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The Applications of Operations Research in E-Commerce Logistics

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ABSTRACT: The present study is a systematic literature review-cum-bibliometric analysis of e-commerce logistics to examine the field holistically. Through this review, the study aims to identify the dominant themes, major research trends, and emerging areas in e-commerce logistics. It also seeks to understand how logistics practices and technological developments contribute to improving operational efficiency, delivery performance, customer satisfaction, and sustainability. The data for the review was obtained from Elsevier's Scopus database using relevant keywords. The final dataset comprises 851 articles and 12 review papers. Bibliometric analysis is used to examine publication trends, keyword patterns, research themes, and gaps in the existing literature. The study provides an overview of the development of e-commerce logistics research and identifies areas that require further investigation.

KEYWORDS: E-Commerce; Online Shopping; Supply Chain; Logistics

1. INTRODUCTION

E-commerce logistics is the backbone of online retail. It covers the storage, movement, delivery and return of goods purchased online, and it plays an important role in ensuring that orders reach customers on time and at an acceptable cost. As digital marketplaces expand across borders, logistics has become both a strategic capability and a major operational cost. It influences customer satisfaction, business competitiveness and the environmental impact of cities and supply chains (Risberg, 2023). While mature markets focus on improving delivery networks in densely populated urban areas, emerging markets continue to develop the infrastructure needed to support growing online demand (Janjevic & Winkenbach, 2020). E-commerce logistics has therefore become an important area of research for academics, logistics managers and policymakers.

The rapid growth of online shopping has increased the complexity of logistics operations. Rising order volumes, shorter delivery times, high product return rates and expanding cross-border trade place considerable pressure on fulfilment networks. Last-mile delivery, which involves transporting goods from distribution points to customers, is particularly challenging because of its high costs and operational inefficiencies (Mangiaracina et al., 2015). At the same time, fragmented deliveries, packaging waste and transportation emissions have increased concerns about the environmental sustainability of e-commerce. The COVID-19 pandemic further highlighted the importance of flexible and resilient logistics systems when demand patterns change unexpectedly (Kalkha et al., 2023). These challenges have encouraged researchers and businesses to explore better ways of planning, managing and optimizing logistics activities.

Operations Research (OR) provides important methods for addressing these challenges. It uses mathematical modelling, optimization and analytical techniques to support decision-making in complex operational systems. In e-commerce logistics, methods such as vehicle routing, mixed-integer programming, heuristics and metaheuristics are used to improve delivery planning, inventory allocation, warehouse scheduling and resource utilization. For example, Lee et al. (2023) examined a nested MAX-MIN ant algorithm in a cloud-based cyber-physical logistics system, while Prajapati et al. (2023) studied a clustering-based routing heuristic for fresh-food last-mile delivery. Alongside these approaches, digital technologies have expanded the possibilities for improving logistics performance. Robotics and automation

support faster and more accurate warehouse operations (Huang et al., 2015), big data analytics assists demand forecasting and logistics modelling (Verma et al., 2023), and deep learning has been applied to capacity allocation in cross-border logistics (Ren et al., 2020). These developments demonstrate the growing relationship between operational optimization and digital technologies. However, the effectiveness of logistics systems also depends on how these methods are applied to practical challenges involving cost, delivery speed, customer service and sustainability.

The development of e-commerce logistics has generated research across several interconnected areas, including optimization, intelligent warehousing, last-mile delivery, reverse logistics, cross-border distribution and sustainable transportation. Existing review studies have examined different aspects of this expanding field, including logistics technologies, operational challenges, distribution systems and emerging approaches to sustainable delivery (Risberg, 2023; Kalkha et al., 2023). Other research has explored urban freight distribution and the challenges associated with the growth of online retail (Buldeo Rai & Dablanc, 2023). These studies provide valuable insights into particular aspects of e-commerce logistics. However, the wide range of methods, technologies and application areas makes it important to examine how the research field has developed as a whole, which themes have received the most attention, and which areas require further investigation. In particular, an integrated understanding of publication trends, influential research, thematic relationships and emerging topics can help connect individual research developments within the broader field of operations research in e-commerce logistics.

Although the existing literature provides considerable insight into logistics optimization and digital innovation, several areas require further investigation. First, research on e-commerce logistics covers multiple themes, but their relationships and development over time need to be examined systematically. Second, optimization techniques and digital technologies are increasingly discussed together, creating a need to understand how these approaches are represented within the research landscape. Third, sustainability, reverse logistics, cross-border distribution and last-mile delivery continue to present operational challenges that require further research. Finally, identifying emerging themes and less-developed research areas can help establish priorities for future studies. These issues provide the motivation for the present study, which combines a systematic literature review with bibliometric analysis to examine the development, structure and future direction of research on operations research in e-commerce logistics.

A systematic literature review provides a structured approach to identifying and synthesizing existing research, while bibliometric analysis helps examine publication patterns, influential contributors and relationships among research themes. Together, these approaches offer a broader understanding of the field than examining individual studies alone.

The literature review draws on eleven earlier review studies, which cover business analytics and big data in e-commerce, artificial intelligence and automation, digitalization, sustainable logistics, returns management, supply chain visibility, cross-border trade, consumer behaviour and autonomous mobile robots in warehousing. These studies show strong interest in digital technologies and operational efficiency. Most of them focus on a single technology or theme, and few map the field as a whole through a bibliometric lens. To fill this gap, the study followed a PRISMA-guided search of the Scopus database. The query “(ecommerce OR online shopping) AND (supply chain OR logistics)” returned 2,681 records, which were narrowed to 851 peer-reviewed English-language journal articles after applying the inclusion and exclusion criteria. These were analyzed using Mendeley, Biblioshiny through the R bibliometrix package, VOSviewer, Tableau and Excel. The data analysis covered annual scientific production, author and journal productivity, thematic mapping and keyword co-occurrence. Annual output grew from about 15 papers in 2015 to more than 83 in 2023, with a sharp rise after 2019. Sustainability (Switzerland) is the leading journal, and Huang George Q is the most productive author. The thematic map and keyword network highlight four interconnected areas: optimization and decision-making, digital platforms and cross-border logistics, green and urban logistics, and advanced algorithms and artificial intelligence. Based on these findings, the study identifies future research directions in AI and optimization, sustainable distribution, dynamic routing, smart warehousing, reverse logistics, service quality, cross-border logistics and rural delivery.

This study contributes to the literature by bringing together publication trends, influential research and thematic relationships within a single analytical framework. For researchers, it provides an overview of how operations research in e-commerce logistics has evolved and where further work is needed. For logistics managers and practitioners, it

identifies research areas and approaches that may support better delivery planning, resource allocation, warehouse operations and sustainability. Policymakers may also find it useful for understanding the operational and environmental challenges of growing online retail. The remainder of the paper presents the literature review, research objectives, research methodology, and data analysis and results, followed by the future research agenda and conclusion.

2. LITERATURE REVIEW

The available literature on e-commerce logistics is summarized and critically evaluated through a review of relevant studies. The literature highlights the growing importance of digital technologies, supply chain management, logistics service quality, and sustainability in online commerce. Several studies focus on emerging technologies such as artificial intelligence, big data analytics, blockchain, cloud computing, and automation to improve logistics efficiency and order fulfilment. Other studies examine important challenges related to last-mile delivery, reverse logistics, inventory management, cross-border transportation, and environmental sustainability. Recent research increasingly explores smart e-commerce logistics and the use of data-driven approaches to improve operational performance. The summary of the selected review articles relevant to e-commerce logistics is presented in Table 1.

Authors	Scope of Review	Type of Study
Li (2021)	Examines business analytics in e-commerce and how data-driven approaches support business decisions and online business performance.	Literature review
Alrumiah and Hadwan (2021)	Reviews big data analytics in e-commerce, including customer understanding, personalization, customer loyalty, and implementation challenges.	Literature review
Zhuang (2021)	Examines the role of big data analytics in e-commerce, comparing developments in the United States and China.	Comparative review and analysis
Abdelaziz and Munawaroh (2024)	Examines sustainable logistics service quality and the role of AI, big data analytics, blockchain, and sustainable transportation.	Bibliometric analysis
Halachev (2024)	Reviews the role of AI in automating e-commerce processes and improving business operations.	Review study
Kolomiyets et al. (2024)	Examines digitalization and emerging business models in e-commerce.	Review study
Madanchian (2024)	Reviews returns management across e-commerce sectors and countries, identifying trends and future research directions.	Review study
Stevenson and Rieck (2024)	Reviews the role of predictive analytics in e-commerce innovation and data-driven decision-making.	Literature review

Delgado et al. (2025)	Examines supply chain visibility and the opportunities and challenges associated with AI and Industry 4.0 technologies.	Review study
Mirzaye and Mohiuddin (2025)	Reviews digital technologies and their influence on international trade and cross-border e-commerce.	Systematic literature review
Wang et al. (2025)	Reviews technological innovations in e-commerce and their influence on consumer behaviour.	Systematic literature review
Kumar et al. (2026)	Reviews autonomous mobile robots in intelligent warehousing and their applications in logistics operations.	Comprehensive review

3. RESEARCH OBJECTIVE

The fundamental aim of this review is to examine publication trends, performance, collaboration patterns and the intellectual structure of research on e-commerce logistics, with particular attention to the role of operations research in last-mile delivery. This is pursued through the following specific objectives:

1) To identify prevailing publication trends in e-commerce logistics research in terms of journals, time, authors, affiliated institutions and countries.
2) To identify the most influential studies, models and methods in the field, such as routing optimization, simulation and predictive analytics.
3) To trace how research in this domain has evolved over time and what its current trends are.
4) To analyse whether past studies lean towards segments of e-commerce logistics, such as last-mile delivery, reverse logistics, warehousing and fulfilment, cross-border logistics or sustainability.
5) To identify research gaps and propose directions for future research.

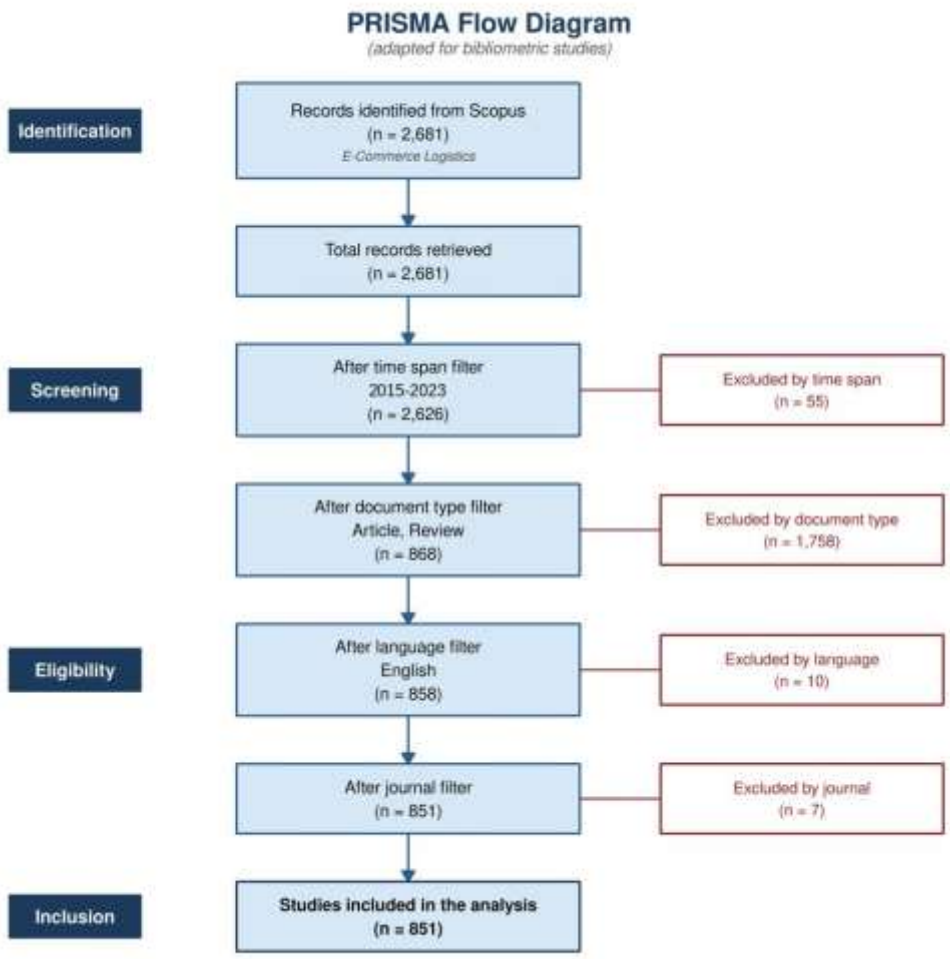
4. RESEARCH METHODOLOGY

One of the most well-known techniques for understanding the trends in each area is systematic literature review (SLR). SLR is helpful in summarizing findings of previous research and understanding the gaps for future research (Paul & Criado, 2020). As opposed to narrative reviews that are likely to have subjectivity problems and limited sample size ranges, SLR follows a rigidly defined procedure intended to ensure exhaustiveness, transparency, and replicability of the entire search and evaluation procedure, therefore creating various types of inputs for different users of reviews. This study employs one such technique to analyze the research trends in E-Commerce Logistics.

4.1. Article selection, inclusion and exclusion criteria

An organized search was conducted on 10 September 2026 through the Scopus database, which is well known to be one of the most reputable abstract and citation databases of peer-reviewed literature. The search string used for the search was intentionally formulated in such a way as to incorporate the relationship between retail electronic commerce and supply chain management: “(ecommerce OR online shopping) AND (supply chain OR logistics)”. This thorough

initial search generated a raw base sample of 2,681 papers. Naturally, these raw data covered an array of diverse disciplines of publications attributed to the diverse nature of operations involved in e-commerce logistics, which includes computer science, business management and accounting, engineering, decision sciences, social sciences, mathematics, and additional multidisciplinary areas. To keep up with temporal relevancy and focus on current trends, the dataset went through time span reduction. Publications were selected to belong to the time frame of 2015 to 2023, resulting in eliminating 55 outliers publications that did not fall into this time span and reducing the number of publications in the active dataset to 2,626 publications. In order to preserve academic credibility and prefer peer-reviewed scientific information over initial commentary, non-empirical types of documents were eliminated from the dataset. These included conference papers, conference reviews, scholarly notes, editorials, book chapters and surveys. This resulted in shrinking the number of publications to 868 publications. Additional criteria were set to determine the final search of articles, such as all publications in languages other than English not being considered in the sample. This led to the removal of 10 articles which weren't of English language. The restriction on the source type was imposed only for the peer reviewed journal articles, while all other types of media were not taken into account. This restriction of all kinds of documents apart from journals, such as conference papers, book reviews, and editorials, is essential for the methodology of the study. Although conference papers tend to discuss nascent thoughts, scholarly articles from journals indicate full-fledged contributions that have been reviewed by peers. By keeping the search limited to only peer reviewed journals, one ensures the reliability of the research. As a result, 7 more articles were removed from the sample. In conclusion, after this extensive screening process, 851 core journal articles were selected as the main sample. The complete sequence of steps, starting from the first records identified to the final inclusion step, is represented using a formal PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram. (Page et al., 2021)



4.2. Bibliometric analysis

The macro level structural characteristics, citation patterns, author performance measures, and knowledge domain structures that exist within the final article set of 851 papers was assessed using a full bibliometric analysis. Bibliometric analysis is a widely validated method of quantitative research used to analyze academic publications on a structural basis, enabling researchers to map out research articles, journals, citation patterns, author collaboration networks, and other bibliographic information (Donthu et al., 2021)A multi-platform software system was employed to manage and work with such large quantities of bibliographic information. All the selected review papers were downloaded in the standard RIS (.ris) format and then directly uploaded to Mendeley, which became the main reference manager used in the paper. This tool helped organize the files initially, check document validity, and ensure secure metadata storage. In cases where certain records didn't have any automatic fields such as unique web pages, publishers, or odd formatting, we made sure to enter all the information manually. The curated bibliographic text file (.bibtext) that contained the metadata of the 851 articles was exported out of the reference management system and imported into RStudio. In RStudio, the bibliometric package was then employed through the web-based interface Biblioshiny (Massimo & Corrado, 2017). Biblioshiny served as the computational engine to organize, filter, and structure the metadata into a quantifiable matrix, which was then exported into an Excel spreadsheet (.xlsx). In order to assess intellectual connectivity and spatial patterns, VOS Viewer was used to create network visualizations such as keyword clusters, cluster density, and conceptual map. At the same time, Tableau and Microsoft Excel were also employed. The architecture of this methodology is closely linked to two key aims of research. The first objective is performance analysis. This phase emphasizes the evaluation of performance, trajectory, and the impact of the current literature base. Here the trend in publication growth, identification of key publication journals and sources, profiling of productive authors, and the analysis of underlying citations take place. The second objective is intellectual structure and thematic mapping. This phase utilizes matrix analysis of co-occurrences, clustering methods, and thematic mapping to identify the interconnection between keywords. Grouping similar keywords in specific intellectual clusters helps determine the key research focus areas and gaps, and consequently, the research agenda development. Lastly, some potential areas of research for future investigation are identified.

5. DATA ANALYSIS AND RESULTS

Analysis

This section looks at how research on operations research (OR) in e-commerce logistics developed between 2015 and 2023. It approaches the field from five angles: (1) how many papers were published each year; (2) which authors and journals have contributed the most; (3) where the main research themes sit on the thematic map, in terms of their centrality and density; (4) how topics connect to one another through keyword co-occurrence; and (5) what these results suggest for future managerial, algorithmic and practical work. Taken together, they show how optimization, simulation and predictive analytics have moved from abstract mathematical tools to everyday instruments for running omni-channel distribution, urban delivery, automated fulfillment and green logistics. (Risberg, 2023; Kalkha et al., 2023)

5.1. Annual Scientific Production

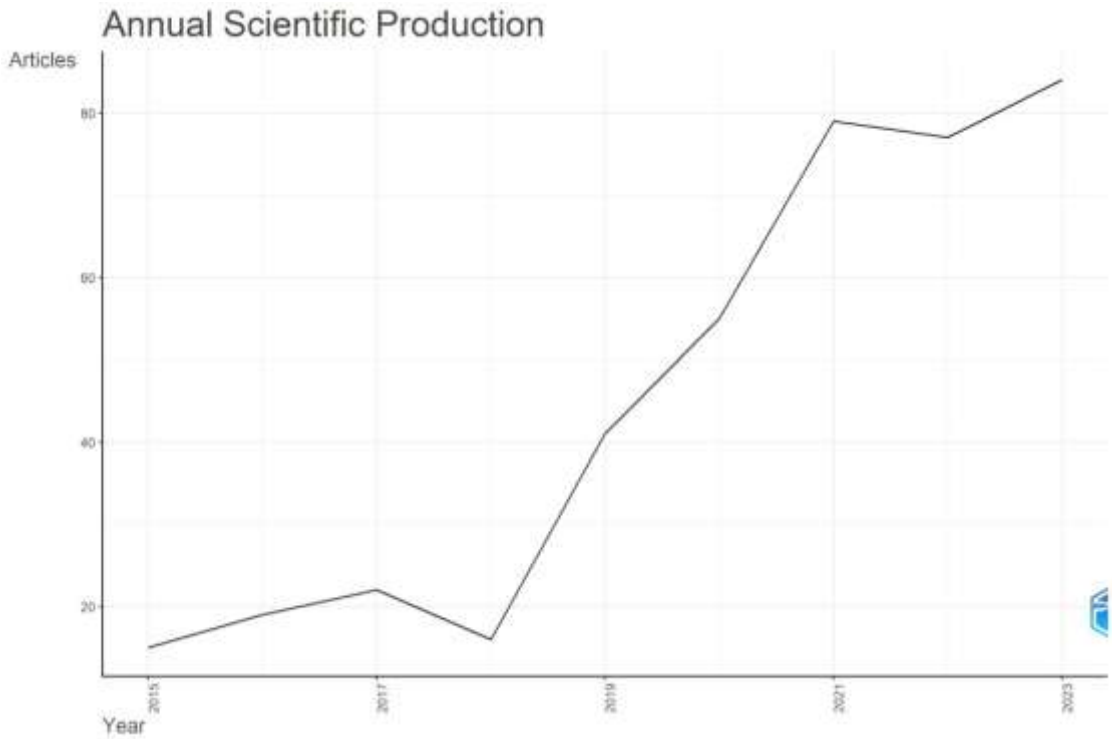


Figure 1: Annual Scientific Production (2015–2023)

Figure 1 shows how many papers on OR in e-commerce logistics were published each year from 2015 to 2023. Output rises across the nine years, in step with the growth of global e-commerce and the operational pressure that came with it.

From 2015 to 2018 the numbers stay small, at roughly 15 to 22 papers a year. There were about 15 in 2015, a modest climb to around 22 in 2017, and a dip to 16 in 2018. At this stage e-commerce logistics had not yet become a mainstream topic within OR, and routing and dispatching problems for online retail attracted limited attention.

2019 is the turning point. Output jumps to about 41 papers, more than double the 2018 figure, and keeps climbing to around 55 in 2020 and almost 79 in 2021. This coincides with the COVID-19 pandemic, when the boom in online shopping put heavy strain on fulfillment networks and made better routing algorithms, dynamic delivery schedules and capacity planning far more urgent in practice. Output dipped slightly in 2022, to about 77 papers, before reaching an all-time high of more than 83 in 2023. Over the whole period, annual publications grew by more than 450%. A trajectory like this suggests that e-commerce logistics is now an established research area that is still developing quickly. (Janjevic & Winkenbach, 2020; Ren et al., 2020)

5.2. Author Productivity and Production Over Time

5.2.1 Most Relevant Authors

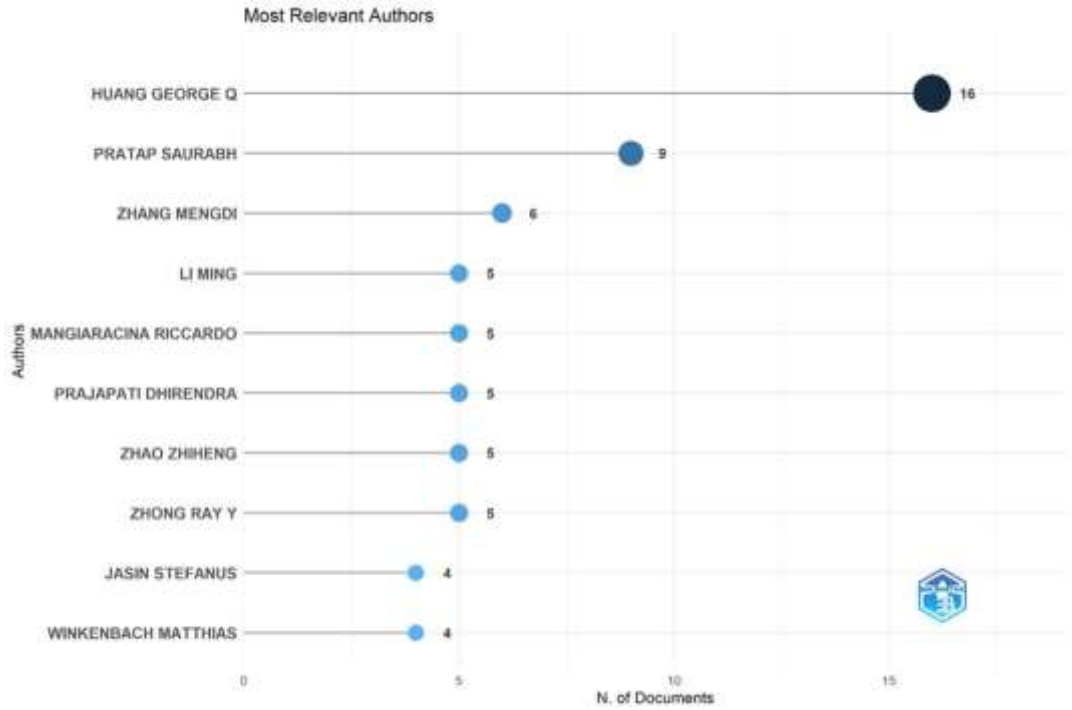


Figure 2: Most Relevant Authors

Figure 2 ranks the most productive authors by number of documents. Huang George Q leads clearly with 16 publications, and his work spans robotics, smart logistics systems and community-based delivery. Pratap Saurabh follows with 9 articles and Zhang Mengdi with 6. Five authors have 5 papers each: Li Ming, Mangiaracina Riccardo, Prajapati Dhirendra, Zhao Zhiheng and Zhong Ray Y. Jasin Stefanus and Winkenbach Matthias complete the top ten with 4 each. Jasin works mainly on multi-item order fulfillment, and Winkenbach on urban distribution strategies.

Apart from Huang, everyone in the top ten has between 4 and 9 papers. That points to a broad international community in which many researchers contribute regularly, rather than a field dominated by one or two names. The authors also come from both engineering and operations management backgrounds, which reflects how interdisciplinary e-commerce logistics research has become. (Huang et al., 2015; Jasin & Sinha, 2015; Prajapati et al., 2023)

5.2.2 Authors' Production Over Time

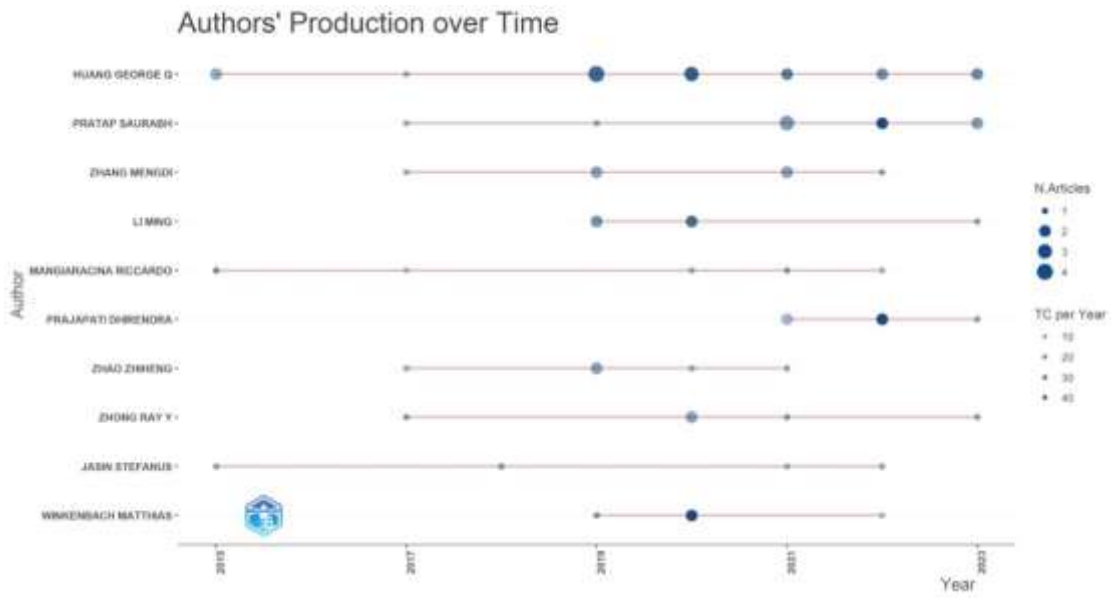


Figure 3: Authors' Production over Time (2015–2023)

Figure 3 follows the top authors year by year. Bubble size shows the number of articles an author published in a given year, and the colour shade shows the average citations per article per year (TC per year), with darker bubbles meaning more citations.

Huang George Q, Mangiaracina Riccardo and Jasin Stefanus were already publishing in 2015 and stay active across almost the whole period. Huang's output is especially steady, with several papers in both 2019 and 2020 and clear citation peaks. Later entrants made a strong mark as well. Pratap Saurabh and Prajapati Dhirendra become much more productive from 2021, and 2022 shows their largest bubbles and darkest shading. Winkenbach Matthias attracts a lot of citations in 2020, around the time of his work on urban distribution strategies, while Zhang Mengdi and Zhong Ray Y publish steadily from 2017 to 2023.

Overall, the early models from 2015 to 2017 seem to have laid the groundwork for a newer group of researchers, whose 2020 to 2023 papers deal with current problems such as crowd-sourced delivery, automated locker networks and real-time routing. (Huang et al., 2015; Mangiaracina et al., 2015; Jasin & Sinha, 2015; Ouyang et al., 2023)

5.3. Source Productivity and Production Over Time

5.3.1 Most Relevant Sources

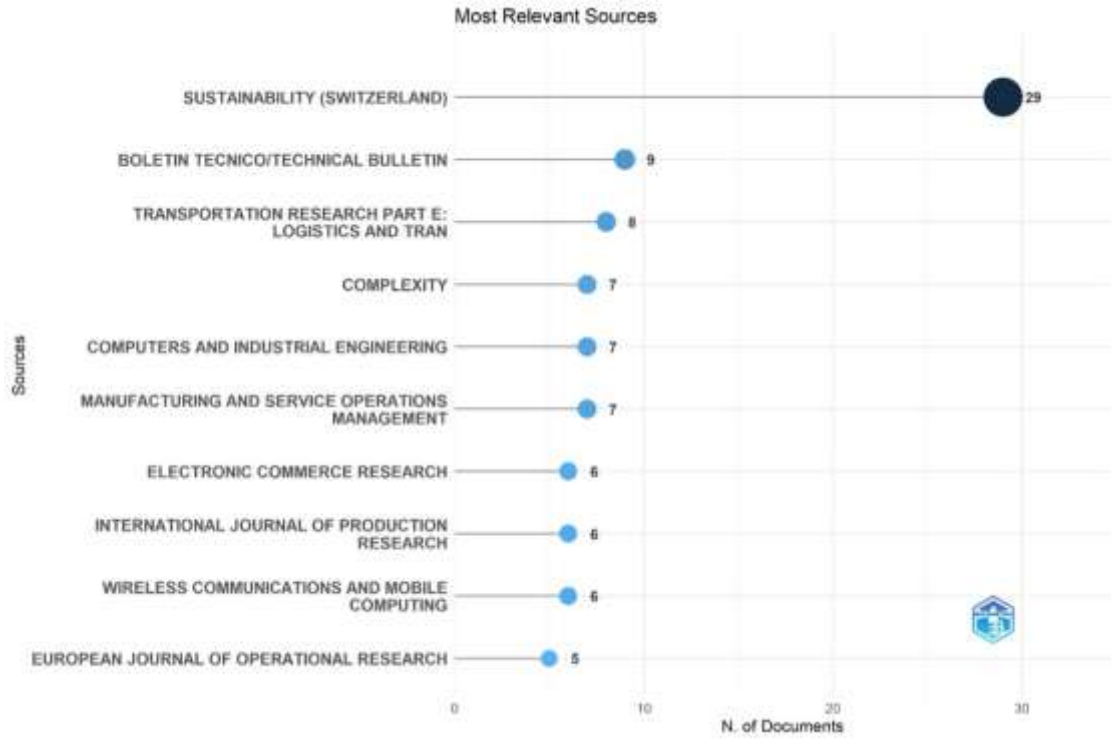


Figure 4: Most Relevant Sources

Figure 4 shows how publications are spread across journals. Sustainability (Switzerland) is far ahead with 29 articles, more than three times as many as any other journal. That lead shows how closely e-commerce logistics research is tied to sustainability concerns such as carbon reduction and green transport policy. Boletin Tecnico/Technical Bulletin comes second with 9 articles, followed by Transportation Research Part E: Logistics and Transportation Review with 8. Three journals have 7 each: Complexity, Computers & Industrial Engineering, and Manufacturing & Service Operations Management (MSOM). The European Journal of Operational Research (EJOR) has 5, and Electronic Commerce Research, the International Journal of Production Research (IJPR) and Wireless Communications and Mobile Computing (WCMC) have 6 each.

Taken together, these sources rest on three pillars: environmental and sustainability science, classical OR and industrial engineering, and information and telecommunication systems. (Mangiaracina et al., 2015; Jurburg et al., 2023; Risberg, 2023)

5.3.2 Sources' Production Over Time

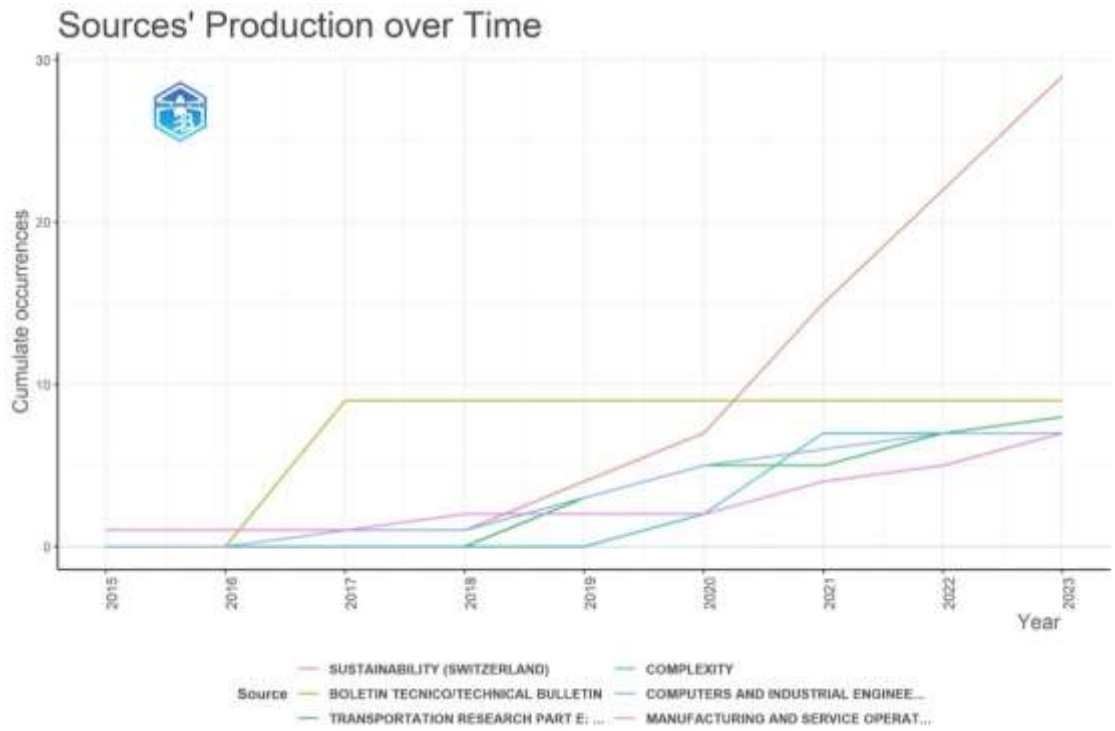


Figure 5: Sources' Production over Time (2015–2023)

Figure 5 shows how the cumulative output of the leading journals built up between 2015 and 2023, and the journals follow quite different paths. Sustainability (Switzerland) grows fastest. It published only a few articles between 2018 and 2020, reaching 7 cumulative articles by 2020, and then climbs steeply and without a break to 29 by 2023. That pace fits the rising interest in eco-routing, electric delivery fleets and sustainable urban logistics.

Other journals look different. Boletin Tecnico jumps to 9 articles between 2016 and 2017 and has levelled off since. The core OR and engineering journals (MSOM, Complexity, Transportation Research Part E, and Computers & Industrial Engineering) grow more gradually, adding up to 7 or 8 cumulative documents each between 2019 and 2023. This steady pace points to lasting interest in publishing rigorous modeling and algorithmic work on e-commerce logistics. (Dutta et al., 2020; Liu et al., 2020; Gonzalez et al., 2023)

5.4. Thematic Map

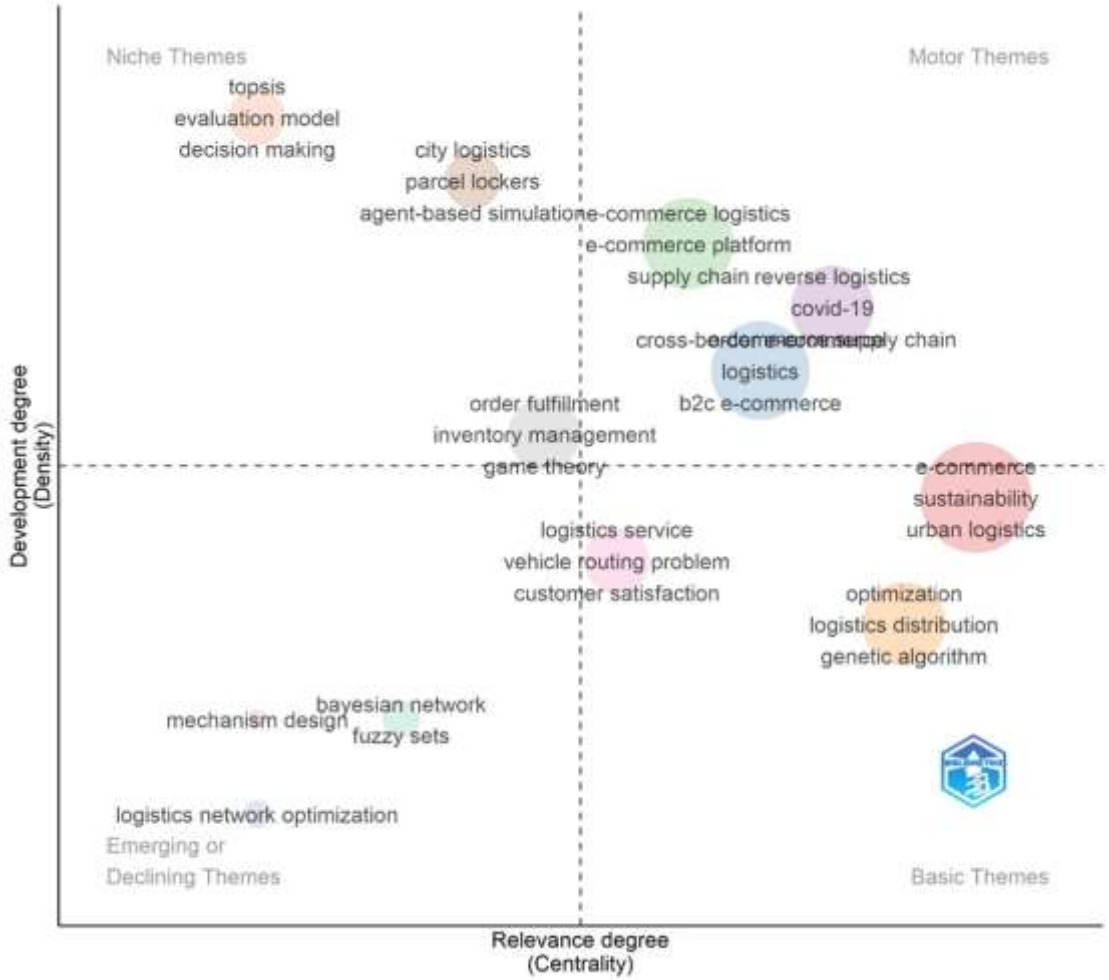


Figure 6: Thematic Map (Callon's Centrality vs. Density)

Figure 6 shows the thematic map, which places the research themes on two axes. Callon's centrality (horizontal) reflects how strongly a theme is connected to the rest of the field, and Callon's density (vertical) reflects how developed and internally coherent a theme is, based on the links among its keywords. The two axes divide the map into four quadrants: motor themes, niche themes, basic themes, and emerging or declining themes. (Risberg, 2023)

Motor Themes (Upper-Right Quadrant)

Motor themes combine high centrality with high density. They are well-developed, influential streams of research that push the field forward. (Risberg, 2023) The clusters in this quadrant are:

- e-commerce logistics / e-commerce platform / supply chain: the core of the quadrant, covering platform-based coordination, multi-tier fulfillment networks and integrated supply chain management. (Xue et al., 2022; He et al., 2023)
- reverse logistics / COVID-19 / supply chain: the operational challenges of handling product returns in closed-loop supply chains and reverse distribution channels, which became more pressing during the pandemic. (Deng et al., 2016; Bernon et al., 2016; Dutta et al., 2020)
- A cross-border cluster at the edge of two quadrants: customs clearance restrictions, cross-border fulfillment channels and cross-border multimodal transport. (Giuffrida et al., 2020; Xue et al., 2022)

Niche Themes (Upper-Left Quadrant)

Niche themes are dense but less central. They are specialized, methodologically mature areas that are less tied to the rest of the field. The key clusters are:

- TOPSIS / evaluation model / decision making: multi-criteria decision-making (MCDM) models for problems such as selecting distribution center locations, evaluating third-party logistics (3PL) providers and ranking facilities. (Wang & Dong, 2023; Lamba et al., 2020)
- urban logistics / parcel logistics / agent-based simulation: automated parcel locker (APL) networks, micro-hub deployment and agent-based simulation of urban delivery systems. (Janjevic & Winkenbach, 2020; Fan et al., 2022)
- order fulfillment / inventory management / game theory: strategic pricing, competitive capacity allocation and inventory positioning, using both cooperative and non-cooperative game-theoretic models. (Acimovic & Graves, 2015; Zhu, 2023)

Basic Themes (Lower-Right Quadrant)

Basic themes are highly central but less dense. They are the foundations of the field, broad topics that many other studies build on. The main clusters are:

- e-commerce / sustainability / urban logistics: the largest bubble on the map. It links e-commerce logistics with urban freight transport, consolidated delivery, environmental concerns and urban policy. (Mangiaracina et al., 2015; Gonzalez et al., 2023)
- optimization / logistics distribution / genetic algorithm: the methodological backbone of OR for distribution problems, including metaheuristics, exact algorithms and evolutionary computation. (Deng et al., 2016; Prajapati et al., 2023; Lee et al., 2023)

Emerging or Declining Themes (Lower-Left Quadrant)

Themes in the lower-left quadrant have low centrality and low density. They are either new topics that are still taking shape or older ones that are losing ground. Notable clusters are:

- logistics service / vehicle routing problem (VRP) / customer satisfaction: basic VRP formulations appear to be maturing and giving way to richer versions with dynamic time windows, crowd-shipping or customer service level constraints. (Liu et al., 2020; Prajapati et al., 2023; Mallari et al., 2023)
- Bayesian network / fuzzy sets / mechanism design: specialized mathematical tools for risk assessment, uncertainty quantification and incentive design for logistics platforms. (Zhang et al., 2020; Lamba et al., 2020)
- logistics network optimization: classic network optimization models, which are increasingly being replaced by real-time, dynamic algorithmic approaches. (Xuetao, 2020; Amini & Haughton, 2023)

5.5. Keyword Co-occurrence Network



Figure 7: Keyword Co-occurrence Network

Figure 7 shows the keyword co-occurrence network, which maps the intellectual structure of the field and how its concepts, tools and methods relate to one another. Node colour marks a thematic community, and the thickness of an edge reflects how often two keywords appear together. A large red node for e-commerce sits at the center and links the different sub-fields. Around it are four fairly cohesive clusters: (Risberg, 2023; Kalkha et al., 2023)

- Optimization and Decision-Making (red/orange nodes): the keywords radiating out from the core e-commerce node include optimization, inventory management, analytic hierarchy process (AHP), data envelopment analysis (DEA), machine learning, supply chain, customer satisfaction and clustering. This cluster holds the mathematical core of OR, with predictive algorithms and multi-attribute decision models used to improve warehousing, fulfillment speed and service quality. (Fan et al., 2022; Chen et al., 2023; Verma et al., 2023)
- Digital Platforms and Cross-Border Logistics (blue nodes): B2C e-commerce, Internet of Things (IoT), big data, cross-border e-commerce, cross-border logistics, China and supply chain management. The cluster points to the growing use of real-time tracking, IoT-enabled smart warehousing and data analytics to move parcels across borders. (Zhou et al., 2020; Ren et al., 2020; Xue et al., 2022)
- Green and Urban Logistics (green nodes): urban distribution, urban logistics, sustainable development, sustainable distribution, reverse logistics, e-commerce supply chain and last-mile delivery. The discussion here centers on the environmental impact of fast delivery, including zero-emission vehicle routing, combined drop-offs and circular packaging. (Mangiaracina et al., 2015; Dutta et al., 2020; Gonzalez et al., 2023)
- Advanced Algorithms and AI (purple and orange peripheral nodes): artificial intelligence, genetic algorithm and logistics distribution. These are the computational engines behind route generation, automated scheduling and combinatorial optimization in large delivery networks. (Huang et al., 2015; Lee et al., 2023; Prajapati et al., 2023)

Overall, the network shows a closely connected field in which traditional OR methods (optimization, heuristics, simulation) are being combined with newer digital technologies (IoT, big data, machine learning) to tackle practical logistics and sustainability problems. (Kalkha et al., 2023; Verma et al., 2023)

5.6. Integrated Findings

The bibliometric results lead to four main conclusions about OR in e-commerce logistics.

First, the field has grown quickly. Annual output rose from about 15 papers in 2015 to more than 83 in 2023, roughly 5.5 times the starting level. The COVID-19 pandemic, and the need for resilient and flexible distribution systems that came with it, acted as a major catalyst. (Janjevic & Winkenbach, 2020; Risberg, 2023)

Second, there is a solid base of productive authors led by Huang George Q and Pratap Saurabh, along with a growing international research community. The publication pattern also moves from theoretical modeling studies in 2015 to 2017 toward more empirical and applied algorithmic work, with higher citation impact, in 2020 to 2023. (Huang et al., 2015; Prajapati et al., 2023; Verma et al., 2023)

Third, journal patterns show a clear move toward environmental and social sustainability. Sustainability (Switzerland) is the leading source, and Transportation Research Part E, Computers & Industrial Engineering and MSOM are also prominent. This suggests that logistics optimization now has to balance two goals, cost and sustainability. (Mangiaracina et al., 2015; Dutta et al., 2020; Jurburg et al., 2023)

Fourth, the thematic map and keyword network show that the field is interdisciplinary. The literature combines classical mathematical programming methods (mainly VRP variants, mixed-integer programming and genetic algorithms) with newer digital approaches such as IoT tracking, big data analytics, parcel lockers and crowd-shipping. With delivery demand still growing and carbon regulations in cities getting stricter, OR is likely to stay central to designing smarter, more sustainable and more resilient e-commerce logistics networks. (Liu et al., 2020; Ren et al., 2020; Lee et al., 2023; Gonzalez et al., 2023)

6. Future Research Agenda

The bibliometric analysis shows that optimization, digital technology and sustainable distribution are central to OR in e-commerce logistics. As e-commerce operations grow more complex, researchers are working on vehicle routing, warehouse management, inventory allocation and supply chain coordination. Earlier studies have shown that mathematical optimization, AI and data analytics can improve logistics performance (Liu et al., 2020; Verma et al., 2023).

The results also point to gaps. The thematic map and keyword network show traditional OR methods being linked with newer technologies, sustainability goals and customer-focused ideas. These links are already being studied, but we still know relatively little about how well the different approaches work in real operating conditions. The directions below come from the bibliometric analysis and the literature reviewed.

6.1 Integrating AI with Operations Research

AI, machine learning and data analytics offer clear opportunities in demand forecasting, delivery scheduling and logistics resource allocation. Earlier work has looked at algorithmic optimization for rural delivery (Liu, 2020) and at data analytics for e-commerce logistics (Verma et al., 2023).

Future studies could explore hybrid approaches that pair machine learning with mathematical optimization for routing, inventory allocation and warehouse scheduling. Comparative studies could test traditional optimization, AI-based and hybrid methods against measures such as delivery cost, computation time, vehicle utilization and service reliability. This would show when advanced computational techniques actually pay off, and whether the benefits justify the cost of implementing them.

6.2 Green and Sustainable E-Commerce Logistics

Environmental sustainability is now a major concern in e-commerce distribution. Some studies have assessed the environmental impact of B2C e-commerce, and others have built routing models that weigh economic against environmental cost (Mangiaracina et al., 2015; Liu et al., 2020). The bibliometric results also show sustainability and urban logistics as significant themes.

Future work could develop multi-objective models that reduce transportation cost, carbon emissions and delivery time while keeping service at an acceptable level. Electric delivery vehicles, consolidated deliveries, parcel lockers and local distribution hubs could be compared under different operating scenarios. It would also help to study how delivery density, traffic congestion and infrastructure availability affect the performance of sustainable strategies, so that approaches that are both cost-efficient and environmentally responsible can be identified.

6.3 Dynamic Routing and Delivery Planning

Vehicle routing is one of the basic problems in OR, and it comes up constantly in e-commerce delivery. Routing problems are usually classed as static, where all orders are known in advance, or dynamic, where new orders arrive while vehicles are already on the road. Time-dependent routing, delivery time windows and collection arrangements have all been studied (Liu et al., 2020; Amini & Haughton, 2023), and community-based approaches have been examined as a way to organize last-mile delivery (Ouyang et al., 2023).

Future research could build dynamic routing models that use real-time traffic data, changing order volumes, customer availability and delivery priorities. Home delivery, community collection points and parcel lockers could be compared on delivery cost, missed deliveries and service reliability. Another option is to build customer preferences and delivery-time requirements into the routing models, to see how much efficiency can be gained without hurting customer satisfaction.

6.4 Smart Warehousing and Automation

Warehouse operations affect order fulfillment time, inventory levels and overall distribution performance. Existing studies have looked at evaluating smart warehouses, allocating storage locations and building cyber-physical logistics systems for e-commerce (Fan et al., 2022; Wan et al., 2023; Lee et al., 2023).

Future research could examine how robotics, automated picking and intelligent storage allocation can be built into existing warehouse management systems. Comparative studies could measure their effect on order processing time, storage utilization, labor requirements and cost. Whether these technologies are feasible for small and medium-sized enterprises (SMEs) with limited investment budgets is another open question, as are the conditions under which automation brings lasting operational improvements.

6.5 Reverse Logistics and Returns Management

Returns create extra logistics work, including transportation, inspection, storage and redistribution, which makes reverse logistics a considerable challenge. Online retail returns management and sustainable reverse logistics have been studied before, including a multi-objective optimization approach for the Indian e-commerce market (Bernon et al., 2016; Dutta et al., 2020).

A natural next step is a single optimization model that covers both forward delivery and reverse collection. Such a model could help choose collection vehicles, return processing centers and product recovery options while weighing transportation cost, environmental impact and customer service. Researchers could also examine how return volumes, product categories and collection frequency affect the efficiency of reverse logistics networks. That would support better returns management and more sustainable recovery of resources.

6.6 Customer Satisfaction and Logistics Service Quality

Logistics service quality influences customer satisfaction, loyalty and repurchase intention. Earlier research has looked at how customers perceive e-commerce logistics quality, including among Generation Z consumers (Do et al., 2023) and in cross-border e-commerce (Do, Kim, & Wang, 2023).

Future studies could look at how delivery reliability, order tracking, communication, delivery charges and the returns process relate to satisfaction. OR models could include customer-related indicators alongside the usual measures of cost, distance and delivery time. Customer preferences could also be compared across age groups, geographic markets, and domestic versus overseas purchases. Findings like these would help logistics managers design distribution strategies that improve service quality without straining operations.

6.7 Cross-Border E-Commerce Logistics

Cross-border e-commerce needs coordination among sellers, logistics providers, online platforms and customs authorities. Existing work covers logistics coordination (Giuffrida et al., 2020), logistics arrangements (Xue et al., 2022) and mode selection (Li et al., 2023).

Future research could optimize international distribution networks under uncertainty, balancing transportation cost, customs procedures and delivery time. International express services, postal networks, overseas warehouses and other fulfillment options could be compared. The relationship between logistics partners and e-commerce companies, and its effect on overall supply chain efficiency, also deserves a closer look. The results could help companies decide which logistics solution suits which market and product.

6.8 Rural Logistics and Inclusive Distribution Networks

Rural e-commerce logistics has to cope with sparse delivery density, long distances and limited distribution infrastructure. Studies have looked at route optimization for rural e-commerce delivery and at combining rural bus transport with e-commerce distribution (RBE) (Liu, 2020; He et al., 2023).

Future work could examine shared transportation networks, community collection points, rural fulfillment centers and combined passenger and freight services. Optimization models could estimate their effects on delivery cost, vehicle utilization and geographic coverage. Comparing rural and urban networks would also show which delivery strategies suit different infrastructure and demand conditions, and could point toward more accessible, cost-effective e-commerce logistics in underserved areas.

6.9 Directions for Further Bibliometric Studies

This study used publication trends, thematic mapping and keyword co-occurrence analysis to trace how OR in e-commerce logistics has developed. These methods are good at showing the intellectual structure of the field, but they cannot show the practical value of any single technology or optimization model.

Future bibliometric work could look at how research themes changed across different phases of e-commerce growth. It could combine keyword analysis with citation network analysis, thematic evolution and qualitative reading of full texts. More attention could also go to underrepresented regions and less-discussed topics. This would clarify how research priorities have shifted and where more empirical work is needed.

6.10 Concluding Remarks

In short, the research agenda points to the need to close the gap between advances in OR and the practical problems of e-commerce logistics. Further work on intelligent optimization, sustainable distribution, warehouse automation, reverse logistics, customer satisfaction and rural delivery would add to the evidence. Bringing operational, environmental and customer-related goals together in the same models should make e-commerce distribution networks more efficient and more resilient.

7. CONCLUSION

This study set out to understand how research on operations research (OR) in e-commerce logistics has developed, what it has focused on, and where it needs to go next. It combined a systematic literature review with a bibliometric analysis of 851 peer-reviewed journal articles drawn from Scopus, selected through a PRISMA-guided screening of 2,681 initial records. The sections below state how far the objectives were met, what the findings mean for different groups, and where the study falls short.

7.1 Extent to which the research objectives were achieved

The study met most of its five objectives. Two were met only in part.

Objective 1: publication trends by journal, time, author, institution and country. This was largely achieved. Annual output was small between 2015 and 2018, at roughly 15 to 22 papers a year. It rose sharply from 2019 to about 55 in 2020 and 79 in 2021, and peaked at more than 83 papers in 2023, which coincides with the COVID-19 surge in online shopping. The author analysis showed a broad international community led by Huang George Q (16 publications), followed by Pratap Saurabh (9) and Zhang Mengdi (6). Authors came from both engineering and operations management backgrounds, which shows how interdisciplinary the field has become. *Sustainability (Switzerland)* was the leading

journal with 29 articles, alongside core OR journals such as *Transportation Research Part E* and the *European Journal of Operational Research*. The breakdown by institution and country was not carried out, so this part of the objective was only partly achieved.

Objective 2: the most influential studies, models and methods. This was achieved mainly through the thematic map and keyword network rather than citation rankings. The methodological backbone of the field consists of vehicle routing, mixed-integer programming, genetic algorithms and other metaheuristics, multi-criteria decision models such as TOPSIS, AHP and DEA, game-theoretic models and agent-based simulation. Predictive analytics and machine learning have been added more recently. A ranking of the most-cited papers would strengthen this objective further.

Objective 3: how the research has evolved and its current trends. This was achieved. The research moved from theoretical modelling in 2015 to 2017 toward applied algorithmic work in 2020 to 2023, covering crowd-sourced delivery, parcel lockers, real-time routing and electric delivery fleets. The rise of *Sustainability (Switzerland)* shows that logistics optimization now has to balance cost against environmental goals.

Objective 4: whether past studies lean toward particular segments of e-commerce logistics. This was achieved. The thematic map showed motor themes (e-commerce platforms, reverse logistics, cross-border logistics), niche themes (multi-criteria decision models, urban parcel logistics, game-theoretic fulfilment), basic themes (sustainability and urban logistics, optimization algorithms) and emerging or declining themes (richer routing variants and uncertainty methods). The keyword network confirmed four clusters: optimization and decision-making, digital platforms and cross-border logistics, green and urban logistics, and advanced algorithms and AI. Last-mile delivery and sustainability dominate, while rural logistics, customer-centred models and integrated forward-and-reverse flows are comparatively underdeveloped.

Objective 5: research gaps and future directions. This was achieved through the future research agenda in Section 6. It proposes eight directions:

- integrating AI with OR through hybrid learning-and-optimization models;
- green and sustainable logistics through multi-objective models;
- dynamic routing and delivery planning with real-time data;
- smart warehousing and automation, including whether it is feasible for small and medium-sized enterprises;
- reverse logistics and returns management through combined forward-and-reverse models;
- customer satisfaction and logistics service quality;
- cross-border logistics under uncertainty;
- rural and inclusive distribution networks.

Directions for further bibliometric work were also suggested.

Taken together, the study achieved its aim of giving an integrated picture of the field. Its main message is that OR in e-commerce logistics has moved from abstract mathematical modelling to practical tools for omni-channel distribution, urban delivery, automated fulfilment and green logistics. The remaining gap is in how well these methods work in real operating conditions.

7.2 Implications

Academic implications. The study contributes to the body of knowledge by providing the first integrated map of OR research in e-commerce logistics. Earlier reviews tended to focus on one technology or theme, such as big data analytics, AI, returns management, cross-border trade or warehouse robotics. This study links them within one framework of publication trends, influential contributors and thematic relationships. It shows that classical OR methods are increasingly combined with digital technologies such as IoT, big data and machine learning. It also identifies underdeveloped areas, which gives researchers a clear and evidence-based agenda. The thematic classification into

motor, niche, basic and emerging themes can guide scholars in choosing topics, journals and collaborators, and the methodology can be replicated for other logistics fields.

Managerial implications. For logistics managers and practitioners, the study shows where proven methods exist and where they are still developing. Routing heuristics, inventory allocation models, warehouse scheduling and multi-criteria evaluation of logistics providers are mature, while real-time dynamic routing, hybrid AI-optimization models and automated warehousing are newer. Managers can use this to decide where to invest. The findings also stress that logistics decisions must balance several goals at once, namely cost, delivery speed, customer service and sustainability. The review points to practical options such as parcel lockers, consolidated deliveries, local distribution hubs, community collection points and integrated returns handling. It also raises the question of whether automation is affordable for smaller firms, which matters for small and medium-sized businesses with limited budgets.

Social implications. The research connects logistics to wider social development. The prominence of sustainability research shows growing concern about emissions, congestion, fragmented deliveries and packaging waste in cities. More efficient and greener delivery systems can improve urban air quality and reduce traffic. The emphasis on rural logistics and shared transport, such as combining rural bus services with e-commerce distribution, points to ways of extending online retail to underserved areas, which supports more inclusive access to goods and services. Better reverse logistics supports resource recovery and a more circular economy. Improving service quality and delivery reliability benefits consumers directly.

Policy implications. Policymakers can use the findings to support smarter regulation and infrastructure. Cities could encourage low-emission delivery through electric vehicles, consolidated deliveries and shared parcel-locker and micro-hub infrastructure. Cross-border e-commerce would benefit from simpler customs procedures and better coordination among sellers, logistics providers, platforms and customs authorities. Rural areas need investment in delivery infrastructure and incentives for shared transport networks. Governments and industry bodies could also promote data sharing and standards that allow the digital and AI-based approaches in the literature to be applied widely and fairly. Stricter carbon regulation in cities will keep increasing the need for models that weigh cost against environmental impact.

7.3 Limitations of the research

The study has several limitations, which should be considered when interpreting the results.

1. Single database. The data come only from Scopus. Relevant work indexed in Web of Science, Google Scholar or other databases may be missing.
2. Restricted document types and language. Only English-language peer-reviewed journal articles were kept. Conference papers, book chapters, notes and editorials were excluded, as were non-English publications. This improves reliability but leaves out emerging ideas that often appear first at conferences and research from non-English-speaking regions.
3. Search string limits. The query “(ecommerce OR online shopping) AND (supply chain OR logistics)” is broad, but it may miss studies that use other terms, such as “omnichannel”, “last-mile”, “parcel delivery” or the hyphenated “e-commerce”.
4. Method limits. Bibliometric analysis shows the volume, structure and relationships within a body of research, but it cannot judge the quality of individual studies or show how well any method performs in practice. The classification of themes and clusters also involves some researcher judgement.
5. Tool dependence. The results depend on the software and settings used, including Biblioshiny, VOSviewer, Tableau and Excel. Different clustering parameters could produce slightly different thematic maps.

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