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Environmental Sustainability in City Logistics Measures

Jagienka Rześny-Cieplińska [1,*] and Agnieszka Szmelter-Jarosz [2]

[1] Department of Finance and Management, WSB University in Gdańsk, Grunwaldzka 238a, 80-266 Gdańsk, Poland
[2] Faculty of Economics, University of Gdańsk, Armii Krajowej 119/121, 81-824 Sopot, Poland; agnieszka.szmelter-jarosz@ug.edu.pl
* Correspondence: jrzesny@wsb.gda.pl; Tel.: +48-793-961-296

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Abstract: Sustainable urban transport is fundamental not only for economic growth but also for the environmental protection, thus all logistics activities within the cities should be organized in a way to be environmentally friendly. The article aims at presenting the environmental sustainability of city logistics measures from different stakeholder perspectives. In the paper, a multi-method approach was implemented: literature review, text analysis, text mining, and statistical analysis. The paper presents how the stakeholders perceive urban logistics, if they see the need for coordination of its elements, who should be responsible for it, and what areas are the most important for them. The main task of this study is to recognize the priorities of different stakeholders. In consequence, the final effect of this article is an insight that is valuable not only for the local authorities but for many stakeholders, groups operating within the city that are and in many cases cooperating within the framework of creating sustainable urban mobility plans.

Keywords: city logistics measures; stakeholders; environmental sustainability; urban logistics

1. Introduction

City logistics (CL) is a popular area of research, and therefore, is perceived as a complex and multi-dimensional term. It consists of coordination and planning, as well as controlling of logistic processes and flows of resources within the urban areas [1]. CL is defined mainly by the aims, and thus indicates the need to reduce nuisances related to the transportation issues within the urban areas while supporting the sustainable development of the cities. It refers not only to the diversity of the goods transported and the heterogeneity of the transportation means, but also involves various stakeholders in designing and implementing solutions. Usually, these stakeholders have different aims and priorities [2]. Their opinions are crucial for urban policy making. The importance of partnership and collaboration among CL stakeholders has been already recognized for effective sustainable urban development [3,4]. For better understanding of freight transport (FT) issues and of individuals' opinions on urban transport design, public authorities need involvement of the private sector in freight planning [5,6].

The key to success for the development of an optimal urban logistics strategy lies in finding consensus between all the identified needs and available resources, also in the area of transport system. Diverse city logistics solutions are implemented all over the world but with varied success—mostly because every city has its own specifics. Moreover, it is challenging to take into account the complexity and diversity of urban logistics while keeping all sides engaged [7].

One of the related concepts is the sustainable city logistics with its economic, social, and environmental dimensions [8–10]. Considering sustainable development as a three-dimensional notion, the question may be raised if these three factors provide equal support or if a hierarchy of

values can be found among them. International organizations and institutions emphasize the need for protecting the environment as an essential prerequisite for social justice and economic development [11]. For many entities, environmental sustainability, defined as "a condition of balance, resilience and interconnectedness that allows human society to satisfy its needs while neither exceeding the capacity of its supporting ecosystems to continue to regenerate the services necessary to meet those needs nor by our actions diminishing biological diversity" [12], becomes an integral factor in strategy planning [13].

It is apparent that the provision of clean water, clean air, or productive and clean land is foundational to a well-organized and responsible socioeconomic system. Moreover, without a sustainable production environment providing a resource base, it would be difficult to imagine a sustainable society. Similarly, a stable economy depends on the sustainable flow of materials, energy and environmental resources—without them, economic systems will collapse [13–16].

Environmental sustainability becomes more and more important for different stakeholders; thus, the paper aims at presenting the environmental sustainability as a part of city logistics expressed in city logistics measures. The study describes the opinions and priorities of representatives of different groups of stakeholders. The auxiliary purpose is to present different data analysis methods and techniques gaining popularity in contemporary sustainability-related research, especially text mining.

The structure of the paper is as follows. Firstly, the concepts were clearly presented to make an introduction to the purpose of the paper. In order to prepare the basis to the main research section, the authors presented the importance of CL issues, along with various approaches to this phenomenon that urge all stakeholders engaged in urban logistics matters to investigate those issues. The stakeholders' cooperation is considered to be particularly significant in relation to the success or failure of the CL measures that are described in Section 2. The literature discusses a number of CL initiatives related applications quite often in respect to their sustainable economic, social, and environmental character. The authors' idea was to examine CL solutions, focusing on environmental sustainability on the basis of stakeholders' opinion.

Afterwards, the methods used within the research framework were described. After presenting all the methods and techniques used at the stages of designing the questionnaire, data gathering and analysis were performed. The next section describes the research results that are discussed in the following part of the paper. The article ends with the conclusion containing research implications, limitations, and future research plans.

2. City Logistics' Stakeholders

City logistics (CL) has been investigated for many years, but the topic is still evolving because of the changes, firstly in the environment, secondly in citizens' habits [17–19]. City logistics is mainly associated with freight transportation issues; therefore, it is likely to be the point of interest of private businesses. Nowadays, much review-based research has been conducted to define CL more precisely and widely [19]. More contemporary approaches tend to define CL in a more holistic way, treating it as a coordination process of all flows within the urban areas—of freight as well as of passengers [20–22]. Passengers' mobility, mainly related to public transport in cities, is naturally organized by public administration, thus, city logistics covering the flows of cargo and people deserves interests of both private and public stakeholders.

Taking into account the strong interactions between city logistics and urban development—the coordination in the management process in the cities whilst considering mobility issues tends to be crucial. Thus, there is a strong need to identify all stakeholders within the urban transport system. Heterogeneous stakeholders operating in cities, in fact, interact, both by competing and cooperating, but are characterized by different objectives [23,24]. Additionally, they are most often considered as entities that are interested in the final decisions to be made, even though those decisions do not affect them [25–28]. The stakeholders can be divided into several main groups [4,29,30]:

- Authorities,
- Shippers,

- Freight carriers,
- Public transport operators,
- Residents,
- Other traffic participants.

Generally, all stakeholders may be divided into two groups: public and private. Public ones are represented by authorities (the local government, the national government) and public transport operators. Private groups include entrepreneurs (shippers and freight carriers) as well as individuals (residents and other traffic participants). Authorities, most often the local ones, are mainly interested in increasing the safety of road traffic reduction and minimizing of congestion and environmental nuisances [31]. From their point of view only urban freight transport (UFT) itself is considered as the main contributor of external effects [32,33]. From a more general perspective, the authorities focus on implementing sustainable urban transport system [34–36]. Therefore, taking care for the development of the consensus between other stakeholders is needed. [37,38]. Although most commonly, it is the municipalities who own public transport operators, any particular case depends on the model of the public transport adopted in a city [39]. Hence, public transport services may be provided by the private and public companies [40].

Shippers' interest is to maximize quality of service in terms of costs and reliability of transport [41]. Freight carriers are usually mostly interested in minimizing their costs by maximizing the efficiency of their pick-up and delivery tours. Additionally, they are expected to provide a high level of service at a low cost [23,42]. Dwellers can experience nuisance generated by UFT as external effects, therefore, they care about sustainable urban transport system [23]. Other traffic participants include cyclists and pedestrians sharing the same infrastructure with freight transport vehicles, especially in the urban area, as well as with passenger vehicles [26]. Visitors and tourists can also be included in this group, because they are affected by UFT, albeit only to a minor degree. Wishing to attract tourists and visitors to come, city authorities should be vitally interested in minimizing the nuisance caused by UFT [27].

Taking into consideration the processes that are fundamental in city logistics, the decision makers are gradually implementing CL measures from the perspective of the needs of future generations.

3. City Logistics Measures

Modern city logistics faces the challenges of sustainable development in urban areas [43,44]. Moreover, the urban transport system should be treated as a whole including both freight movement and passengers [45]. Although there is a growing interest of the local authorities in freight flows within the cities, only a few European municipalities [45] included freight transportation with passengers flows in their urban plans. What needs emphasizing is the support of the European Union, within the sustainable and integrative urban mobility issues planning processes since 2013 [46,47]. More precisely, Sustainable Urban Mobility Plans (SUMPs) were part of EU policy, the main aim of which was to facilitate urban transport planning by European policymakers. According to the official definition, SUMP is "a strategic plan designed to satisfy the mobility needs of people and businesses for a better quality of life. It builds on existing planning practices and takes due consideration of integration, participation, and evaluation principles" [46–48].

The well-known core SUMP principles include preparing plans for sustainable mobility direction, developing all transport modes in an integrated manner and additionally involving all stakeholders of the urban transport system in these processes. Those tasks would not be implemented using the conventional logistics structures—mainly because of the increasing mobility of people leading to increasing demand and flows of goods. That is the reason to seek for the specific solutions that allow for uninterrupted logistics operations of the urban transport system while maintaining the scopes of sustainable development. The future direction of CL issues should contain integrated planning solutions for the CL, leading finally to a city achieving sustainability and liveability targets.

Practical solutions that are applied in the European countries as regards the improvement in city logistics may relate to the following areas [49]:

- Stakeholders engagement,
- Regulatory,
- Infrastructure,
- And new technologies,
- Eco-logistics.

Different solutions and measures aimed to improve the flows within urban areas can come from the stakeholder engagements. Without the co-operation and understanding amongst the stakeholders, it is not possible to implement long-term solutions to urban logistics problems. Stakeholder involvement is becoming increasingly recognized as an essential part of every process in the creation of a sustainable urban transport system [23,50]. Successful collaboration between particular stakeholders can lead to the preparation of high impact strategies that consider needs of the city, businesses, transport operators, and local residents. In participative approach, because of its complex character, the involvement of different players should be stimulated from the very beginning of the planning stage. The most common tools applied to involve stakeholders are the following [49]:

- Freight quality partnership—where various solutions related to freight transport are being worked out by the representatives of the public and the private sector,
- Freight advisory boards and forums—where representatives of the stakeholders meet and discuss challenges and chances of the freight space within the city,
- City logistics manager function.

Within the scope of regulatory measures, various practical solutions can be distinguished. Most of them are—with different results—implemented in European countries. They can refer to [51,52]:

- Restricted access to certain areas in cities, based on different criteria for vehicles,
- Time slots that refer to a situation when certain vehicles can enter excluded streets,
- Exclusivity zones that are related to areas with limited number of transport operators that can perform deliveries.

Presented regulatory CL measures are the most common option adopted by the municipalities to reduce the externalities of road transport. They can be used in form of [51,52] urban congestion charges for certain roads or areas to incentivize car users to reduce traffic in those areas, in form of subsidies, tax reductions, incentives to foster the implementation of infrastructure, equipment, or technology levers.

As a more effective solution in mobility management, creating special and dedicated infrastructure by identifying areas of conflicts between freight activities and other land uses is considered. The initiatives forming this area contain the following [53–55]:

- Urban distribution centers—collecting shipments in a specialized warehouse at the outskirts of the city where they are consolidated before last-mile transport,
- Direct injection—a solution related to bringing goods directly to the city using alternative transportation means,
- Dedicated parking spaces for trucks—preparing special lanes for loading and unloading trucks or letting them use bus lanes during certain times of the day,
- E-commerce pick-up points—enabling transporters to deliver parcels to single locations without having to go from door to door.

A well-known solution to make 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 and can be applied in different solutions, such as [56,57]:

- Intelligent transport system,
- Real-time information system,

- Alternative transportation means,
- Crowdsourced delivery and transport solutions.

The idea behind the eco-logistics measures [58,59] is to promote eco-friendliness and sustainability in the urban transport system. Businesses and individuals shall concentrate on improving supply chain visibility, refining efficiency, and cost-minimizing, and must not focus on a link between environmental performance and financial gains.

4. Methods

4.1. Literature Review and Research Framework

While designing the method for this study, the main assumption was the necessity to implement a multi-method approach (see Figure 1). Firstly, to create the interview questionnaire, a literature review was required to draw a picture of the specified research area. The aim of the review was to define the environmental sustainability elements for city logistics measures. For this purpose, the approaches of Snyder [60] and Lame [61] were implemented. This part of work was executed in October 2019 with use of the keywords search ("city logistics measures" and "environmental sustainability" in title, abstract, or keywords) in different scientific search engines (as the primary engines—SCOPUS, ScienceDirect, EBSCOhost, and MDPI, and as the auxiliary engine—Google Scholar). The search results were limited to the social sciences discipline. The resulting literature database was refined using the abstract search and this way the basic literature base was set. Then, with use of the Mendeley Desktop, the content analysis was performed, which resulted in indicating the main environmental sustainability criteria. Eventually, just 21 papers were taken into consideration in the analysis of the assessment procedure, and indicated the individual, specific variables (see Tables 1 and 2). Those, in turn, built one of the areas of the interview questionnaire. The literature review results were placed in Table 1 in the previous section and Table 2. Then, the interview was conducted in November 2019. The next research phases were based on text analysis, text mining, and the statistical analysis, namely the tools characteristic for assessing the relations between nominal and ordinal variables. Taking into consideration the character of the variables, a few procedures were applied (see Sections 4.2 and 4.3). This part of the study was held in January 2020.

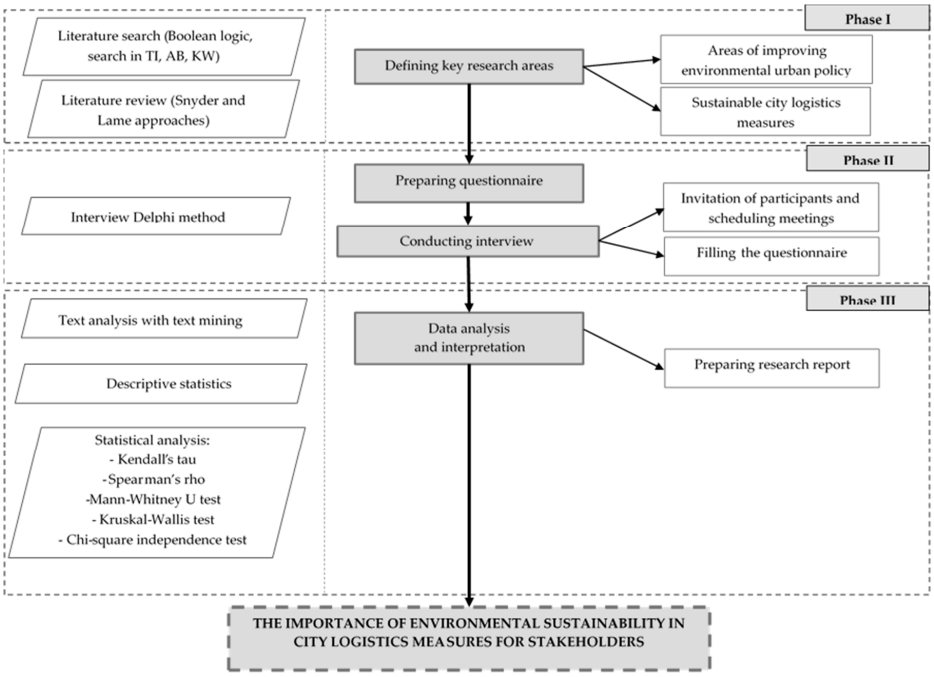

Figure 1. Research framework.

Table 1. Groups of CL initiatives.

No.	Area	Solution	Meaning	Sources
1	Stakeholders engagement	Freight quality partnership	Private and public stakeholders of freight logistics meet to discuss problems and apply solutions in UFT.	[23,62,63]
2		Freight advisory Board	Opportunity for the stakeholders engaged in meeting and discussing opportunities and challenges in the freight transportation area.	[64,65]
3		City logistics manager (CLM)	CLM reconciles the need of the different companies, businesses, and associations engaged in transport issues with the authorities to find the best solutions.	[40,50]
4	Regulatory measures	Restriction on vehicles	Access restriction to the certain areas of the city, most often in city centers.	[51,52]
5		Exclusivity zones	Exclusivity for a limited number of transportation companies within certain areas.	[66]
6		Environmental restrictions	Reducing the environmental impact of freight traffic within the cities mainly by promoting the use of electric or low-emission vehicles for deliveries in cities.	[51,67,68]
7		Pricing/taxation	Options adopted by municipalities to reduce externalities of UFT by road pricing, congestion charging, and parking charges.	[51,52]
8		Tradable permits and mobility credits	Solution based on the mobility credits model in order to reduce congestion and pollution in city centers.	[51,52]
9		Incentives and subsidies	This tool is to encourage the development of sustainable urban distribution by the provision of incentives or subsidies by local authorities.	[69,70]
10	Infrastructure	On-street zones	Designing special infrastructure to accommodate traffic needs in form of adequate curbs for parking and loading activities, parking places, and loading-zones.	[54,55,71]
11		Nearby delivery areas	Implementation of special area on streets dedicated for loading activities.	[54,55,71,72]
12		Collect points	Specific locations for pick-up and delivery, such as automated locker systems, parcel shops and post offices, and mini depots.	[54,55]
13		Urban consolidation centers	Shared logistics centers for consolidation of goods in the suburb of the cities or in front of the city centers.	[72,73]
14	New technologies	Dynamic routing	The solution used by municipalities to optimize traffic flows.	[74–76]
15		Real-time information	Monitoring and managing traffic based on real-time traffic information.	[74–76]
16		Traffic control	Controlling traffic with the help of signs and devices.	[74–76]
17	Ecologistics	Eco-driving	Fuel efficiency techniques that helps in emphasizing road safety, economy, and the environment.	[58,59]
18		Greener trucks	Lower or zero-emission trucks.	[58,59]
19		Alternative transportation means	Usage of the alternative means of transport.	[77]

Table 2. Environmental sustainability criteria in the research framework.

No.	Category	Criterion	Crit. Code	Description	Source
1	Reducing emissions and waste	Reduction of emission of CO_2 and other harmful substances	RedEmiss	Choosing low carbon modes, such as public transportation, riding a bike, or walking	[78,79]
2		Reducing noise (to improve fauna life)	RedNoise1	Promoting quiet transport modes, implementing recording noise systems, and distributing current information about its level	[80]
3		Reducing noise (to improve quality of life)	RedNoise2	Using quiet transport modes, recording and controlling noise, and keeping users informed about its level	[81,82]
4		Less waste (e.g., vehicle spare parts, tires)	RedWaste	Less waste caused by decreasing use of the modes of transport polluting the environment	[43,78]
5	Reducing other external costs	Less congestion and traffic	RedCong	Less traffic caused by the growing popularity of active transport modes	[41,43,83]
6		Fewer road accidents and their effects	RedAcc	Fewer road traffic accidents by making traffic participants aware of driving customs to avoid the accidents	[84–86]
		Less environmental losses	RedLoss	Fewer environmental losses by the implementation of reducing, reusing, and recycling rules	[87,88]
7	Implementing beneficial practices	Using renewable fuels and energy sources	EcoFuel	Using energy that produces no greenhouse gas emissions from fossil fuels and reduces some types of air pollution	[89–91]
8		Improving safety	Safety	The security of goods has to be delivered, as well as procedures established in case there is damage	[41]
9		Informing about health benefits	HealthBen	Modal choice can improve air quality and lead to better health outcomes	[78]
10		Increasing the quality of life	LifeQual	Raising the level of well-being of individuals and societies	[92–95]
11		Implementing the strategy of cooperation to care for the environment	CoopStrat	Effective marketing as well as cooperation on local and regional scales, which refers particularly to partnerships with IT specialists, investors, and most prominently to retailers and individuals	[78,96]
12		Effective use of resources	UseRes	Reducing the number of empty runs	[77]

On the basis of the literature review, 12 criteria that are potentially important for diverse stakeholders and correspond with the environmental dimension of sustainable development in the light of city logistics and its measures were provided (see Table 2). All the city logistics measures influence (in differentiated scope) the shape of the 12 identified criteria. Those criteria were taken into account in the preparation of the interview questionnaire scale question (see Section 4.2). The remaining elements of the questionnaire resulted from the questionnaires taken from the literature base.

While preparing a research report, a few methods were used to receive as much information as possible from raw data (triangulation of methods), primarily to make the results more reliable. The different methods were used to analyze the same data (if possible). These methods are described in Section 4.3 with its subsections.

4.2. Interview and Delphi Method

After defining the aim of the paper, the need for choosing the right research method became essential. Because the primary methods in the identified literature were interviews and surveys on stakeholders' needs, the hybrid approach was chosen (Delphi method and interview) to address the requirements of the reliable research results and valuable insights. Multiple researchers have used the Delphi method in their research in the city logistics field, exploring future mobility [97], multi-stakeholder scenarios for its development [39,40], and societal trends on urban public transport, to name a few [98]. Therefore, it was recognized as the proper method for this study. Moreover, the interview is perceived as a reliable method for analyzing mobility patterns among generations [99], their environmental awareness [100], also in transport [71,101], crowd logistics [79], urban transport planning, and transport policy [102,103].

The questionnaire contained mostly open and semi-closed questions (see Table 3). Listening to the voices of various stakeholders allows to understand the different perspectives better than surveying only individuals or random people. Therefore, the groups of city logistics stakeholders were identified according to the approach of Rześny-Cieplińska and Szmelter-Jarosz [104], and then, the invitations were sent to the representatives of the groups, listed as potential respondents. They, in turn, were chosen to reflect the specifics of local economy, especially a big number of forwarders and carriers, according to Pikora et al. [105]. Scientists were intentionally omitted as experts, as was done in other studies, because it was considered that a representative of each stakeholder group would best know their own priorities in the studied area.

Table 3. Interview questions.

No.	Question	Type of Question	Type of Data	Type of Analysis
Q1	How do you understand city logistics issues?	Open question	Plain text	Text analysis, text mining
Q2	Can you see the need for coordination of city logistics processes?	Semi-closed question (yes/no and possibility to add a comment)	Nominal	Descriptive statistics, text analysis
Q3	By whom the city logistics processes should be coordinated?	Semi-closed question (a group of answers and possibility to add a comment)	Nominal	Descriptive statistics, text analysis
Q4	What kind of measures can influence the reduction of negative impacts of transportation in cities?	Open question	Plain text	Text mining, text analysis
Q5	Do you find it possible to reduce the negative impacts of transportation in cities?	Semi-closed question (yes/no/don't know and the possibility to add a comment)	Nominal	Descriptive statistics, text analysis
Q6	Which area is the most important: stakeholders' engagement, regulatory measures, infrastructure, new technologies and eco-logistics for improving city logistics system?	Closed question (a group of given possible answers)	Nominal	Descriptive statistics
Q7	Please assess the importance of the given areas/elements of sustainable development in shaping urban logistics	Scale question	Ordinal	Statistical analysis

The responsiveness of the interview invitation was very low. Despite being guaranteed full anonymity, potential respondents refused to participate in the study, mostly due to lack of time. Finally, 19 respondents were available to be interviewed in November 2019 (very limited willingness to

participate was observed). They were people from the Tricity agglomeration (Gdansk, Sopot, Gdynia), Poland. Gdansk and Gdynia are port cities, with developed business centers. Sopot is a smaller city between Gdansk and Gdynia. The three cities have different characteristics and history. Gdansk is the oldest city with developed tourism (the famous Old Town), industry, and business areas. Sopot is a spa city, a popular holiday destination with a specific climate. Gdynia is the youngest city, a modern one with different architecture and developed industry and business areas. The Tricity agglomeration is located in the north of Poland, on the Baltic Sea. The specifics of this location build the uniqueness of the business activity, mostly shared services centers, IT companies and port services.

The stakeholders' group consisted of six subgroups: three forwarders, three carriers, one public transport operator, three entrepreneurs, six individuals and three local authorities' representatives from all the three cities. Therefore, four of them were public and 15 were private (see Table 4). The samples from the particular subgroups were not representative, as this is not required by the Delphi method. Because of the strong masculinization of the branch, most of the research sample were men.

Table 4. Interviewees characteristics.

Category	Interviewed Stakeholder
Stakeholders group	Forwarders/shippers (three persons, 15.79%), carriers (three persons, 15.79%), public transport operator (one person, 5.26%), individuals (six persons, 31.58%), entrepreneurs (three persons, 15.79%), local authorities (three persons, 15.79%)
Gender	Male (13 persons, 68.42%), Female (six persons, 31.58%)
Age	21–30 (four persons, 21.05%), 31–40 (three persons, 15.79%), 41–50 (seven persons, 36.84%), 51–60 (five persons, 26.32%)
City	Gdansk (four persons, 21.05%), Gdynia (13 persons, 68.42%), Sopot (two persons, 10.53%)
Stakeholder category	Private (15 persons, 78.95%), public (four persons, 21.05%)

The interview lasted from 24 to 33 min. Firstly, the short introduction was presented by the interviewer. Then, the questions Q1–Q6 were asked. In this part, all the issues were explained that were unclear for the readers. The last part of the interview based on scale question, assessing the importance of the criteria and measures for the particular interviewees. The interviewees' answers were transcribed (Q1–Q6) and recorded in the response sheet (Q7). The results have been presented in the Appendix A section (see Tables A1 and A2).

4.3. Dataset Analysis

4.3.1. Text Analysis with Text Mining

The open and semi-closed questions (Q1–Q5) within the questionnaire allowed respondents free expression of thoughts. However, some of them required only a short answer. Therefore, the answers to some questions were not complicated and needed a simple analysis (descriptive statistics or text analysis), for the others required more advanced one (text mining). In result, a simple analysis was held for questions Q2, Q3, Q5 and the more complicated one for Q1 and Q4.

The text analysis consisted of analyzing the opinions expressed by respondents and did not require the use of any additional tools. Text mining was carried out with chosen approach [106] and using such tools as the R software ("tm" and "wordcloud" packages) and (for a more attractive presentation of the results) an online word cloud generator. Firstly, the raw data had to be cleaned to remove the stop words ("a", "the", "and", etc.). Then, the list of single words and phrases was made and their occurrences were estimated (see Appendix B, Tables A3–A6). Finally, the word clouds were drawn.

4.3.2. AHP Method

In the scale question (Q7), the priority of the areas of sustainable development was assessed using a standard Likert scale (1 for unimportant and 5 for very important). For this purpose, the AHP method was chosen, a well-known classic multi-criteria decision-making method. Saaty's AHP introduced in the 1980s is aimed at supporting the decision-making process in many areas, also related to social sciences as a whole and in the specific area of city logistics [107]. It is especially useful when variables are nominal or ordinal [108]. Hence, it can be a good method to describe the priorities of decision-makers. [43].

The mean values of the grades given by the interviewed stakeholders were calculated for the whole group and subgroups. The means were then translated into AHP scale values (9, 7, 5, 3, 1, 1/3, 1/5, 1/7, 1/9). Those built the initial matrix used to estimate the most important areas for particular stakeholders' subgroups.

4.3.3. Statistical Analysis

The tools and tests for the statistical analysis were chosen for the kind of data that needed to be analyzed. The data obtained from Q2, Q3, Q5, and Q6 were nominal; from the Q7 ordinal (see Table 3). The characteristics of the respondents were also nominal (city, gender, stakeholder subgroup, and category) or ordinal (age group, see Table 4). Because of the small group of respondents, the variables could not be perceived as having a normal distribution. Therefore, only non-parametric tests were used, where possible [109,110]. Those can be divided into two groups: independent groups' comparison and examining relations between variables. For group comparison, the analysis contained the Kruskal-Wallis test (when more than two groups, dependent variable ordinal), chi-square test (when the dependent variable was nominal), U Mann-Whitney test (when two groups, dependent variable ordinal), and independence chi-square test (when nominal). For examining relations between variables, the rho-Spearman test (if two variables ordinal) and independence chi-square (if nominal or mixed) were applied, possible when the ordinal variable has a small number of categories. Statistica 13.1. was used as a tool.

5. Results

5.1. Text Analysis and Text Mining Results

The first question had to determine how the stakeholders understood the city logistics issues. As presented in Figure 2, there are some areas associated mainly with city logistics. Firstly, the city logistics, according to the opinions of respondents, relates to processes and objects of interest to those processes. Namely, it contains such processes as management, optimization, organizing (organization), and improving, mainly with regards to transport. The objects of such actions are mostly people, goods (cargoes, freight), their flows, deliveries, and supply area. According to the raw data (see Appendix B, Tables A3 and A4), its main area is organizing and—broadly speaking—improving flows within urban areas. Therefore, the group of all respondents sees city logistics primarily as managing the operations held within the city.

Looking at answers to Q2, they focused on the potential need for coordination of city logistics processes; it is obvious that the vast majority of the interviewees said that this coordination was required. Only one person, a carrier, said it had to base on self-regulation, and one of the shippers said that it was needed only in the area of the transport of people. Therefore, the stakeholders see the need for the coordination and are aware of the role of city logistics in functioning urban areas.

Q3 was aimed to investigate who should be responsible for the coordination. The majority of interviewees said that responsibility for such actions concerned city authorities (63.16%, all the shippers, two carriers, transport operator, two entrepreneurs, and three individuals) or a hybrid solution (public and private; all the representatives of authorities and one entrepreneur, 21.05%). This probably resulted from a different perspective of the authorities on the investments and implementation of new solutions

within the urban areas. One carrier and one individual thought the public transport operator should coordinate the city logistics and one individual did not know who would be the best choice in this regard. Therefore, according to the voices of the stakeholders, the local authorities, optionally with private companies, should create, implement, and control city logistics projects.

Figure 2. Word cloud for answers to Q1.

The fourth question was "What kind of measures can influence the reduction of negative impacts of transportation in cities?" and aimed at identifying the crucial areas that need to be improved within urban policy. The open character of the question allowed the participants to speak freely. However, they did not indicate many areas in this regard (see Appendix B, Tables A5 and A6), even if there was no limit of time and no closed collection of possible answers. The homogenous opinions express the main areas for improvement (see Figure 3). The most popular answer concerned the legal issues, for example regarding the access of trucks to the city center, to zones free from any motorized mobility, to special delivery zones, logistics consolidation center, and electromobility. Another answer often mentioned areas with investments in different parts of the urban space: eco-friendly solutions, public transport and others, precisely speaking—investments made for city users, to adjust the city functions to their needs. Among those, environmental sustainability elements can also be noticed: technology, broad term "ecology", reduction of smog, sustainable development investments, and the development of electromobility. The most-often mentioned legal regulations can also be a part of environmental sustainability policy, because they usually impose some limits on the allowance for cars or truck with required ecological class, or will simply bar entry to some parts of the city, charge entry fees, etc.

Figure 3. Word cloud for answers to Q4.

Answering Q5, the respondents stated that it was possible to reduce the negative impacts of transportation within the city areas (12 persons, 63.16%) but that it could be difficult and should be combined with proper instruments. Five people thought that this was impossible or only partially possible, for example, because of a short time of effectiveness of new solutions or conflictive objectives of different stakeholders. Two carriers (10.53%) were not able to determine if it was probable.

Q6 was a closed question aimed at indicating which area within the city logistics measures was the most important to be coordinated. One individual and one authority representative thought stakeholders' engagement was essential for achieving this purpose. Six persons, according to their previous response for Q4, pointed at the regulatory measures as the uppermost ones. The most popular answer was the infrastructure investments (nine people from different stakeholder groups, 47.37%). In the opinion of one individual, the new technology were the prime area of concern and for another individual—the eco-logistics.

The responses to Q2, Q3, Q5, and Q6 were also the variables for the further statistical analyses presented in 5.2 and 5.3.

5.2. AHP Results

Calculating the AHP matrix aimed at indicating which of the presented criteria are the most important for the whole interviewed group and which are the most important for the specified subgroups. Taking into consideration all respondents, three criteria were essential: RedLoss, RedNoise1, and HealthBen (see Table 5). The interviewees care the most about reducing environmental losses by implementing eco-friendly solutions such as reusing and recycling of materials. This element was the most vital for them. The second and third ones were related to the use of eco-friendly solutions, namely the modal choice concentrated on minimizing noise and improving air quality.

Table 5. Results of the AHP calculations (matrix of priorities) *.

Variable/Subgroup	All	Forwarders	Carriers	PT Operator	Individuals	Entrepreneurs	Local Government
RedEmiss	0.0546	**0.1423**	**0.1551**	0.0202	0.0162	0.0391	0.0180
RedNoise1	**0.1297**	**0.1423**	**0.2176**	0.0823	0.0355	**0.1307**	0.0369
RedNoise2	0.0546	**0.1423**	0.0916	0.0202	0.0162	**0.2433**	0.0369
RedWaste	0.0660	0.0560	0.0402	**0.2647**	0.0797	0.0391	0.0654
RedCong	0.0152	0.0133	0.0152	0.0202	0.0162	0.0158	0.0180
RedAcc	0.0256	0.0210	0.0271	0.0202	0.0355	0.0391	0.0369
RedLoss	**0.3141**	0.0560	0.0777	0.0823	**0.3637**	**0.1307**	**0.1948**
EcoFuel	0.0487	0.0210	0.0152	**0.2647**	0.0797	0.0247	**0.1022**
Safety	0.0162	0.0103	0.0087	0.0202	0.0797	0.0119	0.0654
HealthBen	**0.1143**	**0.2528**	**0.2176**	0.0823	0.0162	**0.1307**	0.0180
LifeQual	0.0546	0.0881	0.0916	0.0202	0.0355	**0.1307**	0.0180
CoopStrat	0.0546	0.0334	0.0271	0.0823	0.0797	0.0391	**0.1948**
UseRes	0.0519	0.0210	0.0152	0.0202	**0.1461**	0.0247	**0.1948**

* the bold in the table indicates the highest values in the category.

The detailed assessment for subgroups was differentiated, although some similarities occurred. Firstly, private companies (forwarders, carriers, entrepreneurs) focused more on the reduction of noise (both for fauna life and city dwellers), promoting quiet transport modes that can be related with their own business. From their perspective, this kind of action is the closest to their companies. For transport companies, the reduction of gas emissions was also important, probably because they are producers of such emissions and are obliged to control this area. Public transport operators also cared

about using eco-friendly fuels and transport modes, but from another point of view than the previous stakeholders—producing less waste being a result of intensive use of means of transport.

The environmental losses were also a concern for individuals (the most important group), entrepreneurs (the second most crucial group ex aequo with three others) and local government (ex aequo with two others as the most vital group). Entrepreneurs highly valued improving the level of well-being of individuals and societies, thus, they are closely associated with local society. In turn, the local government had a very diverse scope of actions because it has to care about the overall activity in the area: business activities, the life of residents, issues relevant to city users, legal issues, etc. This stakeholders' subgroup, aside from the environmental issues mentioned earlier, was interested in cooperation strategies of all the stakeholders within the city logistics system to care for the natural resources. Individuals present a similar approach in this matter (use of resources).

Surprisingly, the reduction of congestion was not so important for all the subgroups as expected. Usually, when respondents have to say what is the biggest problem in urban logistics, congestion and traffic jams were the main topics indicated by respondents. A similar situation applies to the reduction of accidents and increasing safety.

5.3. Results of the Statistical Analysis

As indicated in Section 5, the kinds of gathered data determined the choice of the statistical tool. Therefore, the analysis of results was divided into a few parts. Firstly, the correlation analysis was made for the variables from Q7 (the only scale question). Before presenting the research results, it has to be indicated that different stakeholders demonstrated different opinions based on their own priorities (private stakeholders) and the priorities of the city users (public ones).

The rho-Spearman test and tau-Kendall's correlation tests were made in order to check the potential correlations between the ordinal variables (see Table 6). As the results of Kendall's tau presented far more correlations between variables than Spearman's rho, only correlations indicated as statistically important by both tests were presented here. It appeared that the higher the rate for the reduction of greenhouse emissions, the higher priority was given to the reduction of noise and accidents. It was also more important to inform about the health benefits of environmental sustainability investments and increasing the quality of life within the city area. Respondents who valued health benefits more than other variables also highly rated the quality of life and reduction of emissions. The higher the value of cooperation strategy for particular stakeholder, the higher it was for using eco fuels. Those who cared about the reduction of noise were interested more in the reduction of emissions, improving health benefits and quality of life. Therefore, it is visible that the same persons rated few elements high: reduction of emissions, noise, accidents, informing about health benefits, increase in quality of life, intensifying cooperation strategy, and using eco fuels. Those were probably the younger interviewees, because the older the respondent, the lower their care was for reduction of emissions and noise, but the higher their care for safety. They, in turn, wanted more reduction of congestion and were also more interested in the reduction of accidents and losses.

There were no correlations with the reduction of waste, using resources. Those areas were not correlated with any other environmental sustainability variable.

Staying in the area of possible correlations, the potential relationship between nominal variables was examined with the chi-square independence test (see Table 7). The analysis proved the correlation between the opinions of people from different cities and subgroups. Representatives of different cities responded differently about the need for coordination of city logistics and about who should be responsible for such coordination if it was possible to reduce the negative impact of transportation in cities. This is probably the effect of different characteristics of the member cities of the Tricity conurbation with their different profiles. Moreover, different stakeholder subgroups had different opinions about the same areas compared to different city representatives and about the most important element of environmental sustainability policy according to city logistics. Gender and category of the stakeholder (private/public) did not differentiate the answers of the interviewees.

Table 6. Results of rho-Spearman and tau-Kendall calculations *.

Rho-Sp	RedEmiss	RedNoise1	RedNoise2	RedWaste	RedCong	RedAcc	RedLoss	EcoFuel	Safety	HealthBen	LifeQual	CoopStrat	UseRes
RedEmiss	1.000	0.907	0.872	0.224	0.253	0.514	0.015	0.021	−0.389	0.891	0.889	0.152	−0.215
RedNoise1	0.907	1.000	0.870	0.266	0.250	0.378	0.033	0.150	−0.285	0.921	0.928	0.172	−0.293
RedNoise2	0.872	0.870	1.000	0.318	0.251	0.410	−0.053	−0.021	−0.433	0.849	0.826	0.094	−0.222
RedWaste	0.224	0.266	0.318	1.000	0.122	0.011	0.266	0.318	0.144	0.200	0.129	0.234	0.088
RedCong	0.253	0.250	0.251	0.122	1.000	0.520	0.425	−0.353	−0.121	0.372	0.166	−0.145	−0.092
RedAcc	0.514	0.378	0.410	0.011	0.520	1.000	0.359	−0.242	−0.253	0.490	0.442	−0.078	−0.070
RedLoss	0.015	0.033	−0.053	0.266	0.425	0.359	1.000	−0.077	0.553	−0.055	0.009	−0.107	0.248
EcoFuel	0.021	0.150	−0.021	0.318	−0.353	−0.242	−0.077	1.000	0.355	0.111	0.179	0.661	0.211
Safety	−0.389	−0.285	−0.433	0.144	−0.121	−0.253	0.553	0.355	1.000	−0.430	−0.254	0.131	0.408
HealthBen	0.891	0.921	0.849	0.200	0.372	0.490	−0.055	0.111	−0.430	1.000	0.842	0.043	−0.363
LifeQual	0.889	0.928	0.826	0.129	0.166	0.442	0.009	0.179	−0.254	0.842	1.000	0.296	−0.166
CoopStrat	0.152	0.172	0.094	0.234	−0.145	−0.078	−0.107	0.661	0.131	0.043	0.296	1.000	0.261
UseRes	−0.215	−0.293	−0.222	0.088	−0.092	−0.070	0.248	0.211	0.408	−0.363	−0.166	0.261	1.000
tau-b Ken	**RedEmiss**	**RedNoise1**	**RedNoise2**	**RedWaste**	**RedCong**	**RedAcc**	**RedLoss**	**EcoFuel**	**Safety**	**HealthBen**	**LifeQual**	**CoopStrat**	**UseRes**
RedEmiss	1.000	0.853	0.794	0.204	0.229	0.471	0.016	0.017	−0.345	0.830	0.821	0.125	−0.188
RedNoise1	0.853	1.000	0.801	0.234	0.218	0.332	0.030	0.127	−0.237	0.864	0.885	0.134	−0.252
RedNoise2	0.794	0.801	1.000	0.278	0.227	0.365	−0.048	−0.025	−0.362	0.754	0.760	0.049	−0.195
RedWaste	0.204	0.234	0.278	1.000	0.110	0.010	0.238	0.283	0.142	0.173	0.116	0.212	0.081
RedCong	0.229	0.218	0.227	0.110	1.000	0.515	0.395	−0.325	−0.112	0.343	0.152	−0.130	−0.089
RedAcc	0.471	0.332	0.365	0.010	0.515	1.000	0.330	−0.216	−0.237	0.448	0.396	−0.059	−0.070
RedLoss	0.016	0.030	−0.048	0.238	0.395	0.330	1.000	−0.067	0.518	−0.031	0.008	−0.100	0.213
EcoFuel	0.017	0.127	−0.025	0.283	−0.325	−0.216	−0.067	1.000	0.340	0.105	0.155	0.606	0.187
Safety	−0.345	−0.237	−0.362	0.142	−0.112	−0.237	0.518	0.340	1.000	−0.353	−0.225	0.119	0.368
HealthBen	0.830	0.864	0.754	0.173	0.343	0.448	−0.031	0.105	−0.353	1.000	0.758	0.040	−0.306
LifeQual	0.821	0.885	0.760	0.116	0.152	0.396	0.008	0.155	−0.225	0.758	1.000	0.243	−0.142
CoopStrat	0.125	0.134	0.049	0.212	−0.130	−0.059	−0.100	0.606	0.119	0.040	0.243	1.000	0.212
UseRes	−0.188	−0.252	−0.195	0.081	−0.089	−0.070	0.213	0.187	0.368	−0.306	−0.142	0.212	1.000

* the color red in the table indicates statistically important results with $p < 0.05$.

Table 7. Results of chi-square independence test*.

	Q2		Q3		Q5		Q6	
	Chi-Sq	***p*-Value**	**Chi-Sq**	***p*-Value**	**Chi-Sq**	***p*-Value**	**Chi-Sq**	***p*-Value**
gender	6.500	0.994	8.583	0.969	9.667	0.942	16.550	0.554
city	50.500	0.000	47.083	0.000	37.500	0.005	11.617	0.866
subgroup	183.000	0.000	79.583	0.000	147.667	0.000	62.033	0.000
category	4.500	0.999	8.583	0.969	7.667	0.983	18.950	0.395

* the color red in the table indicates statistically important results with $p < 0.05$.

For the comparison of two groups with the ordinal dependent variable, a Mann-Whitney U test was performed (see Table 8). In this regard, two independent nominal variables were taken into consideration: gender and stakeholder category. The analysis presented the significant relations for similar ordinal variables than before in the correlation analysis. While gender did not matter when answering questions, a different was found here. For women, the reduction of emission, noise, health benefits, and quality of life were more important than for men (for women, those ratings were between 4.5 and 4.83; for men, between 3.08 and 3.46). On the other hand, men were focused on safety more than women were (for men 4.77 and for women 4.0).

Table 8. Results of the Mann-Whitney U test *.

	Gender vs.				Public/Private Stakeholder vs.			
	Z	***p***	**Z (corr.)**	***p***	**Z**	***p***	**Z (corr.)**	***p***
RedEmiss	−2.061	0.039	−2.195	0.028	−1.950	0.051	−2.077	0.038
RedNoise1	−2.193	0.028	−2.260	0.024	−1.650	0.099	−1.701	0.089
RedNoise2	−1.886	0.059	−1.986	0.047	−1.600	0.110	−1.685	0.092
RedWaste	−0.132	0.895	−0.143	0.886	−0.350	0.726	−0.381	0.703
RedCong	0.219	0.826	0.285	0.776	−0.950	0.342	−1.235	0.217
RedAcc	−0.219	0.826	−0.259	0.796	−1.650	0.099	−1.947	0.052
RedLoss	1.052	0.293	1.108	0.268	−1.350	0.177	−1.421	0.155
EcoFuel	−0.044	0.965	−0.047	0.962	0.650	0.516	0.701	0.483
Safety	1.710	0.087	2.084	0.037	−0.050	0.960	−0.061	0.951
HealthBen	−2.368	0.018	−2.476	0.013	−1.600	0.110	−1.673	0.094
LifeQual	−2.061	0.039	−2.148	0.032	−2.350	0.019	−2.449	0.014
CoopStrat	0.482	0.630	0.518	0.605	0.100	0.920	0.107	0.915
UseRes	1.009	0.313	1.108	0.268	−0.100	0.920	−0.110	0.913

* the color red in the table signifies statistically important results with < 0.05.

There were fewer differences between private and public stakeholders. The public ones gave higher rates for the need for reduction of emissions (5.0) than the private ones (3.6). Additionally, improving the quality of life of city users was more important for public stakeholders (5.0) than for the others (3.53). These results were probably high for the public stakeholders because their mission is to help the city users and meet their requirements. It is interesting why such differences did not occur in the case of other variables.

The multiple-group comparison was made by use of the Kruskal-Wallis test. When the non-significant results occur, the results of the interview are similar or the same regardless of the group. In this analysis, two nominal variables were considered as independent—subgroup of stakeholders and the age of the respondents. Looking at the calculations (see Table 9), it is clear that the representatives of different stakeholder groups valued different reductions of emissions, noise, informing about health benefits, and improving quality of life. For shippers, carriers, and entrepreneurs (to a lesser extent) those were not as important as for the other interviewees. Maybe this is a result of their professional activity—they are focused on business issues, not environmental ones. It is important

to present the environmental policy in such a way to increase their interest in sustainability. There is a need for them to perceive environmental issues as important and beneficial for their businesses.

Table 9. Results of Kruskal-Wallis test *.

Subgroup vs.	KW	*p*	Age vs.	KW	*p*
RedEmiss	14.573	0.012	RedEmiss	9.599	0.022
RedNoise1	12.509	0.028	RedNoise1	7.168	0.067
RedNoise2	14.917	0.011	RedNoise2	8.928	0.030
RedWaste	4.200	0.521	RedWaste	2.206	0.531
RedCong	4.738	0.449	RedCong	1.405	0.705
RedAcc	7.267	0.202	RedAcc	1.692	0.639
RedLoss	7.516	0.185	RedLoss	3.928	0.269
EcoFuel	3.300	0.654	EcoFuel	5.164	0.160
Safety	10.406	0.065	Safety	11.225	0.011
HealthBen	13.801	0.017	HealthBen	7.743	0.052
LifeQual	11.971	0.035	LifeQual	6.668	0.083
CoopStrat	0.655	0.985	CoopStrat	3.725	0.293
UseRes	6.862	0.231	UseRes	4.206	0.240
Q2	9.692	0.084	Q2	3.749	0.290
Q5	5.004	0.415	Q5	0.756	0.860
Q6	2.652	0.753	Q6	0.038	0.998

* the color red in the table signifies statistically important results with < 0.05.

When looking at the age groups, reduction of emissions and noise were also observed as significant, as was safety. However, the reduction of emissions and noise were more important for younger respondents while safety was more important for older ones. There is a conflict of interests between the different age groups. The younger respondents are more focused on environmental issues and the older respondents are more focused on their own needs. This is also an area for actions to inform the older about the benefits of clearer air and water for their own health.

The analysis of the results of Kruskal-Wallis for some other variables is pointless in this respect because no results are statistically significant. Therefore, it is enough to indicate that Q3, Q5, and Q6 are not significant and do not influence the creation of the RedEmiss to UseRes variables.

6. Discussion

The environmental part of sustainability turns out to be crucial not only for the present but also for future generations. Therefore, controlling and assessing the city logistics activities becomes the necessary condition for the quality of life in cities.

Comparing the research results with existing literature is not easy, mainly because the issue of sustainable development has been investigated in its all three dimensions (economic, social, environmental). Additionally, some of them refer only to the opinions of freight transport stakeholders. However, fragmentary comparisons with already presented research confirm the obtained results. In some papers, younger people are more focused on environmental issues [111–113], and similarly, women are more eco-oriented than men [113–115]. Moreover, the obtained results confirm that the authorities in cities are most dedicated to environmental development [114–119].

The results of conducted interviews within the general questions allow to present the similarities and differences between the particular respondents. Stakeholders interviewed by the authors most often understood CL as managing and improving flow processes within the urban areas. In comparison with published literature, where CL is mostly associated with freight transportation [1,17] and rarely with passengers transport [17,21,22], responders perceived CL in a holistic way as a coordination of the flow of freight and people within the city [4,17,30,52]. Additionally, they often find the coordination of passengers and cargo flows in cities necessary, with the municipalities responsible for these processes—this was already confirmed in other research [3,120].

Several surveys that have been dedicated to CL measures, presenting opinions of the respondents similar to those obtained from the interviewees in this study. According to those sources, minimizing the external costs is not easy but possible with the help of dedicated infrastructural solutions [121,122]. Other studies that are focused on various solutions, improving flows in cities or on systematizing them, present CL measures as related to material infrastructure, immaterial infrastructure, special equipment, or governance [45,123]. CL solutions are also treated as measures initiated by public authorities and policy makers in areas of infrastructure development, distribution centers, regulatory measures, traffic management measures, or land-use zoning [51,71,124,125]. They all demonstrate that infrastructural solutions tend to be most effective in improving CL. This result was also confirmed in this article.

Comparing this study to the cited sources with similar research scopes, it is evident that the main advantages of the presented study are a holistic approach related to all stakeholders of the urban logistics system, multiple methods applied in the research process, and a detailed analysis of environmental sustainability criteria in relation to CL measures.

7. Conclusions

Urban transport is essential not only for economic growth but also for caring for the environment. All logistics activities within the cities have to be organized in a way to allow the flow of passengers and goods to be efficient while meeting the conditions of environmental friendliness.

To sum up the findings, it is worth noticing a few identified results. Firstly, city logistics is perceived by the respondents as managing the operations within the city, especially the transport of people and goods, as well as optimizing, improving, and organizing those operations. Secondly, the interviewees see the need for coordination of the city logistics processes, and mostly, they indicate that the local authorities are responsible for this area. Thirdly, according to them, the reduction of the negative impact of transportation on city areas is possible and requires the creation of legal restrictions, investments, and the implementation of sustainable solutions. Among the main measures for improving city logistics, they indicate infrastructure investments and legal instruments. Fourthly, the environmental aspect of sustainable urban logistics is essential for all stakeholders, but in different aspects. The most important variables within environmental city logistics and correlated with others were the reduction of greenhouse emissions, of noise, informing about the health benefits and improving the quality of life. The younger the respondent, the more focus on environmental issues but not on a reduction of waste and losses. However, there were some significant differences between respondents from different cities. Fifthly, there are differences between genders. Women are more eco-oriented than men, who are in turn more focused on safety. On the other hand, public stakeholders are more eco-oriented than private ones. Finally, for business-oriented stakeholders, the environmental issues are less critical than for the remaining ones. Surprisingly, congestion and traffic were not indicated as the most important as it used to be in other literature sources.

The result of this study is a valuable insight not only for the local authorities but also for many stakeholders and groups operating within the city and, in many cases, cooperating within creating sustainable urban mobility plans. This should also be interesting for the researchers focusing on the urban logistics stakeholders. Policymakers are obliged to pay special attention to improving the quality of life, reducing noise, and environmental losses (e.g., by limiting the liquidation of green areas for housing). They should analyze the trade-offs resulting from different priorities of all parties and try to keep the balance between them. One of the approaches of such action is organizing open meetings for all stakeholders to agree with the elements of sustainable urban mobility plans.

This study definitely increases awareness about the priorities of different stakeholders. There is a need to reconcile the goals of many parties and build a strategy for the whole city and suburban zones based on environmental sustainability, perceived as very important by the youngest generations. The way to improve the city logistics in environmental sustainability area is very long and challenging but worth fighting for. The set of tools possible to implement is wide and the most important ones seem to be legal regulations and various investments, especially in infrastructure. Combining many solutions for meeting the needs of stakeholders will require many trade-offs and analyses, but is possible.

This study has one strong limitation. Using the interview and Delphi methods allows for very limited analysis of the stakeholders in cities that, in this case, has been amplified by surveying the representatives of only three cities. Additionally, the samples from the cities are not proportional to the number of inhabitants. Therefore, this study can be called a panel study and its results obviously cannot be extrapolated to the whole population. The research results are only a reference point for other researchers. However, the study is compatible with the Delhi method and the authors adhered to the rules of the chosen research approaches rigidly to achieve the highest possible reliability.

The authors believe this paper will start a new direction in the scientific discussion about city logistics measures and environmental sustainability and increase the interest in text mining and correlations analysis in social sciences.

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Appendix A

Table A1. Criteria assessment (Q7).

Respondent	RedEmiss	RedNoise	LessLoss	LessCong	RenewFuel	Safety	HealthBen	LessTraff	LifeQual	LifeLevel	CoopStrat	UseRes	LessCong
SP1	3	3	3	5	5	5	2	4	3	4	5	4	4
SP2	3	3	4	5	4	5	3	5	3	3	4	5	5
SP3	3	3	4	5	4	5	3	4	3	3	3	4	5
Prz1	1	1	4	5	3	5	1	4	2	2	3	4	5
Prz2	2	2	2	5	5	5	1	3	3	3	5	5	3
Prz3	2	1	2	4	4	5	2	4	2	2	3	3	4
OrgPT	5	4	4	5	3	5	4	5	5	5	4	5	5
Indv1	5	5	2	5	5	5	5	4	5	5	5	4	5
Indv2	5	4	3	5	4	4	5	5	5	4	4	3	5
Indv3	5	4	2	5	3	3	4	4	5	4	3	4	4
Indv4	4	4	2	5	4	4	5	4	5	4	3	4	5
Indv5	4	4	2	4	3	3	4	4	4	4	4	3	5
Indv6	5	5	3	5	4	4	5	5	5	5	4	3	5
Ent1	3	2	3	5	3	5	2	4	2	2	3	4	5
Ent2	4	3	4	5	5	5	3	4	3	3	5	5	5
Ent3	5	5	3	5	5	5	5	4	4	5	4	4	4
LG1	5	5	4	5	4	5	5	4	5	5	4	3	5
LG2	5	5	5	4	4	5	5	5	5	5	3	4	5
LG3	5	4	2	5	4	3	5	5	4	5	4	4	5

Table A2. Respondents responses (Q1–Q6).

Q1. How Do You Understand City Logistics Issues?	
SP1	Efficient supply for residents
SP2	Processes that aim to optimize the transport of people and goods throughout the city
SP3	Freight transportation in cities
Prz1	Optimization of people and goods transport in cities
Prz2	Transport of goods and people
Prz3	Improving passenger transport in cities
OrgPT	Optimization of urban flows of people and goods
Indv1	Organization of passenger transport
Indv2	Improving and coordinating the flow of people and cargoes in urban areas
Indv3	Urban transport in cities and its improvement
Indv4	Urban transport of people and goods
Indv5	Providing city dwellers and businesses with the things they need
Indv6	Organization of city life, e.g., urban transport, deliveries to shops
Ent1	Ordering materials for offices, organizations and companies in the city, urban transport
Ent2	Organizing transport in the city, truck flow, infrastructure, cooperation with ports, railways, city hall
Ent3	Organizing the functioning of the city
LG1	All matters dealing with the flow of people and cargoes in the city, storage of goods and warehouse management, waste management, office and home removals, and home delivery services
LG2	All processes taking place in the city regarding the transport of people and goods
LG3	All matters related to the delivery system, mobility solutions in cities in the field of transport
Q2. Can You See the Need for Coordination of City Logistics Processes?	
SP1	Coordination in the transport of people is necessary
SP2	Yes, it is necessary
SP3	It is necessary
Prz1	I see this necessity
Prz2	Self-regulation is the best
Prz3	There is a need for its coordination
OrgPT	Yes
Indv1	Yes
Indv2	Yes
Indv3	I think so
Indv4	Yes
Indv5	Yes
Indv6	Yes, someone has to coordinate it
Ent1	Yes, but no one probably does it
Ent2	Yes, special units in city offices
Ent3	Yes
LG1	Definitely yes
LG2	Yes, I think it is an area not fully developed by the city authorities
LG3	Yes, necessarily

Table A2. *Cont.*

Q3. By Whom City Logistics Processes Should Be Coordinated?	
SP1	Public entity
SP2	Local government
SP3	Local government
Prz1	Public entity
Prz2	Hard to say
Prz3	Public authorities
OrgPT	Public authorities
Indv1	By municipalities
Indv2	By public administration
Indv3	I do not know
Indv4	Public transport operator
Indv5	Local government
Indv6	I don't know, probably someone in the local government
Ent1	Special person designated by the local government
Ent2	A special unit in the city hall (local government) in cooperation with governmental authorities dealing with transport
Ent3	Public authorities (local government) and private entrepreneurs
LG1	Many entities, local government, private companies
LG2	Local government, private entrepreneurs
LG3	Local government with transport operators
Q4. What Kind of Measures Can Influence on Reducing Negative Impacts of Transportation in Cities?	
SP1	Changing urban areas functions and adjusting solutions to these needs
SP2	Adapting infrastructure to changes and creating relevant legal regulations
SP3	Maybe some legal regulations
Prz1	Implementation of eco-friendly solutions
Prz2	Better adapting the infrastructure to the needs of city
Prz3	Legal regulations
OrgPT	Implementation of IT solutions; coordination of passenger and cargo transport, incorporation of the private sector into activities of the public sector, adapting the infrastructure to the needs of city users
Indv1	Adapting the infrastructure to the needs of city users
Indv2	Instruments developed and implemented by city authorities
Indv3	Appropriate instruments implemented by the city
Indv4	Adapting infrastructure and urban transport to real needs, e.g., during rush hour
Indv5	Organizing the city space so that it would be easy to get everywhere
Indv6	Legal regulations in order to have less smog and traffic jams, and more parking spaces where needed, and if not, free urban transport in the center, where you cannot enter
Ent1	Legal regulations that will make everyone obey it
Ent2	Many aspects, e.g., legal, organizational, aiming to care for ecology, quality of life, but also the quality of doing business
Ent3	Infrastructure investments
LG1	Infrastructure investments, obviously new technologies and a team of people who will manage mobility
LG2	Development of public transport, electromobility
LG3	Infrastructure investments and sustainable development investments

Table A2. *Cont.*

Q5. Do You Find Possible to Reduce Negative Impacts of Transportation in Cities?	
SP1	Hard to say
SP2	It is possible
SP3	I do not know
Prz1	Difficult but possible
Prz2	Rather not, all implemented solutions are effective only for a short time
Prz3	I think so
OrgPT	Yes
Indv1	Impossible
Indv2	Yes, but with the right instruments
Indv3	Difficult to implement
Indv4	Yes, but officials do not care
Indv5	All goals cannot be reconciled
Indv6	I don't know, I don't think everything can be achieved
Ent1	Yes, but nobody wants to do it
Ent2	Yes, but it's very complicated
Ent3	Yes
LG1	Yes
LG2	Not completely, it is possible only partially
LG3	Yes
Q6. Which Area is the Most Important:Stakeholders Engagement, Regulatory Measures, Infrastructure, New Technologies and Eco-Logistics for Improving City Logistics System?	
SP1	Regulatory measures
SP2	Infrastructure
SP3	Infrastructure
Prz1	Infrastructure
Prz2	Infrastructure
Prz3	Regulatory measures
OrgPT	Infrastructure
Indv1	New technologies
Indv2	Stakeholders engagement
Indv3	Ecologistics
Indv4	Infrastructure
Indv5	Infrastructure
Indv6	Regulatory measures
Ent1	Regulatory measures
Ent2	Regulatory measures
Ent3	Infrastructure
LG1	Infrastructure
LG2	Regulatory measures
LG3	Stakeholders engagement

Appendix B

Table A3. Text mining results (Q1).

Phrases Containing:	
6 words	**Occurrences**
the flow of people and cargoes	2
the transport of people and goods	2
4 words	**Occurrences**
in cities optimization of	2
3 words	**Occurrences**
people and goods	5
transport in cities	3
2 words	**Occurrences**
urban transport	4
organization of	2
the flow	2
cities optimization	2
passenger transport	2
optimization of	2

Table A4. Text mining results (Q1).

Order	Word Count	Occurrences	Percentage
1	transport	12	6.35
2	city	9	4.76
3	people	8	4.23
4	goods	7	3.70
5	urban	6	3.17
6	cities	5	2.65
7	flow	3	1.59
8	improving, passenger, organization, home, processes, delivery, optimization, organizing, cargoes, management, matters	2	1.06
9	flows, residents, truck, companies, ordering, optimize, life, warehouse, hall, railways, waste, dwellers, mobility, place, office, removals, infrastructure, providing, improvement, transportation, offices, organizations, services, supply, materials, freight, shops, coordinating, solutions, businesses, system, storage, efficient, cooperation, deliveries	1	0.5291

Table A5. Text mining results (Q4).

8 words	Occurrences
adapting the infrastructure to the needs of city	2
6 words	**Occurrences**
adapting the infrastructure to the needs	3
4 words	**Occurrences**
legal regulations implementation of	2
2 words	**Occurrences**
legal regulations	5
infrastructure investments	3
adapting infrastructure, urban transport, regulations implementation, city users, quality of	2

Table A6. Text mining results (Q4).

Order	Unfiltered Word Count	Occurrences	Percentage
5	infrastructure	8	3.96
6	city	6	2.97
7	legal	6	2.97
8	adapting	5	2.48
9	regulations	5	2.48
10	needs	5	2.48
11	transport	4	1.98
12	investments	4	1.98
13	urban, solutions	3	1.49
21	development, public, users, sector, quality, instruments, implementation	2	0.99

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