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Crowd Models for Last Mile Delivery in an Emerging Economy

Ahmad Alharbi *, Chantal Cantarelli and Andrew Brint

Management School, University of Sheffield, Sheffield S10 1FL, UK; c.c.cantarelli@sheffield.ac.uk (C.C.); a.brint@sheffield.ac.uk (A.B.)

* Correspondence: aalharbi5@sheffield.ac.uk

Abstract: The dramatic rise in online shopping means that the last mile delivery (LMD) task is becoming extremely important. However, last mile delivery faces many economic, social, and environmental challenges. A fast-growing innovative solution is Crowd Logistics Delivery (CLD). This study investigates how CLD is meeting these challenges in a rapidly emerging economy (Saudi Arabia). It uses semi-structured interviews to analyse CLD from the perspectives of multiple stakeholders, focusing on its implementation, benefits to different stakeholders, and its limitations. While the findings of this study broadly support the work of other studies in this area, it provides several new insights. It observed three different business models being used for CLD: B2B, B2C, and C2C. It identified the internal success factors of each business model, including registration, assigning orders, compensation, and the payment model. It revealed the motivations for stakeholders to use CLD as a last mile delivery solution, such as LMD-related benefits and the social impact on society. In addition, the study highlighted the four main challenges these CLD implementations face that impede their success: legislation, availability of supply/drivers, trust, and culture. These results add to the rapidly expanding field of CLD.

Keywords: last mile delivery; crowd logistics; business model; stakeholder analysis

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1. Introduction

Even before the COVID-19 pandemic, the relentless rise in online ordering meant that last mile delivery (LMD) was a key element of city logistics. Since the advent of COVID-19, it has become even more crucial. Recently there has been increasing interest in using Crowd Logistics Delivery (CLD) for this key stage in the delivery chain. In CLD, retailers let individuals cover the last mile for other shoppers [1] with the crowd being defined as individuals who choose to undertake the last mile delivery task [2–6]. Buldeo Rai et al. define crowd logistics as:

> "an information connectivity enabled marketplace concept that matches supply and demand for logistics services with an undefined and external crowd that has free capacity with regards to time and/or space, participates on a voluntary basis, and is compensated accordingly"
>
> ([5], page 1) (also quoted in [7]).

Therefore, the growing interest in CLD is expected to continue to rise as the move to smart cities improves the information and communications technology (ICT), providing the 'crowd' with better knowledge of the real time marketplace and reducing the knowledge imbalance with large logistics providers [7,8].

Although the use of CLD has been increasing, a number of implementations have not been viable, for instance some start-ups, such as WebVan and Kozmo.com, failed due to an absence of critical volume. Similarly, Myways is no longer available [9], and Metro Post (a USPS service) has been phased out [2]. Therefore, a deeper understanding of the CLD models and their strengths and weaknesses is needed. While a number of analyses of LMD have been published in advanced economies [10–12], there have been relatively few

studies investigating CLD as an LMD solution in rapidly emerging economies. Compared with developed economies, different factors can have a significant influence, such as the logistics infrastructure, the nature of society, and the values deriving from the country's culture and norms. Typically, the rapid development in these countries is leading to quickly growing cities, providing the logistics infrastructure both with challenges and the scope for innovation. For example, one of the challenges is the delivery problems due to incomplete addresses found in regions of the Middle East and North Africa (MENA). As a solution, applications of CLD are currently being used in a quartet of nations across the Middle East (namely Bahrain, Egypt, the UAE, and Saudi Arabia).

Additionally, the cultural values vary between countries, and these differences can have a significant impact on whether business models succeed or fail. In these quickly developing countries, employing CLD for LMD can and is providing assistance in overcoming LMD issues. Hence, this research investigates the CLD business models that are employed as LMD solutions in an emerging economy. While all emerging countries have their own particular circumstances, there is often a degree of similarity of the cultural, economic and developmental positions between countries in a region, such as within South America, Asia, and the Gulf. This study focuses on the Gulf and investigates the position in three fast growing cities in Saudi Arabia by carrying out a comprehensive study involving the perspectives of different groups of stakeholders. Saudi Arabia is amongst the countries classified by the IMF as an 'emerging market and developing' country [13] and is also featured in commonly used indices for emerging markets such as Morgan Stanley Capital International [14]. The use of CLD is increasing dramatically as a last mile solution in Saudi Arabia, and even replacing some of the logistic service providers (LSPs) in cities.

Consequently, the objective of the study was to answer the following questions:

RQ1: What are the typical CLD business models in Saudi Arabia? What are their features?
RQ2: What economic, environmental, and social benefits do the stakeholders see these models as providing? How do these perceived benefits match with those reported in the crowd logistics literature?

In the next section, the background of LMD is described including a review of the current literature. Then, the research methodology and research design are presented in more detail. The results reveal the presence of the three business models and how they help solve the challenges in LMD. The study concludes with a discussion of the empirical findings and contributions to the research field.

2. Background and Literature Review

2.1. Last Mile Delivery (LMD)

In the literature, last mile delivery (LMD) refers to the activities required for physical delivery to the receiver's chosen final destination [15]. *Last mile* is used to refer to the physical transfer of a material or product from its source to its final destination, i.e., from supply side to demand side [16]. Therefore, it does not refer to an exact mile (or km) but depends substantially on the location and geographical configuration of the supply chain [12]. Thus, for retail supply chains, the final delivery destination corresponds with the home of the end-users. Subsequently, from the LMD point of view, crowd logistics is a solution adopted by companies to execute the LMD, where the crowd executes the last phase of the delivery process to the final destination, thus leading to the label crowd logistics delivery (CLD). Here retailers let customers cover the last mile for other shoppers [1]. Crowd logistics is defined as the 'outsourcing of logistics services to a mass of actors, supported by a technical infrastructure, in order to achieve economic benefits for all stakeholders' [3] (p.123). Technical infrastructure refers to a communication medium or information technology platform to coordinate the demand and supply for logistics services [3].

The development of the internet has opened up possibilities for crowd logistics, where every step in the entire value chain can be supported by a virtual network [17]. Digital technologies allow for detailed tracking, alerts, and the monitoring of deliveries in real

time. Payment processing is likewise handled using a digital platform, e.g., credit cards, wire transfers, and electronic invoices [18]. Crowd logistics is a new breed of logistics services, with structural advantages in terms of flexibility, speed, and volume in service delivery [19]. By using millions of citizens as part-time delivery labour in LMD, fewer vehicles are needed by logistics service providers (LSPs), leading to cost-efficiencies for all involved parties [20]. As Pfenning points out, where users of crowd logistics can obtain flexible and convenient logistic services, service providers benefit financially by offloading costs and responsibilities to the actual users of the logistics service [21].

Frehe et al. identify three types of crowd logistics services, namely freight transport, personal transport, and purchase-and-delivery [4]. The personal transport service is a type of taxi service, for example, whereas the freight transport service is like traditional courier, express, and parcel services, including food delivery [4]. Uber is among the most popular and successful examples of crowd logistics. The company acts as a mediator between the crowd, who either demand or provide the logistics service. Uber provides the infrastructure, via a freely downloadable mobile application through which users can communicate: (1) to request a parcel, food, or transportation service, or (2) to respond to a specific request by another user [3]. Drivers and riders connect over the Uber application and payments are charged once a successful transaction is completed and confirmed using the application. Different business models have developed for the delivery of different types of products and these include, amongst others, parcels, food, groceries, and cosmetics. This solution is advantageous for retailers, e-commerce companies, locals, and other stakeholders.

Checkrobin is another online platform for transport services. Their business model promotes "ride-sharing" where cars travelling with unused loading space can offer to deliver private shipments and, in the process, reduce their travel costs. The app also allows senders and drivers to post reviews to ensure service quality. A further example is MyWays which works in a similar way to Checkrobin. The main difference is that the packages are delivered to a DHL station or branch, instead of directly to the receiver's address. Crowds are thus able to select which parcels they want to collect and deliver using the MyWays platform [17].

CLD faces many economic, social, and environmental challenges. Two studies, [5] and [6], have assessed the sustainability of CLD. They both relied on the most common definition of sustainable development 'meeting the needs of the present without compromising the ability of future generations to meet their own needs' [22]. This falls in the area of the Triple Bottom Line (3BL) of sustainability, i.e., economic growth, social equality and environmental, or the Triple P of people, profit, planet [23]. However, both studies [5,6] do not explain the details of the implementation of the business model, i.e., the implementation of C2C.

Following the 3BL categories: economically—crowd logistics provides consumers access to a greater variety of goods [24], faster delivery [24–26], less missed deliveries [7] and more flexibility [3,27]. Furthermore, it becomes more convenient, better priced [2,28], and more personal [2,24]. Socially—with crowd logistics the local user is known, enabling people to have private interactions with their neighbourhoods and to support communities [29,30]. Environmentally—by using the current transport flows, crowd logistics increases the consolidation of deliveries to nearby locations, and so decreases the emissions of traffic, congestion and air pollution [2,25,27,31], and contributes to the reduction of land use and CO_2 emission [28,32]. Table 1 tabulates these possible benefits.

2.2. Challenges with LMD

Despite some promising benefits, many previous freight consolidation initiatives have failed. These failures could be attributed to focusing solely on the aims of a particular stakeholder in the growth phase [33]. Similarly, based on a review of the supply chain literature since 1995, Harrington et al. found that last mile solutions are often proposed based on one dominant perspective [34]. They found that there is a clear bias towards using

an industrial point of view, indicating that decisions on last mile solutions may mostly be based on considerations of transaction cost [34].

Table 1. Summary of the possible advantages from crowd logistics.

	Environmental		Social		Economic
1.	Reduction in traffic congestion	4.	Private interactions	6.	Greater variety of goods
2.	Reduction in traffic emissions	5.	Supporting community	7.	Faster delivery
3.	Reduction in CO_2			8.	More flexibility
				9.	More convenient
				10.	Better priced
				11.	More personal
				12.	Less missed deliveries

An Eye for Transport survey questioned a total of 400 logistics professionals and found that 60% described their supply chain as "customer-driven" and quickly supplanting the "product-driven" approach [35]. In the sense of customer relationship management, service initiatives often fail due to the lack of customer alignment, the lack of clarity regarding network goals, poor design and planning, and use of misleading measures [36,37]. If such conditions are not integrated, a last mile solution may become inefficient, resulting in many operational 'smart city' initiatives failing to be implemented because the environmental and social benefits cannot be evaluated effectively or appropriately [34]. However, dealing with customers in LMD involves many challenges related to considerations about costs, delivery times, reliability, and "greenness" [38].

Consequently, many innovative solutions have been developed to address these problems, such as shared collection and pick-up points, reception boxes, drones, and 3D printing [9]. Crowd logistics is one of the innovative last mile solutions that is adapting to customer delivery preferences. CLD is a frontier in the logistics systems [18] that have started proliferating. Rześny-Cieplińska and Szmelter-Jarosz identified twenty 3BL criteria for crowd logistics sustainability based on stakeholders' needs (see Table 2 in [6]). In addition to the advantages listed in Table 1, Table 2 shows the additional factors they identified that are pertinent to LMD.

Table 2. Additional crowd logistics sustainability factor for LMD from Table 2 of [6].

	Environmental		Social		Economic
1.	Reducing noise	2.	Connecting individual providers and consumers	7.	Access to adequate IT infrastructure
		3.	Voluntary character	8.	Attractive revenue model
		4.	Tracking transparency	9.	Strategy of cooperation
		5.	Simplicity and trust		
		6.	Indicating country specifics and ethics in business model		

However, the CLD literature fails to fully acknowledge the met and unmet interests of different stakeholders which is required to understand how to orientate the stakeholders towards having an LMD solution. In particular, there is a dearth of understanding of the variety of value creation and exchange methods that motivate the stakeholders towards CLD and its business models.

2.3. The Context of Emerging Economies

Although CLD has been widely discussed in the business world, it has not yet been the subject of many academic publications in emerging economies [30]. While the number of companies providing crowd-sourced services is rapidly growing, there is still limited literary coverage of problems associated with these services [39]. Moreover, a variety of crowd logistics applications can be established using information technology and the exchange of information in practice, yet the theory behind this trend has received far less

attention [28]. Indeed, crowd logistics research is challenging due to the novelty of the topic, rapid developments in the field leading to a lack of operational uniformity, and an absence of standardized real-world data distribution structures [18].

Buldeo Rai et al. carried out a systematic literature review of 42 papers using different terms for crowd logistics, such as crowd shipping, crowd sourced delivery, and crowd logistics [5]. They concluded that the number of business models and crowd logistics initiatives has increased significantly. However, so far only limited scientific research has been carried out on the potential economic, social, and environmental effects of the economic sharing process in general and crowd logistics in particular. Similarly, Mehmann et al. and Ermagun and Stathopoulos concluded that crowd logistics is still in its infancy and that there is a need for more research [3,40]. Ermagun and Stathopoulos [40] noted that to date, work has been based on theoretical or opportunistic data from other fields [11], on conceptual data [41], or on the case study [32], and that studies using primary empirical data are few. Most of these published studies have employed only secondary data and quantitative methods. Moreover, most studies are focused on developed countries in Europe [5] while far less attention is given to crowd logistics in emerging economies. Emerging economies is a term applied to countries with fast growing economies that are moving towards being a developed economy. While there are many differences in the circumstances of these countries, their rapid economic growth means that they share some common problems, for example LMD for a growing urban population, often coupled with an increasingly affluent middle section of society.

In emerging economies, even though same-day delivery is an option for many people these days, the United Nations predicts that almost 4 billion people are situated in areas without street numbers or names [42]. For example, this is a problem for the Gulf region where this study is focused as some Middle Eastern countries do not use post codes. Such drawbacks in logistics lead to delivery problems on a regular basis in regions of the Middle East and North Africa (MENA). Although same-day delivery is an attractive option for many people these days, this is not as easy for people living in areas where postal codes, street numbers and names are not used by customers and drivers. This explains why a large number of parcels are sent back to the shipper with a label on them saying that the location was not found, even in urban and affluent areas. This problem originates from issues in the address infrastructure. As many as 30 different Middle-Eastern cities rely on applications of CLD as a solution. Meanwhile, in some countries where several e-commerce service platforms are based, a high percentage of the country's businesses and homes are still unable to have parcels delivered to their front doors.

The rapid growth of developing countries means that understanding and improving their business models is very important, but primary research data is generally missing for them.

3. Methodology and Research Design

An exploratory empirical study into CLD implementations for LMD was carried out. This approach was chosen because it is particularly suitable for studies in an emerging field [43–45]. Explanations can be obtained from exploration and analysis when the research context is unfamiliar and novel [46]. Thus, qualitative studies provide the opportunity to explore a new topic and provide more flexibility in understanding an established topic, such as the impact of culture on participants' behaviour in the present study.

3.1. Research Context

The research context is Saudi Arabia. While its GDP was the 20th largest in the world in 2020 [47], this was heavily reliant on oil revenue. Hence, Saudi Vision 2030 is striving to rapidly expand its non-oil economy and develop its public sector services [48]. The country with the highest usage of CLD in the region, with one application passing 220k orders a day. It is growing so rapidly that another application's new users in the first four months of 2020 were more than all the users who had registered in the past three years [49]. The

research was conducted in three major cities in Saudi Arabia: Riyadh, Khobar, and Madinah (Medina). Riyadh is the capital city of Saudi Arabia and has the highest population with around 7 million people out of the 33 million in the country. Khobar is in the eastern province of the country where the major oil and petrochemical companies are located, such as Saudi Aramco (the largest oil company in the world). Madinah is the second holiest Muslim city in the world after Mecca, and has a population of $1\frac{1}{2}$ million people. Although all stakeholders are from the same country, having interviewees from different cities allowed the researcher to obtain different perspectives from different backgrounds, which enriches the study. See Figure 1 the cities where the research was conducted.

Figure 1. Map of Saudi Arabia showing the cities where the research was carried out. (Outline downloaded 29 December 2021 from http://www.clker.com).

3.2. Sample

Stakeholder theory was used in the research to guide the data collection. This resulted in the identification of three stakeholder groups:

1. Institutional: decision makers in transportation and other authorities
2. Industrial: application owners and employees, retailers' owners and employees, and Logistics Service Providers' employees
3. Individual: customers and drivers/crowd.

Convenience sampling was adopted recruiting interviewees using the snowballing technique, starting from the author's and interviewees' contacts who were familiar with the industry. The sampling was complemented with purposive sampling to address some of the drawbacks with convenience sampling and to ensure a more balanced sample, in particular to have a balanced number of interviewees for the different business models.

The type of business model the interviewee uses is determined by the initial interview questions regarding the implementation, such as the product flow path. Some customers use more than one business model, so his/her perspectives about all models were included. A detailed list of the interviewees by stakeholder group and the business models they utilized is presented in Appendix A.

3.3. Data Collection

The study's focus was on the use of CLD for LMD across multi-faced markets. In other words, different markets and business models that use CLD were considered, including delivery models from e-commerce warehouses to customers, from retailers to customers, and from customers to customers.

Interviews are the primary data collection form used in qualitative research [50]. Since there is a lack of published work on CLD in rapidly emerging economies, the literature needs to be augmented with knowledge from the field—and in this case, the qualitative

method seems the most appropriate way to gain this information. Moreover, as this paper aims to understand an emerging phenomenon and the complicated contextual factors involved, the qualitative semi-structured interviews method is the most appropriate. In-depth semi-structured interviews including open-ended questions were conducted with different stakeholders. Individual interviews helped the researcher to obtain rich, personalized information [51], and to know how the participant thought or felt [52].

The interview questions consisted of three main categories. The first part aimed to identify the implementation of CLD and its business model along with its sustainability. The second part covered questions related to stakeholder values linked to CLD. The third part of the interview covered questions related to the factors that influence the sustainability of CLD as well as the operational challenges faced in last mile and crowd logistics.

The questions were based on some of the last mile solution dimensions from [34], and the social, economic, and environmental factors from CLD studies in sustainability [5,6].

The researcher used an interview protocol but to avoid biases, the researcher refrained from suggesting dimensions or there being any right answers. Moreover, the researcher used follow-up questions where needed to have a better understanding of the answers. The researcher conducted the interviews using a mixture of English and local language, depending on respondents' level of English and preferences. The interviews took place from August to December 2018.

3.4. Data Analysis

The interviews were recorded where permission was given and, in the few cases this was not possible, notes were taken. Interviews were transcribed, verified by the interviewees, and then, if necessary, translated. Nvivo and Mindview software were used to organize the transcripts, generate codes, and identify themes.

The research used the thematic analysis method to analyse the interview data, with the six phases of thematic analysis [53] being followed, namely: familiarity with data, initial codes generation, searching for themes, reviewing themes, identifying the theme names, and producing the report. As an important and useful benefit of thematic analysis, the researcher retains flexibility and avoids rigid rules during the analysis, and the researcher's judgment is necessary to determine what constitutes a theme [53]. Hence, the theme can be identified from a majority of the data provided by interviewees or from a small but important quantity of information related to the research question, as there is no right or wrong way to determine prevalence [49]. According to Braun and Clarke [53] a theme should not be measured in a quantified way (unlike content analysis) [54], such as depending on the number of participants.

This study focuses on the two inclusion criteria of codes that create themes, namely the density and intensity within the data. Density refers to the number of times the concept is mentioned by an interviewee, while the intensity refers to the rigor of the idea and experience of an interviewee regardless of the number of times it is mentioned [55].

The interviews were triangulated with informal discussion and these data were used to verify the themes developed from the interviews.

4. Results

Three major types of CLD models are currently implemented in Saudi Arabia: Business-to-Business contract (B2B), Business-to-Customers (B2C), and Customer-to-Customer (C2C). The models can be differentiated by the stakeholder who organizes the last mile delivery. Table 3 defines these types.

Table 3. Business models categorized by 'Who organizes the last mile delivery?'.

	B2B-Contract	B2C	C2C
Stakeholder who organizes the LMD:	E-commerce company contracts with CLD provider to organize LMD tasks.	App organizes the LMD for the customer by automatically selecting the drivers based on location	The customer organizes the LMD through the app by selecting the suitable driver for the LMD task

4.1. Business-to-Business Contract Model

In contrast to the other two models, the B2B-Contract CLD application business model deals with e-commerce companies/logistic service providers (LSPs), rather than customers (individuals). Although the naming convention could have used B2B, the term B2B-Contract was chosen to separate it from other known B2B models in the literature.

The B2B-Contract model deals with e-commerce/LSP, as a sales provider and contractor, and arranges for the drivers to deliver to e-commerce/LSP customers. Hence, the B2B-Contract model relies on existing customers provided by e-commerce. Two applications of B2B-Contract models were revealed from the interview process, B1 and B2. Table 4 shows the key features of the two B2B contract variants, highlighting the differences. Although they are based on the same model and their stakeholders are similar, their ways of assigning their drivers and the payment models are different.

Table 4. The two business-to-business contract variants.

Focus	B1	B2
Products flow path	From warehouses to the end consumers	From warehouses to the end consumers
Assigning drivers	Based on driver's availability Notification given	Based on driver's availability No notification
Assigning items for drivers	Automated assigning	Drivers' preferences, scan items on way out
Customers' role	Contact e-commerce/LSP company if issues arise	Contact e-commerce/LSPs company if issues arise
Direct and definitive stakeholders to CLD	Application owners, E-commerce companies, LSPs companies, and drivers	Application owners, E-commerce companies, LSPs companies, and drivers
Registration	Physically come and attend two-hour training session 2500 SR deposit Older car models allowed	Physically come and sign. No training required. No deposit required, but agree to pay up to 100,000 SR in cases of non-delivery, damage, or loss Not mentioned
Revenue Model: Application owners	Percentage of number of items assigned from e-commerce/LSPs High transaction level needed	Percentage of number of items assigned from e-commerce/LSPs High transaction level needed
Payment method for drivers	Distance-based	Fixed-Price

4.2. Business-to-Customers Model

In the B2C model, customers can either be individuals who make the order through the application (business) or retailers who pay a commission fee to the application owner for its use. For example, the application provider takes 20% of the value of each restaurant order made through their application. According to one of the application owners interviewed

"*We are a mediator between restaurants and customers.*"

BS (Application Owner)

The retailers in this model are restaurants, but it might be applied to other types of retailers in different contexts.

4.3. Customer-to-Customer Model

In the C2C model, customers are individuals who request products from any shop or place using the application. The drivers then purchase/pick up the items and deliver them on behalf of the customer. In other words, the application facilitates the delivery of anything from anywhere in an immediate delivery process. The C2C business model matches two customers (the sender and the receiver), and the driver to do the LMD task. A C2C application owner explained the need for such a business model:

> "*We realized that there is a problem people face in their daily life. People need items from shops that do not deliver, so we thought why don't we have a solution that delivers anything from anywhere? So this application simply links someone who offers a delivery service with someone who needs that delivery service.*"
>
> LA (Application Owner)

In the C2C model, the customer posts the shipment request on the CLD application and specifies the pick-up and drop-off location using the application map. After both parties have agreed on the price, the customer and driver can both contact each other through the application

The C2C model employs a different way of generating revenue for CLD application owners compared to the previous two models. It can be characterized as a bidding process, where drivers offer a price and customers then choose the price that is acceptable to them. The customer pays the driver for the product plus the delivery fee. The application takes a percentage of the delivery fee from the driver. Therefore, the customer and driver negotiate the price and the application generates money from the drivers after a certain number of deliveries. For example, a driver explained:

> "*I receive an order in my account and I post the price that I see as being reasonable for me. If the customer agrees on it, I start delivering. Sometimes the CLD provider takes a third of the delivery fees and sometimes they take 25%.*"
>
> IND (Driver)

Thus, the CLD application's revenue comes directly from the drivers by taking a percentage of the delivery fees.

4.4. Comparison of the Models

Table 5 highlights the differences between the three business models.

Table 5. Differences between the three types of business model.

Aspect	B2B-Contract	B2C	C2C
Product flow path	Warehouse to customer's place	Retailers to customer's place	Any place to any place
Registrations for drivers	Attendance required	Online	Online
Payment method to the drivers	Distance-based Fixed price	Distance-based	Bidding-based
Products generator	E-commerce companies LSPs	Retailers	Any
Type of agreement	Contract-based	Contract-based	No contract (Matching individuals)
Assigning drivers	Availability	Proximity and availability	Best offer/bid
Direct stakeholder involvement	E-commerce company LSP Driver	Retailer Driver Customer	Driver Customer
Communication method	Calling on the way and upon arrival	Notification upon arrival/calling customers services	Chatting through application

The comparison shows that C2C allows the individual stakeholder more opportunities to choose the LMD services and price than the B2C model. In other words, the B2C model relies on location in assigning drivers for customers, while C2C relies on bidding offers for assigning drivers.

The C2C model revealed two main advantages over the other two models. First, it results in the best possible price. Drivers take into consideration time, quantity, and distance when setting the price. A high number of drivers leads to low prices being offered by drivers to the customers. Second, the option to negotiate a price was seen as a positive feature of this business model. However, this model also has two main drawbacks, i.e., the payment method being cash on delivery rather than online payment, and the restriction due to the amount limit. Table 6 shows some of business models examples comparison inside and outside Saudi Arabia.

Table 6. Examples of the business models inside and outside Saudi Arabia, along with their differences.

CLD Implementation	International	Saudi Context	Difference
B2B Contract	Amazon flex; Myways DHL (Europe—no longer active).	Company A	Registration method (attendance required); Payment method (fixed rate for drivers, customers not involved); Direct stakeholder involvement (e-commerce provider, LSP); Communication (calling on the way and upon arrival).
B2C	Deliveroo; UberEat; Trunkrs [7].	Company B	Communication method (calling customer services); Payment method (cash on delivery).
C2C	None	Company C	

4.5. How do CLD Business Models Help in LMD Issues?

The interviews revealed that the CLD implementations helped to solve the issues highlighted in Section 2.3. This section discusses the benefits of using CLD as an LMD solution for different stakeholders.

4.5.1. Delivery Address Issues

The data revealed that the delivery address is a major issue faced by stakeholders involved in LMD in Saudi Arabia. This issue enhanced the value of CLD for the interviewees and consequently emphasises the importance of CLD.

Interviewees highlighted that the main issues related to the address are caused by different factors affecting stakeholders at an individual, institutional, or industry level. Various stakeholder factors contribute to address problems such as the complexity of the address, language barriers leading to spelling and communication issues, customer and driver awareness of using the delivery address, and e-commerce companies' websites that allow customer to proceed with their orders without filling in the right address information. These address problems led to increased communication cost, inefficiency, delay, and returned items for LMD. The highlighted problems are of considerable concern for stakeholders and result in inefficiency in both urban and rural areas, communication cost, delay, and a rise in reverse logistics.

The interviews revealed that these problems are caused mainly by a lack of stakeholder engagement. Interviewees from one stakeholder group blamed stakeholders from another group. This illustrates a vital need to engage stakeholders in decision making to increase understanding and the identification of appropriate solutions.

4.5.2. Sharing Location and Real-Time Tracking

Sharing location by customers and real-time tracking of items are two of the most desirable features for customers. They are important features in the last mile logistics industry because they can influence the efficiency as well as the service quality. These two features become even more important and game-changing if addresses are not used well, for the reasons mentioned above.

Sharing location and real-time tracking provided by CLD gives transparency and benefits to individuals in urban and rural areas, solves address issues, and results in increased levels of customer trust. In contrast, LSPs are not providing these features.

The LSPs have a tracing feature that allows them to trace the item's moving phases, such as from the warehouse, and the assignment of different employees and drivers to certain items. Additionally, LSPs provide their customers with a tracking number that they can use on their website to receive an update about their packages, and customers get notifications about the progress of their delivery. However, in the LMD, LSPs do not provide the sharing location and real-time tracking features that customers mentioned are provided with CLD. As WF, the manager of an LSP, stated:

> "*We have in . . . (name of the company) full tracking of packages, from when they enter the country until they get to the final customer. The packages go through many moving phases. In each phase we know who is carrying it, I know which employee checks it, and who takes it.*"
>
> WF (Local LSP Manager)

LSPs do not provide live tracking to customers as a transparent way of providing the lead time or map tracking of the customers' locations to drivers. One interviewee stated in comparing the two services:

> "*Tracking, tracking, tracking. Knowing the estimated delivery time gives CLD the edge over the traditional delivery methods, in my opinion.*"
>
> HG (Customer)

4.5.3. Speed of Delivery

The speed of delivery is one of the most significant LMD values for CLD stakeholders. The benefit of fast delivery in all business models of CLD solved many issues that customers and retailers faced. Although some of the LSPs have improved their delivery speed, currently, there is no delivery faster than that of CLD. One of the reasons for the fast delivery is the larger number of drivers employed by CLD compared to that of the traditional LSPs. Therefore, CLD has the advantage of having one driver for a few or each of the customer orders. For instance, the application owner of a B2B-Contract CLD discussed how CLD is an efficient solution for the delay issue in LMD.

> "*We studied the market, and we found that the average delivery time the LSP courier takes to deliver a package from e-commerce is 2-4 days. Keep in mind, four days for a product that is ready in the warehouse, which does not make sense as if you call domino's pizza today, for example, and order a pizza, they will make it from scratch and deliver it within 40 minutes. Why should a final product in a local warehouse like an iPhone take up to 4 days to be delivered? What happens is that the final product arrives at the warehouse and they wait until they get more orders to the same zone before they deliver it, which is basically optimization and reducing cost for them. Let us say they have 1,000 items and 10 drivers; each driver takes 100 items to deliver to his zone, which will take days. Why not having 1,000 drivers who will get all items delivered in an hour. Who can do this? Crowd Logistics.*"
>
> HD (Application Owner)

From the application owners' perspective CLD may be an ideal solution for fast delivery. However, taking a multiple stakeholder perspective, this would not be a sustainable solution in the long-term, considering the environmental impacts, particularly when comparing with large businesses with distribution centres located far away from the city centres.

The study revealed interviewees generally agreed on the need to adopt CLD type solutions to deal with the increased demand due to seasonality and the resulting operational issues. For this reason, some LSPs have adopted a sharing economy model by using CLD

as one of their solutions, especially in seasons with high demand. For example, one interviewee highlighted:

> "*We adopted the CLD model recently, for the locals who can drive using their own vehicles. We pay them per parcel. Different payments based on the season; in the high season, we pay more. We started less than a year ago. It was very successful, above our expectations.*"
>
> RA (Int. LSP Regional Manager)

He continued explaining the advantages CLD brings to the firm:

> "*Demand is very high, so we need this kind of solution to expand our capacity. The good thing is that CLD relies on a large number of people so if someone does not turn up, there are always replacements.*"
>
> RA (Int. LSP regional Manager)

This particular LSP has its own way of organizing this service rather than outsourcing to a CLD company as a solution. Another LSP employed a different approach involving a third party. Their manager discussed, with regard to the high demand, their CLD solution for faster delivery:

> "*We believe CLD reduces the operation headache, reduces it big time. Like we have here in . . . (name of the company) 200 drivers in the Kingdom and we have huge growth, which needs right now 800 drivers. With those 200 we need also to hire supervisors for them and then we hire a manager, and we will need more cars, insurance, salaries, system, so we get into an operation headache circle that is not easy. So, we can avoid all of this and hire third party . . . , . . . , . . . , and . . . (CLD companies) so we minimize costs. The idea we are thinking of is to build an application something like . . . (name of a CLD company) in a small version for us for those who want to work part-time.*"
>
> WF (Local LSP Manager)

The higher number of drivers in CLD than in traditional delivery models gives them the advantage of ensuring faster delivery. Business models and applications compete on providing the fastest delivery so as to increase their customer base. For example, they provide compensation in the case of delayed delivery, or they offer a specific service to ensure even faster delivery. Hence, the speed of delivery is one of the values that enhances the use of CLD as a last-mile solution.

4.5.4. Drop-Off Flexibility vs. Unattended Home Delivery and Returns

The drop-off flexibility in CLD gives stakeholders a considerable advantage in terms of efficiency and effectiveness. It contributes to solving several LMD issues that cause inefficiency and complaints from different stakeholders.

Drop-off flexibility is represented in this study by the ease of communication. Customers and drivers revealed that the ease of communication, whether through the application or by direct calls, saved them a lot of time, and hence the service became more efficient and more productive. For instance, a customer can call or text the driver through the application to change the destination. More importantly, a driver can make a call to notify a customer when he is on his way, which allows the customer to be ready, or if customers are not at home, they can inform the driver and redirect him to their current location. This flexibility can be provided due to the fewer number of items assigned for drivers to deliver. In other words, the drivers do not consolidate items for more deliveries, and each driver is assigned deliveries to one or a few customers. In contrast, in the case of LSPs that have not adopted drop-off flexibility, the driver covers a particular geographical area, limiting the CLD flexibility and leading to increased inefficiency. LSP drivers are unable to meet a customer's request to change the delivery location, as RA, international LSP regional manager, explained:

> *"We distribute drivers based on geographical areas. If the customer asks us to deliver it to a different address in a different area than the originally provided one, it will be assigned to a different driver who is in charge of delivering in that area, on another day, or the customer will have to pick it up from the branch."*
>
> RA (Int. LSP regional manager)

In cases where the home is unattended at the time of delivery, CLD drivers can easily and quickly call the customers and ask them where to put the package. This is different from the traditional way of handling the items, where the driver takes the items back to the warehouse/office. This will incur extra and unnecessary cost for the LSPs and lead to customer dissatisfaction.

Customers see drop-off flexibility as one of the central values of CLD. For instance, with CLD, the customers do not have to go to the branch to collect the items and do not have to be concerned about items being delivered to unattended homes. Table 7 depicts the benefits of CLD to the stakeholders.

Table 7. The benefits to the stakeholders of the CLD models.

LMD-Related Benefits	Individual: Customers & Drivers	Industrial: Application Owners, Retailers, and LSPs	Institutional: Local Authorities and Decision Makers
Solved Address issues	Benefited customers and driver stakeholders in many ways, such as complexity and communication issues: cost and language barriers	More efficient deliveries, higher number of deliveries, easier way to locate destination, delay, and repeated visit	Less complex address and improves the social aspect.
Sharing location and Real-time tracking	More transparency and less leading time for customers and faster to reach destination for drivers, and gained customers' trust.	Increases efficiency as well as service quality, allows easier accessibility to remote and rural areas	
Speed of delivery	Faster receiving for customers and more deliveries and income for drivers	More deliveries and high turn-over, lower inventory cost	
Drop-off flexibility	Solves the unattended home delivery issue for both customers and drivers	More flexibility that overcomes the geographical limitation and unattended home issues. More deliveries and high turn-over, lower inventory cost, less reverse logistics	

4.5.5. Cultural Factors That Impact on CLD

The study found how cultural awareness can be used to gain competitive advantage by application owners developing and implementing strategies to overcome last mile delivery issues. In particular, two cultural factors that could affect CLD were revealed, namely privacy and trust, and handling of delivery.

Privacy and trust. Regarding privacy, this study found that customers have concerns about the sharing of their personal information, home addresses and purchase habits. Trust in this study is related to cultural practices around communication and payments, particularly, for drivers and customers there are trust concerns over online payment systems. Cash on delivery is the preferred payment method among customers, which may increase the inefficiency of the last mile process.

A major role culture has on CLD is the communication while delivering the packages. Unlike with LSPs where the customer's information is only in a few employee's hands, in CLD, any driver from the crowd who delivers the package will have the customer's infor-

mation. Drivers and customers may face a cultural challenge when it concerns interacting with the opposite gender. As a result, some application owners implemented a call centre service to facilitate the delivery and logistics between the drivers and customers. Another solution is the use of window chatting as the only way of communicating with a customer. This is done through the application without showing any personal information. Although the extra steps that are taken by application owners to overcome these issues makes the delivery inefficient, it meets the privacy purposes of the customers.

Another problem related to privacy is the issue of the potential misuse of personal data. For instance, one interviewee highlighted that, after delivering a package drivers may call customers from a different number that is not registered in the CLD application.

If culture is not considered in the communication and interaction of drivers and customers, it may be a barrier for CLD growth. While CLD implementations by their nature allow a certain level of communication between drivers and customers, this is seen as a challenge by both customers and drivers.

Handling of delivery. The handling of the delivery encounters cultural challenges caused by the interaction between opposite genders that consequently can make delivery inefficient. Some female customers prefer not to interact with male drivers based on cultural and religious grounds. Not paying attention to this factor the delivery process takes longer. It may also cause increased environmental impact due to higher fuel use and emissions, increased economic impact as drivers may not be able to take other orders, which reduces their income, and social impact when drivers or customers may feel embarrassed. This shows that the handling of culture needs to be carefully considered for successful CLD.

5. Discussion

Sections 5.1 and 5.2 respectively discuss the findings with regard to research questions RQ1 and RQ2.

5.1. The CLD Business Models in Saudi Arabia

The study found that three CLD business models are being used in Saudi Arabia, i.e., B2B-Contract, B2C, and C2C. Although the business models corresponded with those in some other studies in terms of their typology [2,4,6,56], the *implementations* differ in relation to the context where the study took place. For instance, while there are B2B and B2C implementations in developed countries such as Amazon flex (B2B), Deliveroo (B2C), and UberEat (B2C), there are marked differences between these models and the Saudi Arabian ones.

Regarding B2B, this is commonly defined as a business transaction where products move from one business to another [56]. The B2B-contract model in this study differs from this definition since products move between business and customer. However, instead of looking at the product flow, the B2B-contract model is based on the payment flow between one business and another. In this case, the E-commerce company has a contract with the CLD provider/application owner. The customer is not involved in the agreement or payment to the CLD application owner, hence the B2B terminoloy.

The definition of the C2C business model in our study is consistent with other studies, such as [2], but the implementation is different. Rougès and Montreuil highlighted that C2C matches two individuals, one is the sender who sends the package, and the other one is the traveller who executes the task [2]. However, in this study the sender is not necessarily involved, as the receiver may request from a driver or from a business. While C2C has been recognized in the literature, it has not been widely applied in an international context.

Comparing the three identified CLD business models operating in Saudi Arabia, there are eight main differences between these business models, relating to the product flow path, registrations, product generation, type of agreement, driver allocation, payment method, relevant stakeholders, and communication methods (see Table 5). While there are some similarities between the B2B and B2C business models, such as the way in which drivers are allocated to and paid for a CLD task and the contract-based nature of agreement,

the similarities with C2C are far fewer. C2C has distinct bidding-based allocation of tasks and payments, and it uses a matching feature rather than formal contracts to agree on transactions. The stakeholder involvement in CLD differs between all three business models. In this study, a B2B-Contract acts as third-party logistics (3PL) for LSPs or deliveries to customers who order from e-commerce companies. This is in contrast to C2C which is from anywhere to any customer. In this model, the customer could be a business or individual and can also be a sender or receiver.

While three business models were identified, the extent to which they are adopted in CLD and their sustainability depends on their attractiveness to the crowd. The study found that order assignment plays a large role in making the business model attractive to the crowd. This study identified three ways of assigning the crowd to the last mile task: the traditional model of self-checking, assigning based on location, and assigning based on a bidding process, the latter being part of the payment element of the business model. Location-based and bidding-based assigning are the types most commonly used in CLD. However, unlike other models, which use a platform for assigning orders to drivers, the B2B-Contract (B2) business model uses self-checking as the way of assigning drivers. In other words, (B2) drivers have to come and check for available items for the last mile delivery task. Our study showed that this traditional method is not in line with crowd preferences.

The two models based on location or a bidding process for crowd assignment are in line with those identified in previous studies [30,40]. Both Carbone et al. [30] and Ermagun and Stathopoulos [40] showed that management of the platform's logistics activities may be coordinated in a centralized or decentralized way. In a centralized approach, also referred to as trajectory-dependency [5], the platform matches a sender and courier with algorithms which optimize the delivery probability. This approach therefore matches the location-based method found in this study. In contrast, the bidding-based model in this study is similar to the decentralized approach where a sender chooses from a list of available couriers who bid on the request.

Whereas a decentralized platform only plays an informative role, a centralized administration deals with flows and sends information to the public [30,40]. Moreover, several authors (Rougès and Montreuil, Archetti et al., Arslan et al., McInerney et al., and Paloheimo et al.) have clearly indicated benefits of the linkage of order assignments to pre-existing travel routines [25,29,32], commuting trips [2], or delivery locations near the driver's destination [11]. Without the utilization of current vehicle flows, unnecessary travel may be induced [57]. Hence, it could be argued that the location-based model is a more sustainable solution compared to more random models because it utilizes pre-existing trips instead of generating potential additional trips due to the random selection process [5].

5.2. Advantages for the Stakeholders Provided by CLD

In order to identify the advantages for stakeholders provided by the CLD implementations, the sustainability of the three business models of CLD are assessed and compared with the reported benefits from the literature reviewed in Sections 2.1 and 2.2. Although the analysis is split into the 3BL categories, there is some crossover between these categories. For example, interaction between the driver and the customer provides social and economic benefits.

5.2.1. Economic Benefits

Economic benefits are often the primary motivation for adopting collaborative business models [7]. Although other factors such as social awareness are important and can be more important in some cases [30], a business model with low economic benefits is unlikely to be sustainable.

As reported in Section 4.5.3, the CLD implementations provide individual and industrial stakeholder groups with advantages through faster delivery, as identified previously by [24–26] (see Table 1 point 7). The faster delivery allows drivers to make more deliveries

and hence increase their income, while it results in higher turnover and lower inventory costs for retailers and LSPs (Table 2 point 8's attractive revenue model). The CLD implementations provide a solution to the high level of undelivered items as a consequence of the address problems (see Section 4.5.1), further reducing costs and making the delivery service more efficient (Table 1 point 12). In addition, more flexibility is an advantage identified by stakeholders (Table 1 point 8). However, flexibility in the context of Saudi Arabia is different to that of other countries, particularly that of developed countries. It refers to the drop-off flexibility that allows fewer deliveries to unattended homes (see Section 4.5.4). Again, this brings economic benefits to stakeholders (Table 1 points 11 and 12, Table 2 point 9), as does the greater variety of goods that can be delivered (Table 1 point 6) mentioned by application owner LA in Section 4.3.

While all models meet the criteria of speed of delivery, the revenue model is one of the main economic criteria that differentiates the sustainability of the CLD models. This study revealed that in the case of C2C, customers enjoy having an opportunity to negotiate, and drivers like the feature of being able to increase and sometimes lower the price based on time, distance, and demand. Hence, there is a perception among both customers and drivers that from an economic viewpoint this is the best model for them. However, despite some advantages for the CLD provider implementing a C2C business model in providing greater platform efficiency, it is a more expensive solution for the CLD provider [40]. Application owners may also lose some control over the process and miss out on revenues. Moreover, since the crowd is frequently focused on economic benefits, this could result in business transactions that have a negative environmental impact if it leads to an increase in unsustainable levels of supply and demand. B2B and B2C are likely to be more sustainable when considering a wider geographical scale. However, even if it can compensate the higher costs for deliveries over longer distances, economic sustainability is low due to the higher price and delivery fees for drivers and customers.

5.2.2. Social Benefits

In Saudi Arabia, there is generally a higher level of communication between the driver and the customer than often happens in developed countries (Table 1 point 4, Table 2 point 2). Besides providing economic benefits such as reducing missed deliveries and providing more flexibility mentioned above, it allows the sharing of location and real time tracking (Table 2 point 4) to take place (see Section 4.5.2). It is particularly important in handling problems with cultural interactions (Table 2 point 6), such as male–female interactions (see Section 4.5.5). However, it can sometimes lead to privacy concerns as noted in Section 4.5.5.

As noted by point 3 in Table 2, the voluntary character of the drivers' participation is socially beneficial. This benefit also applies to the implementations investigated in Saudi Arabia.

5.2.3. Environmental Benefits

Although environmental issues were raised in the semi-structured interviews, they were not seen as a primary driver for CLD by the stakeholder groups. The environmental benefits in Tables 1 and 2 principally stem from reducing the number of delivery miles travelled. The main way to do this is to make use of existing journeys where there is unused capacity—the benefits are generally far less when the journeys were not already planned [7]. However, this seems more applicable to longer distance journeys than for LMD in urban areas.

Some traffic reduction can be achieved by the mechanism for allocating drivers to jobs (see Section 5.1), and by the design of the revenue model (see Table 4).

6. Conclusions

This study determined the CLD business models for LMD being used in Saudi Arabia, and investigated the benefits that these models provided to their various stakeholders in

terms of 3BL sustainability. Three models were discovered—B2B, B2C, and C2C. The motivations for using these models were economic and social. There was little environmental pressure. The economic factors fell broadly into the categories that had been reported in the literature and summarized in Tables 1 and 2. However, there was a significant overlap between the economic factors and the more social aspects driven by the country's cultural background. For example, the high degree of communication between the drivers and the customers ameliorated issues such as the address problems and male–female interactions.

CLD for LMD faces different challenges in rapidly emerging economies than it does in developed countries. There have been very few studies that have focused on CLD for LMD in emerging economies, and so this study helps to address this gap. While their rapid growth means that there will be similarities between emerging economies, each one will have its own special features. Hence it can be expected that Saudi Arabia's CLD models experience similar issues to those in other Gulf states, and there is likely to be more divergence from the models suitable for emerging economies in South and Central America and Asia. Consequently, it would be valuable for similar studies to be carried out in emerging economies in other regions.

The exploratory nature of the study meant that it was carried out by interviewing 39 stakeholders who were identified by snowballing. Therefore, a large-scale quantitative survey is desirable to provide confirmation of the findings, for example with regard to the stakeholder evaluations of the 3BL benefits that CLD provides.

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Appendix A List of Interviewees

Table A1. The stakeholders interviewed for the research.

Interviewees' Shareholder Group	Interviewees' Position	Interviewees' Abbreviations	Business Model the Stakeholder Belongs to
Industrial	Application owner	HD	B2B
Industrial	Application owner	BS	B2C
Industrial	Application owner	LA	C2C
Industrial	Application owner	FE	B2C
Industrial	Local LSP manager	WF	B2B
Industrial	Int. LSP regional manager	RA	B2B
Industrial	Local LSP vice president	DMJ	B2B
Industrial	Restaurant owner	YL	B2C
Industrial	Restaurant owner	TF	B2C
Institutional	Decision maker address infrastructure	ZH	B2B, B2C, C2C

Table A1. *Cont.*

Interviewees' Shareholder Group	Interviewees' Position	Interviewees' Abbreviations	Business Model the Stakeholder Belongs to
Institutional	High level decision maker in regulations and laws	ZF	B2B, B2C, C2C
Institutional	High level decision maker in Public Transport Authority	SR	B2B, B2C, C2C
Institutional	High level decision maker in strategies and planning	IJ	B2B, B2C, C2C
Institutional	High level decision maker in national address	SB	B2B, B2C, C2C
Individual	Driver	MHS	B2B (B2)
Individual	Driver	ATS	B2C
Individual	Driver	ZIY	B2C
Individual	Driver	IND	C2C
Individual	Driver	ASL	C2C
Individual	Driver	MHF	C2C
Individual	Driver	BGT	C2C
Individual	Driver	QH	B2C
Individual	Driver	YSA	B2B (B2)
Individual	Customer	ABS	C2C
Individual	Customer	HG	C2C
Individual	Customer	MAL	B2C, C2C
Individual	Customer	DGN	B2C
Individual	Customer	SMN	B2C
Individual	Customer	RAJ	C2C
Individual	Customer	ADL	C2C
Individual	Customer	UF2	B2C, C2C
Individual	Customer	FMG	B2C
Individual	Customer	QR	B2C
Individual	Customer	NW	B2C
Individual	Customer	KM	C2C
Individual	Customer	UF1	C2C
Individual	Customer	ED	C2C

References

1. Hübner, A.; Kuhn, H.; Wollenburg, J. Last mile fulfilment and distribution in omni-channel grocery retailing: A strategic planning framework. *Int. J. Retail Distrib. Manag.* **2016**, *44*, 228–247. [CrossRef]
2. Rougès, J.-F.; Montreuil, B. Crowdsourcing Delivery: New Interconnected Business Models to Reinvent Delivery. In Proceedings of the 1st International Physical Internet Conference, Québec, QC, Canada, 28–30 May 2014; Available online: https://www.cirrelt.ca/ipic2014/pdf/1027a.pdf (accessed on 1 December 2021).
3. Mehmann, J.; Frehe, V.; Teuteberg, F. Crowd logistics—A literature review and maturity model. In *Innovations and Strategies for Logistics and Supply Chains: Technologies, Business Models and Risk Management*; Kersten, W.B., Thorsten, R., Christian, M., Eds.; epubli GmbH: Berlin, Germany, 2015; Volume 20, pp. 117–145.
4. Frehe, V.; Mehmann, J.; Teuteberg, F. Understanding and assessing crowd logistics business models—Using everyday people for last mile delivery. *J. Bus. Ind. Mark.* **2017**, *32*, 75–97. [CrossRef]
5. Buldeo Rai, H.; Verlinde, S.; Merckx, J.; Macharis, C. Crowd logistics: An opportunity for more sustainable urban freight transport? *Eur. Transp. Res. Rev.* **2017**, *9*, 39. [CrossRef]
6. Rześny-Cieplińska, J.; Szmelter-Jarosz, A. Assessment of the Crowd Logistics Solutions—The Stakeholders' Analysis Approach. *Sustainability* **2019**, *11*, 5361. [CrossRef]
7. Sampaio, A.; Savelsbergh, M.; Veelenturf, L.; van Woensel, T. Crowd-based city logistics. In *Sustainable Transportation and Smart Logistics: Decision Making Models and Solutions*; Faulin, J., Grasman, S., Juan, A., Hirsch, P., Eds.; Elsevier Science: Amsterdam, The Netherlands, 2018; Chapter 15; pp. 381–400. ISBN 978-0128142424.
8. Ranieri, L.; Digiesi, S.; Silvestri, B.; Roccotelli, M. A review of last mile logistics innovations in an externalities cost reduction vision. *Sustainability* **2019**, *10*, 782. [CrossRef]
9. McKinnon, A.C. The possible impact of 3D printing and drones on last-mile logistics: An exploratory study. *Built Environ.* **2016**, *42*, 617–629. [CrossRef]
10. Dettenbach, A.M.C.; Ubber, S. Managing disruptions in last mile distribution. In Proceedings of the 48th Hawaii International Conference on System Sciences, Kauai, HI, USA, 5–8 January 2015; pp. 1078–1087. [CrossRef]
11. Archetti, C.; Savelsbergh, M.; Speranza, M.G. The Vehicle Routing Problem with Occasional Drivers. *Eur. J. Oper. Res.* **2016**, *254*, 472–480. [CrossRef]
12. Cardenas, I.; Borbon-Galvez, Y.; Verlinden, T.; Van de Voorde, E.; Vanelslander, T.; Dewulf, W. City logistics, urban goods distribution and last mile delivery and collection. *Compet. Regul. Netw. Ind.* **2017**, *18*, 22–43. [CrossRef]
13. Duttagupta, R.; Pazarbasioglu, C. Miles to Go, International Monetary Fund (IMF) 2021. Available online: https://www.imf.org/external/pubs/ft/fandd/2021/06/the-future-of-emerging-markets-duttagupta-and-pazarbasioglu.htm (accessed on 16 September 2021).

14. Morgan Stanley Capital International. MSCI (Emerging Markets) Index 2021. Available online: https://www.msci.com/documents/10199/c0db0a48-01f2-4ba9-ad01-226fd5678111 (accessed on 1 December 2021).
15. Olsson, J.; Hellström, D.; Pålsson, H. Framework of last mile logistics research: A systematic review of the literature. *Sustainability* **2019**, *11*, 7131. [CrossRef]
16. Ji, G.; Liu, W. Research on the logistics outsourcing based on e-commerce. In Proceedings of the International Conference on Business Management and Electronic Information, Guangzhou, China, 13–15 May 2011; pp. 598–601. [CrossRef]
17. Mladenow, A.; Bauer, C.; Strauss, C. Crowdsourcing in logistics: Concepts and applications using the social crowd. In Proceedings of the 17th International Conference on Information Integration and Web-Based Applications and Services, iiWAS 2015—Proceedings, Brussels, Belgium, 11–13 December 2015. [CrossRef]
18. Punel, A.; Stathopoulos, A. Modeling the acceptability of crowdsourced goods deliveries: Role of context and experience effects. *Transp. Res. Part E Logist. Transp. Rev.* **2017**, *105*, 18–38. [CrossRef]
19. Bubner, N.; Helbig, R.; Jeske, M. Logistics Trend Radar. DHL Trend Research. 2014. Available online: https://www.dhl.com/global-en/home/insights-and-innovation/insights/logistics-trend-radar.html (accessed on 1 December 2021).
20. Wang, Y.; Zhang, D.; Liu, Q.; Shen, F.; Lee, L.H. Towards enhancing the last-mile delivery: An effective crowd-tasking model with scalable solutions. *Transp. Res. Part E Logist. Transp. Rev.* **2016**, *93*, 279–293. [CrossRef]
21. Pfenning, K. Verbesserung Durch Crowd Logistics Sourcing. Verkehrsrundschau: Who Is Who Logistik, 2014. p. 5. Available online: https://www.pfenning-logistics.com/wp-content/uploads/2014/03/2014_01_01-VR-Who-is-Who-2014-KMP-Statement.pdf (accessed on 1 December 2021).
22. Brundtland Commission. *Our Common Future: The World Commission on Environment and Development*; Oxford University Press: Oxford, UK, 1987.
23. Soubbotina, T.P. *Beyond Economic Growth: An Introduction to Sustainable Development*, 2nd ed.; The World Bank: Washington, DC, USA, 2004.
24. Botsman, R. Crowdshipping: Using the crowd to transform delivery. *AFR Boss Magazine*. Available online: https://scholar.google.com.hk/scholar?hl=en&as_sdt=0%2C5&q=Crowdshipping%3A+Using+the+crowd+to+transform+delivery&btnG= (accessed on 1 December 2021).
25. Arslan, A.M.; Agatz, N.; Kroon, L.; Zuidwijk, R. Crowdsourced delivery—A dynamic pickup and delivery problem with ad hoc drivers. *Transp. Sci.* **2019**, *53*, 222–235. [CrossRef]
26. Chen, M.; Wang, D.; Sun, Y.; Liu, C.; Bai, Z. Service evaluation of public bicycle scheme from a user perspective. *Transp. Res. Rec. J. Transp. Res. Board* **2017**, *2634*, 28–34. [CrossRef]
27. Mckinnon, A. *City Logistics Innovations: Game-Changers or Over-Hyped Curiosities*; TRB Executive Committee: Washington, DC, USA, 2015; Available online: https://onlinepubs.trb.org/onlinepubs/excomm/15-06-McKinnon.pdf (accessed on 1 December 2021).
28. Mladenow, A.; Bauer, C.; Strauss, C. "Crowd logistics": The contribution of social crowds in logistics activities. *Int. J. Web Inf. Syst.* **2016**, *12*, 379–396. [CrossRef]
29. McInerney, J.; Rogers, A.; Jennings, N.R. Bus, bike and random journeys: Crowdsourcing aid distribution in Ivory Coast. *Significance* **2013**, *10*, 4–9. [CrossRef]
30. Carbone, V.; Rouquet, A.; Roussat, C. The Rise of Crowd Logistics: A New Way to Co-Create Logistics Value. *J. Bus. Logist.* **2017**, *38*, 238–252. [CrossRef]
31. Chen, C.; Pan, S. Using the crowd of taxis to last mile delivery in e-commerce: A methodological research. In *Studies in Computational Intelligence*; Springer: Berlin, Germany, 2016; pp. 61–70. [CrossRef]
32. Paloheimo, H.; Lettenmeier, M.; Waris, H. Transport reduction by crowdsourced deliveries–a library case in Finland. *J. Clean. Prod.* **2016**, *132*, 240–251. [CrossRef]
33. Suksri, J.; Raicu, R. Developing a conceptual framework for the evaluation of urban freight distribution initiatives. *Procedia-Soc. Behav. Sci.* **2012**, *39*, 321–332. [CrossRef]
34. Harrington, T.S.; Singh Srai, J.; Kumar, M.; Wohlrab, J. Identifying design criteria for urban system 'last-mile'solutions—A multi-stakeholder perspective. *Prod. Plan. Control* **2016**, *27*, 456–476. [CrossRef]
35. Garner, H. *Supply Chain Hot Trends*; Reuters Events: London, UK, 2016.
36. Jain, R.; Jain, S.; Dhar, U. CUREL: A scale for measuring customer relationship management effectiveness in service sector. *J. Serv. Res.* **2007**, *7*, 37–58.
37. Foss, B.; Stone, M.; Ekinci, Y. What makes for CRM system success—Or failure? *J. Database Mark. Cust. Strategy Manag.* **2008**, *15*, 68–78. [CrossRef]
38. Srai, J.S.; Christodoulou, P. *Capturing Value from Global Networks: Strategic Approaches to Configuring International Production, Supply and Service Operations*; University of Cambridge, Institute for Manufacturing: Cambridge, UK, 2014.
39. Savelsbergh, M.; Van Woensel, T. 50th anniversary invited article—City logistics: Challenges and opportunities. *Transp. Sci.* **2016**, *50*, 579–590. [CrossRef]
40. Ermagun, A.; Stathopoulos, A. To bid or not to bid: An empirical study of the supply determinants of crowd-shipping. *Transp. Res. Part A Policy Pract.* **2018**, *116*, 468–483. [CrossRef]
41. Punel, A.; Ermagun, A.; Stathopoulos, A. Studying determinants of crowd-shipping use. *Travel Behav. Soc.* **2018**, *12*, 30–40. [CrossRef]

42. United Nations. World Urbanization Prospects. 2018. Available online: https://population.un.org/wup/ (accessed on 1 December 2021).
43. Aldrich, H.E.; Baker, T. Blinded by the cites? Has there been progress in entrepreneurship research. In *Entrepreneurship*; Sexton, D.L., Smilor, R.W., Eds.; Upstart Publishing: Chicago, IL, USA, 2000; pp. 377–400.
44. Busenitz, L.W.; West, G.P., III; Shepherd, D.; Nelson, T.; Chandler, G.N.; Zacharakis, A. Entrepreneurship research in emergence: Past trends and future directions. *J. Manag.* **2003**, *29*, 285–308. [CrossRef]
45. Cornelius, R.D.; Stepniczka, A.; Chu, K. Initiating an Agreement in an e-Commerce Environment. United States Patent and Trademark. Office Patent No. US7069234B1, 2006. Available online: https://patents.google.com/patent/US7069234B1/en (accessed on 1 December 2021).
46. Ketokivi, M.; Turkulainen, V.; Seppälä, T.; Rouvinen, P.; Ali-Yrkkö, J. Why locate manufacturing in a high-cost country? A case study of 35 production location decisions. *J. Oper. Manag.* **2017**, *49*, 20–30. [CrossRef]
47. World Bank. Gross Domestic Product 2020. Available online: https://databank.worldbank.org/data/download/GDP.pdf (accessed on 1 December 2021).
48. Saudi Vision 2030. Available online: https://www.vision2030.gov.sa/ (accessed on 1 December 2021).
49. Communications and Information Technology Commission (CITC). 2020. Available online: https://www.citc.gov.sa/ar/Pages/default.aspx# (accessed on 1 December 2021).
50. Bryman, A.; Bell, E.; Harley, B. *Business Research Methods*, 5th ed.; Oxford University Press: Oxford, UK, 2018.
51. Mason, J. *Qualitative Researching*, 2nd ed.; Sage Publication: London, UK; Thousand Oaks, CA, USA, 2002.
52. Collis, J.; Hussey, R. *Business Research: A Practical Guide for Undergraduate and Postgraduate Students*; Macmillan Education: London, UK, 2013.
53. Braun, V.; Clarke, V. Using thematic analysis in psychology. *Qual. Res. Psychol.* **2006**, *3*, 77–101. [CrossRef]
54. Wilkinson, S. Women with breast cancer talking causes: Comparing content, biographical and discursive analyses. *Fem. Psychol.* **2000**, *10*, 431–460. [CrossRef]
55. Asmussen, K.J.; Creswell, J.W. Campus response to a student gunman. *J. High. Educ.* **1995**, *66*, 575–591. [CrossRef]
56. Buldeo Rai, H.; Verlinde, S.; Merckx, J.; Macharis, C. Can the crowd deliver? Analysis of crowd logistics' types and stakeholder support. In *City Logist. 3 Towards Sustain. Liveable Cities*, 1st ed.; Taniguchi, E., Thompson, R.G., Eds.; Wiley-ISTE: London, UK, 2018.
57. Chen, C.C.; Chen, Y.C. Dynamic programming model for attended delivery time slot management. *Transp. Res. Rec.* **2016**, *2548*, 43–52. [CrossRef]