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Assessment of the Crowd Logistics Solutions—The Stakeholders' Analysis Approach

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Abstract: This article presents the assessment results for crowd logistics (CL) solutions from the perspective of the needs of different stakeholders. The uniqueness of this study lies in entering these needs in the implementation of the three spheres of sustainable development in cities (social, economic, and environmental). The purpose of this publication is to present the benchmark solutions for the CL area, helping to adjust the business model and market offer of other providers to the needs of different groups of stakeholders. The reason for such valuation is the fast-paced sharing economy development in the city logistics area, as well as in the courier activity. For this study, the AHP (analytic hierarchy process) method was applied in order to develop the proposed evaluation tool of the CL initiatives. The evaluation criteria (the needs of particular groups of respondents) are derived from document-based data analysis and the primary data for the model are derived from information provided by service providers. The list of the best solutions is made for indicating benchmark brands on the market. The recommendations for managers were drawn on how to adjust solutions to the stakeholders' needs.

Keywords: crowd logistics; urban freight; city logistics; sharing economy; stakeholders analysis; AHP

1. Introduction

About 52% of the population all over the world is city inhabitants, and it is expected that by 2050, this number will reach 67% [1,2]. Very fast urban growth is, at the same moment, a challenge and the opportunity for decision-makers in the city management area.

The urbanization and population growth, the fast development of e-commerce and, moreover, the growing expectations of the customers require introducing new, innovative solutions to ensure effective, social-friendly, and sustainable transportation within the cities [1,3]. These facts influence the necessity of making systemic changes according to the integration in the transport services of passengers and cargoes carried out within metropolitan areas. Urban mobility contributes to achieving the socioeconomic objectives of cities, but also impacts on the quality of life in cities, including the level of pollution and congestion [4]. Transport in cities has an evident impact on the environment [5]. According to the European Commission's data, it emits nearly 40% of the European Union's total emissions of carbon dioxide [6]. At present, 67% of passenger transport has been taking place in urban areas, and by 2050, the number of kilometers traveled in urban areas will triple [7]. Similar trends can be observed in freight transport.

All transport operations within the cities cause problems that are related to transport policy, customer service, and above all, traffic flows, which are considered to have a negative economic impact [8,9]. In response to these problems, a number of European initiatives in the area of city logistics were introduced [10]. The lack of a holistic view on city logistics problems (describing the city as a whole logistics system with many subsystems and actors) relates to the flows of both people

and goods. The popular and improper approach focuses on logistics in individual areas (e.g., only transport or building new settlements) without considering their impact on others and on the entire system. The problem is, the majority of them focuses on single areas (without analyzing tradeoffs with other areas) such as freight or passenger transport [3,9,11,12], instead of focusing on shared passenger and freight transportation practices [9]. They are widely described in European Commission reports with regard to SUMPs—sustainable urban mobility plans. In those documents, different areas of applying sustainable transport systems are described. The sharing economy solutions include two main groups—Mobility-as-a-Service (MaaS) for people mobility and crowd logistics (CL) for freight transport [13,14].

There are two vital gaps in understanding the purpose of the CL solutions, their mission, and their usefulness for different stakeholders' groups, justifying this research. The first one, the conceptualization gap, concerns the weak consistency of the various stakeholders' analysis in the literature about CL, which brings the conclusion that it is unclear and underdeveloped. There is a literature and knowledge gap in the mentioned research subject, because there is no paper about the benchmark solutions addressing the needs of different groups of stakeholders and the guidelines for the construction of a market offer to match one product to different needs. The second gap, the construction gap, regards no well-established approach to building a set of variables referring to stakeholders and current trends in managing urban areas, such as the application of sustainable development. In this research, the classic, well-known, and widely used AHP method was implemented to assess the identified CL solutions. Understanding the needs of different groups of stakeholders helps with defining the well-suited service portfolio to address them by one provider, and even one solution offering different types of services.

Taking into consideration the above-mentioned arguments, the authors raised the following research questions:

RQ1: What are the needs and priorities of different groups of CL stakeholders?

RQ2: What are the benchmark CL solutions addressing the needs of those groups?

Given that, the purpose of this article is twofold: first, to conceptualize the way of assessing CL solutions according to sustainable development areas and stakeholders' needs, and second, to present the empirical investigation of existing CL solutions. The structure of the article is given as follows. First, the literature review is conducted to present the main characteristics of CL solutions and stakeholders of an urban transport system. Then, the research approach, procedure, and method are described. The importance of criteria for different stakeholders is presented, followed by the research results containing the full calculation and analysis of the chosen CL solutions. The next part describes the research results and presents the benchmark CL brands, their characteristics, and their strong and weak points. This section contains also the recommendations for managers, including what characteristics should be improved to correspond with the needs of particular stakeholder groups. The last part of the article contains the conclusion and, moreover, indicates future research directions.

2. Literature Review

2.1. Crowdsourcing in Logistics

The term 'crowdsourcing' comes from two notions 'crowd' and 'outsourcing' [15]. It relates to the global sharing economy that has changed a lot the way of using different goods. The sharing economy is a trend involving the sharing, lending, and exchanging of products and services [16–18]. Users get temporary access to resources, services, or competences of other units when their capacity is not fully used [19]. In fact, the concept of sharing is not new. According to the literature [20,21], Charles Babbage, an English mathematician and engineer who lived in the 19th century, hired the crowd (actually the contractors) to help him with the astronomical computing of the tables that could be used for stellar navigation. Babbage has been famous for being the 'father of the computer'. In addition, he also developed several key ideas of crowdsourcing (macrotasking).

Although the concept of crowd sharing is not new, the current sharing economy boom is possible thanks to the advancement of ICT (information and communication technology). Thus, nowadays, the sharing economy is implemented primarily through online platforms [18,22,23]. This model is gaining popularity, and its main purpose is engaging a wide range of people (mostly using innovative technologies) in a given project [24]. This approach has a huge potential to rise, but the development of various initiatives within crowdsourcing is dependent on the growth of modern technologies [25–29]. As a consequence of the sharing economy development [30,31], new models and solutions that were based on access to assets rather than ownership have emerged [32,33]. The sharing economy can be divided into three categories [34]:

- the recirculation of assets, having its origin in an eBay platform were the recirculation of goods is taking place, but nowadays, many similar online exchange platforms operate on the Internet,
- increased use of goods, which refers to platforms thanks to which assets are being used more intensively. The first example of such initiatives was Zipcar—a company offering car rentals for hours and even minutes,
- sharing of assets, concerning sharing goods dedicated to production, not consumption. The best example of such solution are networks of co-operators, operating for many years all over the world.

The sharing economy is treated as an umbrella term to collaborative consumption [19,23,35], crowdsourcing [15,36], and asset-based consumption [18,30]. It contains new abilities or preferences of the users to rent or borrow goods or services rather than own or buy them [35,37]. In the literature, crowdsourcing was popularized by Howe [36] and, according to his approach, is a kind of an outsourcing strategy in which a company places an open call on the crowd to perform a task.

Along with the technological progress in the digital sphere, the development and adaptation to new trends in urban areas emerge [38]. Cities begin to operate in accordance with the idea of cities 4.0, based on innovations in digital techniques, especially the automatization of processes and operations [18]. The most common examples of the sharing economy applied in cities are the energy mix, offices, parking sites, warehouses, flows of goods, knowledge, and data [39]. However, one of the most important areas is mobility, so amongst the various types of crowdsourcing initiatives, many of them are related to logistics. According to the current research [30,35,40] in logistics, five types of crowdsourcing initiatives occur [16]:

- peer-to-peer logistics,
- open logistics,
- business logistics,
- logistics-as-a-service (LaaS), and
- CL.

Peer-to-peer logistics is already proven to be an inventive and efficient way to deliver goods around the world [41–43]. In this solution, the individuals share or exchange goods and services by organizing essential activities in a customer-to-customer (C2C) channel [35]. Peer-to-peer logistics should provide the support to the sharing consumption initiative, while being organized and managed by peers. The main function of the web platform is just informative and controlling, because the users interact directly with each other without intermediaries [18]. What needs emphasizing is that buyers can get what they need quickly, and travelers can also get additional cash for delivering the goods [44]. Well-known peer-to-peer logistics practices are: Drivy (ensuring access to a car without having a car) or Leboncoin (service for placing private sales announcements) [43].

Business logistics can be treated as a primary, traditional solution within crowdsourcing initiatives in a business-to-customer channel (B2C) [45]. Managing of the physical flows is made centrally by the platform promoting the collaboration in order to organize the exchange between users. Therefore, the platform's role is to enable and to support exchanges between peers [46,47]. In contrast to the

previous solution, the platform's role is physical (logistics platform as well as informational—Internet platform—intermediary) [35,48]. To conclude, the aim of the business logistics platform is to provide the logistics solutions necessary for the exchange, and the orientation of the flow is extended to the consumer-to-business-to-consumer type (C2B2C). Vestiare Collective—a community-driven online resale site dedicated to luxury fashion—is an example of such a solution.

Open logistics is related to the solutions that enable users to have control of logistics choices related to the goods' supply and distribution [46]. Such solutions were primarily developed in the food industry by agro-food manufacturers as well as retailers [49]. The logistics role of the platform is to provide consumers with a logistics infrastructure to take control of the good's distribution, and the orientation of the flow is from business to consumers (B2C). An example of open logistics is Food Assembly (an American initiative), an online market where farmers sell their products directly to consumers.

The LaaS business model is used to develop models and methods that would enable the self-configuration of resources in sustainable logistics decision making [50]. LaaS providers employ logistics professionals to manage an enterprise's transportation network and inbound and outbound logistics in the whole channel—from production facilities to warehouses, retailers, and users [48]. Within this concept, different services are taken into consideration: supply chain transparency, robust logistics planning, and demand collaboration [40].

The main scope of logistics is to deliver goods and information to the right place at the right time. The aims of CL may contribute toward these objectives [21,28]. CL is alternatively called crowd-sourced delivery, crowd shipping, or collaborative delivery [9,51]. In all previous types of crowdsourcing in logistics, the role of logistics was to support activities. In CL, logistics is the proper purpose of the creation of the sharing initiative [46]. Within CL initiatives, the platform is used to sell logistics services provided by individuals, and its role is essential, because it enables individuals' logistics resources to be shared by optimizing their use at the same moment [35,51].

The CL concept comes from the sharing economy or resource sharing, regarding exchanging or sharing resources without owning the goods [52]. Its main scope is to improve the efficiency as well as the sustainability of the manners according to which goods are moved, supplied, stored, and used across the world by applying the concepts from Internet data transfer to real-world shipping processes. According to quite a comprehensive approach, several conditions within the CL concept have to be fulfilled: proper infrastructure, free capacity, compensation, crowd network, and voluntary [53]. In spite of numerous benefits of CL initiatives—financial, environmental, or social ones [34,47]—the risks such as social (unsuitable society, labor risk) as well as quality (unequally service quality) [47] and sustainability (the rebound effect can higher the emissions) [34] aspects are hard to ignore.

The most complex definition of CL term states that "CL designates the outsourcing of logistics services to a mass of actors, whereby the coordination is supported by technical infrastructure" [52]. The main objective of CL—according to this approach—is to achieve the economic benefits for all engaged stakeholders [52,54]. CL initiatives can be applied within different crowd-sourced services in which customers or institutional users place a request for a good delivery service on an ICT platform that is going to be fulfilled by one of the drivers registered in the system [53,55]. The most common services within crowd-sourced initiatives are door-to-door and store-to-door. Door-to-door are a kind of service wherein drivers announce trips they plan, and shippers post requests for goods they would like to pick up and deliver. Store-to-door services focus on the B2C channel, offering same-day delivery using crowdsourced delivery as well as courier services [1,3].

It is very important to indicate that pure CL activity should use existing flows—it is one of the necessary conditions of this phenomenon [11]. If existing flows are used for services fulfilment, this will contribute to more sustainable city logistics [56]. That is why various integrated freight and passenger transportation initiatives are rising. So, from a sustainable point of view, cargo-hitching services that extend crowdsourced deliveries by exploiting free capacity in public transport—buses, trams, metro, and taxi services—are even better. A big challenge in cargo-hitching services is the coordination and

synchronization of flows; in addition, some safety issues related to the operationalization of transport may be problematic [57]. Consequently, in spite of possibility of playing a significant role in efficient deliveries, only a limited number of such initiatives have been undertaken, or research efforts exploring these areas have been reported in the publications [57].

2.2. Stakeholders in the Urban Transport System

Congestion and environmental problems caused by passenger and freight transport may be observed in many European cities. For many years, such problems were mainly discussed from a narrow perspective of private stakeholders [58]. Due to a lack of holistic point of view, all parties involved in the urban transport system were treated as a whole [59,60]. In general, the urban transport system can be defined as the set of the transportation elements—public as well as private—that contains all issues regarding people and goods mobility within the city area: infrastructure, management, means of transport, entities, service providers, and users [7,13,61]. The cooperation of different actors in the urban management process in order to improve flows within the urban areas is essential. Thus, there is a strong need to identify all stakeholders within the urban transport system. Stakeholders can be generally described as those who are interested in the decision to be made, even if they are not the final decision makers or they do not play an official role in the decision-making process [39,62–66]. The stakeholders referring to the private and public sphere can be divided into several main groups [67]:

- authorities,
- public transport (PT) operators,
- shippers,
- freight carriers,
- transport operators,
- residents, and
- other traffic participants.

Within the authorities group, the following stakeholders can be distinguished [23,59]: the local government, the national government and, even the European Commission. The local authorities focus on the attractiveness of a city [55,68]. This stakeholders group is mainly interested in the reduction of pollution and congestion, and also in increasing the quality of life in cities as well as the safety of road traffic [56]. From this point of view, urban freight transport (UFT) can be considered as the major factor contributing to pollution and nuisance [9,69]. On the other hand, the local authorities want to implement an effective and efficient transport system [70–72]. Therefore, their main scope should focus on resolving problems amongst the other actors engaged in the urban transport system [73,74]. National authorities are usually rather only marginally involved in UFT issues [75]. However, their interests (such as reducing externalities at a regional or national level) affect many UFT operations, as well as local authority policies.

PT operators are most often owned by the municipalities but specifically, it depends on the model of the organisation of the PT adopted in the urban transport system [76]. That is why in the most common models, they have options of performing the services themselves or contracting out the service to the outer private companies. In practice, it means that the PT services may be provided by a mixture of public- and private-owned companies [58].

Shippers generate freight demand, so their role is organizing cargo transport from providers to receivers. They operate in the private sphere [30]. The main activities of shippers are related to sending goods between companies or persons, but often are not located in the city—consequently, they do not feel responsible for UFT issues [77]. Their main scopes focus on maximizing the levels of service in terms of the cost and reliability of transport. Shippers can be owners of the freight, or they can be just responsible for hiring a carrier [17,59]. Freight carriers usually aim at minimizing their costs by maximizing the efficiency of their deliveries and shipping, and they are supposed to provide a high level of service at a low cost [68].

Transport operators are the stakeholders carrying out UFT, but in many cases, they are restricted by boundaries set by others—for example, designated time slots to make the deliveries, opening hours of stores, or loading and unloading bays' accessibility. It is worth noting that transport operators are most often active in a larger area than the city itself [63].

City dwellers and other users are the people living, working, and shopping within the city area. Inhabitants dramatically experience nuisance and other externalities by UFT as noise, smell, or vibrations, so they are most interested in sustainable urban transport systems [68]. The group of other traffic participants (users) consists of road users such as pedestrians or cyclists sharing the same infrastructure as freight transport vehicles, especially within the urban area, and of passenger vehicles that are blocked by lorries involved in loading and unloading at the kerbsides [63]. Visitors and tourists can also be included in this group as well. They are also affected by UFT only to a lesser extent. This group of stakeholders is mostly interested in having an attractive city to visit even for a whilst, so for them, minimizing nuisance by UFT is essential [66].

Actually, various stakeholders operating in cities interact, compete, and cooperate, which can be characterized by heterogeneous scopes (see Table 1) [11,68]. Regarding the sustainability context of the urban transport system, authorities represent environmental objectives—according to European Union (EU) transport policy issues—as well—but social ones at a lower level—in striving to provide good quality of life and availability of the PT services to city residents [5,7,13,61].

Table 1. Objectives of main stakeholders' groups in the city logistics area.

Stakeholders	Objectives in the Area of Logistics		
	Social	**Economic**	**Environmental**
Authorities			■
PT operators	■		
Shippers		■	
Freight carriers		■	
Transport operators		■	
Dwellers	■		
Other users	■		

Source: [5,7,11,13,61,68]. PT: public transport.

PT operators most often operate as public entities, being controlled by the authorities, and generally, their activity is based on subsidies from the municipality budget. Consequently, their objectives are closest to social sustainability [5,7,13,61].

The stakeholders group of shippers, freight carriers, and transport operators represents private capital, and thus is guided by the pursuit of profit. Hence, the objectives of these stakeholders can be placed within frame of the economic sustainability [7,61,77].

The intention of residents and other urban transport users is a good quality of life and the best availability of PT, which can be placed within the area of social sustainability. On the other hand, the environmental issues (focusing on externalities' reduction) gain their attention over a long-term perspective [5,7,13,61].

3. Methodology

3.1. Research Procedure

The main framework of this study is based on the well-known definition of sustainability [76,78], containing its three dimensions: social, economic, and environmental [13,37,52,61,79]. The research procedure used in this research was based on few steps (see Figure 1).

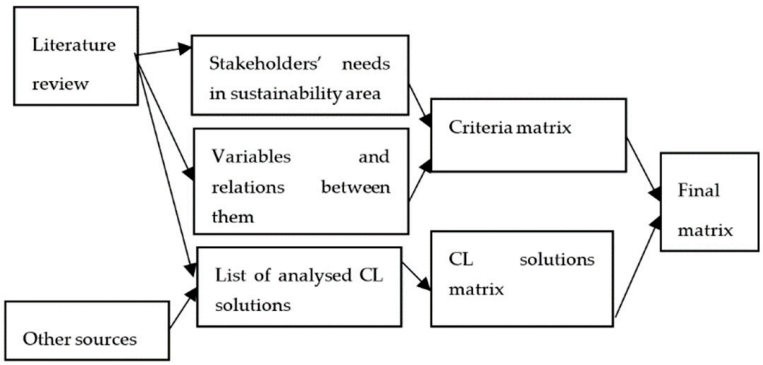

Figure 1. The research procedure.

Firstly, the Denyer and Tranfield approach [80] was used to define the literature search strategy. This is approach designed for social sciences, which is mainly based on the set of steps that need to be done in order to compose a reliable literature database. It requires the identification of crucial keywords and other conditions helpful in searching the literature sources. For this purpose, the Boolean logic was a support to this approach to identify and later refine the literature base. The search words 'crowd' and 'logistics' as keywords and 'sustainability' or 'sustainable' as abstracts were used to search for literature sources in EBSCOhost, Science Direct, SCOPUS, Springer, and DOAJ and then, the Mendeley Desktop tool was used for eliminating the duplicates and defining the literature database for further analysis. According to the chosen approach, after reducing the duplicates, the content of abstract was analyzed, and some literature items not fitting to the scope of this research were eliminated. The final literature base about the CL solutions came to 69 items. It was helpful later to draw the list of CL service providers. The last step in this analysis was to find the variables and stakeholder analysis approaches to define the basic assumptions for this study. This allowed establishing the list of variables (criteria) and stakeholders. Finally, 20 criteria were identified (see Table 2), including six environmental (1–6), seven social (7–13) and seven economic (14–20).

Table 2. Criteria in the proposed framework.

Group		Criterion	Group		Criterion	Group		Criterion
Environmental	1.	Reduction in CO_2 emissions	Social	7.	Connecting individual providers and consumers	Economic	14.	Access to adequate IT infrastructure
	2.	Effective use of loading space		8.	Voluntary character		15.	Free capacity, flexibility, accessibility
	3.	Developed model of using resources		9.	Tracking, transparency		16.	Attractive revenue model
	4.	Reducing noise		10.	Simplicity and trust		17.	Short time of delivery
	5.	Less waste		11.	Safety		18.	Strategy of cooperation
	6.	Less congestion and traffic		12.	Health benefits		19.	Geographical scale
				13.	Indicating country specifics and ethics in business model		20.	Insurance

The literature review results registered in the report sheet were focused on assigning the stakeholders' needs to the identified criteria (previously presented in Table 1). In this regard, only 15 literature items were helpful [9,11,16,20,29,34,52–54,56,61,63,64,66,70] (see Tables 3–5) to define the relations between the criteria according to the needs of different stakeholders groups.

Table 3. Description of the environmental criteria and their relations—literature review results.

No.	Criterion	Description/Information—Importance
1	Reduction of CO_2 emissions	Choosing zero-emission or low-emission transport modes (bike, going on foot; public transportation)/low attention of users and providers [9]; important for 30% of drivers [54]
2	Effective use of loading space	Reducing a number of routes to deliver goods/low importance [54]
3	Developed model of using resources	Enabling the service in a sustainable way by using the existing resources (both companies and individuals)/low to medium importance [21,30,35,54]
4	Reducing noise	Using quiet transport modes (bikes and going on foot, using public transportation); recording the noise; and keeping the users informed about its level/important for local society [21]
5	Less waste (e.g., tires)	Less waste caused by decreasing the use of the modes of transport polluting the environment/as important as reducing noise [9,65]
6	Congestion and traffic	Less traffic caused by growing active transport modes' popularity/as important as reducing noise [30,35,65]

Table 4. Description of the social criteria and their relations—literature review results.

No.	Criterion	Description/Information—Importance
7	Connecting individual providers and consumers	Connecting business and individual providers and consumers, Courier, Express and Parcel (CEP) service providers, freelancers; the crowd logistics company operates as a mediator between these two networks/essential [9,54]
8	Voluntary character	People select logistics services themselves of their own accord/basic element [9]
9	Tracking, transparency	The crowd is registered and tracked by the platform, but usually, quality and service are more difficult to control and rarely can be guaranteed/crucial, but are indicated as a source of stress if the crowd identify is unknown [9]
10	Simplicity and trust	The customer is not interested in contractual details, but in ordering and safety [21]/important to the individual and customer [21,54]
11	Safety	The security of goods has to be delivered, as well as the procedure in the case of damage/very important for the customer [30]
12	Health benefits	Modal choice can influence lower CO_2 emissions, better air quality, and better health/as important as environmental issues [9]
13	Indicating country specifics and ethics in business model	Culture and ethics may have an impact on the safety of transactions and delivering parcels/does not have a certain impact on customer decision [54]

Table 5. Description of the economic criteria and their relations—literature review results. CL: crowd logistics.

No.	Criterion	Description/Information—Importance
14	Access to adequate IT infrastructure	The IT solution (portal, mobile applications) provides the opportunity to engage a wide range of users; many mechanisms can be put in place: rigorous verification process, feedback system, etc. [26]/crucial for every CL solution [9]
15	Free capacity, flexibility, accessibility	The CL solution can provide a range of possibilities and providers every time and every place, to every route needed/very important for the customer [9,54]
16	Attractive revenue model	Available revenue models: resale margin, financial or matching fees, fixed or negotiated prices, membership, rewards, barters, or discounts; mostly the CL platform provider receives a part of the final revenue from the service provided by the crowd/the most important factor [9]
17	Time of delivery	The most attractive is the same-day delivery/very important factor [54]
18	Strategy of cooperation	It includes effective marketing to gain the competitive advantage, number of users (Internet advertising, social media, and bonus programs) and cooperation at a regional or local scale that refers especially to partnerships with IT specialists, investors, and most prominently, retailers and individuals/very important for both sides of transactions [9,52]
19	Geographical scale	On one hand, the distinction can be made between intra-urban, inter-urban, and global scales, and on the other hand, they can be made between regional, national, international and worldwide scales/very important [9,21]
20	Insurance	The customer wants to know that his or her parcel is safe and there is some insurance/important [54]

Then, the criteria matrix was prepared (see Section 3.2). It was the result of evaluating the importance of particular criteria for the identified groups of stakeholders according to Tables 2–5 and the calculations within the AHP method.

The list of the CL solutions worldwide was made according to the previously mentioned base of the literature sources and using the search phrase 'crowd logistics' in the internet search engine. There were a few literature items that were the most valuable for preparing the initial list of CL providers [11,21,30,54,59,81]. Finally, 70 initiatives were identified. In the next step, CL brands were found in the Internet sources (their websites) to find their main service profile and actual characteristics corresponding to the 20 criteria for environmental, social, and economic sustainability (their characteristics change very quickly, so there was a need to use up-to-date data). The identified CL solutions were very diverse; many of them were not active (there is a small success factor regarding the global market for CL solutions), and among them food-delivery services dominated. Therefore, to meet the requirements of the definition of the crowd logistics presented in Section 2, there was a need to refine this initial list. For the purpose of the further analysis, the inclusion criteria for the further analysis were established: being an active company, providing only freight transport solutions, small area of activity (mainly urban and suburban), offering providing services in the C2C channel, offering not only food deliveries, but also deliveries of other kinds of parcels/goods. Finally, 24 solutions were established as those presenting all of the needed characteristics (see Appendix A, Table A1). With the use of the basic information from their home webpages (terms of use, service portfolio, mission statement, other), and according to the rules of the AHP method, the main database was made (see Appendix A, Tables A1 and A2). For the assessment for the variables 2, 3–8, and 10–13, the scale of prioritization was focused on having the needed characteristic or not, so the probable rankings were 1

(when compared solutions had the same characteristic), 3 (when the first had the characteristic the second did not) or 1/3 (when the first solution did not have the characteristic, but the second had). For the variables 1, 9, and 14–20, the full AHP prioritization scale (1–9; 1/9–1) was used to assess the size of the differences between compared CL solutions.

3.2. The AHP Method

The study aims to build a model for assessing the freight transport CL solutions according to real requirements of the different stakeholders groups that were identified earlier [39,58,59,62,66]. The scope of those business activities should include the city center, other city districts, and the suburban zone. According to Table 1, three groups of stakeholders with similar requirements and needs have been identified. The first group consists of local authorities, residents, and other traffic participants (e.g., tourists, people on a business trip), and remains focused on environmental and social issues. The second group is a business-oriented group (shippers and freight operators), striving for profit and increasing market share. The third group consists of only one stakeholder—the PT operator—the purpose of which is to meet the needs of residents, so the objectives are mostly social.

The complex character of the sustainability criteria and characteristics of the stakeholders (the number of variables and kinds of relations between them; the same situation in the case of the stakeholders) necessitated the choice of a method that allows the combination of quantitative and qualitative data whilst maintaining a multiple criteria approach to the analysis of individual market solutions. The best solution, also widely used in crowdsourcing and CL research, is the analytical hierarchy process, which was introduced to social sciences by R.W. Saaty [82]. This approach is usually used to evaluate business activity in logistics—for example, in the supplier selection [83]. The AHP method was also used in the identified literature to analyze the needs of the CL stakeholders and assess the particular market service providers [65], but this is not the most popular approach. The most popular are interviews [9,54,58,65] and surveys [3,22,55,58,63,84].

Whilst preparing the article, a classical version of AHP was implemented. First, the set of criteria was identified and analyzed. Criteria were prioritized for all three separate stakeholder groups (see Table 6). For local authorities and all types of users, safety was the most important variable when using CL solutions. It is a very capacious concept, including the safety of transaction, the safety of the vehicle, the safety of payment, avoiding crime, and the risk of road accidents. For service providers, the most crucial was the attractive revenue model, which is an obvious result. PT operators care about safety, similar to the first stakeholder group. This part of the analysis allowed the answer to research question 1 (RQ1).

Table 6. Criteria (variables) matrix—the importance for different groups of stakeholders. PT: public transit.

For Authorities, Residents, Other Users		For Shippers and Freight Operators		For PT Operators	
Criteria	**Result**	**Criteria**	**Result**	**Criteria**	**Result**
1	0.0353	14	0.137069	7	0.113628
2	0.0353	15	0.137069	8	0.113628
3	0.0353	16	0.351055	9	0.113628
4	0.0353	17	0.137069	10	0.113628
5	0.0353	18	0.137069	11	0.459298
6	0.0353	19	0.050335	12	0.043095
7	0.0999	20	0.050335	13	0.043095
8	0.0999				
9	0.0999				
10	0.0999				
11	0.3175				
12	0.0353				
13	0.0353				

According to the rules of the AHP method, calculating the final matrix requires two matrices: first for the criteria (see Table 6), and second for the basic (and then in the next one, normalized) values of the assessed solutions. The second matrix was made from the initial table for measuring the CL brands (see Appendix A, Tables A1 and A2). If two solutions had the same level of the criterion value, the relation between them received the value of 1, if one first noted a higher variable level, it received the value of 3, 5, 7, or 9, regarding the difference between levels of the two compared solutions. Then, the second solution compared to the first one received respectively the value of 1/3, 1/5, 1/7, or 1/9. In the next step, the solution assessment matrix was normalized and multiplied by the criteria matrix to form the final matrix (see Table 7).

Table 7. Criteria in the proposed framework.

No. of Solution	Assessment Result		
	For Authorities, Residents, Others	For Shippers and Freight Operators	For PT Operators
AmazonFlex	0.0598	0.0734	0.0660
Colis-voitourage	0.0423	0.0588	0.0386
Deliv	0.0454	0.0764	0.0499
Deliveree (USA)	0.0393	0.0227	0.0386
Deliveree (Thailand)	0.0468	0.0984	0.0431
Easyvan (today: Lalamove)	0.0406	0.0603	0.0431
EpiFruit	0.0406	0.0201	0.0398
GoGoVan	0.0380	0.0226	0.0386
Hitch	0.0409	0.0364	0.0386
Instacart	0.0472	0.0278	0.0495
Kanga (GEODIS partner)	0.0368	0.0528	0.0343
ManyShip	0.0367	0.0246	0.0386
MetroAfricaXpress	0.0338	0.0355	0.0339
MyTaxi delivery (Daimler Group)	0.0331	0.0355	0.0331
MyWays (by Agheera by DHL)	0.0478	0.0380	0.0487
Nimber	0.0456	0.0383	0.0415
Pack'n'drive (incl. Chainly)	0.0368	0.0259	0.0386
Parcify	0.0382	0.0293	0.0386
PickThisUp	0.0367	0.0336	0.0386
PiggyBee	0.0357	0.0249	0.0386
Roadie	0.0380	0.0239	0.0386
Sociotransit	0.0433	0.0285	0.0386
Stuart	0.0546	0.0538	0.0495
Veho	0.0419	0.0584	0.0431

4. Research Results

A relatively small number of the identified and analyzed CL solutions represented features related to the environmental dimension of sustainable development, which was quite surprising given that in almost every CL definition, the environmental dimension exists, and in many CL solutions, the marketing materials were concentrating on this matter as a main priority. What was worth noting is that the scores in this group for different environmental sustainability features (criteria) were very diverse. The most important in this group was the reduction of CO2 emissions, mainly by allowing the use of low-emission cars, electric cars, motorcycles, scooters, and above all, bicycles, to be serviced by clients. This was not surprising, given that most of the solutions for urban logistics are focused on CO_2 emissions, which is the main feature of every urban logistics solution deemed "sustainable". Attention was also paid to the need to control the filling level of the means of transport during route implementation (variable efficient use of loading space, very correlated with the level of empty runs), as well as the way of using means of transport. In most cases, the means of transport should (according to the policy of the CL provider) belong to a private person, and it was less likely that the CL provider

provided its own fleet of vehicles. However, there were CL solutions based on its own fleet model, and providers used this feature to ensure the reliability of services, especially in the same-day delivery model. The least represented feature was the elimination of waste and care for the reduction of congestion and traffic (e.g., through the use of bicycles with special travel routes and infrastructure), which is one of the most important external costs of transport, and is indicated in almost every transport costs paper.

CL solutions place great emphasis on the social dimension, especially on the building and integration of the local community (this criterion was represented by all of the 24 analyzed solutions). Those local relationships should be developed to ensure the market success of the solution. Users can build the community, in which the same person is a service provider and consumer. That is why most CL solutions met the basic definitional assumptions of simplicity and building trust, a traceable and transparent system, and safety (which is the most crucial for two stakeholders groups—public transport operators and authorities, residents, and other users). In addition, most CLs were adapted to the local operating conditions—the law, spatial distribution, ethics and hierarchy of values in a given local community, taking into account the specificity of the region (e.g., related to the specialization of the region). CL providers particularly emphasized these features. The worst represented is the criterion of health benefits provided by CL solutions. Probably, a weak emphasis on the realization of this postulate and low priority of this issue stems from the fact that it is related also to poorly represented environmental criteria.

In turn, the economic dimension was well represented by the examined solutions, especially in the field of an attractive model of remuneration of individual service providers (the criterion "attractive revenue model"), 100% availability of services for clients, and a flexible form of cooperation (the criterion "free capacity, flexibility, accessibility"), also including flexible working hours and weekdays for the individual providers from the crowd ("strategy of cooperation"), the possibility of choosing a specific geographical area (for example, a part of the city; criterion "geographical scale") for customer service. Although the dominant means of transport is still a car, many providers offer the choice of other means of transport (scooter, bicycle, other), and—as a consequence—different pricing options. Usually, CL offers a delivery standard of within a couple or a dozen hours, up to 48 h if the area of operation is larger than one city (e.g., the offer includes interurban delivery or delivery to suburban zones). Same-day delivery became a standard, so every CL offer should strive to offer it in basic services. The geographical scale of operation is not such an obvious characteristic for CL solutions as it seemed, and was presented in the definitions of the CL as an area of one city. It was different amongst the selected solutions, ranging from typically local solutions (handling freight transport within one city) to regional deliveries. In the individual cases of the identified solutions (not included in the final analysis), international deliveries using air travel were offered. The geographical scope was also measured by the number of served regions/cities (the same CL platform was available in many cities such as popular cafes or fast food restaurants), which testifies to the business success and popularity of the solution. The least-developed element of economic sustainability was providing insurance in the event of a delay, lack of delivery, and damage to transported goods. Some suppliers clearly defined the rules for handling this type of complaint; many indicated that there is such insurance, but did not provide specific information on this subject, which are not available to customers wanting to know their rights if something went wrong with the delivery. A few providers clearly indicated that they do not guarantee in any way handling complaints, which reduces the credibility and attractiveness of their offer.

Taking into account the final evaluation of each of the 24 selected solutions (see Table 7), it turns out that their assessments do not differ much from each other. However, the best solutions can be distinguished, taking into consideration the fulfillment of the requirements of stakeholder groups (see Table 7). For each of them, five solutions have been designated (six for shippers and freight operators because of the very similar assessments of two solutions). CL solutions that were best evaluated in terms of meeting the needs of the local authorities, residents, and others are AmazonFlex (USA), Stuart (France), MyWays (Sweden, Germany), Instacart (USA), and Deliveree (Thailand). Their high rating mainly results, in addition to providing security, from a strong emphasis on creating local community. For PT operators, for whom the CL freight logistics solutions are complementary (some of the staff employed by CL providers are moving by using PT lines), the best solutions are AmazonFlex, Deliv, Stuart, Instacart, and MyWays—the solutions provided by most of them are same as those for the previous group. This is mainly due to the high relative validity of the same criteria—the social criteria, particularly the safety criterion. In turn, for shippers and freight operators, for whom business and economic criteria are the most important, Deliveree (Thailand), Deliv, AmazonFlex, Easyvan, Colis-voiturage, and Veho are the best rated. These are mostly different solutions than those that have been highly rated for other groups, which results from the different priorities of this group of stakeholders in comparison with the other groups.

Some solutions were considered the best for more than one group of stakeholders, and in fact, this is the most important finding of this study: information for potential or existing CL providers on how to prepare the market offer to meet the needs of different stakeholders. These include AmazonFlex (indicated for three groups of stakeholders), Deliv, Deliveree (Thailand), Instacart, MyWays, and Stuart (for two groups of stakeholders). This part of the analysis allowed the answer to RQ2.

The findings of this research using multi-criteria assessment of the CL solutions provide insights for designing the proper CL market offer, both universal and special, dedicated to particular target groups (particular stakeholders groups). Usually, the CL providers address their services to private stakeholders, especially individual customers and small companies. In this study, they are presented as freight operators, shippers, and some of the city users. However, there are many possibilities to include the public transport providers into developing CL solutions, also local authorities, creating urban logistics policy, and many documents related to this area such as sustainable urban logistics (or mobility) plans.

Firstly, according to the empirical research results, CL solutions addressing the needs of the stakeholders improve the efficiency of the whole urban logistics system, such as for example, by reducing the greenhouse gas emissions and traffic. They can improve the sustainability of the urban logistics system in all of the three mentioned areas (economic, environmental, and social) by meeting the different needs of different stakeholders related to sustainability. Some of the solutions such as AmazonFlex read those needs very well; thus, they are better suited to the customers' expectations, and can be a benchmark for other solutions.

Secondly, the research emphasizes the important role of the freight transport, not only passenger transport in creating the urban logistics system. Based on this finding, the development of crowd logistics solutions should be an element of contemporary city management in the area of logistics and transport.

5. Discussion and Conclusions

The results of the conducted research correspond with the results presented in other scientific articles from the studied area. First of all, the analysis covered different groups of stakeholders, as well as different groups of their priorities, related to CL solutions [39,58,59,63]. This enabled the separate assessments for specific CL solutions and a final global assessment, taking into account partial scores for stakeholder groups. It turned out that there are common areas of interest for various stakeholders groups, especially for local authorities, residents, visitors, and partly, PT providers [17,54,55,68]. The business stakeholders, shippers, and freight operators had the same priorities [68], which were mainly focused on the economic dimension [77,85]. Nevertheless, it should be noted that still, stakeholder analysis in areas of crowdsourcing, urban development, urban logistics, mobility, and CL should be improved, and more empirical studies are needed to address the problem of their needs and characteristics [86–88].

This article is the first dealing with stakeholder needs assessment in the area of CL solutions regarding the three dimensions of the sustainable development in cities (environmental, social, and economic). The developed concept of analysis provides insights for many decision-makers, including practitioners, market analysts, and local authorities. The results of the research allowed to find CL solutions that meet the requirements of several interest groups. One solution (AmazonFlex) was rated highly for all five groups of stakeholders, including two groups with homogenous needs (PT operators and authorities, residents and other users). This CL solution will be a role model for others that currently have problems; for example, with a small number of clients or a low level of profitability. Their business models, development strategies, and services offered should be further studied to enhance the knowledge about the ideal CL solution model [17,66]. Managers can use the assessment procedure to verify their business models and concepts regarding CL solutions. It can be a basis for adjusting their offer to market needs and planning future activities (e.g., new services). The procedure increases the awareness of stakeholders' needs and benchmark solutions to model on. On the other hand, this approach is useful for the local authorities to verify the local market offer and its compatibility with the needs of the different city users and companies doing business within the urban and suburban areas. The results of this study can be a good reference point to create, evaluate, and improve the sustainable urban mobility plans, related also to building a good environment for developing new market players for the sustainable mobility of people and goods.

The main areas of improvement for the existing CL solutions should be to enhance the environmental dimension of their activities [9,64], including for the health of the local community, as well as to design complex insurance and customer service (including complaints) systems. These areas have already been mentioned in this regard in the literature [9,11,56,69,71].

This paper contains a unique proposition of the tools, approaches, and implementation of CL solutions assessment. The CL solutions evaluation model, based on the needs of stakeholders, is a good instrument for evaluating market bidders as well as assessing their own business ideas. The presented model is one of the few that use the AHP approach to build a multi-criteria assessment of solutions in this area [39,65]. This study is, according to the authors' knowledge, the first about evaluating this kind of sharing economy service in the context of the stakeholders' needs using the AHP method. Both academic staff (to make comparisons with other research, to compare their own research with this one) and current or future CL providers (to verify and extend their market offers) can use it. This paper can also start a new scientific discussion about the concepts of stakeholder needs analysis according to different approaches and topics related to sharing economy solutions in cities, including Mobility-as-a-Service and CL.

The authors are aware that this research has four strong limitations. Firstly, the set of variables focused only on the sustainability area, and its subareas cannot fully describe the complex character of the needs of stakeholders. Secondly, using multi-criteria methods other than AHP for research goal implementation can give other results. Therefore, one of the future research directions can be the multi-criteria analysis based on the AHP-based hybrid methods, other multi-criteria methods, or comparisons of the results obtained by using different methodological approaches. Thirdly, the set of variables was built based on the literature review, not on the primary data (interviews and surveys), so one of the next steps of developing and enhancing this study will be gathering the primary data. Fourthly, the presented methodological approach might not provide the full list of the existing CL solutions. There is a risk of omitting some CL solutions in this manuscript, even when using the described research method and approach (for example, some CL solutions are called crowdsourcing solutions). However, the authors tried to get access to different sources (literature sources, datasets, the results of the simple search in the Internet search engine) to identify as many CL solutions as possible.

Nevertheless, this study provides useful insights and contributes to the development of knowledge about the construction of CL solutions and their market offer. The research results are promising, and provide many practical implications and future investigation possibilities. Future studies should be conducted to obtain the primary data on CL stakeholders' needs, using other research methods to address the same research problems and comparing the results with other studies. The authors hope that these and many other issues in the area of CL solutions will be addressed in the near future in both theoretical and empirical research.

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Appendix A

Table A1. The primary dataset for assessing the CL solutions—assessment of general data and environmental sustainability.

Number in the AHP Analysis	Solutions	Country	Year of Launch	Website	Still Existing? (Y: yes, N: no)	Main Business Area	Criteria					
							Environmental					
							1	2	3	4	5	6
							Reduction of CO_2 Emissions	Eff. Use of Loading Space	Developed Model of Using Resources	Reducing Noise	Less Waste	Congestion and Traffic
	Agheera	Germany	2014	http://www.agheera.com/	Y (see MyWays)	telematics, crowd logistics						
1	AmazonFlex	USA	2015	https://flex.amazon.com/	Y	crowd logistics	no	yes	no	no	no	no
	Backpackband	USA/ Bangladesh	2013	https://backpackbang.com/	Y	foreign shopping and delivery, mostly Bangladesh–USA relations	no	definitely yes	no	no	no	no
	Barnacle	USA	2013	http://p2ppostal.appspot.com/	N	no information						
	Beelivery	UK	2015	https://www.beelivery.com/	Y	same-day grocery delivery	yes (using bikes)	yes	yes	no	no	no
	Bistip	Indonesia	2011	https://www.bistip.com/	Y	connecting travelers and item lookers	no	yes	yes	no	no	no
	Boncarry	Spain	2015	http: //boncarrytestapp.appspot.com/	N	connecting travelers and item lookers						
	Bringbee (by PolyPort GitHub)	Switzerland	2011	http://bringbee.ch/en	N (since 2014)	online shopping and delivery	yes	no	yes	yes	no	yes
	Cabenamala	Brazil	2012	https://www.cabenamala.com.br/	N (WWW not working)	crowd logistics						
	Checkrobin	Germany	2012	https://checkrobin.com/	Y	courier services (B2B, B2C)	no	yes, very	yes	no	no	no
2	Colis-voitourage	France	2008	https://www.colis-voiturage.fr/	Y	passenger/freight transport	yes	no	yes	yes	yes	yes
	Dealtrotter	France	2015	http://www.deal-trotter.com/	N	connecting travelers and item lookers						
3	Deliv	USA	2013	deliv.co	Y	Last-mile delivery and returns	yes (cars 1998 and newer)	no	no	no	no	no
4	Deliveree	USA	2015	https://delivereeinc.com/	Y	on-demand delivery, food delivery	yes (bikes allowed)	yes	yes	no	no	no
5	Deliveree	Thailand	2015	http://www.deliveree.com	Y	on-demand logistics	yes	yes, very	yes, well-developed	no	no	no
	Deliveroo	UK	2014	https://deliveroo.co.uk/	Y	on-demand food delivery	yes	yes	yes	yes	no	yes

Table A1. *Cont.*

Number in the AHP Analysis	Solutions	Country	Year of Launch	Website	Still Existing? (Y: yes, N: no)	Main Business Area	Criteria					
							Environmental					
							1	2	3	4	5	6
							Reduction of CO_2 Emissions	Eff. Use of Loading Space	Developed Model of Using Resources	Reducing Noise	Less Waste	Congestion and Traffic
	Doordash	USA	2013	doordash.com	Y	food delivery	yes (bikes allowed)	yes	yes	no	no	no
6	Easyvan (today: Lalamove)	Hong Kong	2013	http://www.lalamove.com	Y	on-demand delivery	no	yes	yes	no	no	no
	Entrusters	USA	2014	entrustters.com	Y	connecting travelers and item lookers	no	yes	no	no	no	yes
7	EpiFruit	USA	2017	https://www.epifruit.com	Y	local on-demand deliveries	yes (bikes allowed)	yes	no	no	no	yes
	Expediezentrevous	France	2009	http://www.expediezentrevous.com/	N	local deliveries						
	Friendshipper	Dubai	2013	http://www.friendshippr.com/	N (since 2016)	mobile application for crowd shipping						
	GoFellow	Canada	2012	gofellow.com	N	local freight transport						
8	GoGoVan	Hong Kong	2013	https://www.gogovan.com.hk	Y	on-demand delivery	no	yes	yes	no	no	yes
	GrubHub	USA	2004	grubhub.com	Y	food delivery	no	no	no	no	no	yes
9	Hitch	USA	2014	HITCHIT.CO	Y	on-demand local delivery	yes	yes	yes	yes	no	yes
10	Instacart	USA	2012	INSTACART.COM	Y	shopping delivery	yes	yes	no	no	no	yes
	Jibli	France	2012	https://www.jibli.com/	Y	connecting travelers and item lookers	no	yes	yes	no	no	no
	Jwebi	France	2014	https://www.jwebi.com/	Y	connecting travelers and item lookers	no	yes	no	no	no	no
11	Kanga (GEODIS partner)	USA	2013	https://www.getkanga.com	Y	on-demand local delivery	yes (bikes allowed)	yes	yes	no	no	yes
	KombiBus Brandenburg	Germany	2012	kombibus.de	Y	freight transport using passenger transport bus lines	yes (to some extent)	yes	yes	no	yes	yes
12	ManyShip	USA	2013	https://www.manyship.com	Y	local, national, international on-demand transport	no	yes	yes	no	no	no
	MeeMeep	Australia	2011	https://meemeepdotcom.wordpress.com/	N (since 2014)	freight last-mile deliveries						

Table A1. *Cont.*

Number in the AHP Analysis	Solutions	Country	Year of Launch	Website	Still Existing? (Y: yes, N: no)	Main Business Area	Criteria					
							Environmental					
							1	2	3	4	5	6
							Reduction of CO_2 Emissions	Eff. Use of Loading Space	Developed Model of Using Resources	Reducing Noise	Less Waste	Congestion and Traffic
13	MetroAfricaXpress	Nigeria	not specified	https://www.max.ng	Y	local freight and passenger transport	no	yes	yes	no	no	yes
	Muber	USA	2013	not reachable	N	connecting travelers and item lookers						
	Muber	Australia	2014	muber.com.au	N	local freight shipping						
	My Lorry/food express (today: Takeaway.com)	Germany	2013	https://www.takeaway.com	Y	local food delivery	yes	yes	yes	yes	no	yes
14	MyTaxi delivery (Daimler Group)	Germany	2013	https://mytaxi.com	Y	local on-demand delivery	no	yes	yes	no	no	yes
15	MyWays (by Agheera by DHL)	Sweden, Germany	2010	http://www.agheera.com	Y (very few information)	crowd logistics solutions	yes	yes	yes	no	no	yes
16	Nimber	Sweden	2010	nimber.com	Y	local and national deliveries	yes	yes	yes	yes	yes	yes
	Packmule	Italy	2010	http://www.packmule.it/	N	local freight transport						
17	Pack'n'drive (incl. Chainly)	France	2015	http://www.packndrive.com/	Y	blockchain for smart mobility	yes	no	no	no	no	yes
	Parcelio	USA	2012	http://www.parcelio.com	N	local freight transport						
18	Parcify	France	2017	https://parcify.com/en/	Y	local freight transport	yes (bikes allowed)	yes	no	no	no	no
	PickApp (today: Scharff)	Peru	2015	https://www.holascharff.com/	N	freight transport (only B2B and B2C)						
	Picknpass	Israel	2011	www.picknpass.com/	N							
19	PickThisUp	Netherlands	2015	https://www.pickthisup.nl/	Y	local and national freight transport	no	yes	yes	no	no	no
20	PiggyBee	Belgium	2012	https://www.piggybee.com	Y	international, national, local deliveries	no	no	yes	no	no	no
	PleaseBringMe	Turkey	2012	http://pleasebringme.com/	Y	being a portal for travelers and locals	no	no	no	no	no	no
	Postmates	USA	2011	https://postmates.com/	Y	local deliveries (food)	yes	yes	yes	no	yes	yes
	Rideship	USA	2014	https://www.rideship.com/	N	local deliveries						

Table A1. *Cont.*

Number in the AHP Analysis	Solutions	Country	Year of Launch	Website	Still Existing? (Y: yes, N: no)	Main Business Area	Criteria					
							Environmental					
							1	2	3	4	5	6
							Reduction of CO_2 Emissions	Eff. Use of Loading Space	Developed Model of Using Resources	Reducing Noise	Less Waste	Congestion and Traffic
21	Roadie	USA	2014	www.roadie.com	Y	local and national freight transport	no	yes	yes	no	no	yes
	Shipeer	Spain	2014	http://www.shipeer.com/	N	local freight transport						
	Shipizy	Portugal	2012	http://www.shipizy.com/	N	local freight transport						
22	Sociotransit	Denmark	2013	http://www.sociotransit.com/	Y	local, national, and international freight transport	yes	yes	yes	yes	yes	yes
23	Stuart	France	2015	www.stuart.com	Y	local deliveries (urban areas)	yes (mostly bikes)	yes	yes	yes	no	yes
	Suppertime	Australia	1985	http://suppertime.com.au/	N	local food delivery						
	Tinycarrier	USA/ Singapore	2013	tinycarrier.com	N	connecting travelers and item lookers	no	yes, very	yes	no	no	yes
	Toktoktok	France	2013	toktoktok.com	N	on-demand pick-up and delivery						
	TramFret Saiint Etienne	France	2012	http://tramfret.com/	Y	local deliveries using recycled tramway rolling stock	yes	yes	yes	yes	yes	yes
	Triwer	Norway	2017	http://www.triwer.com/	N (pause from mid-2018)	delivering goods						
	UberEats	USA	2014	https://www.ubereats.com	Y	local food delivery	yes (bikes, scooters allowed)	no	yes	yes	yes	yes
	UberRUSH	USA	2014	https://rush.uber.com	N (since 2018	local on-demand delivery						
	Urbink	Singapore	2017	http://www.urbink.com/	N (since 2017)							
24	Veho	USA	2016	https://shipveho.com/	Y	local and regional deliveries	no	yes	yes	no	no	yes
	VIL	Belgium	2003	https://vil.be/en/project/crowd-logistics/	N (project closed)							
	Wunwun	USA	2015	http://wunwun.com/	Y	blog of one traveler (not included in the analysis)	no					
	Zaagel	Egypt	2013	http://zaagel.com/Default.aspx	Y	connecting travelers and item lookers		yes (luggage)	no	no	no	no
	Zipments (today Deliv)	USA	2013	https://www.deliv.co/courier-service/nyc/	Y	local delivery						

Table A2. The primary dataset for assessing the CL solutions—assessment of social and economic sustainability.

Number in the AHP Analysis	Solution	Social									Economic					
		7	8	9	10	11	12	13	14	15	16	17	18	19	20
		Connecting Individual Providers and Consumers	Voluntary Character	Tracking, Transparency	Simplicity and Trust	Safety	Health Benefits	Indicating Country Specifics and Ethics in Business Model	Access to Adequate IT	Free Capacity, Flexibility, Access	Attractive Revenue Model	Time of Delivery	Strategy of Cooperation	Geographical Scale	Insurance
1	AmazonFlex	yes, high	definitely yes	very advanced	yes	Yes	no	yes	yes	very flexible, yes	18–25 USD per hour	same-day	partnership	very restricted	well developed
	Backpackband	yes, but restricted	yes	advanced	not very well	Yes	no	yes	yes	flexible (but restricted to luggage size)	traveler and portal up to 20% of item price	up to 16 days	travelers deliver goods to foreign customers	very wide	not well developed
	Beelivery	yes	definitely yes	very advanced	yes	Yes	no	yes, definitely	yes	very flexible	7–20 pounds per one delivery	up to 90 min	very flexible, anyone can be carrier, very well-developed	national, mainly nine cities	not well developed
	Bistip	yes	yes	weak	yes	Yes	no	yes	yes, but not well-developed	flexible (but restricted to luggage size)	flexible, depends on bidder	nor declared, flexible	flexible, but controlled	restricted to Asia, mainly Jakarta, Seoul, Tokyo, Singapore	not developed
	Bringbee	yes	yes	yes	yes	Yes	no	yes	yes	yes, but there were problems with demand coverage	not specified	same-day	flexible, strong neighborhood relations	2000+ cities in one country	yes, free of charge
	Checkrobin	no	no	yes, well done	yes	Yes	no	no	yes	yes, flexible	no	it depends	not flexible, only B2B or B2C	Europe and other	yes
2	Colis-voitourage	yes (invitations)	yes	yes	yes	Yes	no	yes	yes	yes, flexible	yes, flexible	it depends	flexible	one country (regions)	yes
3	Deliv	yes	yes	yes, very well developed	yes	Yes	no	yes	yes, very advanced	restricted to weight and size of cargo	yes, up to 22 USD/hour	same-day	very flexible	restricted to USA	well developed
4	Deliveree	yes	yes	yes	yes	Yes	no	yes	yes	yes	no information	same-day	no information	small, restricted	no
5	Deliveree	yes	yes	yes, well developed	yes	Yes	no	yes	yes	yes, not restricted	yes, many options (depends on car and services)	mostly same-day	very, very flexible	3 countries+ international	yes
	Deliveroo	yes	yes	yes	yes	Yes	no	yes	yes	yes	up to 120 pounds/day	up to 30 min	flexible	14 countries	
	Doordash	yes	yes	yes	yes	Yes	no	yes	yes, well-developed	yes, also disabled people	yes (guaranteed minimum promotion)	up to 30 min	flexible	whole country	yes, well developed
6	Easyvan (today: Lalamove)	yes	yes	yes, well developed	yes	Yes	no	yes	yes, very advanced	yes, flexible	yes, but not specified	local – up to 55 min	flexible	100+ cities across China and Southeast Asia	yes

Table A2. *Cont.*

Number in the AHP Analysis	Solution	Social								Economic						
		7	8	9	10	11	12	13	14	15	16	17	18	19	20	
		Connecting Individual Providers and Consumers	Voluntary Character	Tracking, Transparency	Simplicity and Trust	Safety	Health Benefits	Indicating Country Specifics and Ethics in Business Model	Access to Adequate IT	Free Capacity, Flexibility, Access	Attractive Revenue Model	Time of Delivery	Strategy of Cooperation	Geographical Scale	Insurance	
	Entrusters	yes (invitations)	yes	yes	yes	Yes	no	no	yes	flexible (but restricted to luggage size)	yes, but not specified	not specified	flexible	world	not specified	
7	EpiFruit	yes	yes	yes, well developed	yes, restricted	Yes	no	yes	yes	yes, but restricted to Manhattan	no information	Various	flexible	only Manhattan	yes	
8	GoGoVan	yes	yes	yes	yes	Yes	no	yes	yes	yes, but restricted for big lorries	yes, but not specified	Various	flexible	Six countries	yes	
	GrubHub	yes	yes	yes	yes	Yes	no	yes	yes	yes	not specified	Quick	flexible	USA and London	not specified	
9	Hitch	yes	yes	yes	yes	Yes	no	yes	yes	yes, in 100%	yes, specified only as price of delivery	same-day	flexible	USA	not specified	
10	Instacart	yes, definitely	yes	yes	yes	Yes	yes	yes	yes	yes	yes, but not specified	same-day	flexible	USA and Canada	not specified	
	Jibli	yes	yes	yes, well developed	yes	Yes	no	no	yes	Yes, but restricted	yes, but not specified	various	no information	world	not specified	
	Jwebi	yes	yes	yes	yes	Yes	no	yes	yes	yes, but restricted	yes, but not specified	various	flexible	world	not specified	
11	Kanga	yes, restricted	yes	yes, but not specified	yes	Yes	no	yes	yes	yes	yes, flexible	various, mostly same-day	flexible	USA	not specified	
	KombiBus Brandenburg	no	no	yes	yes	Yes	no	yes	yes, but not well developed	yes	no	according to timetables	flexible (but only bus stations)	Germany	not specified	
12	ManyShip	yes	yes	yes	yes	Yes	no	yes	yes	yes, but restricted	not specified	2–3 days (country), 5–10 days (international)	flexible	world	no	
13	MetroAfricaXpress	yes	yes (but restricted)	not specified	yes	Yes	no	yes	yes	yes	not specified	3–5 h for same-day deliveries	flexible	Nigeria, Lagos	not specified	
	My Lorry/food (Takeaway.com)	yes	yes	no	yes	Yes	yes	yes	yes	yes, always	yes, but not specified	up to two hours	very flexible	nine countries (mostly Europe)	not specified	
14	MyTaxi delivery	yes, restricted	Restricted	yes	yes	Yes	no	yes	yes	yes	yes, but not specified	same-day, usually quick	flexible	world, but mostly Europe	not specified	

Table A2. *Cont.*

Number in the AHP Analysis	Solution	Social							Economic						
		7	8	9	10	11	12	13	14	15	16	17	18	19	20
		Connecting Individual Providers and Consumers	Voluntary Character	Tracking, Transparency	Simplicity and Trust	Safety	Health Benefits	Indicating Country Specifics and Ethics in Business Model	Access to Adequate IT	Free Capacity, Flexibility, Access	Attractive Revenue Model	Time of Delivery	Strategy of Cooperation	Geographical Scale	Insurance
15	MyWays	yes	yes	very advanced	yes	Yes	no	no	yes, well-developed	yes	not specified	same-day delivery	flexible	wide	well developed
16	Nimber	yes	yes	yes	yes	Yes	yes	yes	yes	yes	yes	various, also same-day	flexible	wide, mostly national	not specified
17	Pack'n'drive	yes	yes	yes	yes	Yes	no	yes	yes	yes	not specified	Various	flexible	wide	yes
18	Parcify	yes	yes	yes	yes	Yes	no	yes	yes	yes	yes, but not specified, low prices	Short	flexible	France	yes (up to 2000 EUR)
19	PickThisUp	yes	yes	yes	yes	Yes	no	yes	yes	yes	yes, but not specified	8–24 h	flexible	Netherlands (up to 640 km)	not specified
20	PiggyBee	yes	yes	yes	yes	yes	no	yes	yes	yes, sometimes restricted	yes, but not specified	various	flexible	world (mostly Europe and America)	yes, up to 1500 USD
	PleaseBringMe	yes	yes	no	yes	No	no	no	yes	no	no	various	flexible, but without the responsibility of portal	world	no
	Postmates	yes, very well	yes	yes	yes	Yes	yes	yes	yes	yes	yes	same-day	flexible	US cities	yes
21	Roadie	yes	yes	yes	yes	Yes	no	yes	yes	yes	yes, but not specified	various	flexible	USA	yes
22	Sociotransit	yes	yes	yes	yes	Yes	no	yes	yes	yes, sometimes restricted	yes, but not specified	various	flexible	many countries (mostly Western Europe)	very wide
23	Stuart	yes	yes, definitely	yes	yes	yes (requirement)	yes	yes	yes, well developed	yes	yes, specified	same-day	very flexible	three countries (UK, France, Spain), 14 cities	yes
	Tinycarrier	yes	yes	yes, restricted	yes	Yes	no	yes, requirements	yes	yes, sometimes restricted	yes, but not specified	various	flexible	world	yes, up to 500,000 Singapore dollars
	TramFret Saiint Etienne	yes	yes, restricted	yes	yes	Yes	yes	yes	yes, restricted	yes, restricted in some way	not specified	same-day, very short	flexible	within a city	not specified
	UberEats	yes	yes	yes	yes	Yes	no	yes	yes, well developed	yes, always	yes, specified	short, up to two hours	very flexible	many countries, worldwide	not specified
24	Veho	yes	yes	yes, well done	yes	Yes	no	yes	yes, well developed	yes	yes, guaranteed	2–8 h, same-day, next-day deliveries	very flexible	regions, USA	not specified
	Zaagel	yes	yes	no	yes	Yes	no	yes	yes, not well developed	yes	yes, flexible	flexible	flexible	USA, Egypt	not specified

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