishing and categorising their roles within the network, which would enhance the cooperation and facilitate the successful implementation of green last mile delivery solutions on the e-commerce market in cities.

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Pomiar relacji interesariuszy zielonych dostaw ostatniej mili na rynku e-commerce w miastach

Streszczenie

Cel: Niniejsze opracowanie ma na celu zbadanie złożonych relacji między interesariuszami zielonych dostaw ostatniej mili (GLMD) na rynku e-commerce w miastach, ze szczególnym uwzględnieniem cech relacji sieciowych, takich jak siła, wzajemność i bliskość.

Metodyka: Przegląd literatury identyfikuje mierzalne komponenty cech relacji sieciowych, uzupełnione badaniem eksperckim. Badanie ocenia wagi zidentyfikowanych komponentów w ramach cech relacji sieciowych – siły, wzajemności i bliskości.

Wyniki: Wyniki pokazują, że siła jest najbardziej kluczową cechą relacji sieciowych, a na kolejnych miejscach plasują się bliskość i wzajemność. W ramach komponentów siły, zaangażowanie i zaufanie są identyfiko-

wane jako kluczowe. Zaufanie jest najbardziej krytycznym czynnikiem wśród komponentów wzajemności, podczas gdy w ramach bliskości wymiary organizacyjne i społeczne odgrywają nadrzędną rolę.

Implikacje i rekomendacje: Przeprowadzone badania dostarczają konkretnych informacji na temat kształtowania relacji pomiędzy interesariuszami miejskiej zielonej dostawy ostatniej mili. Władze lokalne i menedżerowie firm kurierskich mogą wykorzystać wyniki badań do świadomego kształtowania relacji z interesariuszami, co ułatwia realizację celów środowiskowych oraz związanych z jakością życia.

Oryginalność/wartość: Badanie jest próbą wypełnienia luki w literaturze poprzez zwrócenie uwagi na dynamikę relacji interesariuszy w zielonych dostawach ostatniej mili w miastach, uznając ich kluczową rolę w zrównoważonym podejściu do środowiska.

Słowa kluczowe: dostawy ostatniej mili, interesariusze, sieć, e-commerce, miasta