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Priorities of Urban Transport System Stakeholders According to Crowd Logistics Solutions in City Areas. A Sustainability Perspective

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Abstract: This article presents assessment results for the priorities of different urban logistics stakeholders in order to launch crowd logistics (CL) solutions within a city area. Additionally, this analysis was conducted by using various dimensions of sustainable city development. The unique character of this study lies in presenting the priorities of the interviewed stakeholders. Therefore, the purpose of this publication is to analyze the priorities of various stakeholders in relation to the introduction of CL solutions within a city area. The reason for such analysis is the rapid development of a large number of sharing-economy initiatives, including services. For this study, a few methods were used to achieve the research goal. Firstly, text mining and text analysis methods were implemented to analyze the opinions of the interviewees. Then, two chi-square tests allowed us to determine whether the groups of stakeholders are statistically different or not. Finally, the AHP (analytic hierarchy process) and DEMATEL (decision making trial and evaluation laboratory) methods were applied in order to define the priorities of the stakeholders. The needs of particular groups of respondents were derived from the interview based on the questionnaire. The results of the analysis allow for defining the demand characteristics for CL solutions by presenting the areas that are crucial for particular groups of stakeholders.

Keywords: urban logistics; urban transport; stakeholder analysis; crowd logistics; sharing economy; sustainable development; sustainable city; urban freight; MDCM

1. Introduction

Cities are major drivers of economic development, mostly by providing infrastructure, and by supporting activities and services. Currently, about 52% of the world's population lives in cities, though it is estimated that by 2050 this level will reach 67% (see Table 1) [1].

Table 1. World's population by size class of settlements, 2016 and 2030 (forecast).

Area	2016			2030		
	Number of Settlements	Population (million)	Percentage of the World Population	Number of Settlements	Population (million)	Percentage of the World Population
URBAN	–	4.034	54.5	-	5.058	60.0
10 m or more	31	500	6.8	41	730	8.7
5 to 10 m	45	308	4.2	63	434	5.2
1 to 5 m	436	861	11.6	558	1.128	13.4
500,000 to 1 m	551	380	5.1	731	509	6.0
Fewer than 500,000	-	1.198	26.8	-	2.257	26.8
RURAL		3.371	45.5		3.367	40.0

Source: references [1,2].

The urbanization and population growth, as well as the rapid development of e-commerce and growing expectations of customers, cause cities to have to face an increasing demand for different types of mobility. The growing number of passengers and freight transport causes many problems related to sustainability, including congestion, noise, pollution, an increase in transportation costs, and growing risk of road accidents [3]. According to the data of the European Commission, the congestion cost for European cities accounts for about EUR 100 bn annually [3,4].

Therefore, transport within urban areas is essential to maintain their economic life, but, at the same time, it is a source of certain inconveniences, such as external effects (costs) [5]. All transport operators running their businesses in cities experience problems related to transport policy, customer service, and above all congestion, which is considered as a negative economic result of urbanization [6–8]. To respond to these problems and requirements, the European Union focuses on the development of sustainable urban mobility by introducing various formal directives and legislation. In White Papers, specific scopes for sustainable transport have been developed. Following the European Commission's directives, the implementation of improvement measures in the Sustainable Urban Mobility Plans (SUMPs) is already being carried out [5,9–14].

Additionally, in order to solve the problems associated with urban transport systems and to ensure there is effective, socially-friendly, and sustainable transportation within urban areas [11,15], many innovative solutions and initiatives in urban logistics have been introduced. One of the main scopes of city logistics is the optimization of mobility within the cities and suburban zones in order to reduce flows of vehicles and, at the same time, reduce external costs. The answer to those needs can be crowd logistics (CL) solutions [6,11,12,16–18].

Most of these solutions focus on passengers or freight flows [6,7,19,20] and because of a lack of holistic and comprehensive views, they are treated separately. The growing interest in shared passenger and freight transportation practices indicates that a significant opportunity for improving city competitiveness could be found in combining both [6] in order to provide a comprehensive solution for demanding urban residents.

This paper aims to understand the potential for crowd logistics solutions, which entails answering the following research questions:

RQ1. What are the stakeholders' opinions about city logistics problems?

RQ2. What are their priorities towards the implementation of crowd logistics services within urban areas?

Those two research questions were addressed through the results of the semi-structured interviews with the chosen stakeholders from all the identified groups in the Tricity Area (Poland).

The structure of the paper is as follows. Firstly, the literature review results are described to present the origin and the main characteristics of CL solutions. Then, the methodology of the research is featured, followed by the research results containing the priorities of stakeholders in the field of sustainable urban logistics, including launching CL solutions. The last parts of the paper discuss the results, conclude the paper, and provide possible future research directions.

2. Literature Review

The crowd logistics concept has its origin in the idea of the sharing economy or resources sharing (including assets sharing). It includes collaborative consumption enabled by the activities of sharing and exchanging of resources without needing to purchase them [17,18,21,22]. The rise of the sharing economy makes it possible to use goods and services that were not deemed to be assets before [23,24]. Consequently, new models have emerged based on access to, rather than ownership of assets [25–28]. Moreover, the CL term comes from the term crowdsourcing. Crowdsourcing relates to the global sharing economy, which refers to an economic system based on sharing underused assets [29,30] or the potential for providing services for free or for a small fee [31,32]. The sharing economy is treated as an umbrella term for:

- collaborative consumption [12,33–36],

- crowdsourcing [37–39],
- assets-based consumption [32].

It contains new forms of distributed production or consumption facilitated by new forms of technology and brings people together in new ways [36,40,41]. Actually, the idea of sharing is not a new one, because in the 19th century the English mathematician and engineer Charles Babbage hired a crowd to assist him with computing astronomical tables [42,43].

The crowdsourcing term is derived from the words "crowd" and "outsourcing" [27,44,45] and was popularized by Howe (2006). According to his approach, it is a kind of an outsourcing strategy where a company places an open call to an undefined group of people (the crowd) to perform a task that could have been carried out without their assistance [29,30,36]. The crowd is defined as a mass of people and outsourcing describes a shift of processes, functions, and duties to third parties [37]. The number of people constituting the crowd could be varied but will depend on the type of crowdsourcing initiative. As such, the characteristics, number, heterogeneity, and knowledge of individuals will be determined by the requirements of the special CL solution [46,47].

Various types and implementation models of crowdsourcing have emerged on the market. Many of them are related to logistics [47,48]. It is worth noting that nowadays, the strength of sharing has been enabled by the Internet and the new technologies [33,43,49] that bring many possibilities for [49,50] developing similar solutions in the logistics area and in other areas.

Crowd logistics is alternatively referred to as:

- crowd shipping [51,52],
- crowdsourced delivery [53,54],
- cargo hitching or collaborative delivery [6,47].

In crowd logistics, logistics is the actual purpose of the crowdsourcing initiative [40,50]. Within crowd logistics initiatives, the platform is used to sell logistics services provided by individuals. Its role is essential because it enables individuals' logistical resources to be shared and optimized [10,40].

Crowd logistics is a concept of sharing services such as transportation that aims to improve efficiency and sustainability of the way objects are moved, stored, supplied, and utilized across the world by applying concepts from internet data transfer to real-world shipping processes. Moreover, crowd logistics relates to a network because technology enables passengers to use the capacity in their vehicles more efficiently, including by carrying parcels for others [7,55]. According to a quite comprehensive approach, several conditions within crowd logistics concept have to be addressed such as technological infrastructure, free capacity, the crowd network, compensation, and voluntary character [50].

The most common and complex definition of the crowd logistics term says that "crowd logistics designates the outsourcing of logistics services to a mass of actors, whereby the coordination is supported by technical infrastructure" [20,56]. The main aim of crowd logistics—according to this approach—is to achieve economic benefits for all stakeholders or shareholders. A growing interest in describing different types of CL definitions or various CL initiatives does not go hand in hand with investigating the advantages of CL solutions (see Table 2).

Table 2. Advantages of CL solutions.

Benefits of CL Solutions	Sources
For consumers:	
Reduced time of delivery	[22,57–59]
Reduced cost of mobility	[6,60]
Better access to service	[61,62]
For authorities:	
More safety	[40,63,64]
Reduction in emissions	[22,65–67]
For society:	
Less congestion and traffic	[66–70]
Less noise	[43,65,69]
Health benefits	[6,65]
Increased employment possibilities	[70,71]
For CL solutions providers:	
Less waste	[6,72,73]
Effective use of loading space	[74–76]
Extra capacity	[74–76]

The crowd logistics concept can be applied within various crowd-sourced services. According to the research conducted by Sampaio et al. [50], the main identified types of CL services are:

- crowdsourced delivery (door-to-door and store-to-door), dedicated to freight deliveries [6,43,61,77].
- cargo-hitching services—where the spare capacity of public transport is used for freight transportation [78,79].

In the concept of Buldeo Rai's et al. [73], the most common CL solutions were divided into five types:

- a business marketplace,
- a community marketplace,
- a flex work platform,
- a commissionaire platform,
- a logistics marketplace.

They all differ from each other based on several key factors: the direction of flows (B-to-B, B-to-C, C-to-C), and the characteristics of the crowd engaged (professional, or non-professional). In a business marketplace CL type (B-to-B), the demand and supply for transportation services of companies underpins their ability to use their spare capacity and to optimize their cargo flows. A community marketplace (B-to-C or C-to-C) is characterized by the non-professional crowd engaged, mainly involving existing flows and passengers being transported in ways that optimize irregular good flows. A flex work platform (B-to-C or C-to-C) is dedicated to providing a supply of flexible workers to help meet demand for logistical services. A commissioner platform (B-to-C flows), using professional and non-professional crowds, is intended for facilitating a supply of commuters to help organize a commissioner's flow of goods in addition to delivery services by utilizing traditional LSPs (logistics service providers). A logistics marketplace (C-to-C flows) is dedicated to linking a demand for logistical services with a supply of users that can organize local flows of goods in a more environmentally friendly way.

Carbone et al. [74,80], based on the research undertaken on 57 CL initiatives, distinguished four types of CL:

- crowd local delivery,
- crowd freight shipping,
- crowd freight forwarding,
- crowd storage.

Each of these CL types creates various types of logistical value. Crowd local delivery is based on the crowd's resources like cars, vans, and bikes. It relies on making use of individual capabilities such as driving, as well as picking up goods and delivering them [14,68]. The second type of CL initiative offers shipping services but in a broader perspective—within a country or continent. The basis of these services also relies on the crowd's transport resources—mainly road vehicles (cars and vans). The next type of CL initiatives is based on using other resources related to individual mobility to make products that are unavailable in one country economically accessible [75]. The added value of crowd storage lies in property resources that are possessed by the crowd, like garages or cellars. Thus, crowd storage offers local storage services for city inhabitants.

Most popular solutions can be distinguished as [50]:

- services for people's mobility,
- services for freight delivery [26,81],
- cargo-hitching services [82,83].

It is very important to highlight that a pure crowd logistics activity should use existing flows—this is one of the necessary conditions of the phenomenon. If existing flows are used for services fulfilment, then this will contribute to more sustainable city logistics [51]. However, many popular platforms, especially for the transportation of people, operate as an intermediary for on-demand transportation services. Thus, fulfilment is realized by creating a new service, rather than exploiting the existing ones. After taking into consideration the fact that freight transport and express delivery are two of the fastest-growing industries in urban transport [7,9], and that the number of vehicles used for freight transport within cities is going to grow [17], the authors focused only on services for freight deliveries.

3. Materials and Methods

3.1. Research Framework and Criteria

The research procedure implemented in preparing this study was built upon a set of different approaches (see Figure 1). A systematic literature review was applied, based on a literature search using the chosen approaches. Boolean logic was used for the search criteria. The well-known approach of Denyer and Tranfield [77] was used, which was designed for literature analysis in the social sciences. For defining the primary literature database, several search engines were used: EBSCOhost, JSTOR, Emerald, ScienceDirect, Wiley, and MDPI. The search criteria were "crowd logistics" in the title, keywords, or abstract. This part of the study was implemented in February 2019.

Then, the text analysis was made in order to define the papers focused on assessing CL solutions. Finally, only 11 papers were included in the analysis of the assessment procedure, out of which eight indicated the individual, specific variables (see Table 3) [6,12,18,28,32,35,66,78]. In those literature sources, different research methods were used to identify and assess the criteria, mostly surveys and interviews (both with the consumers and the service providers). However, in those papers, only the individual criteria or a few of them were taken into account. There was no complex approach involving combining the three dimensions of sustainable development and the criteria contained therein. Afterwards, the second search was implemented, with "crowdsourcing" and "city" in the title, keywords, or abstract (because of the low popularity of the crowd logistics research area). However,

after the abstract review, they were not found to be compatible with the main aim of the study. That was why the results of this search were not included in the literature review preceding the preparation of the interview questionnaire.

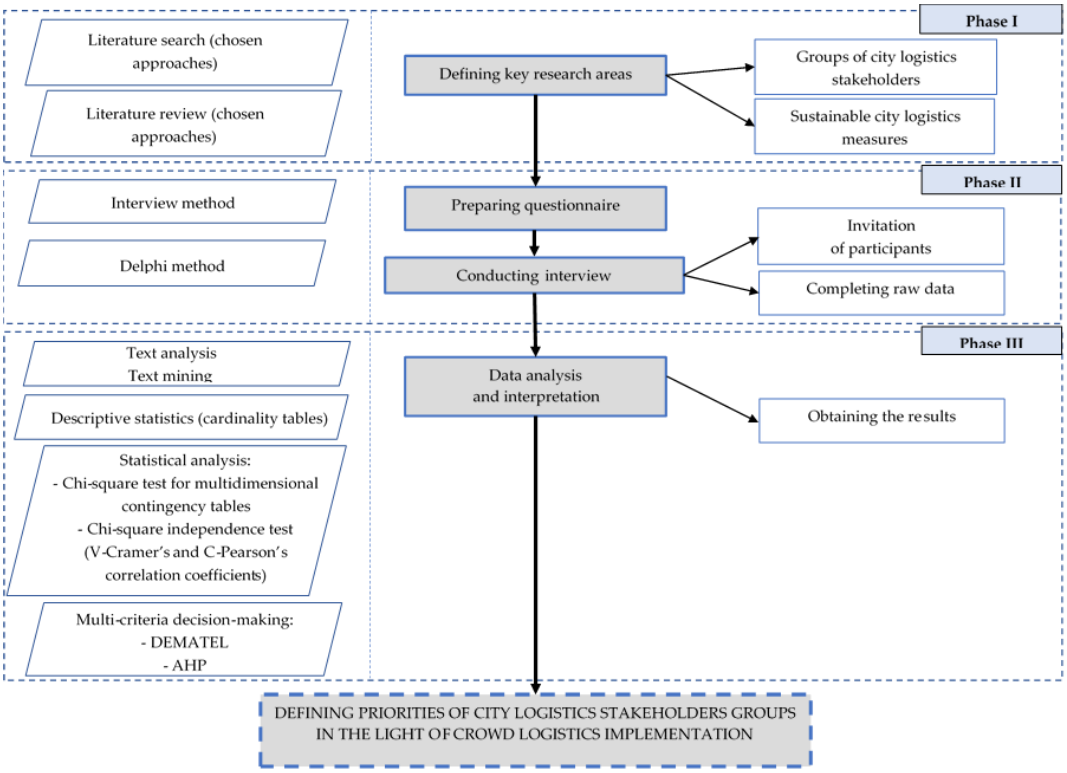

Figure 1. Research framework.

Table 3. Criteria in the research framework.

No.	Dimension	Criterion	Description	Source	Relation to CL
1	Environ-mental	Reduction of CO_2 emissions	Choosing zero- or low-emission transport modes (riding bike, walking, or public transportation)	[6,12]	Effect
2		Effective use of loading space	Reducing the number of empty runs	[12]	Cause
3		Resources use model	Enabling the service in a sustainable way by using existing resources (both owned by companies and individuals), not only cars and other forms of transport, but also mobile phones, routers, IT platforms, and social media	[12,28,32,35]	Cause
4		Reducing noise	Using quiet transport modes, recording and controlling noise, and keeping users informed about its level	[35]	Effect
5		Less waste (e.g., Tires)	Less waste caused by decreasing use of the modes of transport polluting the environment	[6,66]	Effect
6		Congestion and traffic	Less traffic caused by growing popularity of active transport modes	[28,32,66]	Cause
7	Social	Building the crowd network	Connecting business and individual providers and consumers, freelancers and cep (courier, express and parcel) service providers	[6,12]	Cause
8		Voluntary character	People self-select the logistics services they wish to use or provide	[6]	Effect
9		Tracking, transparency	The platform registers and tracks the crowd	[6]	Effect

Table 3. *Cont.*

No.	Dimension	Criterion	Description	Source	Relation to CL
7	Social	Building the crowd network	Connecting business and individual providers and consumers, freelancers and cep (courier, express and parcel) service providers	[6,12]	Cause
8		Voluntary character	People self-select the logistics services they wish to use or provide	[6]	Effect
9		Tracking, transparency	The platform registers and tracks the crowd	[6]	Effect
10		Simplicity and trust	The customer is not interested in contractual details, but does seek ordering convenience and safety	[35]	Effect
11		Safety	The security of goods has to be delivered, as well as procedures established in case there is damage	[32]	Cause
12		Health benefits	Modal choice can improve air quality and lead to better health outcomes	[6]	Effect
13		Country specifics and ethics	Culture and ethics may have an impact on the safety of transactions and delivering parcels	[12]	Effect
14	Economic	Access to adequate IT infrastructure	The IT solution (portal, mobile app) provides the opportunity to engage a broad spectrum of users	[78]	Cause
15		Free capacity, flexibility, accessibility	The CL solution can provide a range of possibilities and providers during every time and to every place or route needed	[12]	Cause
16		Attractive revenue model	Available revenue models: fixed price, resale margin, financial or matching fee, negotiated price, membership, reward, barter, and discount	[6]	Cause
17		Time of delivery	The most attractive option is same-day delivery	[12]	Cause
18		Strategy of cooperation	Effective marketing as well as cooperation on local and regional scales, which refers particularly to partnerships with IT specialists, investors and most prominently, retailers and individuals	[6,18]	Effect
19		Geographical scale	The distinction can be made between intra-urban, inter-urban, regional, national, and global scales	[6,35]	Cause
20		Insurance	Insurance for parcels when they are damaged or lost	[12]	Cause

The literature review results provided 20 criteria that are potentially important for various stakeholders and correspond with three dimensions of sustainable development—the classical approach to this issue (see Table 3). Those criteria were used to create the interview questionnaire (see Section 3.2)

3.2. Interview and Delphi Method

This paper aims to provide valuable insights to help understand the potential of crowd logistics solutions for the development of contemporary urban logistics. In order to do that, the priorities of the stakeholders should be known and addressed by the market offer. To get to know those perspectives, the semi-structured interviews were conducted in a similar way to those recognized in the literature [73,79]. The questionnaire was based on the results of the literature review and contained nine questions, including four closed questions, four open questions, and one scale question about the 20 criteria presented in Table 4.

The interviews were conducted between October and December 2019. The interviewees came from three cities of the Tricity Area (Gdańsk, Gdynia, Sopot located in Poland) and represented all the identified groups of stakeholders (see Table 4). Telephone calls were used to make initial contact with the stakeholders. They were sampled from all known stakeholders in the studied cities in order to provide insights from those with different characteristics and backgrounds, both within the public sector and the private sector. Access to the stakeholders and their willingness to participate

in the interview were very limited and that is why the Delphi method was chosen to be a part of the research approach. The usefulness and effectiveness of this method have been proven many times in scientific research on urban transport and urban logistics [80,81]. Finally, 19 stakeholders from six groups were interviewed (see Table 5). Additionally, those six stakeholder groups were categorized as public or private stakeholders. Finally, four public and 15 private stakeholders were interviewed.

Table 4. Interview questions.

No.	Question	Type of Question	Type of Analysis
Q1	Do you know the concept of the sharing economy?	Closed question (yes/no)	Descriptive statistics
Q2	Do you know the concept of crowd shipping or crowd logistics?	Closed question (yes/no)	Descriptive statistics
Q2a	Have you heard about CL solutions relating to cargo or people transportation?	Closed question (yes/no)	Descriptive statistics
Q2b	Could you give any examples of CL solutions?	Open question	Text analysis
Q3	What are the problems with freight transport in your urban area?	Open question	Text mining
Q4	Do you find preparing urban freight transport documents and procedures useful?	Closed question (yes/no/don't know)	Descriptive statistics
Q5	Who, in your opinion, should be responsible for the implementation of crowd logistics?	Open question	Text analysis, descriptive statistics
Q6	What are your predictions about the development of the crowd logistics market in the future?	Open question	Text analysis
Q7	Please assess the importance of individual dimensions of sustainable development in shaping urban logistics, including crowd logistics services.	Scale question	Multi-criteria methods

Table 5. Interviewees description.

Stakeholder Group	Stakeholder Category	Interviewed Stakeholder
Forwarders	Private	Three persons from different companies (two CEOs, one vice-CEO)
Shippers	Private	Three persons from different companies (two CEOs, one vice-CEO)
Public transport company	Public	One person—Managing Director
Individuals	Private	Six persons—three male, three female
Entrepreneurs	Private	Three persons from small companies: one from the trade sector, one from the construction sector, and one from the beauty sector
Local authorities	Public	Three persons—one person for every local authority from three cities of the Tricity: Gdańsk, Gdynia, and Sopot

The data for further analysis were derived from the transcript record of the conversations (for most of the questions asked) and responses sheets (for the single scale question) [6]. All the interviews were conducted on the basis of the interview instructions [12,73]. If the respondent did not know about the concept of crowd logistics, the interviewer was obliged to present the definition of CL and explain all the concerns and doubts raised by respondents.

3.3. Dataset Analysis

3.3.1. Text Analysis and Text Mining

Because some of the questions used in the interview questionnaire was open and the respondents were not limited in any way while answering the questions, their answers had to be transcribed. Some answers, for example, those regarding opinions on who should be responsible for implementing CL solutions, were very short. In those cases, only simple text analysis was considered as the proper option to present the results [82]. One question demanded longer answers (Q3: What are the problems with freight transport in your urban area?) and for the answers to this question, a more complicated analysis method, namely text mining, should be implemented [82,83]. For this part of the analysis, the R software ("tm" and "wordcloud" packages) was used, as well as an online word cloud generator an auxiliary tool.

3.3.2. Statistical Analysis

Since all of the analyzed variables related to the interview questions were described on nominal scales, only the chosen statistical tools could be used to analyze them. In this study, two kinds of chi-square tests were implemented. Firstly, the chi-square independence test was used twice [84]. The primary analysis was made for the stakeholders group divided into the private and public ones. The other test was calculated to check the differences in answers given by the six stakeholder subgroups. Secondly, to enhance the analysis and check the differences between the groups of respondents for more than two variables, the chi-square test for multidimensional contingency tables was prepared. This test is an enhancement of the classic chi-square test for comparison of independent groups of respondents when the variables are measured on a nominal scale. For this part of the analysis, Statistica and PQ Stat tools were used.

3.3.3. Multi-Criteria Decision-Making Methods

The criteria (measures) for CL implementation in the light of sustainable city logistics development were measured on the standard Likert scale (1–5). The lowest weight meant that the criterion was definitely unimportant to the interviewed person and the highest meant that it was extremely important. Then, for the declared weights, the mean value was calculated and the weights were analyzed using the two chosen multi-criteria decision-making methods. In the study, only one part of those methods was used, namely calculation of the matrix of criteria comparison and final matrix of criteria validity, presenting the priorities of stakeholders in the field of sustainable city logistics. The raw data were normalized according to the rules of the chosen methods and modified according to the equations to form the final matrix. The methods used in the research were the DEMATEL (Decision-Making Trial and Evaluation Laboratory) and AHP method (Analytic Hierarchy Process).

The AHP, created and introduced to the social sciences by R.W. Saaty in the 1980s [85], is typically used in decision-making processes and for evaluating solutions in different areas of business activity. It is useful when the variables have various characteristics (e.g., describing nominal and ordinal scales) and when the aim of the calculation is to rank some variables according to adopted assumptions [81]. This method is very popular in logistics, including for studying urban logistics issues [81,86,87]. The main advantage of this method is not only its popularity but also its transparency. Therefore, the complex characteristics of the sustainability criteria the stakeholders can be analyzed without any doubts for a wider audience. To meet this requirement, a classical version of the method was implemented. However, fuzzy AHP (FAHP, a combination of fuzzy logic and classic AHP method) is recognized as the most popular method of stakeholder analysis [66,88–90].

The second method, to confirm (or not confirm) and enhance the results of the AHP was DEMATEL, which is also widely used in stakeholder analysis [91–93]. DEMATEL was first used prior to AHP in 1973 [94] and for many years the research community used it as one of the favored multi-criteria methods in social sciences. This is a proper method of analysis when the research sample size is small [95]. The advantage of this method over others is that it provides information about core causes and effects among the criteria taken into consideration in the research process [96], by using a digraph map (see Figure 2). This map helps to identify whether a certain criterion is a cause or effect by launching the described solution(s) and assessing its strength and importance for the examined problem (based on the principles of two-factor classification of elements in the classic DEMATEL method). After creating the basic matrix, normalizing it, and calculating the relation matrix, the rows and columns are summed up and the final results ($r_i + s_i$; $r_i - s_i$) are presented on the causal-effect graph. The higher the value of $r_i + s_i$, the higher the degree of importance of a given variable. On the other hand, the $r_i - s_i$ value defines the general nature of the variable. If this value is greater than 0, it dominates the others, while if it is negative, it is dominated by other variables [97].

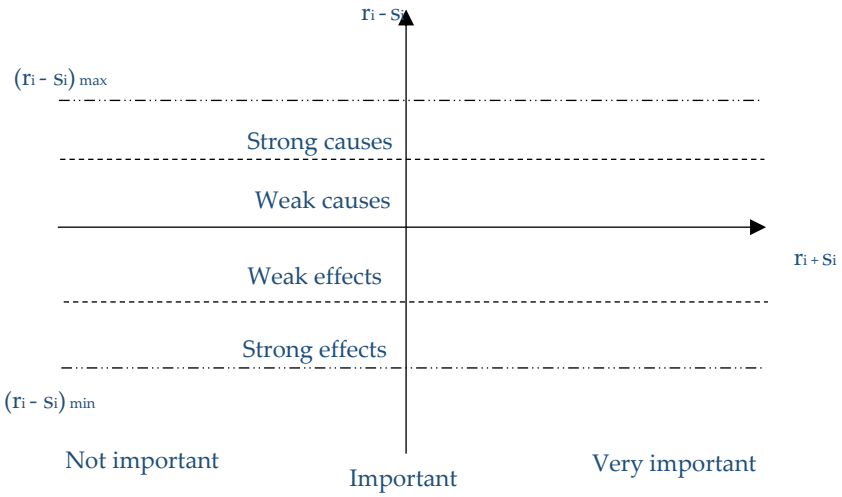

Figure 2. The cause-effect diagram in the DEMATEL method (Source: reference [98]).

4. Results

4.1. General Results

In this section, the results for the previously-mentioned questions will be presented, starting with the most general questions and going on to the more detailed ones. Among the interviewed group, 63% (12 persons) were aware of the sharing economy concept, but none of them was a carrier. In addition, 36% (seven persons) knew the crowd logistics concept (one forwarder, three individuals, one entrepreneur, and two representatives of local authorities). Surprisingly, after explaining the CL definition to the interviewees, it appeared that 13 persons (68.42%) had heard about CL solutions. All those persons nominated the Uber-related solutions for the Q2b question (only Uber, or Uber Freight, Uber Eats). The second popular CL solution was the Blablacar, a platform providing consumer mobility for medium and long distances. In total, three people combined Uber and Blablacar in their response to this question. In addition, three persons indicated Traficar as a CL solution. Traficar is actually a Mobility-as-a-Service solution, meaning it is a sharing-economy solution, but not a CL one. The other mentioned service providers were food-related ones, including Grabfood, Pyszne.pl, and PizzaPortal, as well as car-related service providers (but in fact not CL) like Minitaxi, Free Now, Bolt, MiiMove, and Panek, in addition to bike-sharing systems (which are also not CL) such as Next Bike, Verturilo, Mevo, and other city bikes in many Polish cities.

The next question (Question 3) was focused on problems with freight transport in cities within the Tricity Area. This question was open, so the interviewees could freely express their opinions. Text mining was used to analyze the transcript of answers for this question. The results of this analysis are presented in Figure 3.

The interviewed stakeholders indicated that congestion, traffic (including traffic jams), and trucks being limited in the city center are the most important problems for city freight transport. Additionally, poor infrastructure and transport restrictions were considered to be important to maintain the flow of goods within city centers. According to the respondents, the lack of special delivery zones and general crowds meant that too many people and means of transport occupy the roads and the city center, which generate most of the problems with cargo shipments. Additionally, the movement of goods in the city caused noise and poor air quality, especially in Sopot as a resort and spa town. According to the opinions of the interviewees, the best solution for cities would be to establish a city logistics center for re-loading cargo onto smaller vehicles and then shuttling it to final destinations within that city. This refers to small and big parcels as well as shop deliveries. One person mentioned establishing special unloading zones within city centers as being crucial, complementary to the other solutions, helping not to block traffic in the city and maintain an undisturbed flow of vehicles within the city area.

Questions 5 and 6 were open questions, so text analysis was an appropriate method to assess the answers. However, some of them were the same, so the simple descriptive statistics could be presented. The fifth question was about responsibility for the implementation of CL solutions within the city areas. For this matter, three main responses can be described. Firstly, nine persons (47.37%) of respondents thought that only local authorities held responsibility for those actions, five persons (26.32%) thought that private stakeholders should be involved in launching the CLs, and the same share of the group of respondents stated that both local authorities and private companies should cooperate in establishing a CL local market.

For the sixth question, the interviewer asked the respondents for their predictions of the development of CL solutions in the future. Only one person (one carrier) did not know how to predict this issue and the rest outlined some developments. Three persons (two local authority representatives and one entrepreneur) thought that this development would be very fast. One person (individual) indicated that this development was impossible in Poland and another person (also an individual) stated that because of legal issues, this development would be hindered.

Figure 3. Word cloud for answers to Q3.

4.2. Detailed Results

The interviewees represented different stakeholders groups with—theoretically—different priorities. Some of them represented their own needs and some represented the needs of someone else or many people (public transport operators and local authorities). This matter was analyzed twice: firstly when stakeholders were divided into public and private stakeholders, and then when they were divided into six groups as stated in the Methods section. In the first part, because the rest of the variables had only two variants (yes/no), to compare two independent groups (public/private) when using nominal scales, a chi-square independence test demonstrated no statistically important difference between the opinions public and private stakeholders (see Table 6). The only one dependent variable was being a public or private stakeholder and knowing CL concepts. Among the public stakeholders the proportion of those who knew about the CL concept was 50% (two representatives of local authorities knew this concept) and the proportion among the private ones was 33.33%. So, in this interview, the public stakeholders seemed to be more familiar with the CL concept than the private ones.

The next part of the analysis contains the results of C-Pearson's and V-Cramer's tests, non-parametric tests for checking the relations between the variables (see Table 7). In this analysis, all stakeholders were divided into six subgroups (forwarders, carriers, PT organizers, individuals, entrepreneurs, and LG representatives). As presented in Table 7, there was no significant relationship

between the variables. So as the previous analysis in Table 6 showed, public stakeholders are probably more aware of the CL solutions but in less precise forms when considered separately. Generally, there is no significant difference between the awareness of stakeholder groups about the sharing economy and existence of CL solutions, or the need to prepare UFT documents to regulate the movement of goods in cities.

Table 6. Results of the chi-square independence test for public and private stakeholders.

Variables	Chi-sq	*p*-Value
Public/private stakeholder vs. knowing the sharing economy concept	1.15	0.2832
Public/private stakeholder vs. knowing the CL concept	**6.91**	**0.0086**
Public/private stakeholder vs. knowing CL solutions	0.54	0.4613
Public/private stakeholder vs. opinions about necessary UFT solutions	2.07	0.15

* bold type in the table for statistically important results with level of significance 0.05.

Table 7. Results of the chi-square independence test results for detailed groups of stakeholders.

	Q1	Q2	Q2a	Q4
C-Pearson's	0.533002	0.415227	0.358457	0.592749
C-Pearson's (max)	0.707107	0.707107	0.707107	0.816497
C-Pearson's (adjusted)	0.753778	0.58722	0.506935	0.725966
V-Cramer's	0.629941	0.456435	0.383974	0.520416
Chi-sq	7.539683	3.958333	2.801282	10.291667
Degrees of freedom	5	5	5	10
p-value	0.183496	0.55543	0.73059	0.415288

* significance level—0.05.

Additionally, those analyses were strengthened by using a chi-square test for multidimensional contingency tables. The results for the calculations (see Table 8) confirm that there are no significant relationships between variables.

Table 8. Results of the chi-square test for multidimensional contingency tables.

Category	Result
Analyzed variables	Q1, Q2, Q2a, Q4, stakeholders (6 groups)
Chi-sq	588.008013
Degrees of freedom	1137
p-value	1

* significance level—0.05.

4.3. Scale Question Results

In the seventh question (Q7) the respondents were asked to assess how essential particular sustainable development criteria were for them. Then the results, based on the chosen multi-criteria methods (MCM), were normalized and calculated into a final matrix (see Table 9). The use of the two MCMs allowed a comparison of the results and strengthened the final conclusions. It was initially assumed that different stakeholder groups may have different views on CL and different priorities for its introduction. However, statistical analysis showed that significant differences occurred only in the answers to one question.

For the AHP method calculation, the higher the score was, the more important the criterion became. That is why three criteria should be considered as being the most important for the stakeholders: congestion and traffic, safety and free capacity, as well as flexibility and accessibility. In the DEMATEL calculation, according to the cause-effect diagram (see Figure 4), five criteria were the most important. Those are: reducing noise, congestion and traffic, safety and free capacity, flexibility and accessibility, and a strategy of cooperation. Additionally, this method allows for indicating the causes and effects

among the criteria, since the same five categories were indicated as being important when using other methods. The definite causes of problems within sustainable city logistics measures are congestion and traffic, free capacity, and accessibility, and the results are noise and increased cooperation strategies, which are a result of the priorities of both sides of transactions in the crowd logistics market.

Table 9. Results of AHP and DEMATEL.

Criteria	AHP	DEMATEL	
	Weight	**R + C**	**R − C**
1	0.029213	5.6745	−0.20573
2	0.057425	5.680529	0.334195
3	0.051586	5.674799	0.213935
4	0.010733	**5.903876**	**−1.65301**
5	0.029213	5.673111	−0.16235
6	**0.145894**	**5.837719**	**1.394904**
7	0.06093	5.682961	0.373759
8	0.02181	5.694252	−0.51946
9	0.02181	5.694252	−0.51946
10	0.024234	5.686733	−0.42795
11	**0.102711**	**5.735839**	**0.866836**
12	0.020764	5.708574	−0.65977
13	0.029213	5.67623	−0.24946
14	0.051586	5.676442	0.254289
15	**0.114339**	**5.747129**	**0.939539**
16	0.051586	5.672343	0.132398
17	0.051586	5.674799	0.213935
18	0.017279	**5.741257**	**−0.90244**
19	0.0392	5.670823	0.007929
20	0.068889	5.698814	0.567889

* bold type in the table for statistically important results with level of significance 0.05.

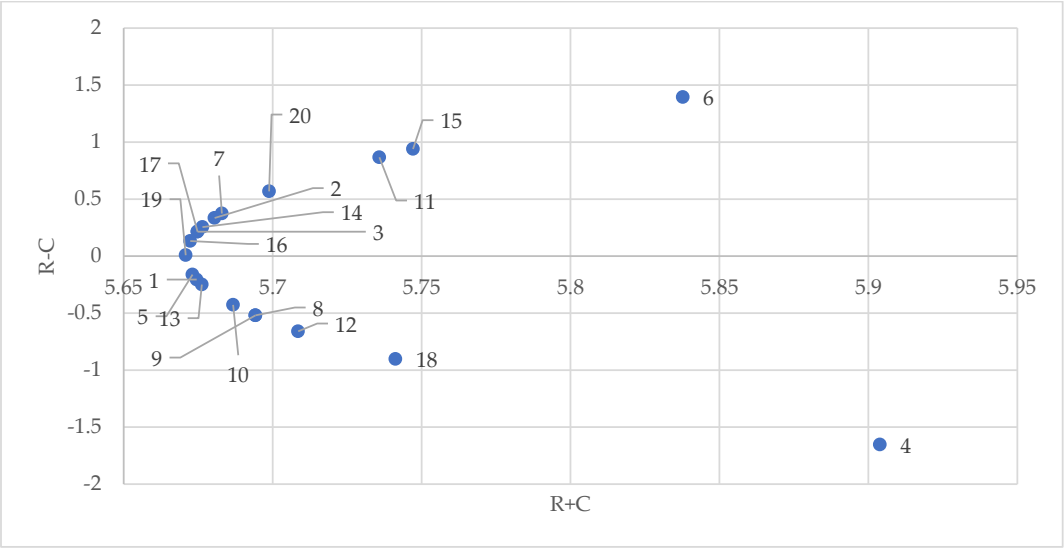

Figure 4. Results of DEMATEL matrices calculation.

Therefore, the two implemented methods allowed us to identify the most important criteria confirmed to be causes of the problems on the CL market: congestion and traffic, safety and free capacity, flexibility, and accessibility. Those were the most valuable criteria for the entire interviewed group of different stakeholders.

5. Discussion

This article is the first dealing with stakeholders' opinion regarding the particular environmental, social, and economic sustainability of CL solutions. The most valuable critera for the whole interviewed group of the different stakeholders were environmental (congestion and traffic), economic (free-capacity, flexibility, accessibility), and social (safety) criteria related to the CL solutions.

Despite quite a lot of scientific articles presenting the CL idea, most of them focus on the rise of the concept [32] or strictly focus on the definition [18,50,99] and typology of CL solutions [28,74,100,101]. Only few literature sources analyze stakeholders' perspective related to urban policy as a basis for launching CL solutions. The papers about stakeholder analysis of CL solutions treat stakeholders as individuals, organizations, and companies strictly involved in providing CL services, not consuming them [6,15]. Conducted research showed the visible differences between the stakeholders' knowledge and expectations related to CL, depending on their public or private nature. The amount of knowledge of the CL concept was much greater in case of public stakeholders than in private stakeholders.

Results identified in the literature confirm the most problematic issues with urban transport for all stakeholders. Almost all of the articles—similarly to the obtained research results—indicated that congestion [102,103], traffic and limited access to the city centers [104,105] were the most difficult issues to deal with. Moreover, the best way, often presented in the literature, to eliminate those troubles was to build out-of-the-city delivery zones [106,107].

6. Conclusions

The results of the above-described analysis allowed us to draw a few conclusions about the stakeholder analysis in order to identify their opinions about sustainable city logistics and the launching of CL solutions on the local market. Firstly, there are several main problems with freight transport in cities and city logistics as a whole. Most of all traffic and congestion are invariably viewed as the most crucial issues to be addressed in improving urban flows. Additionally, limits made for trucks and deliveries are indicated as important ones as well. Meeting the requirements of stakeholders must be focused on solving those problems within sustainable urban mobility plans. Secondly, even if the whole stakeholders group was divided into public and private groups or in a more detailed way into local authorities, individuals, carriers, forwarders, small entrepreneurs, and public transport organizers, they would not differ in their assessment of urban logistics or priorities in this area. Thirdly, even if treated as a homogeneous group, the stakeholders assess some sustainable development criteria as being more important, and the others as less important. In this study, after implementing the Delphi method and the interview, congestion and traffic, safety and free capacity, flexibility, accessibility (as causes), as well as noise and strategies of cooperation (as results) were indicated as the most important factors for the surveyed group.

The results of this study can be treated as a valuable insight not only for the CL providers but also for city or wider local authorities that are responsible for regulating the urban logistics system. The priorities of stakeholders are the elements of travel or transport demand, and therefore, should also be analyzed by the public transport operators, which are both the stakeholders and service providers. This study definitely increases awareness of the needs of urban logistics stakeholders. The results of this study can be a good reference point to create, evaluate, and improve the sustainable urban mobility plans (SUMPs), which are a basis for building a favorable environment for developing new services on the global transport and logistics market. SUMPs, being a complex plan for urban logistics, transport, spatial planning, and citizens' networks, are focused on people, including their needs, quality of life, and access to goods and services. The introduction of CLs in the urban space will allow for meeting the needs of different stakeholders in terms of access to services for the delivery of goods in a fast, safe, efficient, and at the same time, environmentally friendly way, thereby meeting the requirements of sustainable development. Therefore, launching CL solutions in cities should increase the quality of life of citizens and should be a part of SUMPs.

This paper contains an easy-to-repeat proposition of the approaches for assessing the needs of CL stakeholders. This paper should also start a new direction in the scientific discussion about creating a local market for sharing economy services, including CL.

It has to be clearly stated that this study has a few limitations. First of them is the use of the Delphi method. The results of the analysis cannot be extrapolated to the whole population because the small sample size and analysis only allowed one agglomeration, but this can be verified by other researchers. Secondly, the group of the criteria taken into consideration is based on the literature review but could be enhanced if some other approaches, different from those used herein, were implemented. Thirdly, although two MCDM methods were used in this study, some other methods, including such mathematical ones as non-parametric tests, could give different results. However, the authors tried to stick rigidly to the rules of selected methods and approaches and get access to as many sources and persons as possible to increase the reliability of this study.

Nevertheless, this study provides valuable insights and contributes to the development of knowledge about the element of CL solutions, sustainable urban logistics, and its stakeholders. The research results provide many practical implications and provide many directions for future research. The next studies about the topic described here should be focused on examining more stakeholders to verify the results of this study. The authors hope that the discussion about CL solutions will develop at a fast pace and more theoretical and empirical research will appear very quickly in the global research environment.

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