

Review

Framework of Last Mile Logistics Research: A Systematic Review of the Literature

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Received: 23 November 2019; Accepted: 11 December 2019; Published: 12 December 2019



Abstract: Coincident with the rapid growth of omni-channel retailing, growing urbanization, changing consumer behavior, and increasing focus on sustainability, academic interest in the area of last mile logistics has significantly increased. The growth in academic publications has been tremendous, with three out of four articles appearing within the past five years. The influx of research spans multiple disciplines and various methodologies, underlining the complexity and fragmentation of last mile logistics research, which leads to a lack of unity in the understanding of the concept. We provide a systematic review and classification of the literature to provide a more coherent view of last mile logistics research. The review covers 155 peer-reviewed journal publications focusing on last mile logistics. Findings demonstrate that the literature embraces a diversity of aspects and facets that are classified into five themes: emerging trends and technologies, operational optimization, supply chain structures, performance measurement, and policy. Further, we propose a framework of last mile logistics literature that comprises five components and their interrelationships, namely, last mile logistics, last mile distribution, last mile fulfillment, last mile transport, and last mile delivery. The results provide a foundation for further development of this research area by proposing avenues for future research.

Keywords: last mile logistics; systematic review; business logistics; omni-channel; retail; B2C

1. Introduction

Last mile logistics is an emerging research area with growing interest from scholars and practitioners, especially over the past five years. The rapid growth is mainly driven by increasing urbanization and population growth [1], e-commerce development [2,3], changing consumer behavior [2,4], innovation [5], and growing attention to sustainability [2,6]. Many definitions of last mile logistics exist, yet a common view is that it concerns the last stretch of the supply chain from the last distribution center to the recipient's preferred destination point [3,7,8]. The last mile is often described as one of the most expensive, inefficient, and polluting parts of the supply chain [9]. Some studies estimate that the last mile accounts for 13–75% of total supply chain cost, depending on various factors [7]. Efficiency depends on multiple factors, such as consumer density and time windows [10], congestion [11], fragmentation of deliveries [12], and shipment size and homogeneity [13]. Last mile logistics cause various externalities, especially greenhouse gas emissions [14,15], air pollution [5], noise [6], and congestion [16]. Therefore, a better understanding of the last mile is required to enhance its economic, environmental, and social sustainability.

Despite the growing number of contributions to last mile logistics research, the area remains relatively incoherent due to the different disciplines and perspectives contributing to it. Previous reviews focus on specific elements within the area of last mile logistics. Four previous systematic reviews have been identified that focus on last mile logistics innovations [5], e-fulfillment and distribution

in omni-channel retailing [17], last mile logistics models [3], and vehicles-based alternatives for last mile distribution in urban freight [18]. However, to provide a more holistic and coherent overview of the research area of last mile logistics, a systematic literature review of relevant literature is required. Thus, the purpose of this study is to consolidate the knowledge in the research area of last mile logistics to provide an integrated view of the literature published on different aspects and facets of last mile logistics. The focus is to identify what constitutes last mile logistics and to provide a framework for classifying and analyzing the literature. Therefore, the review is guided by the following research questions:

RQ1. *How can the literature on last mile logistics be classified?*

RQ2. *What aspects and facets of last mile logistics have been addressed in the literature?*

The remainder of this article is structured accordingly: Section 2 describes the systematic literature review methodology; Section 3 includes a description of the literature landscape, including themes, an evolutionary timeline, methodologies, and theories. Section 4 develops a framework of last mile logistics and describes the different sub-systems and their interrelationships to structure the various views of last mile logistics concepts. Section 5 contains a discussion and avenues for future research. Finally, the main results of this study and their implications are summarized in the conclusions.

2. Methodology

This systematic literature review of last mile logistics follows a six-step guideline [19]. These steps are built upon previous work [20–23], and are increasingly used in logistics and supply chain management research to achieve rigor and transparency in systematic literature reviews. The steps are presented in the following subsections.

2.1. Define Research and Required Characteristics

A scoping study of the existing body of literature was conducted to identify the gap and define the goal of the systematic literature review as well as to get an overview of relevant terminology. The scoping study resulted in reviewing 137 articles and an overall mind map of topics and terminologies used. The scoping study confirmed the lack of a coherent view of last mile logistics in literature and directed the review toward understanding aspects and facets of last mile logistics research. A list of criteria to select the included literature was established based on the scoping study's findings, as seen in Table 1.

Table 1. Inclusion and exclusion criteria.

Type	Criteria	Rationale
Inclusion	Title, abstract, and keywords shall demonstrate last mile logistics as the clear focus/object of the research.	The search has not been limited to specific journals in order to include all potentially relevant studies [17]. Research from other subjects and research fields may appear in the search. It must be ensured that only papers with a clear focus on last mile logistics are included in the research.
	Articles shall be written in English.	English is the dominant language in logistics and supply chain management research [18,19].
	Articles shall be published in peer-reviewed journals.	Only peer-reviewed journal articles have been included to ensure quality control [24,25]
Exclusion	Studies focusing on humanitarian logistics, telecommunications networks, public transportation, crisis management, tourism, and agriculture shall be excluded.	This review focuses on the last mile from a business logistics and management perspective; therefore, studies from other contexts are excluded, which is in line with previous work [5,26].

2.2. Retrieve Sample and Select Pertinent Literature

The review employs three databases and does not limit itself to any timeframe, specific journals, or publishers to generate a comprehensive list of core contributions and minimize the risk of excluding relevant literature. We selected three of the largest business research databases that are commonly used in literature reviews: Scopus, EBSCOhost, and the Web of Science [17,27]. In line with other systematic literature reviews in the field, we have defined keywords as search criteria [3,5,17,18]. The search was conducted in the middle of February 2019, when a combination of keywords was used to retrieve the sample (see Table 2 for an exemplary list of keywords).

Table 2. Search string for database search in Scopus.

Scopus	TITLE-ABS-KEY ("last mile" AND (logistics OR deliver* OR transport* OR distribution) AND NOT (transit OR feeder OR public OR passenger OR humanitarian OR disaster OR lvdc)) AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English")) OR TITLE-ABS-KEY ("last mile" OR "last-mile" OR "final delivery") AND SRCTITLE (logistics OR deliver* OR transport* OR distribution OR retail*) AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (LANGUAGE, "English"))
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*Truncation of terms was used to capture variation in language.

The sample was reduced to a final synthesis sample of 155 articles by excluding literature outside the scope of this study following the inclusion and exclusion criteria. First, the initial sample of 1058 articles was reduced by removing duplicates, which resulted in 711 potentially relevant articles. After that, the titles, abstracts, and keywords were scanned to exclude literature based on the previously set criteria. In case of uncertainty, one researcher carefully read the full text version of articles and discussed it with the other two until a consensus to include or exclude was reached. The literature selection flow chart is shown in Figure 1.

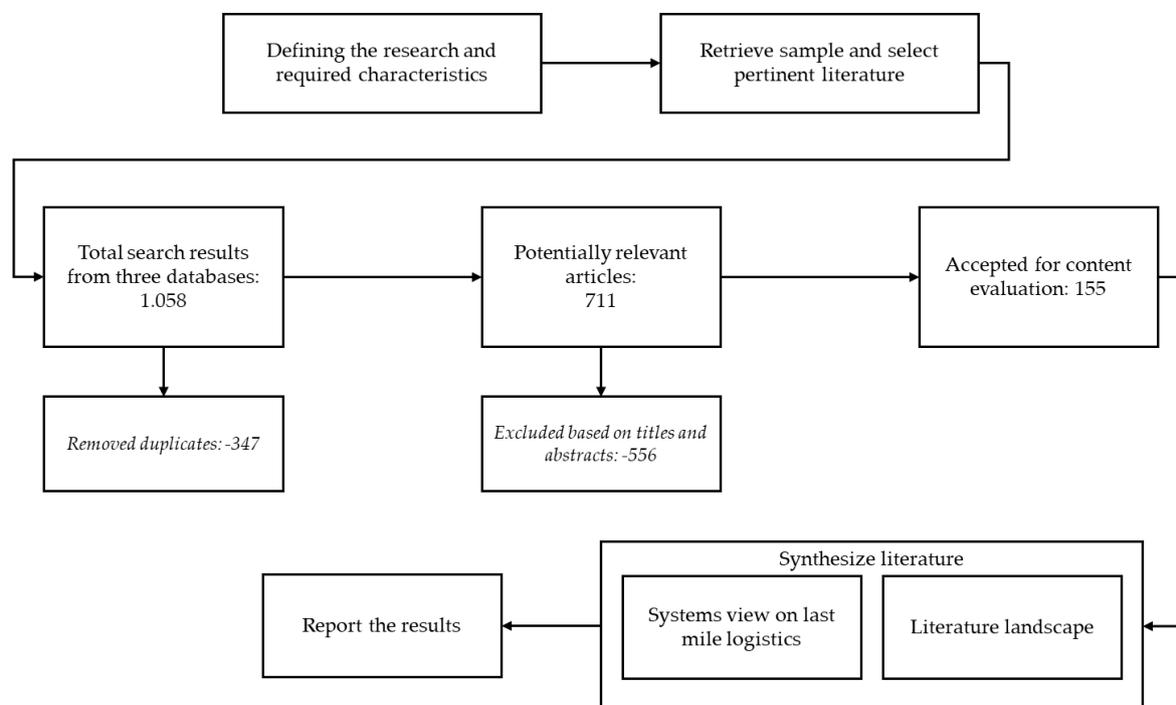


Figure 1. Literature selection flowchart.

2.3. Synthesize Literature and Report Results

We first analyzed publication trends, such as outlets, annual publications, methodologies, and theories, to analyze and synthesize the extant literature. Then, one researcher conducted a qualitative content analysis to identify themes in the literature [28]. Coding categories were derived directly from the literature by giving identified themes of unique codes. The coding was discussed among researchers, especially in cases of uncertainty, until consensus was reached. The codes were then analyzed and clustered into related themes. Finally, all three researchers jointly assessed the derived themes and discussed their consistency. This way of clustering themes is a first attempt to provide an overview of the literature landscape regarding its content. Therefore, we acknowledge that other categorizations may be possible, and we encourage future research to validate our proposed classification of themes.

The next step of the synthesis was to develop a framework of last mile logistics literature. A systems approach was used to provide a holistic, integrated view of the literature. Systems approach is the dominant point of view in business research and assumes that the system as a whole differs from the sum of its parts as their interrelations lead to synergies [29]. Therefore, the various terminologies used to describe different components of the last mile logistics system were collected from the literature. Then, the collected terminologies were coded and clustered into various components, which in turn resulted in an integrated framework. The synthesis was continuously discussed among researchers to ensure consistency of the developed framework. Finally, the findings from the previous steps were reported using text, tables, and figures.

Furthermore, the analysis of themes and the conceptual framework was used to make suggestions for future research based on identified gaps. These suggestions are presented in the discussion section. Moreover, the analysis was used to present implications for researchers and managers presented in the conclusion section.

3. The Literature Landscape

The review shows that the literature landscape is both fragmented and diversified. The influx of research covers a diverse range of themes falling under the complexity of last mile logistics. The literature demonstrates that last mile logistics is an emerging research area with rapid growth in academic publications. In fact, three out of four publications have appeared within the past five years. The selected 155 publications were published in 84 unique academic journals, with only 11 journals publishing more than three articles, which indicates fragmentation of the literature. Overall, last mile logistics research embraces a diverse range of methodologies, which suggests broad methodological coverage of the research area. However, as each of these methodologies is restricted to certain themes, it also suggests a limited perspective on the respective phenomenon under investigation. Despite a general lack of theory in the literature, multiple theories are used in last mile logistics research. These are mainly imported from other disciplines. The following section presents themes found in the literature, an evolutionary timeline for the publications as well as methodologies and theories used.

3.1. Themes in Last Mile Logistics

The literature covers a wide range of themes, indicating that the last mile goes beyond the scope of a single discipline, which underlines the complexity of the research area. To present the literature in a structured way, we derive and consolidate several themes addressed in the literature. The themes contribute to achieving a more comprehensive understanding of the literature landscape. Themes and their respective sub-themes are presented in Table 3. Emerging technologies and innovations refer to articles focusing on technological solutions, innovations, and trends in last mile logistics; four sub-themes have been identified. Goods reception solutions includes articles focusing on self-service technologies [4,30], collection and delivery points [31,32], unattended home deliveries [33], or the comparison of different solutions [34–36]. Innovative vehicle solutions refers to articles focusing on electric vehicles [37,38], bicycles [39], tricycles [40], drones [41], and comparison of different vehicle

solutions [42,43]. Emerging business models incorporate articles focusing on business models emerging for last mile logistics, especially crowd logistics [44–46], and the mix of different business models [47]. New perspectives on collaboration provides new insights into collaboration, particularly drivers and barriers of collaboration [48,49], effects of collaboration [50], and recent advances [51,52].

Table 3. Themes addressed in last mile logistics research.

Themes	Publication References	Count
Emerging trends and technologies		51
Goods reception solutions	[4,30–36,53–66]	22
Innovative vehicle solutions	[18,37–43,67–73]	15
Emerging business models	[44–47,74–76]	7
New perspectives on collaboration	[16,48–52,77]	7
Operational optimization		45
Routing	[10,78–99]	23
Transport planning	[100–111]	12
Scheduling	[112–117]	6
Facility location	[118–121]	4
Supply chain structures		35
Logistics and supply chain design	[3,8,11,12,17,122–140]	15
Urban freight terminals	[11,131–138]	9
Urban planning	[141–145]	5
Urban freight structures	[146–148]	3
Networks design	[149–151]	3
Performance measurement		22
Environmental performance	[1,5,14,15,152–156]	9
Customer focused performance	[2,157–164]	9
Economic performance	[165–168]	4
Policy		2
	[6,169]	2
Total		155

Operational optimization focuses on optimizing last mile operations and making better operational decisions. These articles often employ mathematical modeling and optimization and include four sub-themes. Routing articles focus on planning, selecting, and finding optimal paths within a network, including vehicle routing [80,91], navigation [85], and traveling salesman problems [96,97]. Transport planning refers to articles focused on various planning aspects of transportation, such as consolidation [106], use of spare transport capacity [109], planning of home deliveries [101], and loading optimization [100]. Scheduling focuses on planning the sequence of deliveries in the last mile, including delivery scheduling [112,114] and drone scheduling [113]. Facility location includes articles concerned with the placement of facilities for last mile logistics [120,121].

Supply chain structures refer to articles focused on designing structures for last mile logistics, which includes five sub-themes. Logistics and supply chain design focuses on the design of various supply chain aspects, such as fulfillment [12], distribution [127], hub and spoke systems [124], last mile logistics models [3], and logistics challenges related to the distribution system [130]. Urban freight terminals include urban distribution centers [138], urban consolidation centers [135], mobile depots [132], and loading bays [136]. Urban planning focuses on articles related to urban planning, particularly the impact of urban freight activity [143] and parking practices [145]. Networks design refers to articles focused on the design of networks for last mile logistics, such as last mile supply networks [150], logistics networks [151], and transportation networks [149]. Urban freight structures refer to literature focused on designing models for urban freight, particularly from a sustainability perspective [148] and urban freight strategies [146].

Performance measurement includes articles measuring the performance of different aspects of last mile logistics, which includes four sub-themes. Environmental performance refers to articles measuring the environmental impacts of retail channels [14], solutions for goods reception [152], last mile logistics innovations [5], and urban freight traffic [154]. Customer-focused performance includes articles measuring the performance of last mile logistics from the perspective of its customers, particularly customer satisfaction [158], service quality [157], customer requirements [2], customer experience, [162], and travel modes of consumers, [163]. Economic performance measures the performance of last mile logistics in terms of costs, [166], and profitability [168].

The last theme, policy, refers to articles evaluating available policy instruments in last mile logistics. These articles evaluate the most suitable delivery fleet for freight consolidation policies [6] and the limits of available policy instruments for a reduction of carbon emissions in retail [169].

3.2. Evolutionary Timeline and Main Journals

Last mile logistics is an emerging research area with growing interest from scholars. The evolutionary timeline shows that last mile logistics started gaining academic attention at the beginning of this millennium and is continuously growing (see Figure 2). The oldest article identified is from the year 2001, which suggests that last mile logistics is a relatively new research area. Between 2001 and 2012, the publication rate was rather low, with only one to three annual publications; however, in the following years (2013–2019), the publication rate grew significantly. Notably, there were 50 publications in 2018, and approximately three out of four articles (76%) have been published over the past five years (2015–2019), which also indicates a quickly growing interest in last mile logistics. Also, the ten articles published in 2019 do not reflect a full year's sample since the literature search was conducted in mid-February 2019. This exponential increase is in line with the general increase of publications within the logistics and supply chain fields. However, the growth may also be driven by omni-channel development, changing consumer behavior, increasing urbanization, and innovations, highlighting the need for a more comprehensive understanding of last mile logistics.

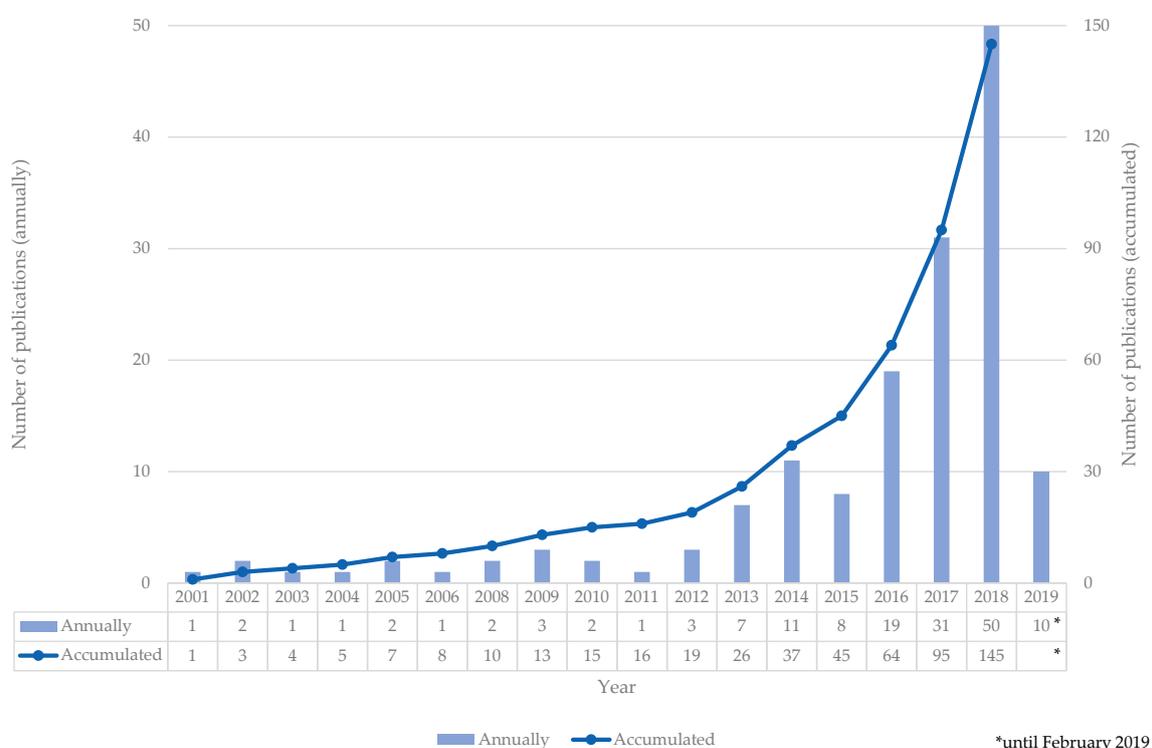


Figure 2. Evolutionary timeline of the literature reviewed.

Research on last mile logistics has been published in a large number of outlets and spans multiple disciplines. While this research offers multiple perspectives on the research area, it also indicates the fragmentation of the literature. The selected articles were derived from 84 scientific journals, with none of the journals leading the area of last mile logistics in terms of the number of publications. Moreover, articles can be found in journals from various disciplines, e.g., transportation, sustainability, retail, logistics, operations management, economics, simulation, and modeling. An overview of the top ten journals is given in Table 4, showing that, even among the top ten journals, the publication rate has increased in recent years and continues to grow.

Table 4. Ten journals contributing the most articles.

Journal	Σ 2001–2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Transportation Research Record	2				2	1		2	3			10
Sustainability							1	1	1	4		7
International Journal of Physical Distribution and Logistics Management	1	1								4		6
International Journal of Retail and Distribution Management	1							1	1	2		5
Transportation Research Part E: Logistics and Transportation Review								1	1	1	2	5
Transportation Science	1				1	1		1		1		5
European Journal of Operational Research									1	2	2	5
Transportation Research Part C: Emerging Technologies							1		1	1	1	4
Research in Transportation Business and Management						1			3			4
Journal of Transport Geography				1		1	1			1		4
Total	5	1	0	1	3	4	3	6	11	16	5	55

3.3. Methodologies Used

The review demonstrates that last mile logistics research embraces a diversity of methodological approaches. By employing previously established methodology classification schemes [17,170,171], this review finds that the literature includes modeling and simulation, case studies and interviews, literature reviews, surveys, and multi-methodology as well as theoretical and conceptual papers (see Table 5). The methodological diversity found in the literature indicates a broad examination and coverage of the research area. However, the imbalance between methodologies suggests a limited perspective regarding the respective phenomena under investigation. Previous calls for more qualitative research in logistics have had an impact on supply chain scholars [172,173]. Next, we elaborate on the methodologies found in the literature.

Modeling and simulation is the largest group of methodologies (73 articles), which constitutes almost half of the articles included in this review. This methodology refers to studies conducted with different kinds of modeling, often based on empirical and quantitative data as well as various simulations. These studies often use heuristics [114], genetic algorithms [167], linear programming [117], integer programming and regression [100], costs modeling [140], life cycle assessment [14], carbon audit models [32], and consolidation modeling [107].

Table 5. Methodologies used in last mile logistics research.

Methodology	Publication References	Count
Modeling and simulation		73
Modeling	[1,6,14,15,32,34,43,53,59,60,70,71,75,80,82,83,86–88,90–100,103–108,110–120,127,128,131–133,140,152,156,159,164,167,168]	59
Simulation	[10,35,37,45–47,62,74,77–79,101,109,139]	14
Case studies and interviews		42
Case Study	[8,11,12,31,39,40,42,44,48,50,54,63,64,67–69,72,81,84,85,89,102,122–124,134–137,142,143,145,149,151,160,165]	36
Interviews	[38,76,125]	3
Focus Groups	[30,49]	2
Field Experiments	[41]	1
Surveys		13
	[2,33,57,58,65,66,129,138,146,157,158,162,163]	
Theoretical and conceptual papers		12
	[16,51,52,73,126,141,144,147,148,153,155,166]	
Multi-methodology		11
	[4,36,55,56,61,121,130,150,154,161,169]	
Systematic literature reviews		4
	[3,5,17,18]	
Total		155

Case studies and interviews are the second largest group of methodologies (42 articles); the group contains different types of case studies, focus groups, interview studies, and field experiments. As shown in Table 5, case studies are quite common in last mile logistics research [8,64].

Surveys are rather rare in last mile logistics research, with only 13 articles using this methodology. The surveys focus mainly on consumers, i.e., consumer behavior [2,57,162,163], customer satisfaction [158], and consumer experience [174].

Theoretical and conceptual papers consist of narrative literature reviews. Edwards, McKinnon and Cullinane [153] review methodological issues in the comparative carbon auditing of conventional and online retail supply chains. Nenni, Sforza and Sterle [148] review urban freight models from a sustainability perspective. McKinnon [73] explores the possible impact of 3D printing and drones on last mile logistics through a literature review.

Multi-methodology refers to papers employing more than one method. Seebauer, Kulmer, Bruckner and Winkler [169] conduct a household survey, assess carbon footprint, model consumption expenditure, and conduct scenario analysis. Morganti, Dablanc and Fortin [61] conduct a survey, perform interviews, and employ descriptive statistical variables for locational factors and strategies. Chen, Yu, Yang and Wei [4] develop a three-factor model to explain factors affecting consumers' intention to use self-service parcel delivery services and tested the model with a survey.

The systematic literature review made important contributions to structure previous findings in the research area. Four systematic reviews have been identified, all of which were published in 2017 or 2018, which shows an increasing need for consolidated knowledge. Ranieri, Digiesi, Silvestri and Roccotelli [5] review last mile logistics innovations from an externalities cost perspective. Melacini, Perotti, Rasini and Tappia [17] review e-fulfillment and distribution in omni-channel retailing. Lim, Jin and Srari [3] review last mile logistics models from the perspective of consumer-driven e-commerce. Oliveira, Albergaria De Mello Bandeira, Vasconcelos Goes, Schmitz Gonçalves and D'Agosto [18] review vehicle-based alternatives in the last mile distribution of urban freight. None of these reviews provide a holistic overview of last mile logistics as a research area. Furthermore, none of these previous reviews employ a systems view of last mile logistics, which shows the need for this study. In general,

this review shows that surveys, theoretical and conceptual papers, and systematic literature reviews are underrepresented in the research area, proving the need for future research.

3.4. Theoretical Lenses

This review finds that the majority of articles in last mile logistics do not employ any explicit theory, while theoretical articles employ a diversity of theories. From the identified 155 articles, we found that 139 articles do not employ any explicit theoretical lens. This lack of theory is in line with previous calls for more theory in logistics and supply chain management by various scholars [173,175,176]. Additionally, in last mile logistics research, the lack might simply be because the research area is growing and cannot yet be considered as mature. However, theoretical articles use a diverse range of theories, although none are leading the research area. The diversity of theories found in the literature confirms previous research suggesting that a unified theory of supply chain management is nonexistent [177]. Theory is a critical element in the development of any research field [178]. Therefore, the opportunity for scholars in last mile logistics remains to increase the explicit use of theory and to contribute to theory building, theory elaboration, and theory testing. Relevant theoretical frameworks offer a way to address and simplify complexity [179]. However, it must be considered that various studies implicitly contribute to theory building (in particular, case studies and modeling studies). Therefore, it is especially the explicit use of theoretical perspectives that are lacking in last mile logistics research.

Previous research developed a classification framework of theory in logistics and supply chain management, proposing twelve categories [178]. On the basis of that classification, we present the theories identified in the literature (see Table 6). Microeconomic theory is the largest group, including game theory [16,107], agency theory [76], and fuzzy set theory [6]. The theory of diffusion of innovation is used in two studies [56,57]. Competitive theory includes contingency theory, used in two articles [45,151]. Theories of organization include configuration theory [150]. Psychological theories include affect-as-information theory [66]. Other theories used in the literature include queuing theory [59,142], compact city theory [149], co-evolution theory [122], and firm location theory [118]. Finally, one study uses multiple theoretical lenses, including resource matching theory and consumer co-production theory [4].

Table 6. Theoretical lenses used in literature.

Theory	Publication References	Count
Microeconomic		4
Game theory	[16,107]	2
Agency theory	[76]	1
Fuzzy set theory	[6]	1
Innovation		2
Innovation diffusion theory	[56,57]	2
Competitive		2
Contingency theory	[45,151]	2
Theories of organization		1
Configuration theory	[150]	1
Psychological theories		1
Affect-as-information theory	[66]	1
Others		5
Queuing theory	[59,142]	2
Compact city theory	[149]	1
Co-evolution theory	[122]	1
Firm location theory	[118]	1
Multiple theories	[4]	1
Total		16

4. Framework

We propose a framework to address the many different aspects and facets of last mile logistics found in the literature. We contend that a systems approach to literature content analysis allows us to address key components and their interrelations; it also allows us to embrace last mile logistics as a whole to capture the diversity and complexity of the literature. The framework is based on five interrelated components identified from the literature, namely, last mile logistics, last mile distribution, and the three central components: last mile fulfillment, last mile transport, and last mile delivery, as seen in Figure 3. The core of the framework consists of the three distinct and sequenced components; the literature in these components is operational with a short-term planning horizon and coalesces under last mile distribution. Subsequently, last mile distribution extends the core components by its tactical character and mid-term planning horizon. Finally, the literature under the broad umbrella of last mile logistics addresses strategic, long-term planning issues and provides a holistic overview of the system and its environment. The framework can further be viewed from both back-end and front-end perspectives. The back-end is the part of the framework that faces the sender, while the front-end of the system faces the receiver. In the following section, we describe the framework components and position the previously identified themes in the framework.

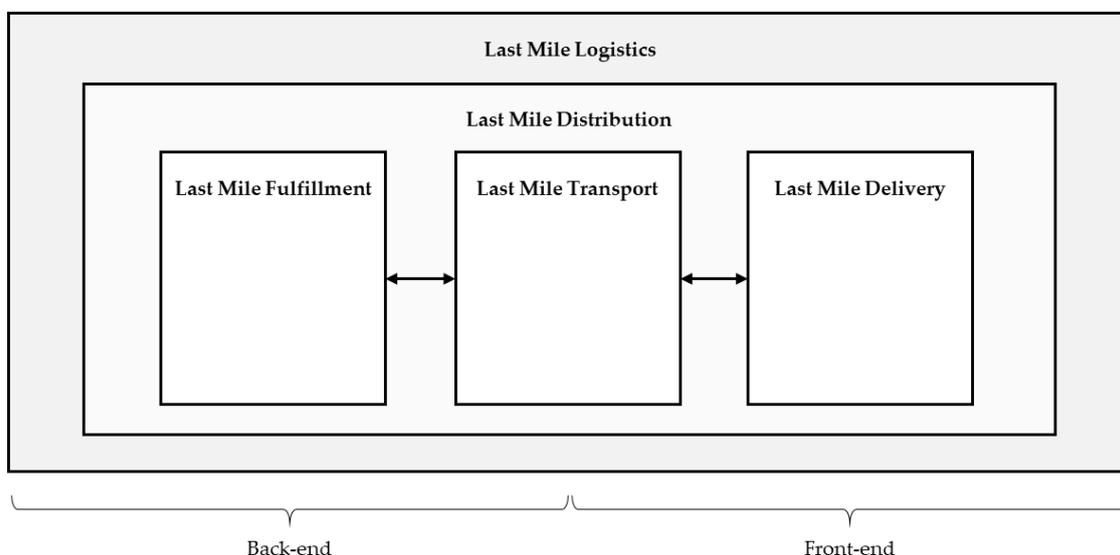


Figure 3. Overall framework composed of five components.

4.1. Last Mile Logistics

On the basis of the literature, last mile logistics can be described as the process of planning, implementing, and controlling efficient and effective transportation and storage of goods, from the order penetration point to the final customer. Last mile logistics has received 39 out of 155 contributions in the reviewed literature, and it covers multiple themes, as can be seen in Table 7. The literature confirms the strategic character of this component. One example of this is found in collaboration literature, which focuses on horizontal collaboration, e.g., drivers and barriers [16,48,49], recent advances [51,52], service quality [77], and the effects of logistics collaboration [50]. Furthermore, the business model literature investigates the use of crowd logistics in the last mile. One study investigates the use of individuals to collect and deliver parcels by experimenting in the 12th district of Paris, France [44]. The results indicate the potential of crowd logistics to develop a network of neighbors that can be used to avoid delivery failures. Another example is the fact that operational optimization cannot be found in this systems components, which indicates a more strategic character.

Table 7. Literature in the last mile logistics component.

Themes	Aspects and Facets	Count
Emerging technologies and innovations		14
Goods reception solutions		
Innovative vehicle solutions		
New perspectives on collaboration	Horizontal collaboration [16,48,50,52,77]; horizontal and vertical collaboration [49,51]	7
Emerging business models	Crowd logistics [44–46,74–76]; integration of traditional and green business models [47]	7
Operational optimization		0
Supply chain structures		12
Logistics and supply chain design	Design of last mile logistics models [3,8]; logistical challenges [130]; strategies [126]; distribution systems [122,123]; and postal operations [129]	7
Urban freight terminals		
Urban planning	Parking practices [145]	1
Urban freight structures	Urban freight models [148]; typology [147]; Urban freight management [146]	3
Networks design	Logistics networks [151]	1
Performance measurement		11
Customer-focused performance	Delivery strategies [162], customer requirements in food deliveries [160], e-commerce success criteria [159]; customer satisfaction with order fulfillment [158]	4
Environmental performance	Carbon emissions [14,153,155] and externality costs [5]	4
Economic performance	pricing [167]; cost-effectiveness [166], postharvest loss [165]	3
Policy		2
	Reduction of carbon emissions [169]; freight consolidation policies [6]	2
Total		39

4.2. Last Mile Distribution

Last mile distribution is associated with the handling, movement, and storage of goods to the point of consumption through various channels. The last mile distribution literature covers various themes, as shown in Table 8. This literature includes a high share of operational optimization, usually touching upon more than one of the three central components. For example, one study establishes a traveling salesman problem with drones to establish a distribution system in which trucks collaborate with drones [96]. Therefore, it can be said that, in this case, operational optimization is conducted to investigate the possibility of changing the distribution system. Further, emerging technologies and innovations are weakly represented in the literature.

4.3. Last Mile Fulfillment

The core of the last mile logistics system consists of three central components: last mile fulfillment, last mile transport, and last mile delivery. These components focus on various themes with varying coverage in the literature. Last mile fulfillment is the process of executing an order by making it ready for delivery. This component has received only six out of 155 contributions from the reviewed literature, which offers opportunities for future research. Last mile fulfillment and last mile transport are strongly interrelated and, therefore, are often researched in combination. The literature further focuses on freight terminals and distribution centers. For example, one study re-engineers the order fulfillment process of e-commerce orders in distribution centers [12]. The results of the study indicate improved operating efficiency in order handling, which allows logistics service providers (LSPs) and online retailers to align their goals better. An overview of the themes' content in last mile fulfillment is presented in Table 9.

Table 8. Literature in the last mile distribution component.

Themes	Aspects and Facets	Count
Emerging technologies and innovations		3
Goods reception solutions	Transport impact of collection and delivery points [55]	1
Innovative vehicle solutions	Impact of drones on urban freight traffic levels [73]; use of drones for last mile transport and delivery [41]	2
New perspectives on collaboration		
Emerging business models		
Operational optimization		20
Routing	Traveling salesman problem with drones [96–98]; decision support systems [78,79,81]; vehicle routing problems [80,82,88]	9
Transport planning	Outbound logistics planning [101,111]; packing problems [100]; decision support systems for urban freight [102]; transport optimization models [103]	5
Scheduling	Drone deliveries from trucks [113]; energy efficiency during transport and delivery/pickup [114]	2
Facility location	Location routing and its impacts on the distribution system [118–121].	4
Supply chain structures		11
Logistics and supply chain design	Hub and spoke distribution systems [124]; alternative distribution systems for small and fragmented volumes [127]; comparison of different distribution setups [140]; fulfillment and distribution [17,125]; eco-logistics system [128]; distribution scheme [139]	7
Urban freight terminals	Urban consolidation centers [135]; mobile depots [132,134]	3
Urban planning		
Urban freight structures		
Networks design	Supply network configuration [150]	1
Performance measurement		0
Policy		0
Total		34

Table 9. Literature in the last mile fulfillment component.

Themes	Aspects and Facets	Count
Emerging technologies and innovations		0
Operational optimization		0
Supply chain structures		6
Logistics and supply chain design	Order fulfillment in distribution centers [12]	1
Urban freight terminals	Urban distribution centers [138]; urban consolidation centers [131,137]; loading bays [136]; performance of urban freight terminals [133]	5
Urban planning		
Urban freight structures		
Networks design		
Performance measurement		0
Policy		0
Total		6

4.4. Last Mile Transport

Last mile transport focuses on the movement of goods in the last mile and can be done through different means, such as light goods vehicles, heavy goods vehicles, electric vehicles, bicycles, tricycles, or drones. Last mile transport is the interface between last mile fulfillment and last mile delivery; as such, last mile transport plays a pivotal role in the last mile logistics system. The literature confirms its importance because the systems component has received the most contributions covering various themes (see Table 10). The largest share focuses on operational optimization, particularly routing. Some examples of the routing literature include electric vehicle routing problems [87,91,92], routing

with drones [94,99], and other types of routing problems, such as vehicle routing with roaming delivery locations where orders are delivered to the trunk of the customer's car [95]. Moreover, a large share of the literature focuses on emerging technologies and innovations, specifically, innovative vehicle solutions. One study investigates the integration of different vehicle types in terms of energy consumption, emissions, and cost [42]. The results of the study indicate that a fleet with different technologies can potentially reduce the cost of the last mile.

Table 10. Literature in the last mile transport component.

Themes	Aspects and Facets	Count
Emerging technologies and innovations		13
Goods reception solutions		
Innovative vehicle solutions	Electric vehicles, [38,69,71]; cargo cycles [39,40,67,68]; comparison of vehicle alternatives [18,37,42,43]; drones [70]; intermodal high capacity transport [72]	13
New perspectives on collaboration Emerging business models		
Operational optimization		21
Routing	Electric vehicle routing [87,91,92]; routing with drones [94,99]; routing with time windows [10,93]; multimodal delivery [89]; crowd navigation [85]; automated vehicle routing [84]; routing with lunch breaks [90]; other routing problems [83,86,95]	14
Transport planning	Consolidation [106–109]; hit rates optimization [110]; modal shift [105]; scalable optimization [104]	7
Scheduling Facility location		
Supply chain structures		4
Logistics and supply chain design		
Urban freight terminals		
Urban planning	Urban freight activity [143,144]; parking availability [142]	3
Urban freight structures		
Networks design	Transportation network impedance [149]	1
Performance measurement		5
Customer focused performance	Willingness to adapt more sustainable delivery options [2]	1
Environmental Performance	Emissions [154,156]; externality cost [1]	3
Economic performance	Profitability of deliveries [168]	1
Policy		0
Total		43

4.5. Last Mile Delivery

Last mile delivery refers to the activities necessary for physical delivery to the final destination chosen by the receiver. Last mile delivery can also be seen as the front-end, where the last mile meets the receiver. Last mile delivery and last mile transport are strongly interrelated and, therefore, are often researched in combination. The largest share focuses on emerging technologies and innovations, particularly goods reception solutions. Some examples of goods reception literature include studies of customer value in self-service technologies (i.e., parcel lockers) [30], consumers' intention to use such technology [4], location of lockers [63], and diffusion of innovation [56]. Other goods reception solutions include collection and delivery points; this literature addresses acceptability from consumers' perspectives [54], greenhouse gas emissions [32], individual travel patterns [31], and the strategy of network operators [61]. An overview of the literature in last mile delivery is presented in Table 11.

Table 11. Literature in the last mile delivery component.

Themes	Aspects and Facets	Count
Emerging technologies and innovations		21
Goods reception solutions	Comparison of delivery alternatives [34–36,59,60,64,65]; self-service technology [4,30,53,56–58,63,66]; collection and delivery points [31,32,54,61]; reception boxes [62]; unattended delivery [33]	21
Innovative vehicle solutions		
New perspectives on collaboration		
Emerging business models		
Operational optimization		4
Routing		
Transport planning		
Scheduling	Delivery scheduling [112,115–117]	4
Facility location		
Supply chain structures		2
Logistics and supply chain design		
Urban freight terminals	Minihubs [11]	1
Urban planning	Accessibility [141]	1
Urban freight structures		
Networks design		
Performance measurement		6
Customer focused performance	Travel modes [163,164]; service requirements [161]; service quality [157]	4
Environmental performance	Emissions [15,152]	2
Economic performance		
Policy		0
Total		33

5. Discussion and Avenues for Future Research

The diversity of aspects and facets found in the literature might imply sufficient coverage of the research area through previous research. However, various opportunities remain for scholars to make a meaningful contribution to the growing body of knowledge in the broad domain of last mile logistics. In the following section, we discuss the results and highlight avenues for future research based on the findings of this review.

5.1. Analyze Environmental and Social Sustainability in Last Mile Logistics

The review shows a clear divide between the three pillars of the triple bottom line, especially with regards to social sustainability, which is lagging behind the other two pillars. Although the three dimensions do not have to be covered equally in the literature, the triple bottom line approach balances the three dimensions against each other. Economic sustainability is the most covered dimension (113 articles), followed by environmental sustainability (62 articles), while social sustainability is only covered by a small number of articles (30 articles). The limited coverage of the environmental and social dimensions is generally in line with findings from previous studies in logistics and supply chain management [170,171,180]. In particular, the environmental and social dimensions are considered complementary to the traditional focus on cost and service in supply chain management research [181]. However, previous calls for further research have not been answered sufficiently, as the understanding of environmental and social sustainability in last mile logistics remains limited. Therefore, more research with a focus on environmental and social sustainability issues is required based on the findings of this review.

5.2. Define the Scope of Last Mile Logistics

This review finds that the phrase “last mile logistics” is ambiguous, as the various definitions and scopes identified in the literature differ significantly. The analysis of existing definitions particularly shows that three main aspects require clarification, namely, commercial transaction, channels, and type of delivery. On the basis of the review findings, the scope of last mile logistics includes both B2C and B2B transactions and is not limited to one type of transaction. Although some authors limit last mile logistics to B2C transactions [3,8,44,64,95,120,123], others refer to deliveries to the final customer [40,106,151,152], which is a broader term that also includes businesses other than only consumers. Multiple types of B2B transactions are covered by the literature, e.g., the supply of retail stores [109,150,151], hotels, restaurants, cafés [51,127,144,160], and hospitals [48,154].

Moreover, the review shows that last mile logistics include all types of channels and is not limited to a single channel. Some authors consider last mile logistics as relevant solely in an e-commerce context [81,106,151,157,162], while others explicitly focus on bricks-and-mortar retail [15,125,163,164]. Literature focusing on bricks-and-mortar retail emphasizes the role of consumer shopping trips, i.e., consumers conducting a part of last mile logistics by themselves.

Last mile logistics include all types of deliveries. In the literature, the scope of last mile logistics is often defined by a specific type of delivery. This review finds that some authors focus solely on deliveries of parcels, while others address other types of deliveries, such as groceries [79,125,130,151,163] and spare parts [11,73]. To achieve a more unified and comprehensive view, there is a need to embrace all types of deliveries in last mile logistics, both forward and reverse flow [71,114,141]. However, the review shows that reverse logistics are not yet widely included in the literature as an integrated part of last mile logistics. Therefore, a more comprehensive understanding that better reflects the research area is required. Future research should embrace the different understandings of last mile logistics by emphasizing a discussion of its scope and definition.

5.3. Apply Theory in Last Mile Logistics Research

This review finds that last mile logistics research generally lacks theoretical lenses. Despite that finding, a diverse range of theories, mainly imported from other disciplines, can be found in the literature. Previous research concludes that there is a lack of unified theory in supply chain management [177], which can be confirmed for the area of last mile logistics. The general lack of theory in last mile logistics research may be because the growing research area cannot yet be considered mature. However, since theory is critical for the development of any field [178], the opportunity for scholars remains to increase the use of theory and contribute to theory building. The application of theory is also a way to address and simplify the complexity of the research area that has been pointed out by this review [179]. Researchers should, therefore, emphasize the use of theory in last mile logistics and develop relevant theories for the development of the research area.

5.4. Extend Perspectives of Last Mile Fulfillment

In our suggested framework of last mile logistics, as seen in Figure 3, last mile fulfillment has received limited coverage when compared with the other components. This limited coverage is somewhat surprising, not only due to the growing importance of fulfillment in omni-channel retailing [151] but the impact of fulfillment on the efficiency of the last mile logistics system as a whole. One possible explanation might be that much of the fulfillment literature does not use the term “last mile” and hence is not included in this review. It can, however, be assumed that most of the last mile fulfillment literature has been covered by this review as other studies also conclude that fulfillment remains neglected in the literature [17]. Essentially, all themes are underrepresented in the last mile fulfillment literature. Future research should emphasize this gap by addressing these themes. Operational optimization needs to be addressed to shorten lead times to address customer requirements. Performance measurement should be addressed to understand better the requirements

of the various stakeholders involved but also the impact of fulfillment on the sustainability in terms of the triple bottom line. Emerging technologies and innovations should be emphasized to advance the back-end side of last mile logistics. Supply chain structures should be addressed not only to understand urban freight terminals better, but also explore their impact on the networks and the distribution system as a whole.

5.5. Clarify Relation to City Logistics

Last mile logistics and city logistics are distinct concepts, and the terms cannot be used interchangeably. Many definitions of city logistics can be found in the literature, yet a common view is that it deals with efficient and effective goods transport in urban areas while considering its externalities such as congestion, safety, and environment [182]. Rodrigue and Dablanc define city logistics as follows: “The means over which freight distribution can take place in urban areas as well as the strategies that can improve its overall efficiency, such as mitigating congestion and environmental externalities” [183]. While last mile logistics emphasizes the perspective of private actors in supply chain networks, city logistics research is often conducted from the perspective of public actors. Generally, much of the city logistics literature focuses on externalities, while last mile logistics focuses on organizations. City logistics aims to increase its effectiveness to reduce externalities and, accordingly, increase social sustainability, especially in terms of livability [184]. In contrast, last mile logistics aims to increase efficiency to contribute to economic sustainability regarding reduced cost and increased profit, as the results of this review show.

However, despite these differences, there seems to be an overlap between the two concepts, particularly for the main drivers, actors, and challenges involved. City logistics are mainly driven by growing urbanization, e-commerce development, consumers’ desire to increase delivery speed, the sharing economy, and increased attention to sustainability [182,185,186]. Stakeholders involved in city logistics can be divided into five groups: carriers, public authorities, receivers, residents, and shippers. Wolpert and Reuter [186] conducted a systematic review of city logistics literature and found the following key challenges as a result of the growing complexity of the research area: congestion, environmental pollution, inefficient use of land, low capacity utilization, physical hindrances, traffic accidents, and waste of energy.

6. Conclusions

This systematic literature review shows that last mile logistics is diversified, fragmented, and complex. Therefore, this paper provides an integrated view of the research area of last mile logistics by providing an overview of themes addressed in the literature and proposing a framework of last mile logistics literature. The framework contributes to a more coherent understanding of last mile logistics by identifying components of the last mile logistics system and explaining their interrelationships. The components and their interrelationships contribute to the development of a more coherent body of knowledge and provides a cohesive overview of the literature in last mile logistics. The findings of this review further indicate that further research is required to enhance environmental and social sustainability of last mile logistics.

6.1. Implications for Research

The results of this review help to resolve the current fragmentation and complexity of the last mile logistics literature. This work provides a foundation for further examination of the area and theory building by pointing out gaps and directions for future research from various disciplines. An important contribution of this work is the classification of themes, the evolutionary timeline, methodologies, and theoretical lenses. The core contribution is the proposed framework of the last mile logistics system with its components and their interrelationship to present aspects and facets of last mile logistics literature. This contribution is important because it helps scholars to position their research better in the last mile logistics domain. Thus, this work makes important contributions to the understanding

and development of the area of last mile logistics. Further, this work provides avenues for further research, highlighting particularly the need to address environmental and social sustainability aspects.

6.2. Implications for Managers

From a managerial point of view, this systematic review provides an overview of the main research contributions related to last mile logistics and consolidates the knowledge in the research area. Moreover, the proposed framework of the last mile logistics system can be useful to understand the individual systems components and their interaction. The literature review provides knowledge and insight into all components of the last mile logistics system. The components can support managerial discussions on the current state of the last mile logistics system and guide the development of such systems in the future. In other words, companies can use the results from this review to find the core contributions when optimizing various parts of their last mile logistics system and can help them make more coherent decisions about their last mile logistics operations.

6.3. Limitations and Concluding Remarks

As with any research, and despite the rigorous methodology applied, this review is subject to limitations. The first limitation is the potential omission of relevant studies from the review. Although the keyword structure was modified several times and discussed among researchers, it is possible that relevant contributions have not been covered by the keywords. Moreover, the search only includes articles published in English; articles published in other languages may potentially be relevant. Second, the classification of the literature has been done based on the themes found in the literature and discussed among researchers. However, we acknowledge that other classifications may be possible and encourage researchers to challenge and further develop our proposed themes. Third, this review does not propose a definition of last mile logistics as that would not reduce the complexity of the research area.

Nevertheless, this review presents an integrated view of the literature and attempts to develop a common language and understanding of the area. However, we encourage researchers and practitioners to facilitate a discussion on the scope of last mile logistics. The results of this review show clearly that more research is needed, especially as the research area evolves rapidly due to the driving forces behind it, which calls for continuous evaluation of the proposed framework, especially through multidisciplinary research.

Author Contributions: Conceptualization, J.O., D.H. and H.P.; methodology, J.O., D.H. and H.P.; validation, J.O., D.H. and H.P.; formal analysis, J.O.; investigation, J.O.; data curation, J.O.; writing—original draft preparation, J.O.; writing—review and editing, J.O., D.H., H.P.; visualization, J.O.; supervision, D.H. and H.P.; project administration, J.O.; funding acquisition, D.H.

Funding: This research was funded by VINNOVA (Sweden’s Innovation Agency), grant number 2017-03457. The APC was funded by Lund University.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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