

Optimization in Routing and Vehicle Selection for E-commerce Last Mile Logistics: Bibliometric Analysis

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Abstract

Background: The study investigates the emerging concept of Last Mile Logistics (LML), focusing on optimization routing for e-commerce deliveries. This research addresses the growing demand for efficient delivery systems driven by the rise of online shopping and technological advancements.

Objective: This article aims to analyse existing literature, identify trends and highlight gaps in LML research.

Methods: A systematic approach was used for the selection of studies and then bibliometric analysis was used to map and evaluate relevant studies. The Scopus citation database was used to gather peer-reviewed articles from 1999 to 2023. R-Studio and VOS Viewer were employed for data analysis and visualization. The initial search yielded 3,898 articles, which were filtered down to 1,606 articles. Key findings include the identification of the most productive journals, top-cited articles and influential keywords in LML research.

Results: The study significantly emphasizes variables such as distance, costs, energy consumption and delivery time in logistics optimization. E-commerce emerged as a predominant topic, with substantial discussions on technology and transportation within LML. The research underscores the critical role of LML in the success of e-commerce.

Conclusion: The findings highlight the need for ongoing innovation and optimization in delivery logistics to enhance efficiency and meet consumer demands. Future research should address the gaps identified, particularly in the context of emerging technologies such as autonomous vehicles and drones, to further improve last mile delivery systems.

Index Terms

Last mile logistics; Optimization; Routing; Bibliometrics; Electronic commerce; Review.

1 INTRODUCTION

The last mile route is the shortest path in distribution, but it is the most complicated, inefficient (Ranieri et al., 2018), complex and expensive (Ghosh et al., 2023). The last mile itself contributes 28% of the total distribution costs (Ghosh et al., 2023; Ranieri et al., 2018). Therefore, critical challenges are improving last mile logistics (LML) and significantly reducing externalities. Moreover, the rapid rise of electronic commerce (e-commerce) has dramatically changed how consumers shop and businesses interact around the world. E-commerce became the largest sector in Indonesia's digital economy in 2023. According to a recent report released by Google, the gross merchandise value (GMV) of e-commerce in Indonesia is estimated to reach USD 62 billion in 2023, contributing 75.6% of the total GMV of Indonesia's digital economy (Google, 2023).

When online shopping becomes more commonplace, delivery services will be made directly to the end consumer, so being efficient and timely is more important than ever (Garg et al., 2023). The last mile delivery problem has computing challenges because the VRP (vehicle routing problem) is an NP-hard problem and parameter values are affected by various uncertainty factors. Constraints such as capacity constraints (Schaumann et al., 2023; C. N. Wang et al., 2023), time window constraints (Bräysy & Gendreau, 2005; Schaumann et al., 2023), travel time (Bräysy & Gendreau, 2005), vehicle availability (Ostermeier et al., 2023), infrastructure, number of allowed trips, driver ability (Ghosh et al., 2023) and type of goods can affect the destination and effectiveness of the journey.

Solving route optimization problems in the context of everyday life is a very challenging task. However, a significant gap between the theory of routing and its implementation in real life is difficult to overcome by conventional optimization approaches (C. N. Wang et al., 2023). The gap is in the fact that in real-life conditions, the quality of a route is not only determined by factors such as distance, travel time or costs, but also by various other factors that affect the driver's ability to execute the route effectively, safely and comfortably according to real-life conditions encountered (Boysen et al., 2021).

Considering the challenges and technological developments, such as autonomous vehicles (Engesser et al., 2023; Samouh et al., 2020), drones (Garg et al., 2023) and artificial intelligence (Jucha, 2021) research related to LML is proliferating. Existing research includes alternative vehicle selection (Allen et al., 2018; Ostermeier et al., 2023), route optimization (Ghosh et al., 2023; Merchán et al., 2024; Ostermeier et al., 2023; Tiwari & Sharma, 2023), delivery form and storage form (Rosenberg et al., 2021; Bajec et al., 2023; Novotná et al., 2022).

This paper aims to analyse the emerging concept of LML in the literature. Our viewpoint is to review articles related to routing optimization over the "last mile" or algorithms or methods of solving challenges in the operation of a particular delivery model. In addition to presenting a literature study, this paper also provides an overview of research trends in LML and interesting research tasks to be carried out in the future. This includes the growing trend of articles and citations on articles related to routing optimization in LML and e-commerce in recent years, given the scope of the articles and the factors that influence this increase. We also analyse which keywords are most popularly discussed in the analysed articles, which keywords are least discussed and how routing optimization in LML and e-commerce has evolved from a research point of view and research trends.

2 MATERIAL AND METHOD

Literature analysis is an important part of the research process because it maps and evaluates relevant literature to identify research gaps that contribute to strengthening the knowledge base (Wangsa et al., 2022). This article applied the PRISMA method to routing and vehicle for last mile logistics in conducting a systematic literature review. In accordance with the PRISMA guidelines, the evaluation was divided into three stages: identification, screening and inclusion (Page et al., 2021). Based on Figure 1, the literature review procedure includes the following steps:

1. Identification

This stage involves identifying articles, journals or other sources relevant to the research topic. These resources may include scientific databases, libraries and internet publications. The author of this study used Scopus as a database. This stage results in the acquisition of a huge number of relevant articles or documents, namely a total of 3,898 documents.

2. Screening

The next step after gathering documents from the database is to screen them. This process is carried out by screening, limiting the document type to "Article", limiting the language to "English" and limiting the source type to "Journal" in Scopus, resulting in 1,691 documents. The next stage is carried out by screening the subject (research) areas (business and economy perspective) of computer science, engineering, business, management and accounting, social sciences, decision sciences, mathematics, environmental science, economics, econometrics and finance, energy, resulting in 1,606 documents.

3. Inclusion

This is the last step; articles that make it through the screening procedure and are thought to be pertinent are subjected to additional research. At this point, the abstracts or contents of the papers are scrutinized to determine

whether they support the goals of the study. There are currently 1,606 publications available and this figure is utilized for analysis in the research.

A systematic approach to the literature review is considered a methodology for identifying and analysing data to obtain clear conclusions and recognize gaps for future research opportunities within this discipline. The research methodology adopted in this paper is shown in Figure 1 and using the search string detailed in Table 1. The analysis was carried out on literature retrieved from the Scopus database as of 25 March 2024. We concentrated on the Scopus database because it was the largest repository of peer-reviewed research literature at the time of our study and a large peer-reviewed research database with various subject areas (Wangsa et al., 2022).

In the first stage, 3,898 documents were found based on keywords defined in Table 1. From the results, 3,898 documents were selected for the final stage and 8 documents were excluded. The author conducted an article screening process to collect data by considering the objectives and ensuring that all relevant data were retrieved. The variables considered were language, document type and source type. From the screening results, 1,691 documents were obtained which were then screened by subject area, so that the final number of the articles to be analysed was 1,606 documents.

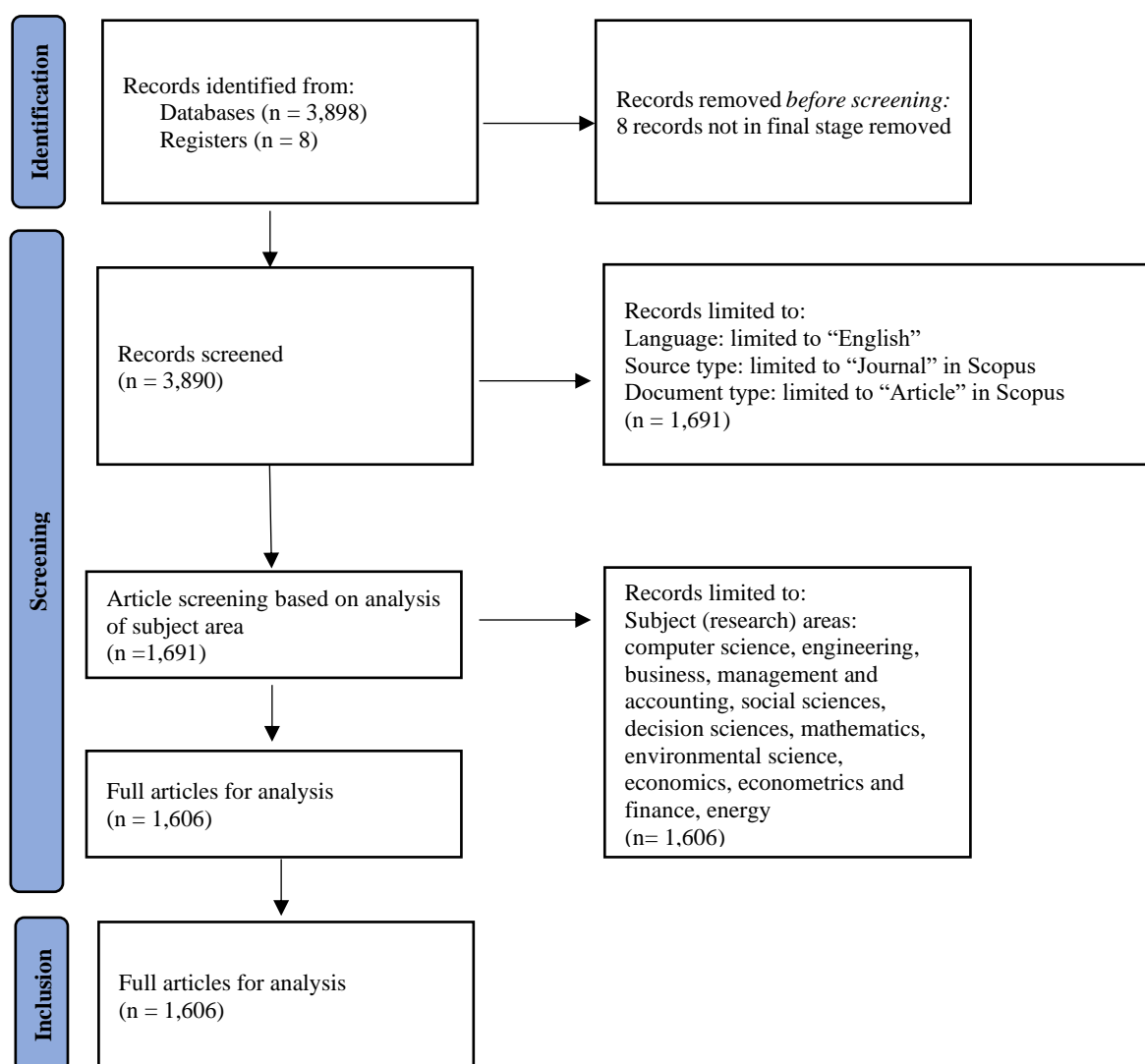


Figure 1. Stages of bibliometric analysis.

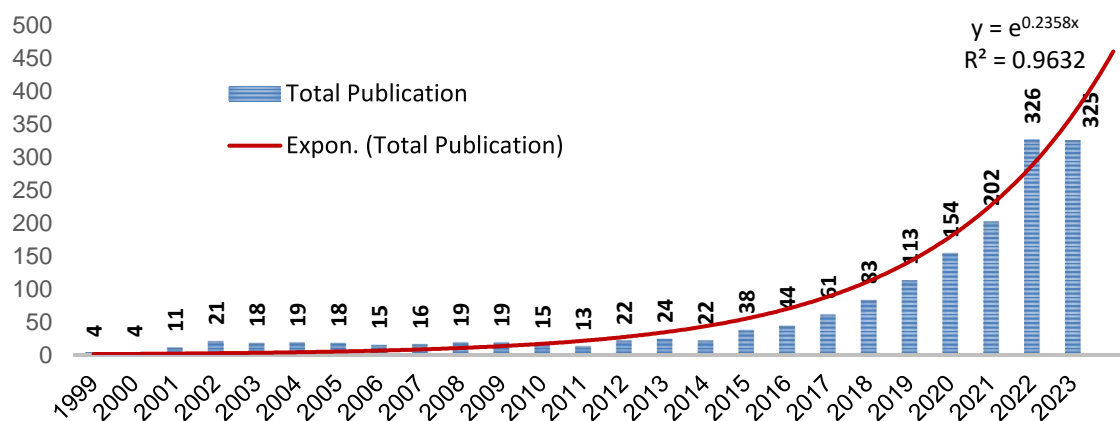
Table 1. Rules, topics and keywords.

Phases: PRISMA	Consideration	Example
Identification	Search focus	Routing and vehicle on last mile logistics
	Search keyword/ string	"last mile logistics" OR "last-mile-logistics" OR "LML" OR "delivery" OR "logistic" OR "final leg logistics" OR "urban logistics" AND "routing" OR "vehicle" OR "technology" OR "develop" OR "optimization" OR "innovation" OR "future" OR "digital" OR "industry 4.0" OR "hybrid" OR "electric" OR "smart" OR "drone" AND "e-commerce" OR "online shopping" OR "online marketplace"
	Search period	Before January 2024
	Search database	Scopus
	Search field	Article title, abstract, keywords
	Publication stage	"Final" in Scopus
	Search result	3,898 documents in Scopus
Screening	Document type	Limit to "Article"
	Language	Limit to "English"
	Source type	Limit to "Journal" in Scopus
	Filtered results	1,691 documents in Scopus
	Subject (research) areas (business and economy perspective)	Computer science, engineering, business, management and accounting, social sciences, decision sciences, mathematics, environmental science, economics, econometrics and finance, energy
	Consolidated results	1,606 documents
Inclusion	Analysis method	Bibliometric analysis - Performance analysis - Science mapping
	Agenda proposal method	Trend analysis and gap spotting

3 RESULTS

3.1 Growth and trend analysis of articles

The increase in the quantity of papers published in yearly LML publications between 1999 and 2023 is demonstrated in Figure 2. The total number of articles published annually culminated in 2022, with 326 articles. It can be seen from the figure that the exponential trend obtained shows an increase with the equation $y = e^{0.2358x}$ and $R^2 = 0.9632$.

**Figure 2.** Article growth trend analysis.

By identifying the exponential trend equation, we can predict the total value of articles in 2024 to be around 363 new studies related to LML. This shows that the curiosity in this research is expanding and evolving rapidly every year. In Figure 3, it can be seen that articles related to LML are growing rapidly in China (531), followed by the United States (264), India (157) and 85 other countries.

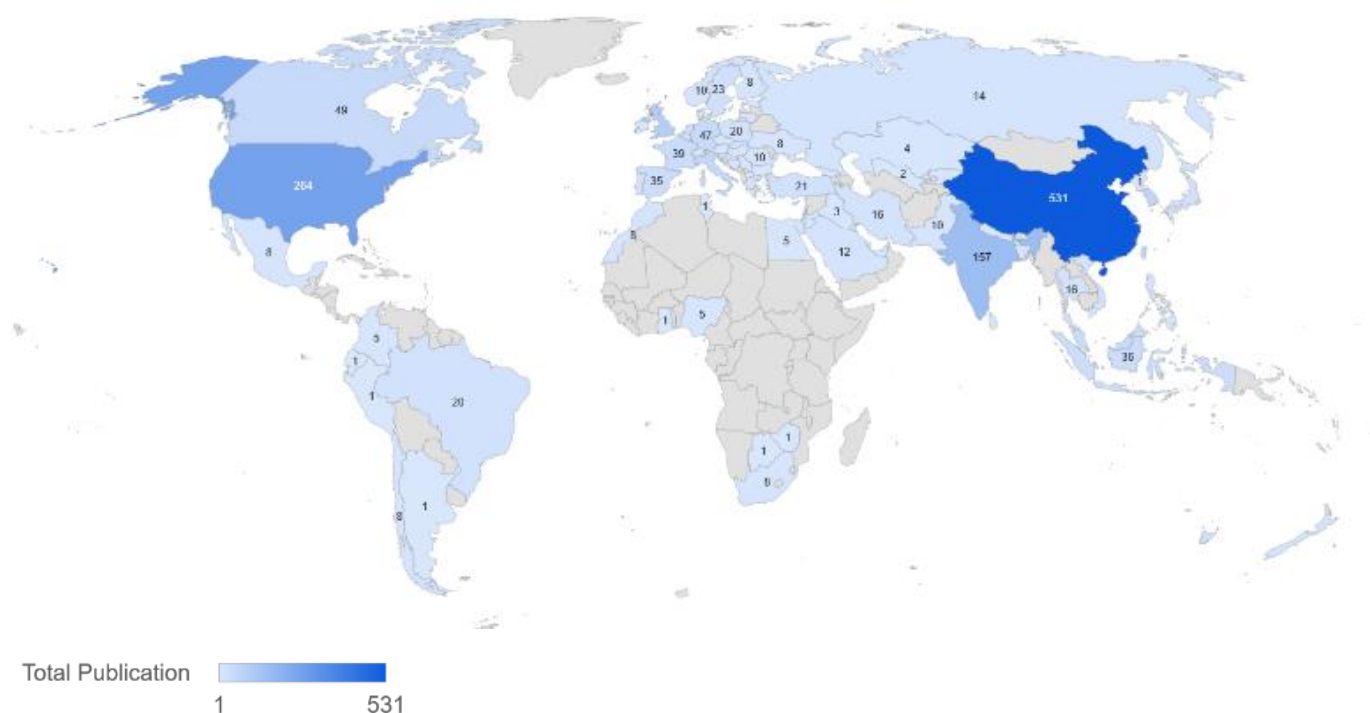


Figure 3. Last mile logistics in the world trend analysis research.

3.2 Most productive journals

Table 2 shows that ten journals have published the most significant articles from 1999 to 2023. We selected journals with a total publication of more than ten articles from 1999 to 2023 and divided them into six periods, with the first period spanning from 1999 to 2005 and the last period from 2018 to 2023. The five leading journals identified were Sustainability(Switzerland) (83), Transportation Research Part E: Logistics and Transportation Review (32), European Journal of Operational Research (28), IEEE Access (24), International Journal of Production Research (23) which together are Q1 indexed by Scimago (2022) and play a significant role by accounting for 53.22% of the total selected publications. Table 2 shows that Sustainability (Switzerland) has published 81 articles in the last six years, which indicates a strong interest in the journal.

Table 2. Journals with productivity above ten articles.

Rank	Journal name	YEAR				Total publication	H-index 2022 (Scimago)	Quartile 2022 (Scimago)
		99-05	06-11	12-17	18-23			
1	Sustainability (Switzerland)	0	0	2	81	83	136	Q1
2	Transportation Research Part E: Logistics and Transportation Review	3	0	1	28	32	134	Q1
3	European Journal of Operational Research	1	4	1	22	28	288	Q1
4	IEEE Access	0	0	0	24	24	204	Q1
5	International Journal of Production Research	0	1	5	17	23	170	Q1
6	Computers and Industrial Engineering	1	1	5	14	21	148	Q1

Rank	Journal name	YEAR				Total publication	H-index 2022 (Scimago)	Quartile 2022 (Scimago)
		99-05	06-11	12-17	18-23			
7	Expert Systems with Applications	1	2	0	12	15	249	Q1
8	Industrial Management and Data Systems	2	3	5	4	14	117	Q1
9	Mathematical Problems in Engineering	0	0	3	11	14	78	Q3
10	Mobile Information Systems	0	0	0	14	14	42	Q3
Total productive journal		9	14	26	308	357		

3.3 Most cited articles

The numbers of most cited articles can be seen in Table 3, which shows that there have been 25 most cited articles in the last 20 years (2003-2023). The most frequently cited article with 844 citations was Tsay and Agrawal (2004). It discussed producer relationships in e-commerce as they navigate the pros and cons of direct sales versus relying on resellers. Direct sales offer better profit margins and control, but disintermediation can lead to channel conflicts with resellers, affecting marketing, market coverage and customer support. Maintaining cooperative channels is essential, as channel conflicts can hamper relationships and overall sales efforts (Tsay & Agrawal, 2004). The second most frequently cited article (Kim & Park, 2013), with 689 citations, examined the effects of various factors and characteristics of social commerce on customer trust. For 371 e-commerce users, it showed the results of empirical analysis, saying that all e-commerce characteristics (except economic feasibility) have a significant effect on customer trust and this trust has an effect on purchases and the desire to provide recommendations or reviews of products or services obtained through word of mouth (WOM) (Kim & Park, 2013). The third most frequently cited article is by Bauer et al. (2006), who applied the transaction process model to electronic service encounters and developed a scale to measure service quality (eTransQual). Their analysis identified five qualities: functionality, satisfaction, process, reliability and responsiveness (Bauer et al., 2006).

Table 3. 25 most cited articles.

No	Author's name	Year	Title of publication	Journal name	Total citation	C/Y
1	Tsay & Agrawal (2004)	2004	Channel conflict and coordination in the E-commerce age	Production and Operations Management	844	44.42
2	Kim & Park (2013)	2013	Effects of various characteristics of social commerce (s-commerce) on consumers' trust and trust performance	International Journal of Information Management	689	68.90
3	Bauer et al. (2006)	2006	eTransQual: A transaction process-based approach for capturing service quality in online shopping	Journal of Business Research	588	34.59
4	Dutta et al. (2020)	2020	Blockchain technology in supply chain operations: Applications, challenges and research opportunities	Transportation Research Part E: Logistics and Transportation Review	581	193.67
5	Gunasekaran & Kobu (2007)	2007	Performance measures and metrics in logistics and supply chain management: A review of recent literature (1995-2004) for research and applications	International Journal of Production Research	571	35.69
6	Pavlou & Gefen (2005)	2005	Psychological contract violation in online marketplaces: Antecedents, consequences and moderating role	Information Systems Research	460	25.56

No	Author's name	Year	Title of publication	Journal name	Total citation	C/Y
7	Hua et al. (2010)	2010	Price and lead time decisions in dual-channel supply chains	European Journal of Operational Research	415	31.92
8	Agatz et al. (2018)	2008	E-fulfilment and multi-channel distribution - A review	European Journal of Operational Research	398	26.53
9	Ghobakhloo et al. (2011)	2011	Adoption of e-commerce applications in SMEs	Industrial Management and Data Systems	384	32.00
10	Jiang et al. (2013)	2013	Measuring consumer perceptions of online shopping convenience	Journal of Service Management	314	31.40
11	Hong & Zhu (2006)	2006	Migrating to internet-based e-commerce: Factors affecting e-commerce adoption and migration at the firm level	Information and Management	273	16.06
12	Chiang & Monahan (2005)	2005	Managing inventories in a two-echelon dual-channel supply chain	European Journal of Operational Research	247	13.72
13	Y. Wang et al. (2016)	2016	Towards enhancing the last mile delivery: An effective crowd-tasking model with scalable solutions	Transportation Research Part E: Logistics and Transportation Review	237	33.86
14	Edwards et al. (2010)	2010	Comparative analysis of the carbon footprints of conventional and online retailing: A "last mile" perspective	International Journal of Physical Distribution and Logistics Management	225	17.31
15	Kitjacharoenchai et al. (2019)	2019	Multiple travelling salesman problem with drones: Mathematical model and heuristic approach	Computers and Industrial Engineering	199	49.75
16	Boysen et al. (2021)	2021	Last mile delivery concepts: a survey from an operational research perspective	OR Spectrum	184	92.00
17	Zwass (2003)	2003	Electronic commerce and organizational innovation: Aspects and opportunities	International Journal of Electronic Commerce	183	9.15
18	Zhou et al. (2018)	2018	A Multi-Depot Two-Echelon Vehicle Routing Problem with Delivery Options Arising in the Last Mile Distribution	European Journal of Operational Research	181	36.20
19	Lee et al. (2019)	2019	Determinants of continuous intention on food delivery apps: Extending UTAUT2 with information quality	Sustainability (Switzerland)	176	44.00
20	Griffis et al. (2012)	2012	The customer consequences of returns in online retailing: An empirical analysis	Journal of Operations Management	169	15.36
21	Kärkkäinen & Holmström (2002)	2002	Wireless product identification: an enabler for handling efficiency, customisation and information sharing	Supply Chain Management	168	8.00
22	Gomez-Herrera et al. (2014)	2014	The drivers and impediments for cross-border e-commerce in the EU	Information Economics and Policy	164	18.22
23	Yuen et al. (2018)	2018	An investigation of customers' intention to use self-collection services for last mile delivery	Transport Policy	155	31.00
24	Kapser & Abdelrahman (2020)	2020	Acceptance of autonomous delivery vehicles for last mile delivery in Germany – Extending UTAUT2 with risk perceptions	Transportation Research Part C: Emerging Technologies	154	51.33

In the data in Table 3, although not the most frequently cited, X. Wang is the most prolific author each year with 35 published articles and he is also linked to G. Q. Huang,, S. Wang, J. Zhang, J. Li and Y. Lin, which can be seen in Figure 5. The second prolific author is G. Q. Huang from the University of Hong Kong, with 19 published articles, followed by Y. Wang from the National University of Singapore, who also has 19 published articles. Their research is interconnected and related to other researchers. Thus, it can be said that X. Wang, G. Q. Huang, Y. Wang, S. Wang and Y. Li are the leading authors in the LML field.

3.5 Author keyword visualization analysis

Keywords represent specific characteristics or fields of study related to research in an information system (Wangsa et al., 2022). Based on the dataset, keywords are categorized into author-based and index-based groups. Author keywords are obtained from keywords written by the authors while the Scopus database system generates index keywords. The author keywords that most frequently appear and are used by authors in their research articles can be seen in the visualization in Figure 6. It is presented by VOS Viewer software in the form of a network of interconnected circles.

The network of keywords in this study has a minimum threshold of ten occurrences. The data show that the 1,606 research articles have 4,515 different keywords from the authors. The circle size represents the keyword network based on its total occurrences. The circle size draws the number of articles with the main keyword depicted in blue, red, yellow, purple and green. For more details, see Figure 7, which presents the data as a tree map processed using R-Studio. Based on the tree map, there are five top keywords, namely “e-commerce,” which appears 406 times, “logistics” 101 times, “online shopping” 70 times, “last mile delivery” 54 times and “COVID-19” 47 times. Figure 7 explains the visualization, where these keywords are found in articles about e-commerce, logistics, online shopping and last mile delivery.

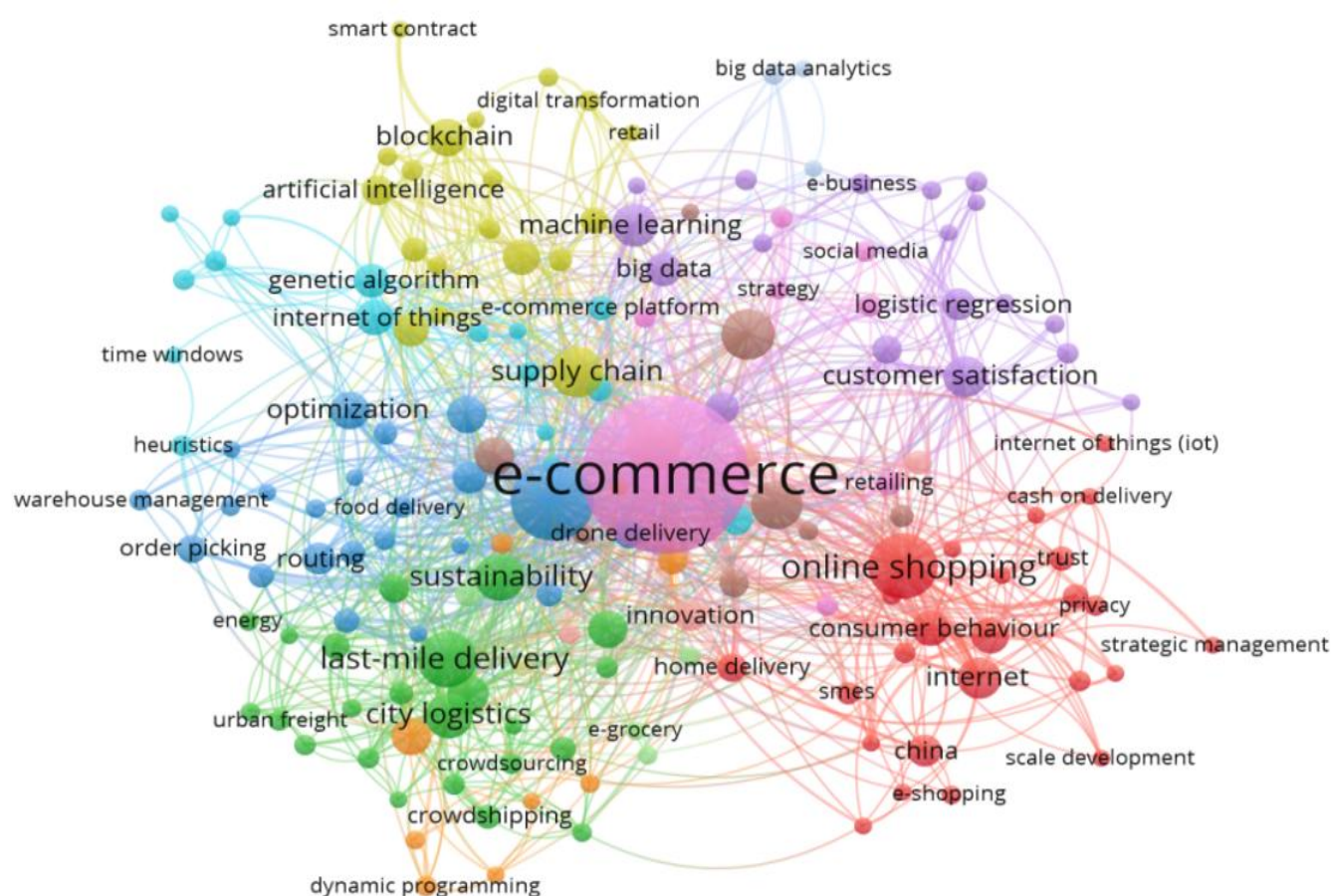


Figure 6. Author keyword network visualization made using VOS Viewer.

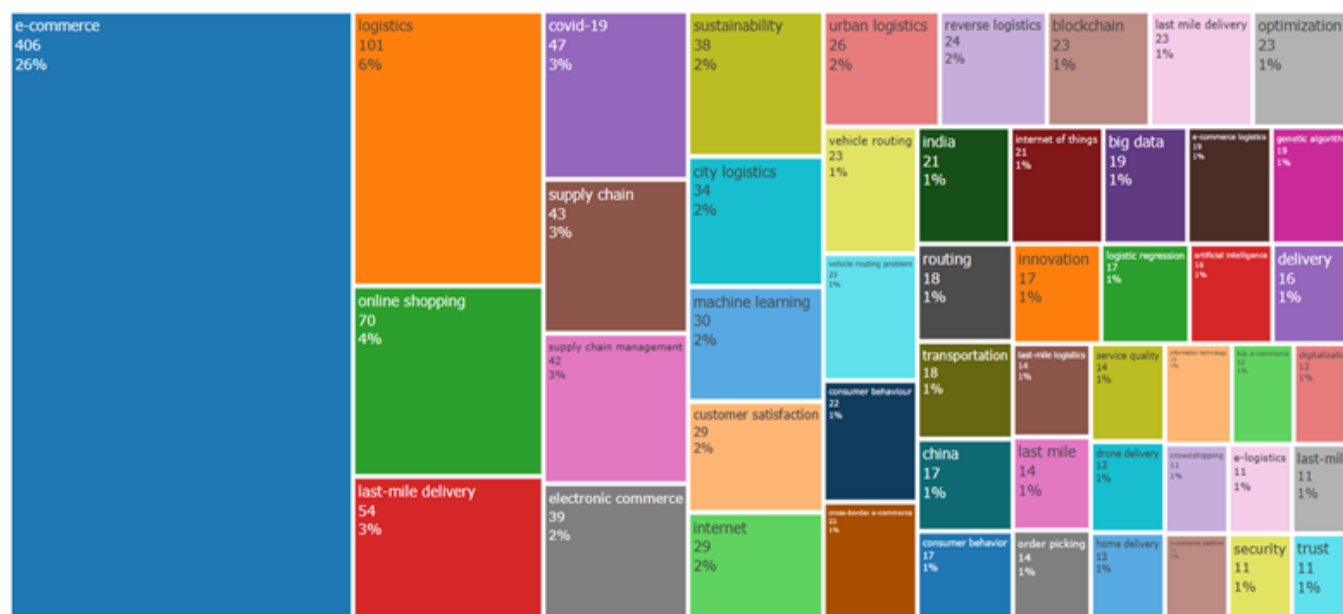


Figure 7. Tree map of author keywords made using R-Studio.

4 DISCUSSION

4.1 Types of research methods

Research methods are systematic approaches used to collect and analyse data to improve understanding of a phenomenon or answer a specific question. Various research methods are used in various disciplines, in both qualitative and quantitative research. As regards the research methods in the 230 analysed articles, 147 (63.91%) dealt with algorithm development (Salehi et al., 2023; Samad et al., 2023), 39 (16.96%) employed fuzzy methods (Aljohani & Thompson, 2019; Moslem & Pilla, 2023), 30 (13.04%) applied mathematical modelling (Samad et al., 2023), 10 papers (4.35%) dealt with structural equation modelling (Samad et al., 2023) and 4 articles (1.74%) applied an analytical hierarchy process (Aljohani & Thompson, 2019; Samad et al., 2023).

As per the widely used algorithms according to Sun et al. (2024), X. Wang et al. (2023) related to supply chain networks using genetic algorithms. The adaptive large neighbourhood search (ANLP) algorithm is also used in routing vehicle paths when delivering packages (Saker et al., 2023). Machine learning algorithms are also a frequently used option in routing scheduling (Li, 2023; Bahaghighat et al., 2023).

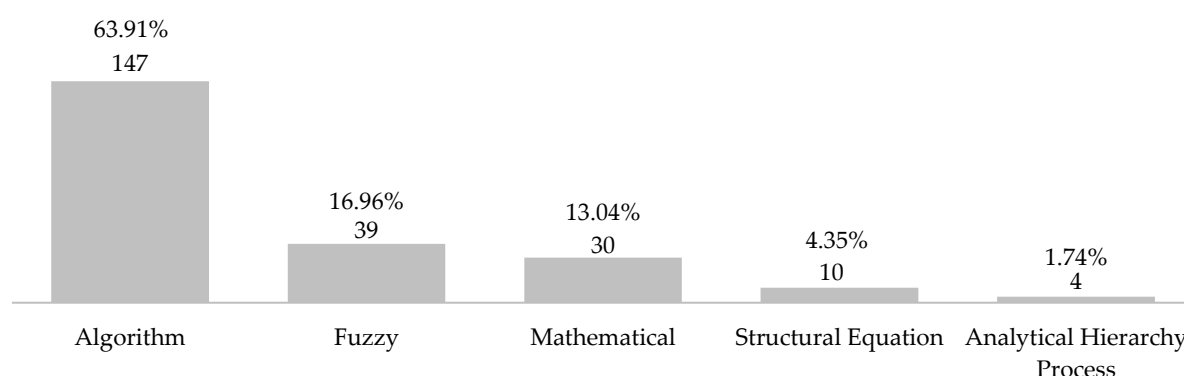


Figure 8. Research method type classification.

4.2 Vehicle type

LML refers to the last stage of delivering goods from a distribution centre or warehouse to the final consumer location. The type of vehicle used in LML depends on various factors, including distance, type of goods being

shipped, local infrastructure and environmental policies. Vehicle classifications (Visser et al., 2014) based on the 143 articles are divided into parcel operator in 68 papers (47.55%), trucking in 36 instances (25.17%), freight forwarder in 27 cases (18.88%) and sea carrier in 12 studies (8.39%). The most widely used vehicle type classification is parcel carriers, as much as 47.55% and the rest use other vehicles. Kötschau et al. (2023) suggested using travel sharing as a novel and effective method of package delivery to address the imbalance between the increasing demand for package delivery and logistics capabilities. Meanwhile, F. Wang et al. (2020) discussed fixed parcel lockers (FPL), which can eliminate high delivery costs and failed deliveries where packages are filled by logistics providers regularly, for example, once every morning.

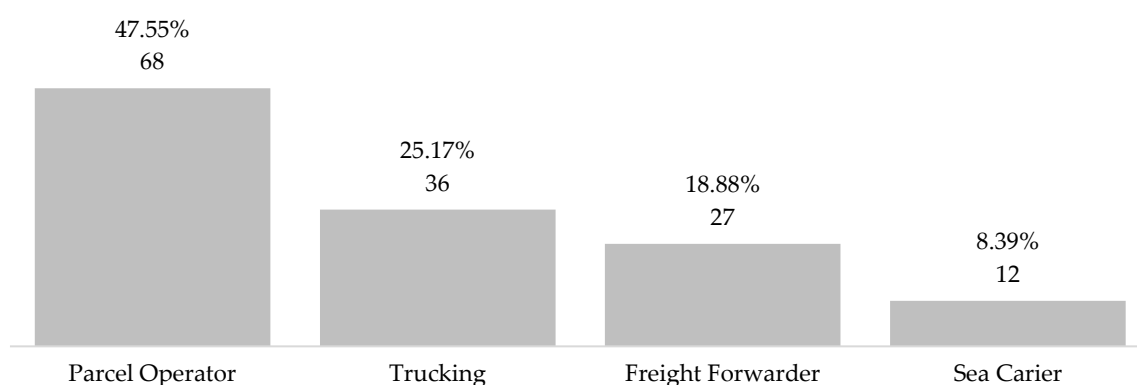


Figure 9. Vehicle type classifications.

4.3 Types of logistics optimization

LML is a phenomenon proliferating due to the spread of e-commerce and the increasing number of consumer deliveries (Calabrò et al., 2023). With the growing popularity of e-commerce, parcel delivery logistics has become the key to many companies' success in last mile delivery (Agatz et al., 2018). Logistics optimization, as a process of improving the efficiency and effectiveness of logistics operations, is carried out through a series of activities of better planning, implementation and control over the movement and storage of goods, services and information from the point of origin to the point of end consumption. Logistics optimization in 185 articles with detailed variables can be classified into distance (Calabrò et al., 2023) in 93 papers (50.27%), delivery costs (Calabrò et al., 2023; Gevaers et al., 2014) in 38 cases (20.54%), energy consumption (Calabrò et al., 2023) in 35 articles (18.92%) and delivery time (Calabrò et al., 2023) in 19 instances (10.27%).

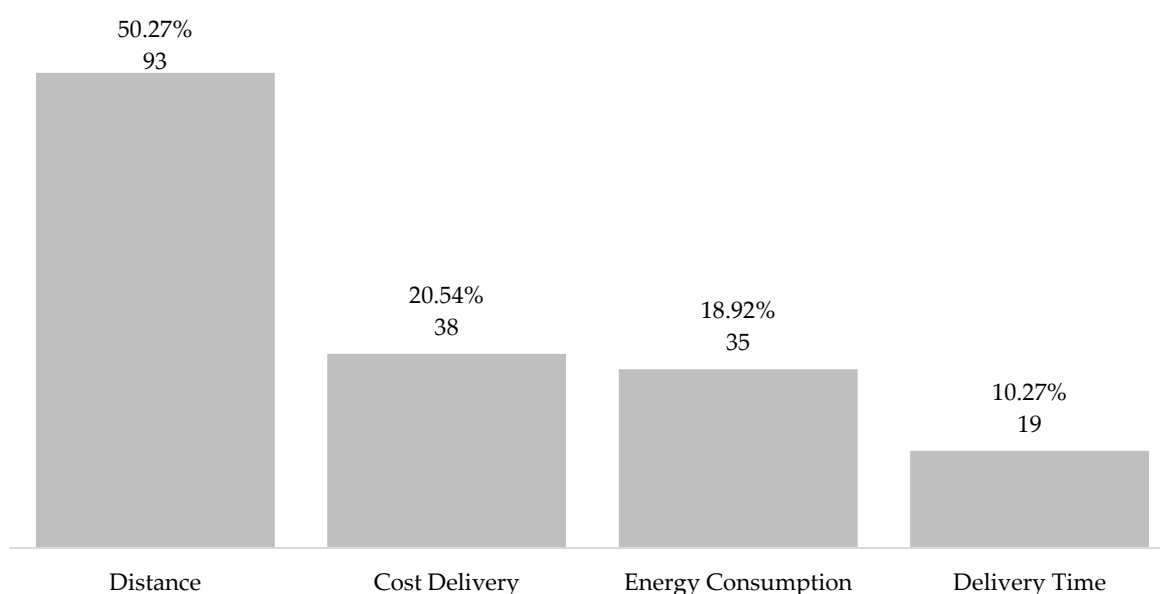


Figure 10. Classification of logistics optimization.

In the logistics optimization classification, distance is the most influential variable compared to other variables. The value of 50.27% in Figure 10 shows a high value in determining the variable. Distance is the basis for assessing the effectiveness of energy consumption for electric vehicles when delivering packages to consumers (Ahsini et al., 2023). Transportation distance is also the basis for planning, considering the probability of customers maximizing the delivery success rate (Pan et al., 2017).

4.4 Industry focus type

Figure 11 shows the classification of articles based on a specific industry focus on LML. The type of industry focus based on a total of 426 articles can be classified into E-commerce (Ha et al., 2023) in 326 papers (63.80%), technology (Chen et al., 2018; Ha et al., 2023) in 185 cases (36.20%), transportation (Ha et al., 2023a) in 55 papers (10.76%), information technology (Ha et al., 2023) occurring 43 times (6.35%), retail (Ha et al., 2023) in 36 cases (5.32%), energy (Ha et al., 2023) in 17 instances (2.51%) and manufacturing (Ha et al., 2023) in 15 studies (2.22%).

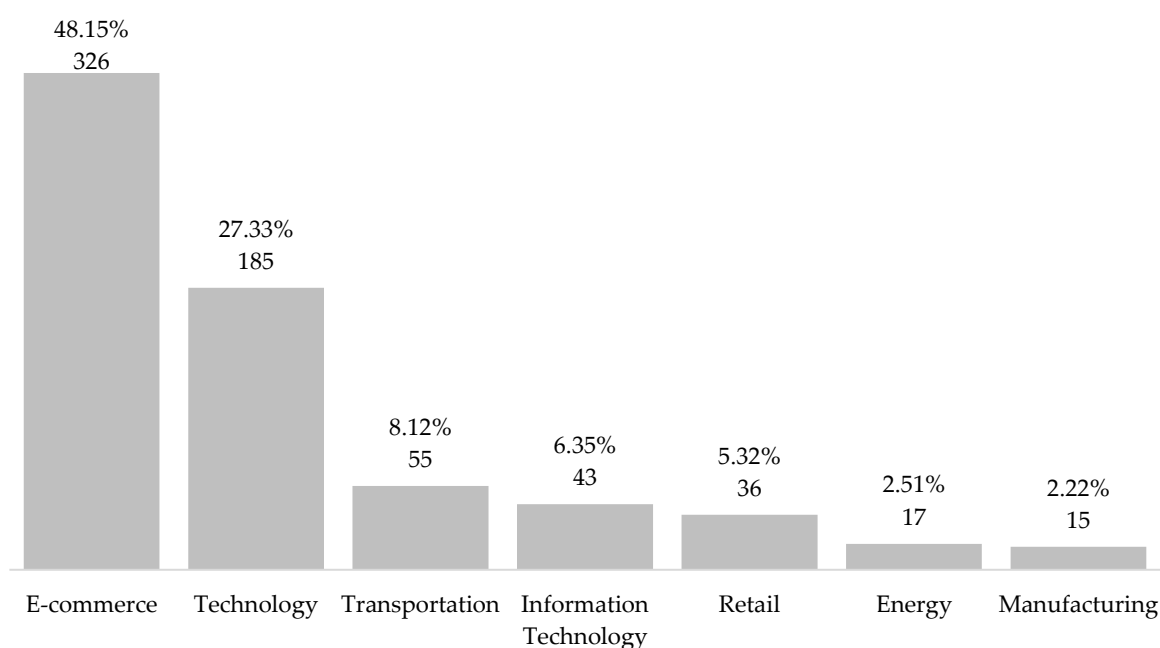


Figure 11. Industry focus type classification.

E-commerce is a topic widely discussed in articles related to LML routing. E-commerce also applies to shipping and distribution logistics (Kostecka & Kopczewska, 2023; Li, 2023). Zeng et al. (2023) discussed the development of e-commerce linked to the level of logistics density, which can provide input to government and businesses with practical plans for China's high-quality economic development. E-commerce can also be utilized in supply chain management, providing financial benefits (Chang et al., 2023; Sun & Karia, 2023).

4.5 Analysis of knowledge mapping, strategic diagram

A strategic diagram is a two-dimensional space constructed by plotting themes according to centrality and density ranking values, using the median or mean to classify clusters along two axes, with centrality on the x-axis and density on the y-axis (Cobo et al., 2011). Centrality measures the interaction level of a network with other networks, while density measures the internal strength of the network (Wangsa et al., 2022). This measure is divided into four quadrants, visualizing a set of research topics on a two-dimensional strategic diagram (Cobo et al., 2011). As in Figure 12, Quadrant 1 (Q1) is located on the top right, followed by quadrant 2 (Q2) on the top left. Quadrant 3 (Q3) is located on the lower left and quadrant 4 (Q4) on the lower right.

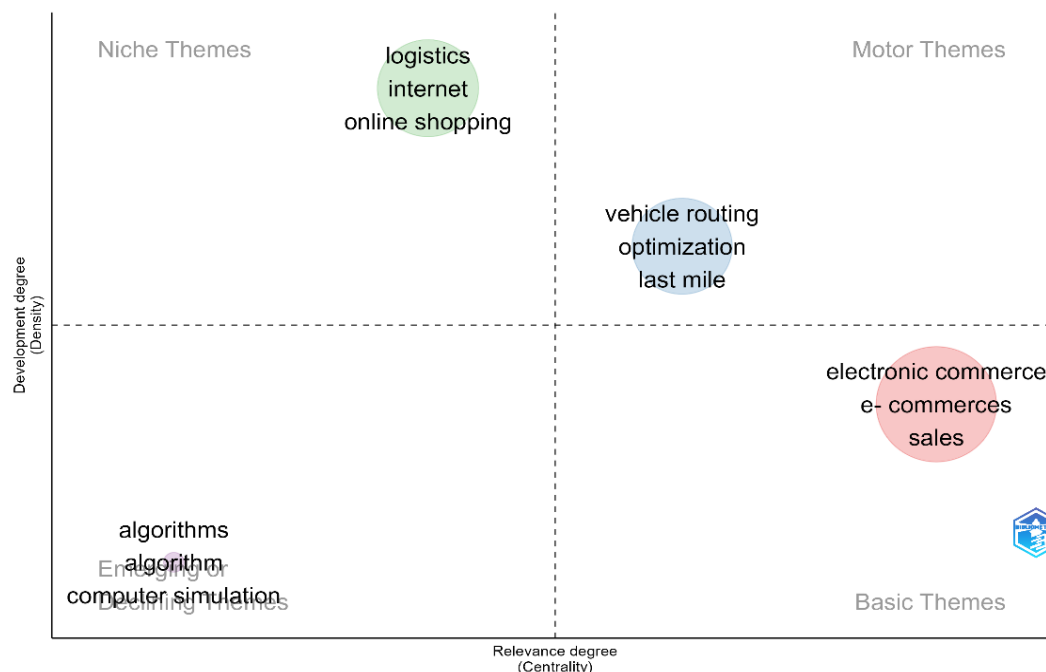


Figure 12. Strategic diagram.

Q1 contains the topics of vehicle routing, optimization and last mile, indicating topics under development and essential variables in the LML discussion. Q2 refers to topics that have not been widely researched but have the potential to provide new insights or understanding consisting of logistics, internet and online shopping. Q3 needs further exploration because articles in this quadrant have a low level of centrality and density, which is in a declining stage. Q4 is crucial in developing LML article topics, but not many have been discussed further; topics that enter Q4 are electronic commerce, e-commerce and sales. From the plotting results, it can be seen which topics have the potential for future research. Based on the content analysis, the most discussed variables related to LML routing are algorithm, distance, parcel operator and e-commerce. These four variables are the variables with the highest weight in each classification. Four articles represent the four variables above. These articles are shown in Table 4 below.

Variables that affect LML are related to e-commerce optimization. This topic is most discussed and developed when discussing LML. As for the industry, the four articles focus on distance. Thus, LML is facilitated in its development and focused on minimizing distance. This is related to optimization in terms of cost and process efficiency.

Table 4. LML highest weight classification article.

No	Author	Research objectives	Research method	Vehicles	Optimization	Industry focus
1	Moganathan et al. (2022)	Comparison of metaheuristic techniques for parcel delivery problem: Malaysian case study	Algorithm (ant-colony optimization (ACO) and genetic algorithm (GA))	Vehicle routing problem (VRP) and asymmetric travelling salesman problem (ATSP)	E-commerce	Shortest distance, including runtime
2	Sadati et al. (2022)	Electric vehicle routing problem with flexible deliveries	Algorithm variable neighbourhood search (VNS) and granular tabu search (GTS)	Electric vehicle routing problem with flexible deliveries (EVRPFD)	E-commerce	Minimising total distance travelled

No	Author	Research objectives	Research method	Vehicles	Optimization	Industry focus
3	Yan & Huang (2022)	Research into optimisation of logistics parcel intelligent sorting and conveying chain combined with variable clustering mathematical method	Clustering algorithms partition-based, hierarchical-based, density-based, grid-based and neural network-based	Logistics parcel intelligent sorting system	E-commerce	Fisher distance
4	Enthoven et al. (2020)	Two-echelon vehicle routing problem with covering options: City logistics with cargo bikes and parcel lockers	Adaptive large neighbourhood search (ALNS) heuristic	Cargo bikes and parcel lockers	E-commerce and city distribution	Two-echelon vehicle routing resulted in the lowest distance travelled and operating costs

5 CONCLUSION AND FUTURE RESEARCH

The bibliometric analysis provides insight into the increase in research publications on long-haul logistics, indicating the interest and importance of this field over time. The most discussed and essential topics in last mile logistics (LML) focus on vehicle routing, optimization and distance minimization, with key variables such as algorithms, parcel carriers and e-commerce. It is important because it significantly improves efficiency through better planning and control, with key factors including distance, costs, energy consumption and delivery time.

Further studies are needed on the influence of e-commerce on delivery and demand patterns in last mile logistics, exploring more deeply the relationship between optimization algorithms and cost efficiency in last mile delivery and focusing on developing new technologies, such as the use of autonomous vehicles or drones for delivery.

ADDITIONAL INFORMATION AND DECLARATIONS

Conflict of Interests: The authors declare no conflict of interest.

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Data Availability: The data that support the findings of this study are available as an online appendix at <https://aip.vse.cz/attachments/000045.xlsx>.

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