

Lack of Collaboration on the CEP Market and the Underlying Reasons—A Systematic Literature Review

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Abstract: The scientific community has been addressing the topic of last-mile delivery for years. To improve parcel delivery efficiency, a variety of different technologies have been created. Over the past 15 years, the focus has shifted from the operational efficiency of the individual organization to restoring sustainability and making cities more livable. As a result of the increased environmental burden, governments are enacting a growing number of restrictive measures, which will intensify economic challenges. To remain competitive, more cost-effective solutions are required. The goal of this article is to examine the significance of collaboration between CEP partners based on scientific interest, with the help of a systematic literature review. This examination is important since, despite the fact that working together with other service providers and competitors could be a favorable option for last mile suppliers looking to improve their efficiency, results show little interest in this approach. Although this strategy appears straightforward due to the potential financial and environmental benefits, there are only a few examples of collaboration in the field of last mile parcel delivery according to the results of the review. Since cooperation seems to be an inevitable operating model of the CEP market in the future, it is of utmost importance for scientific research to investigate the factors hindering the development of cooperation.

Keywords: systematic literature review; last mile parcel delivery; CEP market collaboration; horizontal collaboration



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1. Introduction

The exponential growth rate of e-commerce, largely due to the COVID-19 lockdown in 2020, predicts even more rapid growth in the coming years, along with a rise in customer expectations. According to [1], the sector increased from 15% in 2010 to 35% in 2020. While people preferred to live outside cities 50 years ago, based on 2020 predictions, 72% of the population will live in cities by 2050 [2,3]. Higher levels of technological advancement, rising levels of purchasing power, and an increase in population have all contributed to a major output growth. This expansion has been accompanied by a significant rise in consumption, which has further exacerbated environmental degradation [4]. References [5,6] states that human activity has led to an increase in toxic gas emissions and harmful materials into the environment. The growth of urbanization simultaneously strengthens and increases transport activity, primarily in cities [7,8]. In terms of emissions of pollutants, including carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen oxides (NO_x), and volatile organic compounds (VOC), the transportation sector is one of the biggest contributors. By 2050, emissions should be decreased by 80–95% in accordance with predictions [9,10]. To meet these objectives, a reduction in the transportation sector by at least 60% must be accomplished [11]. Excessive transportation demand and shifting customer expectations are posing severe issues for both logistics providers and local residents.

The goal of this article is to examine the significance of collaboration between Courier, Express, Parcel (CEP) service providers based on scientific interest, using a systematic

literature review that adheres to the PRISMA guidelines (Supplementary Materials) [12]. One option for last-mile suppliers aiming to increase their efficiency is to collaborate with other service providers and rivals [13]. Due to the potential financial and environmental benefits, the idea seems simple, yet there are few examples of collaboration in the last mile parcel delivery industry. In addition, the study of collaboration between last mile service providers has not received significant attention in scientific circles.

The systematic literature review (SLR) was carried out by searching the Web of Science (WoS) and Scopus databases, without year limitations. For this purpose, we used a combined search for words related to cooperation and the last mile parcel service, including urban delivery centers and city logistics. The initial search results of 493 items underwent further filtering, resulting in a list of 52 items. Surprisingly, the 52-item list provided few results, although the goal of our SLR was to highlight that scientists do not pay enough attention to the study of cooperation between service providers who try to meet the expectations set by city logistics, nor do they make recommendations regarding efficiency improvements. We created five groups to categorize the 52-item list. The basis of the groups was cooperation, and cooperation was examined based on the following aspects: collaboration model—mathematical algorithm or route focus, public transport collaboration, service provider collaboration, city logistics, and urban consolidation center (UCC)/urban distribution center (UDC). The topic of cooperation was covered by all 52 articles. The mathematical models proved that cooperation brings economic benefits to the participants and reduces costs and negative environmental impacts.

The paper is structured as follows: The SLR's theoretical foundation, as well as the terminologies employed are presented in the Theoretical Framework section. This section is divided into numerous subsections, each of which presents a comprehensive review technique, the applied inclusion and exclusion criteria, and the method for finding articles using a combination of search phrases. This is followed by an introduction to the article selection procedure and content analysis. The findings are presented in the Research Results section, which consists of five subsections. The Discussion section describes the research findings. Finally, in the Conclusion section, there is a summary as well as some suggestions for further research.

1.1. The Characteristics of Last Mile Delivery Services

The importance of urban and city logistics in the economic development of cities cannot be overstated. According to [14], the term “urban logistics” refers to city-based logistics delivery services. By integrating and streamlining existing logistics platforms and utilizing novel information and communication technologies to generate innovative solutions for the future, urban logistics provides unique, individualized solutions for the transportation of products in cities [15].

The CEP market is a part of the supply chain management that included urban logistics. In the CEP market, the parcel delivery service provider delivers the ordered item to the recipient. The customer has the option of having their parcel delivered to their home, a parcel locker, or a delivery place. During the parcel delivery process, the service provider gathers the parcels to be delivered, arranges them by area, and then uses smaller trucks to deliver them to the recipients. The CEP market has already grown considerably, and it is now a significant sector that directly affects citizens' quality of life [16]. However, the presence of logistics delivery trucks will undoubtedly have a detrimental effect on urban road traffic, as evidenced by an increase in congestion, a rise in the environmental burden of traffic, a decrease in road safety, and a strain on automobile drivers' workloads [17]. Development has been pushed toward a more resource-efficient use and the transition to fossil-free practices in order to fulfill both rising capacity needs and the need to lessen the detrimental effects of urban freight [18].

For logistics service providers, the final leg of last-mile delivery in the inner-city area poses a substantial problem. As the world's population grows, so does the amount of transportation activity associated with cargo distribution and service provision [19]. This

phenomenon has social, environmental, and economic consequences, mostly in the form of traffic congestion, noise, pollution, and greenhouse gas emissions, as well as an increased risk of traffic accidents [20]. The impact of this dilemma, according to experts, may be seen in the last-mile delivery of commodities. Cities must accelerate their transformation and allow for the imaginative exploration of urban freight operations, particularly in relation to the development of new technology, in order to offset these consequences. In addition to these challenges, refs. [11,21] argue that last-mile delivery consumes the majority of logistics costs; as a result, suppliers and stakeholders are encouraged to reduce their transportation costs while attempting to lower their operations' social, environmental, and economic impact. Currently, each service provider providing last mile services is regarded as a separate competitor, and they make every effort to attract as many customers as possible. Despite being economically advantageous to customers, this rivalry comes at a significant cost to society and the city [22]. Furthermore, refs. [23,24] argue that these service providers strive to keep service costs as low as possible, since profit margins in such a competitive environment are always shrinking.

1.2. Last Mile Delivery Challenges and Solutions

Inefficient delivery services, congested roads, and hazardous pollution are only a few of the negative effects of the severe competition amongst service providers in metropolitan delivery networks [25]. According to a European data assessment, freight transportation was typically less than half full. Approximately 15–25% of truck miles are empty, which results in ineffective logistics and high freight costs [26]. Escalating traffic levels caused by urbanization and increased transportation, fewer parking spaces, and levels of environmental pollution have prompted city authorities to take restrictive measures [27]. However, as the authors of [28] highlight, authorities may run the danger of having the opposite effect of their intention when they take action, since the effects are not always known or understood. Municipalities struggle to create rules or incentives that encourage the use of sustainable transportation systems and to include them in their plans for urban growth [23].

Over the past decades, various distribution and route planning algorithms and new operating models have been designed. In addition, the use of alternative fuel-powered vehicles has also been seen as a way to stop the effects of environmental pollution or the inefficiency of the operations. In some cases, collaborations between service providers were also modelled. The previously discussed negative effects and the accelerating changes affecting parcel delivery call for new methods. Despite the large volume of literature on urban logistics issues related to mixing people and freight flows, most contributions focus on a single subject or concern [29]. The only way to meet the city management's expectations, i.e., to reduce environmental pollution and traffic, is to significantly reduce the number of vehicles used in transportation. This solution can be implemented through cooperation between last mile service providers [30].

The literature on collaborations distinguishes between two basic types: horizontal and vertical collaborations. A cooperation is viewed as horizontal if the service providers operate at the same level and in the same segment in the examined market and are often each other's competitors [31]. A vertical cooperation refers to when a subordinate relationship has developed between two service providers, even though they operate in the same market segment [32]. Over the past few years, organizations such as urban logistics centers (urban delivery center/urban consolidation center) have emerged from the basic types of cooperation. In addition, city logistics address the need for cooperation between certain actors of urban logistics, such as city administration, service providers, associations, institutions, and residents. Green cooperation established in the name of sustainability is based on cooperation between service providers and customers and on ethical behavior [33].

The effectiveness of cooperation between last mile service providers has been confirmed by a few scientific articles. In addition to reducing the number of kilometers traveled, jointly operated depots, hubs, and vehicles contribute to reducing the increasingly high costs of the service providers and, where applicable, to maximizing profits. In addition,

there will be fewer vehicles on the roads, reducing the impact of pollutant emissions. Therefore, cooperation is economically beneficial for participants and has a positive effect on the sustainability of cities [34–37]. However, cooperation between service providers is not common in the CEP market service. In addition to quantitative information, some algorithms have taken into account factors such as trust or even customer satisfaction that may have overshadowed the functionality of the models. Despite this, the authors noticed that science does not pay enough attention to further research that would verify the positive effects of collaborations with additional investigation. Therefore, the purpose of this article is to answer the research question of how significant the collaboration is between CEP service providers based on scientific interest. The aim is to demonstrate that there are only a few proposals for cooperation in the scientific literature.

The few articles published in recent years that explore the involvement of public transport and the need for cooperation present readers with a completely new range of cooperation possibilities [38]. The articles in the UCC/UDC and the city logistics groups mainly present case studies or models. However, these case studies also reveal the difficulties in the development of cooperation in some cases. The service provider collaboration category embodies collaboration between service providers only. This type of collaboration is the basis of all other types of collaboration (UCC, UDC, public, etc.). But apart from one article, all of the articles were modeled theoretically or in laboratory conditions. It can be stated that the development of the SLR was successful, as a research gap was found, highlighting the fact that the significance of cooperation in science is underemphasized. Additionally, the SLR describes the different collaborations that were evaluated by the few outcomes and also underlines the need for research to dedicate greater attention to the ongoing confirmation of the collaborations' major benefits.

2. Materials and Methods

For the authors, the primary goal of conducting a SLR was to point out that the scientific literature seems to pay insufficient attention to CEP market collaboration, and to shed light on what alternatives may be proposed instead. In order to achieve the defined goal, a SLR was conducted based on the following research question:

RQ1: How significant is collaboration between CEP service providers based on scientific interest?

In order to complete an appropriate SLR, the authors conducted consistent and repeatable research based on the methodology and recommendations described by [39–42]. In addition, the authors adhered to the PRISMA recommendations to ensure methodological rigor and the accuracy of the findings. PRISMA is a standardized technique for systematic reviews that offers a checklist and guidelines for reporting [12]. Before conducting a SLR, it is necessary to present the terminology used in the literature and applied to the SLR process. This article focuses on collaborations among CEP service provider companies, known as inter-organizational collaboration. According to [43], the definition of collaboration is defined as “a cooperative relationship among organizations that relies on neither market nor hierarchical mechanisms of control” [43] (p. 2). In general, the literature uses four terms to express collaboration: “collaboration”, “co-operation” or “cooperation”, “consolidation”, and “partnership”. During the implementation of the SLR and the preparation of the article, the authors considered collaboration among CEP service provider companies, and accepted the words “collaboration”, “co-operation” or “cooperation”, and “partnership” as collaboration. With regard to CEP market participants, certain articles also used the term “consolidation” to implement cooperation; thus, the word “consolidation” in the present SLR also carries the meaning of cooperation.

When defining cooperation in terms of the CEP market, the literature distinguishes between vertical and horizontal types of cooperation. According to [44], collaboration is vertical when the participants (actors) are subordinate to each other and the actors supply only a certain segment of the chain. Vertical collaborations typically occur in supply chain logistics. Cooperation is horizontal, as [31] states, where cooperation takes place

among market players who operate at the same level in the logistics market and are mostly competitors of each other. In such cooperation, the parties “identify and exploit win–win situations” [31] (p. 23). Vertical collaborations typical of supply chain management are essentially subcontracting relationships. In the logistics CEP market, subcontracting is well known, and service providers often use subcontractors to supply different parts of the process. In the case of horizontal cooperation, the competing market participants carry out predefined processes and tasks together and in cooperation where cooperation is based on the sharing of resources. Horizontal type collaborations have been considered in the design of the SLR. The methodology for preparing a systematic literature review, the search strategy, the evaluation criteria, the article selection process, and the quality assessment is defined in detail in the next section.

This SLR focused on the last mile delivery area within the logistics industry. Last mile delivery is the delivery of goods purchased by the customer delivered by the service provider. According to the literature, there are two types of last mile delivery. In the first case of last mile parcel delivery, the customer orders the goods online. The online shop entrusts a service company with the delivery of the goods. In the second case, the delivery is made on the basis of orders placed by the stores. The present SLR applies to the first type of last mile delivery, i.e., parcel delivery.

3. Review Methodology

According to [12,39,40,42], conducting an SLR primarily requires the precise definition of the purpose of the SLR. This involves formulating questions to which the authors intend to receive answers, designating areas for exploration as well as defining the purpose of the study. It has been suggested that before conducting an SLR, the methodology to be used and its individual elements should be defined, i.e., a review protocol should be developed. The review protocol includes all elements of the methodology, including the background of the research, the research question, the criteria for selecting articles, the system used to narrow the search results, and the method of organizing the information obtained. Therefore, this article is based on the research question described in the previous section. The additional elements of the review protocol will be described in the following subsections.

3.1. Inclusion and Exclusion Criteria

Before collecting articles, the boundaries of collection should be defined. What are the elements that determine which articles will be selected and which should be excluded from the selection? For conducting this SLR, journal articles and conference proceedings published in English between 2001 and 2023 were taken into account. An important consideration regarding an article was its full-text availability. Table 1 shows the inclusion and exclusion criteria used for the SLR.

Table 1. Inclusion and exclusion criteria.

Inclusion criteria	The article is written in English
	The article is available in full text format
	The article is available in Scopus and WoS databases
	Articles between 2001–2023
	Article is related to the research question
	Article is within the domain of CEP market collaboration
Exclusion criteria	The article is not available in electronic format
	Subject area does not fit to the researched area
	The content is out of scope
	The article is not written in English

3.2. Article Search Strategy

The search strategy in this SLR relied solely on automatic searches. The automatic search was conducted using the Scopus and Web of Science databases, using a predefined

combined keyword search method that targeted both the key words and the abstracts of the articles. Since CEP market activity, including last mile delivery, occurs in a variety of contexts in the scientific literature, keywords and combinations of keywords with a high probability of last mile parcel delivery were used. The AND and OR Boolean operators were applied on the keywords shown in Table 2.

Table 2. List of key words used for the search.

collaboration	urban consolidation center
cooperation	horizontal collaboration
co-operation	horizontal cooperation
partnering	horizontal co-operation
partnership	intergated logistics center
last mile	e-commerce
parcel	city logistics
urban delivery center	

The combined keyword search results list was further narrowed with the subject area restriction tool. Areas not relevant to the study, such as medicine, biology, chemistry, physics, agriculture, education, health, mining, pharmacy, nursing, and veterinary sciences, were deselected. The list of results obtained using the combined keyword category was downloaded from the Scopus and Web of Science databases. Subsequently, duplications were eliminated using the Excel software tool. The Excel file containing the list of results became the basis for further operations. As a step before the content analysis, it was necessary to examine whether the full content of the given article was available in the databases. In the Excel file containing the details, the result of each step was documented, which functioned as a selection criterion in the subsequent steps. The first steps in the search process resulted in a list that needed to be subjected to a qualitative analysis. The following figure (Figure 1) shows the process defined in the research protocol, as well as the evolution of the results for each step.

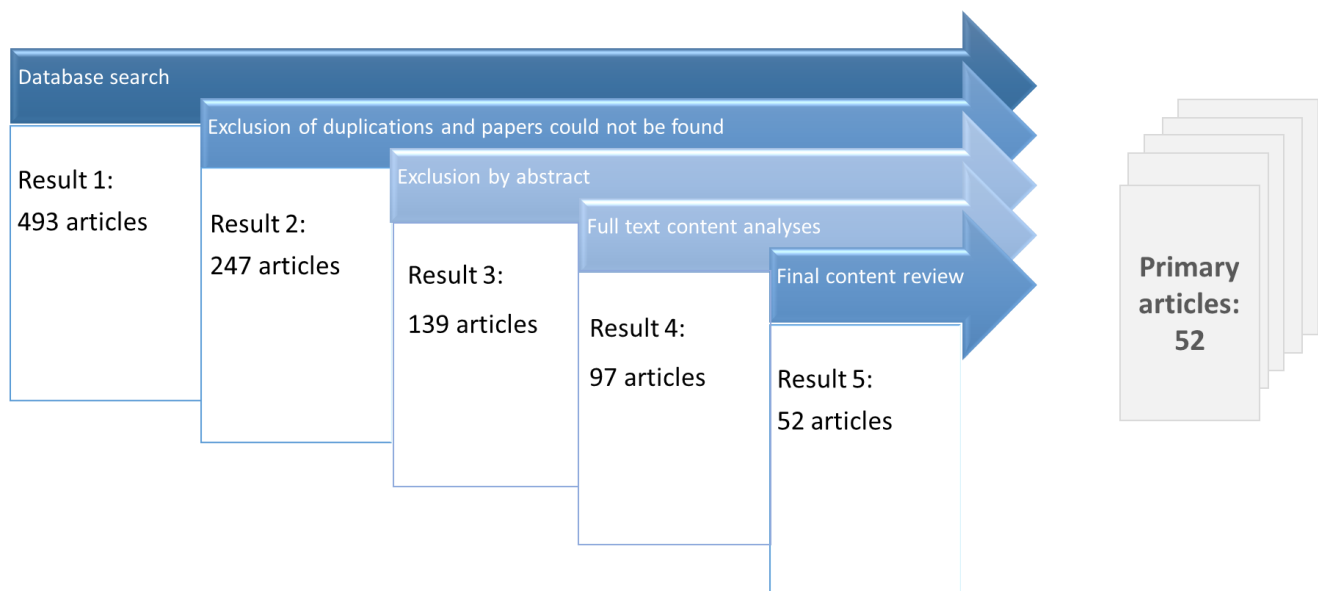


Figure 1. Diagram of the search and selection process (source: compiled by the authors).

3.3. Article Selection

The combined keyword search returned 493 articles. From the 493-item list, 246 articles were deleted due to duplications, irrelevance based on the title and the type of journal, or download problems. A total of 139 articles were found, providing the basis for the analytical work. When analyzing the abstracts, it was necessary to examine whether the

summary of the article applied to CEP market last mile delivery and collaboration, i.e., whether the article itself answered the research question and met the criteria defined in the inclusion/exclusion criteria. Two researchers independently read the abstracts to solely choose studies examining CEP market collaboration in an effort to eliminate bias. A total of 97 papers remained for full-text screening after the abstracts were reviewed.

3.4. Content Analysis

The content analysis of articles is an iterative process. As stated in references [12,39,40,42], at this stage of the process, the authors listed the articles to be excluded and the criteria for exclusion. The authors compiled a list, which was taken into account in the iterative evaluation of each article (Table 3).

Table 3. Evaluation questions.

Question 1	Does the article investigate last mile delivery?
Question 2	Does the article investigate collaboration, cooperation, co-operation or consolidation?
Question 3	Combination of Question 1 and Question 2 applied?
Question 4	Does the article investigate the searched theme in last mile parcel delivery?

Regarding the content analysis of the full texts, 97 articles were subjected to analysis based on the four evaluation questions. As a result, 52 articles were included in the final hit list, i.e., these 52 articles formed the basis of the SLR analysis. In order to process the content of the articles, the authors created subcategories. The subcategories clarified the topic of the article and examined the relevance of the article for the SLR. Finally, the authors divided the studies into five categories: (1) city logistics, (2) collaboration model—mathematical algorithm, (3) public transport collaboration, (4) service provider collaboration, and (5) urban consolidation center and urban distribution center (UCC/UDC).

Following the systematic literature review, only 52 articles were selected that met the research question and additional criteria based on their content. The gap diagram is shown in Figure 2.

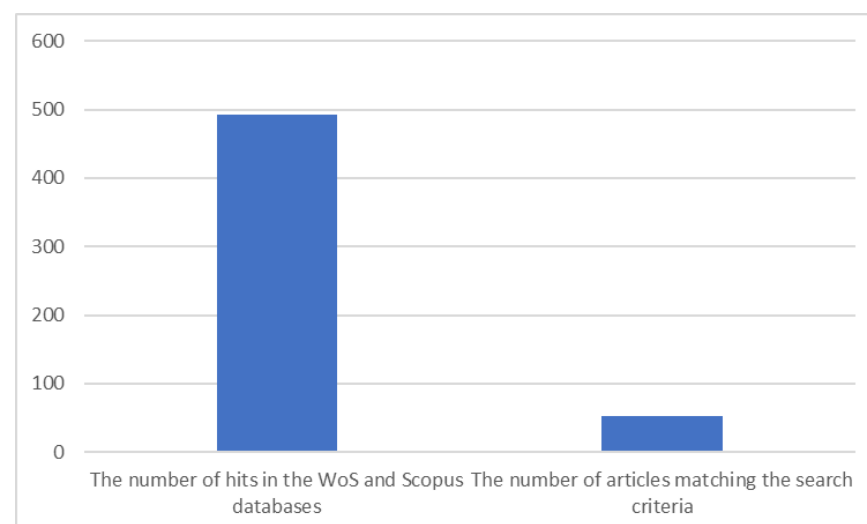


Figure 2. Gap diagram based on the comparison of total hit list and selected articles (source: compiled by the authors).

Although the research covered the period of 2001–2023, the 52 selected articles were within the period of 2014–2023.

The categorization of the articles by the authors according to the five categories and the distribution of year is presented in Table 4.

Table 4. Distribution of articles within the five categories.

Category	2014	2016	2017	2018	2019	2020	2021	2022	2023	Total Number of Publications per Subject Area
City logistics	Lindawati et al. [45]	Eidhammer O. et al. [46]		Ranieri L et al. [47]	Jamshidi A. et al. [48] Cleophas, C. et al. [49]	Hribernik M. et al. [50] Taniguchi E. et al. [51]	Tolentino-Zondervan F. et al. [52]		Fontaine P. et al. [23] Teixeira L. et al. [29]	10
Collaboration model—mathematical algorithm or route focus				Ko S.Y. et al. [37]	Torres-Ramos A.F. et al. [53] Bhasker A. et al. [34] De Souza R. et al. [54]	Hasan M. et al. [36] Ko S.Y. et al. [55]	Wang, Y. et al. [56] Du, JH. Et al. [57]			8
Public transport collaboration					Lucken E. et al. [58]		Villa R. et al. [59]	Ma M. et al. [60] Bhatnagar S. et al. [61]	He Y. [16]	5
Service provider collaboration		Park H. et al. [62] Quintero-Araújo C.L. et al. [63]	Allen J. et al. [64]	Serrano-Hernandez A. et al. [65]	Zhang M. et al. [66]			Ukko, J. et al. [67] Dolati Neghabadi P. et al. [68] Deng Y. et al. [22] Makhmudov M. et al. [69] Justiani S. et al. [30]		10
UCC/UDC	Zhou Y. et al. [70] Gonzalez-Feliu J. et al. [32]	Navarro C. et al. [71] Clausen U. et al. [72] Duin J.H.R.V. et al. [73]	Guerrero J.C. et al. [17] Digiesi S. et al. [5] Estrada M. et al. [74]		Nataraj S et al. [75] Hezarkhani B. et al. [76] Zelenska I. et al. [77]	Letnik T. et al. [78] Akgun E.Z. et al. [79]	Johnson D. et al. [80] Rosenberg L.N. et al. [81] Aljohani K. et al. [82] Deng Q. et al. [83]	Katsela K. et al. [84] Crotti D. et al. [85]		19
Number of publications per year	3	6	4	3	10	6	8	9	3	52

The division of the 52 articles into five categories served as a means of grouping. Although each selected article was written on the topic of last mile parcel delivery and collaboration, most (19 = 36.5%) belong to the UCC/UDC category, followed by the city logistics and service provider collaboration categories, with 10 hits/each, which was 19.2% of the scope. The collaboration model—mathematical algorithm or route focus represented 15.4%, whereas public transport collaboration only represented 9.6%.

The authors made an inventory of the articles according to the journals and proceedings. According to the analysis, with the exception of four journals on the research topic, the number of articles published was one per journal. The International Journal of Production Research published two articles, the European Journal of Operational Research published three articles, Sustainability (Switzerland) published 10 articles, Transportation Research Part B: Methodological published two articles, and Transportation Research Procedia published five of the selected articles. The journals that published only one article based on the list were placed in the “other journals” category with 30 selected articles.

4. Research Results

This chapter summarizes the most important findings of the 52 articles based on the five defined groupings.

4.1. Collaboration Model—Mathematical Algorithm or Route Focus

The collaboration model—mathematical algorithm or route focus group contained eight articles that aimed to address the last mile problem, primarily through the use of mathematical modeling. The group included articles on multi-agent platforms, route optimization or route planning, and collaborating models. According to [35], numerical simulation analysis has the advantages of modeling real-world systems while allowing the researcher to conduct counterfactual experiments in an attempt to understand the system’s behavior or evaluate alternative functionalities. The author of [63] highlights the importance of multi-depot vehicle routing problems, which could become a competitive advantage of horizontal collaboration. Reference [53] focuses on the distribution process and proposes a variant of the Vehicle Routing Problem that Shared Customer Collaboration calls the Vehicle Routing Problem. The strategy is based on a horizontal collaboration that aims to maximize the benefits for those involved in the collaboration. The authors used a hybrid metaheuristic approach to construct a minimum cost distribution plan. Horizontal collaborations comprised collaborations among carriers, where capacities, orders, and delivery requests were shared (although the authors believed this was the most-studied activity in the case of truckloads). The authors built a model using the GRASPxILS (greedy randomized adaptive search procedure and iterated local search) approach. The model aimed to reduce the shipping costs, which was confirmed by performing analyses.

According to [36], collaborations among service providers are a desired option to reduce overall costs and increase utilization. The authors demonstrated the effectiveness of collaboration through the development of a multi-agent system. The primary goal of [36] was to treat the actors as equivalents by developing a model, and to achieve the satisfaction of each actor in order to reduce costs as a global goal. In the model, each service provider is a collaborator solving the last mile delivery problem differently. However, the model works with other collaborators to provide a solution for each agent. The solution also includes a coordinating agent that receives requests from service agents and manages the distribution. As a result of performing the experiment, in the scenario where only cost reduction was the goal, the full collaboration of the agents resulted in a cost savings of 45%. In the scenario where, in addition to cost savings, satisfaction was the goal, there was a decrease in total savings, but satisfaction increased. According to the authors, the obtained result demonstrated that participant satisfaction can be increased with some decrease in profit.

A service cluster-based collaboration model is outlined in article [37]. In the model, a service center plays a central role to which the service providers are connected. The Baduk

Board is used to derive the last mile delivery time function to maximize profits for each participant. As the success of a collaboration also depends on how costs and profits are distributed among the actors, the authors used a cooperative game theory approach to ensure the long-term survival of the collaboration. As a result of the experiment, a traceable cooperation model can be developed, including the profit determined for the players with different market shares. The situation of the players can be continuously improved by applying the cooperative game theory method that forms the basis of the model. The authors explicitly recommend the application of the model in everyday life to model the formation of coalitions. According to [57], courier, express, and parcel companies are attempting to form joint delivery alliances (JDAs) in order to boost their earnings. The goal of their research is to create an incentive model that will motivate members to perform at their optimal level. Furthermore, Ref. [56] proposed a multicenter pickup involving delivery problems designed using a time window assignment to resolve a two-stage optimization problem. In a multicenter logistics network, the collaborative method achieves optimal transportation resource configuration. To improve transportation efficiency and lower total logistics operating costs, an open–closed mixed pickup and delivery route that meets client needs and time constraints is presented. Following that, the authors devised a bi-objective programming paradigm to reduce the total operational costs. The entire model, which includes six scenarios (with and without collaboration), was created using data from Chongqing City’s logistics network. Their findings suggest that a collaborative approach can improve transportation resource usage and operational efficiency.

The author of [34] developed a mathematical model to evaluate fuel consumption for a routing plan in the case of cooperation and non-cooperation. The model resulted in a 19.02% reduction in fuel in the case of cooperation, with a lower number of vehicles used in the service. In the paper [54], the authors argued that collaboration can also be vertical through an outsourcing contract, although it must guarantee logistics needs. This results in fixed costs for the service provider. If the service provider has unequal logistical needs, it cannot enter into fixed contracts and should instead initiate a horizontal co-operation. The authors recommend the fourth party milk run (4PMR) model for cases where the provider uses collaboration from a horizontal provider. This type of agreement is known as “pay-per-use”. The authors conducted the experiment using two logistics scenarios (Jakarta and Surayaba). The Jakarta scenario was artificial, while the Surayaba scenario contained data from an existing provider. As a result of the experiment, a cost reduction of 24.84% was observed for the real-life example. The content of publication [55] is focused on small and medium-sized firms operating in the intensifying market competition in the long-term. The model developed by the authors is both a decision support model and a pricing model to be applied in collaboration. The model seeks to determine the optimal price and maximize profit based on the last mile delivery time function. According to the authors, collaboration always secures profit for the participating service providers. However, under certain market conditions, cooperation does not guarantee satisfaction.

4.2. Public Transport Collaboration

A novel solution to the last mile delivery problem is the use of public transport, especially metro lines, for transportation. The next category of selected articles recommends collaborations where the involvement of public transport is the preferred solution for transportation. Public transport is not a specifically horizontal cooperation, yet it presupposes a new type of cooperation in which the cooperating partner is a non-last mile delivery service provider. The authors of [59] illustrate the use of the metro system in the delivery process using an example from Madrid. The authors note that this results in a new kind of business model; thus, they analyzed the cost and impact of the solution. The costs of the new business model were compared to the traditional business model. In addition to using the metro system, people living near the destination would also be involved in the service. Using the model reduced the economic, social, and environmental costs. The study found that use of this mixed model resulted in 11.6–14.72% lower operating costs for service

providers. Based on the findings of [60], the scientific literature has done little to address metro-integrated logistics systems and their effects. Using a game theory-based approach, the authors examined collaboration among service providers, the metro company, and its implications. The service provider decides how many packages to allocate to the metro for delivery, and the subway decides what price to pay for the packages delivered.

Reference [58] also examined collaborations between public transport and the Mobility on Demand (MOD) business sector. The authors conducted 34 interviews with MOD actors and 27 public agencies. The purpose of the interviews was to develop a service model based on collaborations among the actors. The authors were able to create different types of models based on the results of the interview. The use of public transport can lead to a loss of control for the service providers, but it can also lead to service expansion. Dial-a-ride services are still less known in parcel delivery, although these services could be promoted with the involvement of public transport organizations.

Ref. [61] built a multimodal simulation for the planning and operation of first- and last-mile deliveries. The model simulated the involvement of metro lines, rickshaws, and taxi services to implement pickups and drop-offs through a case study in India. As a result of the simulation, they were able to achieve a 26% increase in resource allocation and a 27% decrease in the number of kilometers traveled. Although the model included real data, the authors note that the results achieved could be further improved by refining the details of the deliveries. Another example of the involvement of public transport in the last mile delivery market is the use of buses [16]. The authors of [16] studied the cooperation between the state and the last mile service providers using a two-layer optimization model. The model simulated cooperation using one-day live data of a Chinese city, which resulted in a significant reduction in the costs of the last mile service provider, while the state gained revenue. In the example, the importance of cooperation arises from the fact that the city administration limits the delivery of parcels during the day with traditional vehicles, but this restriction does not apply to buses. The restriction on traditional vehicles has a negative effect on the delivery regarding customer's expectations, which cannot be met by the last mile service providers due to the restrictions. In the opinion of the authors, the inclusion of buses helps to reduce the production of losses in public transport and takes advantage of the fact that buses are not subject to traffic restrictions for parcel deliveries. If buses are used for parcel deliveries, the state (operator) determines the cost of the bus transportation, while the fee for parcel delivery is determined by the last mile service providers. The cooperation of the two and the pursuit of an economic win-win situation can be a solution to the last mile problem.

4.3. Service Provider Collaboration

Service provider collaboration is a grouping of article analysis in which articles present collaboration between service providers. Parcel carriers see one another as competitors [83], and the idea of cooperation in last-mile operations has been dismissed. Reference [30] states that the existing competition between service providers has negative consequences. With more cars on the roads, traffic and air pollution are rising considerably. The most negative effect of this for service providers is inefficiency. One possible solution to the problem is to encourage horizontal collaborations. Collaboration occurs when two or more actors pool their resources to achieve a common goal, and in transportation, it entails the physical exchange of shipments among collaborating partners who share material and immaterial resources such as logistics facilities, vehicles, data, and planning and optimization methods [86]. In addition, as [87] emphasizes, horizontal collaboration has a strong potential to lower costs, boost productivity, ease traffic, and reduce external costs. According to [67], collaboration is important in building more sustainable businesses, and the rise of e-business has transformed the landscape when it comes to achieving a high performance. In the context of e-business, the authors examined the relationships between supplier collaboration, sustainability, and market performance. They gathered information from internet store owners in Finland. The findings have ramifications for

e-business organizations by promoting supplier collaboration and environmental ideals while retaining strong market performance. The results suggest that the relationship between supplier collaboration and market success is mediated by e-business sustainability. According to [69], there are a variety of strategies for working together in the CEP market, including pooling shared infrastructure, dividing the market into service zones and delivery product categories, as well as pre-agreeing on service schedules. Long-term or short-term (temporal) collaboration are both possible. The authors created a temporal cooperation model in which the level of service was defined. The cooperating parties used a common hub for deliveries, divided the delivery area between them, and fixed the delivery time windows. Mathematical models were used to simulate cooperation, the goal of which were to maximize profit using a cooperative game theory approach. Based on the results, the max-sum model achieved an increase in total profit for the collaborative partners. Furthermore, the article [30] examined cooperation in picking up parcels. In their model, the investigated companies jointly operate a depot and delivery vehicles. In addition, the picking-up activity is also jointly planned by the cooperating companies. The authors involved two CEP market providers, who provided their data for the simulation. Based on the results of the simulation, up to 33% cost savings and 29% reduction in harmful substance emissions can be achieved among the companies that entered into cooperations.

In a case study [62], the authors presented a last mile delivery collaboration in Seoul using an implemented collaboration example. In Seoul, there has been cooperation between certain last mile delivery providers since 2011. The development of cooperation was the result of external pressure, as transportation to certain districts was limited by the city administration. The city administration allowed entrance for certain cooperating service providers into the district. The authors' study was primarily based on this existing case. However, in other parts of Seoul, where the city administration did not impose restrictions, but the citizens wanted to receive cooperating service providers, there was no cooperation. The possibility of cooperation was not attractive enough to the service providers. The authors of article [62] examined the effects of collaboration on different actors using a mathematical model. According to the study, cooperation is beneficial for service providers if the number of households in the district exceeds a certain amount. Nevertheless, the authors highlighted other positive effects of service provider collaborations, such as reduced pollution, less traffic, and fewer vehicles on the roads. An important finding of the authors was the role of city management. Without their effective involvement and without appropriate incentives, cooperation will not take place, at least in Seoul. The method of delivery must also be decided when establishing collaborations. In order to reduce toxic emissions, there are advantages to using transport methods where the overall effect is not harmful to the environment, including reducing costs and increasing profits for the service providers. One possible alternative is multimodal transport. Ref. [22] created a conceptual framework for examining potential market collaborations between competing sources of transportation. They simulated the economic interactions among a group of various service providers of a multi-modal transportation system. In the simulation, the authors encouraged the service providers to cooperate by using incentives, which were modeled using a time-scale stochastic algorithm and profit distribution with the asymmetric Nash Bargaining solution. With the help of the established model, it was proven that the cooperation resulted in a reduction in costs and an increase in profit for the service providers.

The authors of [66] performed a comparative analysis of service providers with or without horizontal collaborations. The study was conducted using two arbitrary last mile delivery providers using a game theory approach. Based on the results of the study, the authors were able to demonstrate the effectiveness of horizontal collaboration, and in a theoretical sense, there was an order quantity that maximized profits for all actors. Reference [65] examined horizontal collaborations among service providers using the following methods: (1) the authors developed a trust-based technique to model horizontal collaboration, (2) they analyzed the impact of trust in collaboration, and (3) they discussed the potential benefits and consequences of service quality. They found that when orga-

nizations cooperate, significant lead time reductions can be realized; nevertheless, trust difficulties were a barrier to improved savings. Further savings were hampered by a lack of trust, especially in a segmented topology. Cooperation is also an effective method for improving service quality by allowing for faster delivery. In article [64] the authors proposed a Freight Traffic Controller (FTC) concept with a trusted third party to allocate the work, including vehicles among the participants. One of the most difficult aspects of developing collaborative connections between parcel carriers is to determine the value of the collaboration. Due to the dynamic nature of parcel distribution, these coalitions may vary in response to daily collection and delivery profiles, indicating that they may become unstable when new opportunities develop amongst different partners.

In recent years, the concept of pooling has appeared among collaboration solutions, or the sharing of resources between service providers of the same level (horizontal collaboration), in order to perform tasks together [68]. According to the authors' opinion, pooling is an innovative solution that increases the load factor rate and reduces the number of kilometers traveled and vehicles in use, thereby reducing costs and CO₂ emissions. The problem with collaborative ventures is that pooling calls for strong stakeholder involvement, as well as their sustained engagement to ensure the profitability of projects. Although the simulation pooling performed by the authors was successful in terms of the number of kilometers traveled and in terms of the load factor and CO₂ emissions, the authors also examined the existence of compatibility constraints, which may have a negative impact on the effectiveness of the pooling models.

4.4. City Logistics

In the literature, city logistics are sometimes referred to as urban logistics or urban freight. City logistics are a phenomenon that has been researched for approximately 15 years. They are based on tackling urban overcrowding, increasing pollution, decreasing traffic jams, and enhancing the livability of cities in general. According to [46], urban transport accounts for 10–20% of transport, and vehicles involved in transport are responsible for 20–30% of congestion and emissions. City governments take various measures to alleviate the problems, but these measures often have a negative impact on the industry, especially transportation, including last mile delivery. Studies in the field of city logistics highlight that the creation of more livable cities is a common intention, and collaborations in which parties with conflicting interests come to an agreement and organize actions produce acceptable results for all. However, these measures often affect the CEP sector negatively, contrary to the original intention. Although countless initiatives have taken place to optimize urban transport, no real breakthrough has occurred. However, the authors of [29] intended to fill the gap with an integrated technological solution (SOLFI), where urban logistics are combined with passengers, public transport, and freight in order to increase the sustainability of the city. The purpose of the model was to demonstrate the feasibility of cooperation, resulting in a reduction in the number of vehicles and environmental pollution. In paper [48], the authors proposed a decision support method to implement a cooperative partner selection. According to [49], categorical dimensions were established to classify creative forms of collaboration in municipal logistics and transportation. The authors emphasized the prospect of incorporating public transportation and ordinary citizens in city logistics projects (crowdsourcing). In European cities, several collaborative transportation systems have been attempted, transporting waste, mail, and freight alongside passengers. In their pursuit of a more efficient design, the authors found that combining vertical and horizontal partnerships was the most efficient. In article [23], by extending the concept of continuous approximation, the authors demonstrated that multi-player service providers, diverse network structures, and heterogeneous vehicle fleets can operate effectively in a consolidated manner. The authors recommended the developed model for the planning of a future, efficiently functioning, smart city, where the interests of last mile service providers are also taken into account. Four methods were analyzed using the model: (1) a two-level urban logistics plan for better performance; (2) partial operation outsourcing in order to

reduce costs; (3) consolidation between service providers in order to reduce the total cost; (4) a central last mile system that enables efficient resource sharing. The authors emphasized that the consolidation resulted in cost and emission reduction, regardless of the distribution structure. In addition, the authors highlighted that a reduction in urban traffic was only achieved in the consolidated and coordinated scenario.

Reference [46] examined the development of city logistics efforts in four Norwegian cities using a questionnaire survey. The results of the survey showed that the city logistics initiative was not sufficiently communicated and coordinated. In addition, there was a lack of cooperation between the city administration and the logistics sector. The conflicts of interest were significant, which could be resolved by creating an urban logistics plan with a common will. One of the main findings of the survey was the need to establish a common forum to facilitate cooperation. Furthermore, Ref. [52] highlights that stakeholders play an important role in city logistics initiatives or in the implementation of smart logistics solutions. Information sharing and collaboration play a key role in achieving efficient and well-functioning city logistics. The authors of [51] argued that advanced technologies such as IoT (Internet of Things), big data, and AI (Artificial Intelligence) can provide appropriate support for city logistics challenges. In addition, Ref. [47] demonstrated that the combined use of IoT technology and electric vehicles could be used to build a smart logistics system. Multi-agent, multi-actor, multi-criteria models, routing, or location modeling tools can also provide a solution for implementing logistics planning or rethinking, including analyzing the impact of collaborations. Furthermore, Ref. [45] clearly stated that stakeholder collaboration is necessary and timely to increase efficiency, especially in large cities. The authors analyzed the motivators and constraints of city logistics collaborations using an example from Singapore. The most important result of the analysis was that, although collaboration was needed, it should be the result of the common efforts of public and private actors in a metropolitan environment. Based on this result, the most important motivator was being aware of the quantifiable benefits of cooperation. The main impediment was the loss of a competitive advantage. Trust or a shared IT platform did not play a significant role for participants. In contrast, Ref. [50] argued that a lack of trust and problems with the implementation of data exchange hinder the establishment of horizontal collaborations. The authors' "blockchain-based" solution was a proposal to address security data exchange and trust concerns. In addition, the authors noted that, although 30 blockchain solutions were analyzed before proposing their solution, the model had not been tested in a harsh CEP market environment. Therefore, it remained only theoretical.

Not all companies are suitable for cooperation, and not all companies are willing to cooperate. However, city logistics are based on collaboration. Participants in the CEP sector must collaborate with each other, the CEP sector, and city leadership to succeed.

4.5. Urban Consolidation Center (UCC)/Urban Distribution Center (UDC)

The literature on urban consolidation centers (UCC) or urban distribution centers (UDC) can be traced back to the 1970s [77]. The first UCCs were established in the United Kingdom, France, the United States, and Canada. The primary goals of UCCs are to reduce pollution, emissions, and congestion in cities and to make cities more livable. The function of UCCs is to consolidate transport to cities, thereby reducing intra-city traffic. Based on their functions, Ref. [44] argues that there are two types of UCCs: (1) city based—UCCs that provide services to the city center, and (2) area based—UCCs that are located close to the city but provide services to the surrounding small towns. The majority of the cited literature state that UCCs are generally successful at lowering CO₂ and NO₂ emissions, yet some management and financial issues impair these platforms' long-term viability [85]. In contrast, according to [78], although the UCC design proves to be a very favorable theoretical alternative, it does not often reach the threshold required to cover the investment. Furthermore, Refs. [72,84] highlight that UCCs do not necessarily guarantee a positive impact on the environment. The authors of [85,88] state that half of more than 100 UCC collaboration initiatives fail in the implementation phase. Nevertheless, UCCs

are the key to a sustainable future that cannot function without cooperation. Due to their operating principle, UCCs are complex, making the level of cooperation more complicated. Although UCCs bring together last mile providers, other players are also involved. An improved method of horizontal cooperation is emerging as service providers continue to compete with each other, but cooperation is levelling off.

According to [77], UCCs can be voluntary or forced. However, in both cases compensation from public administration is needed to make entry into a UCC more attractive. A UCC is forced when city administration intends to block traffic into the city with roadblocks, stopping bans and restrictions. With the support of city administration, a UCC is set up with compulsory entry, otherwise the carrier will not be able to enter the city. The authors of articles [44,79,82,85] argue that—whether forced or voluntary—its success cannot be guaranteed without the financial support of the public administration.

There are a number of factors to be considered before a UCC can operate successfully. According to references [75,76,88], the success of a UCC requires a clear operating mechanism to govern collaboration. Furthermore, according to [80], the choice of a UCC site is also one of the success factors. The financial viability is also the key to success, i.e., a sustainable business model should be developed when designing a UCC [73]. In addition, Refs. [70,74,82] state that success cannot be guaranteed without an appropriate cost and profit maximizing model. Reference [83] demonstrates that a consolidator is essential for the operation of a UCC, thus demonstrating the beneficial effect of a UCC with a consolidator in balancing delivery capacity in a comparative analysis. In addition, UCCs are models in which multi-stakeholder collaboration is desirable [79]. Fundamentally, multi-stakeholder collaboration is the most critical feature of UCCs.

The present SLR describes UCC-related articles for which the analysis of collaboration was relevant. Numerous articles have been written since the creation of UCCs. These articles either analyze the functioning of existing UCCs or focus on the initiatives taken. The authors of [44] examined French and Italian UCCs. The most important finding of these authors was that the structure of UCCs should take cultural differences into account and place a strong emphasis on managing collaborations. In reference [81], the authors presented a case study from Helsinki and Helmond where multi depots were used for consolidation purposes. The project is a new initiative where the cooperation of several different types of actors results in the maintenance of multi depot. In addition, a successful pilot implementation of the LaMiLo UCC (Last Mile Logistics) project was presented by [72]. In the four cities involved (London, Paris, Nijmegen, and Brussels), the project managed to reduce the number of kilometers travelled and increase capacity utilization to 70%. However, paper [71] reported on the completion of the pilot phase of the SMILE (smart green innovative urban logistics models for energy efficient mediterranean cities (Barcelona, Bologna, Piraeus, Rijeka, and Valencia) project, where the project's most significant challenge was determining how the actors could collaborate.

5. Discussion and Future Research Opportunities

CEP market last mile delivery has been struggling with efficiency problems for decades [89]. E-commerce, which has grown significantly since the COVID epidemic, as well as the urbanization trends of recent years, show that it is in the interest of all CEP market stakeholders to solve the problems that are important to them. Urbanization can place a burden on city governments in the search for solutions, since moving back to cities projects the vision that cities will become unlivable within a few years. Typically, in welfare societies, people own more vehicles than 50 years ago. During the COVID pandemic, the use of digitization-based administration and online services, in addition to the growth of e-commerce, also placed pressure on transportation. The way of working has also changed since the pandemic, with the majority of employees being allowed to work from home. More people are shopping online, and the delivery of online orders is entrusted to CEP market providers. The CEP market trends of the pre-pandemic period characterized home delivery as an existing but declining service, and the appearance of parcel lockers took on

a leading role. The reorganization of the labor market after the pandemic brought home delivery back to the forefront, but parcel lockers continue to show an increasing trend. The result of the repeated increase in the demand for home delivery is a rise in truck traffic and a surge in harmful environmental effects. The only possibility for city administrations regarding increasing traffic and lack of parking is to introduce restrictive measures in order to reduce environmental damage. However, as a result of traffic and parking constraints, it is now more challenging for service providers in the CEP market to provide requested services. Among the three main CEP market stakeholders (customer, city administration, service providers) there is a conflict of interest as a result of the emerging tendency. CEP market service providers wish to improve efficiency and cut costs, city administration is interested in minimizing negative consequences, and customers have new expectations for the delivery of online-purchased goods. They all must cooperate if they wish their expectations to be fulfilled and their interests to be mutually reinforced.

In recent years, countless alternative solutions have been created to solve the last mile problem. In order to reduce environmental pollution, alternative fuel-powered vehicles have been created, which are satisfactory for people to use, but still face obstacles in transportation due to capacity and infrastructural deficiencies. Drones that substitute human transportation are still being tested. Although automated parcel lockers, which require a more predictable delivery time window, are becoming more popular, home delivery still needs to be handled by service providers. Customers increasingly desire same-day delivery or delivery within a short period of time. Transport currently requires vehicles. However, in order to reduce the number of vehicles in cities and to decrease traffic and environmental pollution, fewer vehicles are needed on the roads. CEP market service providers are still characterized by individualistic and competitive operation, and they operate their own fleet of vehicles and resources [90]. Since each CEP market service provider operates its own fleet, the number of vehicles can only be reduced if the service providers start using a common fleet pool. Modeling of resource sharing using different models has demonstrated its positive economic effects for CEP service providers, as well as its favorable environmental effects for city administration. The models incorporated various limitations and potential problems, yet they still demonstrated the beneficial effects of such cooperation in the simulations. In the meantime, central hubs and depots have been created through city government initiatives based on cooperation between service providers and city governments. Unfortunately, based on the experience of the past decades, the failure rate of these initiatives seems to be very high; therefore, the established models may not be functional suggestions.

Despite the positive economic and environmental effects, cooperation is not typical of the CEP market, although some successful forms undoubtedly exist. During our research, we noticed that science pays little attention to the analysis of collaborations. To verify whether our assumption is true, we chose to prepare a systematic review. The purpose of this article was to answer the research question: How significant is the collaboration between CEP service providers based on scientific interest? The completion of the SLR produced minimal findings, i.e., CEP market collaborations receive limited attention in the literature. The combined keyword search procedure used to conduct the SLR yielded 493 results, of which 52 articles were analyzed after the methodological steps were taken. Out of a list of 493 items, only 52 articles, i.e., 11%, stated that science reports results in CEP market cooperation. However, the remaining 89% either completely deviated from the topic or reported an analysis of a problem in some part of the CEP market. The 52 articles were divided into five categories. Each category was based on cooperation, CEP market last mile delivery, and parcel delivery, although each category approached the issue of cooperation from a different perspective. Of the total 52 articles, 15 (29%) presented a real-life example of a collaboration, of which nine were UCC related. These figures demonstrate that only a small proportion of scientific articles address the issue of cooperation. Nevertheless, the analyses showed that, as of 2019, there was an increase in interest in examining the topics

of Service provider collaboration and public transport collaboration, and an increasing number of articles have been published in the following years.

In the present study, the collaboration model—mathematical algorithm or route focus and the service provider collaboration category—can be considered as an effort to achieve collaboration. A total of 18 articles were written on this topic, representing 34.6% of the total number of analyzed articles. However, these articles demonstrated the effectiveness and economic viability of collaborations based on these approaches, which have not been tested in a CEP market environment. Mathematical models that simulate collaboration are generally concerned with the utility of collaboration in terms of resource sharing, pooling, or distribution center models. The issue of city logistics and UCC clearly demonstrates that service providers should collaborate with the different stakeholders to find a solution to the existing last mile problems [91]. The authors of [92] analyzed the different phases of the formation of collaborations. The analysis demonstrated that horizontal collaborations begin with vertical collaborations. Establishing horizontal cooperation is a significant step for competing service providers. Firms need to cross previously non-existent boundaries in order to develop a willingness to cooperate [93]. Companies that work alone and compete in the market with a city logistics initiative and companies that join UCCs are in very difficult situations. The high number of failed UCCs may be due to the fact that the service providers need to collaborate, eliminate, strengthen relationships, and solve problems at each level. Of the articles analyzed in the present SLR, one article mentioned problems that may arise due to cultural differences in a UCC [44]. In addition to UCCs, cultural differences can also cause problems in developing horizontal collaborations.

Of the 52 articles, the case studies provided real-life examples that listed success and failure factors. The success of a UCC alone has only UCC-specific criteria, whereas—in addition to selecting the right location—the cooperation of several actors is one of the most important requirements. However, regarding collaboration alone, different factors are needed to develop collaboration in any business model (whether UCC, city logistics, or horizontal collaboration). According to [62], external pressure was one of the motivators in the Seoul example, while [50,94] suggest that a lack of trust and problems caused by data exchange all hinder the development of collaboration. However, Ref. [71] highlighted that the biggest challenge of the SMILE project was to encourage the parties to cooperate. According to [92], trust and economic interest are needed to establish cooperation. Cooperation has numerous potential benefits, but there are also situations where cooperation develops as a result of restrictive measures. Under these types of pressures, collaboration might be beneficial, but the benefits can only be realized if regulation is based on mutual understanding and communication. Furthermore, regulation acts as a restrictive force in the development of cooperation and becomes the most important “motivator”. The role and importance of public administration can be clearly seen in the analyzed examples of city logistics and UCCs. Enforced cooperation can only be successful if external pressure is offset by public administration, i.e., collaboration is incentivized.

Despite the economics demonstrated by the mathematical models, collaborations seem to have been established only to a negligible degree. In the course of our research, we found that, although economic interest is the primary motivating factor when entering into cooperation, other factors that cannot be grasped or quantified appear at the very first moment and require investigation. According to the investigations so far, trust, the ability to take risks, the intention to share information, cultural differences, or the fear of losing the brand are other factors that influence the development of collaborations. There may also be hitherto undiscovered factors that are closer to human nature, which can best be covered by the topic of cognitive bias. Urbanization trends, the expectations of city governments regarding environmental effects, and the development of city logistics disciplines all demonstrate the need for cooperation between CEP market providers. In this case, it may be predicted that, in the future, services can only be provided on the CEP market with the cooperation of service providers (shared use of resources). Consequently, the factors hindering collaborations must be explored and understood, as well as solutions

developed against the inhibiting factors. Science should pay more attention to this topic, and a thorough examination of the topic may also provide multidisciplinary solutions. In the light of the above results, we recommend the following future research topics:

The examination of cognitive bias affecting cooperation, which will provide a deeper understanding of the reasons for resistance to cooperation.

Supplementing the definition of basic horizontal and vertical collaboration, which will primarily enable the refinement of the previously known form of horizontal collaboration. Hybrid formations may occur as a result of the involvement of new trends in the CEP market in the cooperation (cargo bikes, public transport).

Transformation of the regulatory environment as a result of new trends. The regulatory environment for the cooperation between public transport and traditional CEP market service providers must be examined.

Determining the cooperation trade-off between the CEP market service providers, or determining the number of packages that result in efficiency and profit maximization for the service providers.

6. Conclusions and Limitations

Numerous scientific and CEP sector-related solutions have been proposed to solve the inefficiency problems that have burdened the last mile logistics industry for years. The last mile problem has also been researched by the scientific world for decades. The problem was exacerbated by the COVID-19 pandemic of 2020, as e-commerce started to grow exponentially, with a concomitant increase in the number of home delivery demands. As last mile delivery's presence on roads resulted in an increase in traffic jams and pollution, this reduced the livability of cities, and city governments began introducing restrictive measures. These measures further complicate the operation of last mile providers. One option offered to solve the problem is collaboration. However, this was very rare in the CEP market under study.

The authors of this article found that, although the positive economic and environmental effects of CEP market collaborations have been proven, this topic is rarely studied. In order to prove the limited occurrence of CEP market cooperation in the scientific literature, the authors mapped the relevant literature in a systematic literature review (SLR). The SLR of the research was conducted using a combination of keywords based on the Scopus and Web of Science electronic databases. The research process was explained in detail in the Theoretical Framework section, and the statistics of the research results were depicted. The content analysis performed by the authors during the SLR included 52 articles, which was only 11% of the total articles that were found.

The results of the SLR provided an answer to the research question posed. The amount of literature that has been published on the investigation and promotion of CEP market collaborations is sparse. A significant part of the implemented collaborations was located in the UCC environment. However, the number of city logistics articles and articles aimed at examining a direct cooperation between the service providers showed an increasing trend. According to the mathematical models, collaborations are worthwhile. Nevertheless, a number of other factors are also needed for the formation of cooperations. The success factors for UCCs, such as the implementation and effectiveness of multi-stakeholder collaboration and communication, are primarily related to the UCC topic. The results also showed that, in some cases, the root cause of cooperation is restrictions introduced by city administration. The authors have found the SLR result thought-provoking. If collaborations are known and used in logistics transportation, why are they not used in the CEP market? Why does science not provide a wider focus on this topic?

In line with the above results, the authors recommend the following topics as future research opportunities: examinations of cognitive bias, supplementing the definition of horizontal and vertical collaborations, examinations of the current regulatory environment, and determining the cooperation trade-off using further simulations.

This article was prepared with the following limitations: the search was limited to the Scopus and WoS databases only. In order to increase the results, the search could be further expanded by searching the ScienceDirect database. In addition, the investigation of the collaborations was limited to parcel delivery in the CEP market; therefore, the CEP grocery market was excluded from the examination.

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