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Exploring the Evolution of Distribution in E-Commerce: A Bibliometric Analysis

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Abstract

Purpose: This study systematically uses bibliometric analysis to explore and evaluate research on distribution in e-commerce. **Research design, data, and methodology:** The dataset includes 5,169 publications (articles, books, conference papers, reviews, editorials, and corrections) extracted from the Scopus database, spanning from 1977 to 2024, involving 9,284 researchers from 2,326 sources across 70 countries. **Results:** Using the Biblioshiny tool in the R programming language, keyword co-occurrence analysis was performed, revealing seven key research clusters: E-commerce and related factors, Customer Experience and Sentiment Analysis, Technology and Big Data, Data-driven Analysis and Clustering, Algorithms and Distribution, Sustainability and Last-Mile Logistics, and Supporting Technologies in E-commerce. **Conclusions:** The findings highlight the evolution of these themes over four distinct developmental phases. China leads the world in publications, reflecting significant investment in e-commerce and logistics, while developed countries, such as the U.S., India, South Korea, and the U.K., show substantial research engagement in distribution within e-commerce. The study provides a comprehensive overview of the trends and future directions in this field, offering insights into the key technological advancements, sustainability efforts, and the global distribution of research contributions.

Keywords: E-commerce, Online Retail, Distribution, Logistics Distribution, Bibliometrics.

JEL Classification Code: M10, M19, M30

1. Introduction

In recent years, e-commerce has emerged as a thriving field, offering numerous new business opportunities worldwide (Janjevic & Winkenbach, 2020; Zhou et al., 2024). Integrating digital platforms into business operations has transformed how consumers shop and introduced new distribution and logistics management challenges. As businesses increasingly shift to online retail, the demand for effective distribution strategies has become crucial, especially in optimizing costs and ensuring products are

delivered quickly and efficiently to consumers (Zhou et al., 2024). Despite its rapid growth, e-commerce distribution still faces numerous challenges, including shipping costs, delivery times, and the need for service flexibility.

A critical aspect of this transformation is the evolution of distribution strategies, encompassing the complex processes involved in delivering products and services to online consumers efficiently and cost-effectively. This research undertakes a bibliometric analysis to systematically explore and evaluate the existing academic literature on distribution within the e-commerce domain. Our primary

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aim is to understand the historical development, key themes, and emerging trends in this crucial area of research. Specifically, this study seeks to answer the following research questions:

- RQ1:** Which publishing trends, countries, organizations, and authors have contributed most to this field?
- RQ2:** What are the main research topic clusters in e-commerce distribution?
- RQ3:** What are the research trends of the research clusters, which topics are trending, and which are emerging or declining in the field of e-commerce distribution?

Previous research on e-commerce has often focused on broader aspects such as consumer behavior (Khoa, 2023), online marketing strategies (Nguyen & Khoa, 2019), and platform development (Zhu & Iansiti, 2019). While these areas are undoubtedly important, the specific challenges and complexities of e-commerce distribution have received comparatively less attention. This study addresses this gap by providing a comprehensive overview of the research landscape related to distribution within e-commerce. Understanding the evolution of distribution strategies is crucial for several reasons. First, it allows businesses to optimize logistics operations, reduce costs, and improve delivery times, enhancing customer satisfaction and competitiveness (Konstantopoulou et al., 2019). Second, it helps identify emerging trends and technologies, such as blockchain and artificial intelligence, that can transform distribution networks and enable new business models (Singh et al., 2023). Third, it informs policymakers and regulators about the challenges and opportunities associated with e-commerce distribution, facilitating the development of supportive policies and regulations. The lack of bibliometric studies on distribution highlights a significant gap that must be addressed to systematize and clarify its role within the e-commerce ecosystem. For instance, Hu and Chuang (2022) explored ways to optimize warehouse layouts to improve distribution efficiency. Meanwhile, DeValve et al. (2023) clarified the role of flexibility in fulfillment and how it influences the distribution strategies of online retailers. Trends in multi-channel distribution have also been highlighted, and Cicea et al. (2022) provided an in-depth perspective on multi-platform distribution strategies. Advanced technology continues to play a crucial role in e-commerce distribution. Wang et al. (2023) focus on how blockchain can enhance transparency and security in the supply chain. Gong (2023) highlights that digital transformation is an inevitable factor and a lever for optimizing distribution systems. Additionally, the logistics challenges in distribution, such as last-mile delivery and urban delivery optimization, are intensely discussed in Patowary et al. (2021) and Silva et al. (2023).

This study utilizes data from the Scopus database, encompassing 5,169 research papers published between 1977 and 2024. The bibliometrix package in RStudio analyzes keywords and research trends and identifies influential authors, countries, and organizations in e-commerce distribution. The findings of this study provide valuable insights for researchers, practitioners, and policymakers seeking to understand the evolving landscape of e-commerce distribution and its implications for the future of online retail.

2. Methodology

A search query was applied to the Scopus database to find published studies on distribution in e-commerce. Scopus is the best-organized database and adheres to the highest quality standards (Kumar et al., 2020). Furthermore, it is widely recognized as one of the most relevant indexed research publication databases for social science fields (Santos et al., 2022). The terms used in the Scopus database include variations of distribution and e-commerce.

The search string was executed on December 02, 2024. To ensure the comprehensive collection of research papers related to the distribution in e-commerce, a broad search string was employed, combining the most common keywords related to: "distribution" AND ("e-commerce" OR "e-commerce" or "online commerce" OR "etail" OR "Online retail"). In the initial phase, the search string was applied without limitations, returning 7,427 documents; subsequently, following the strategy of previous works (Jia & Jiang, 2018; Kim & So, 2022; Perez-Vega et al., 2022), the first selection criterion was to limit the search to the title-abstract-keywords field, resulting in 5169 documents.

This information has been transferred into a CSV file, an input data source for the bibliometric analysis process. Bibliometric analysis is a valuable research method that allows researchers to perform quantitative analysis across various research outcomes, helping to assess the development and trends of a specific research field. This method provides advantages in objectivity and reliability in data analysis (Aria & Cuccurullo, 2017) and enables researchers to gain a comprehensive overview of existing contributions and research outcomes (Rita & Ramos, 2022). Utilizing bibliometric analysis clarifies current research trends and patterns and creates opportunities to identify gaps in knowledge, thereby opening up new and feasible research directions in the future (Sharma et al., 2020).

This study used the "bibliometrix" program developed in the R programming language by Aria and Cuccurullo (2017). It integrates the most well-known bibliometric tools for citation analysis. (Fosso Wamba, 2020; Jelvehgaran Esfahani et al., 2019; Pourkhani et al., 2019) allows for the

comprehensive examination of research literature and provides researchers with deep insights into developments across various fields.

Table 1: Descriptive Statistics

Description	Results
Timespan	1977-2024
Sources (Journals, Books, etc)	2326
Documents	5169
Annual Growth Rate %	10.96%
Document Average Age	9.61
Average citations per doc	14.51
Keywords Plus (ID)	19864
Author's Keywords (DE)	11376
Authors	9284
Authors of single-authored docs	836
Single-authored docs	949
Co-Authors per Doc	2.79
International co-authorships	13.87
Article	2345
Book	12
Book chapter	143
Conference paper	2353
Conference review	131
Editorial	3
Erratum	5
Note	13
Report	1
Retracted	16
Review	133
Short survey	14

Source: Author's analysis

3. Result

To gain an overview of the research landscape surrounding Distribution in E-commerce, we present a comprehensive analysis of general statistics derived from the dataset. The selected articles, meeting the specified search criteria, were evaluated across various dimensions, aligning with established bibliometric practices (Zupic & Čater, 2014): research productivity over time, document and source types, language of publication, subject areas, most prolific publication sources, geographical distribution of publications, most active institutions, authorship patterns, keyword analysis, title and abstract analysis, and citation analysis.

3.1. Publication Trends

The research trend on distribution in e-commerce has undergone four main development phases from 1997 to

2024. During the initial phase (1997–2003), the number of published papers grew slowly and lacked a clear focus, starting with 24 papers in 1997 and rising to 146 in 2003. This period marked the emergence of e-commerce and preliminary studies on modern distribution systems. From 2004 to 2011, research entered the growth phase, driven by the rapid development of e-commerce platforms and the increasing demand for logistics system innovation. The number of publications rose steadily yearly, peaking at 239 papers in 2011 during this phase. However, from 2012 to 2016, the trend entered a stagnation phase, with the number of publications gradually declining, ranging between 119 and 165 papers per year. This phase may reflect a temporary saturation as researchers shifted their focus to other related technological fields. Notably, from 2017 to 2024, the topic experienced a significant boom, particularly following the COVID-19 pandemic. Disruptions in global supply chains highlighted the critical role of distribution and logistics in e-commerce, leading to a marked increase in research. The number of publications peaked at 436 in 2023 before slightly declining to 398 in 2024. These trends reflect the ongoing evolution of e-commerce while emphasizing the vital role of distribution in meeting the growing demands of the global market.

3.2. Most Cited Publications

The top 10 most cited papers in the field of e-commerce distribution reflect the strong development of research on supply chain optimization and distribution strategies.

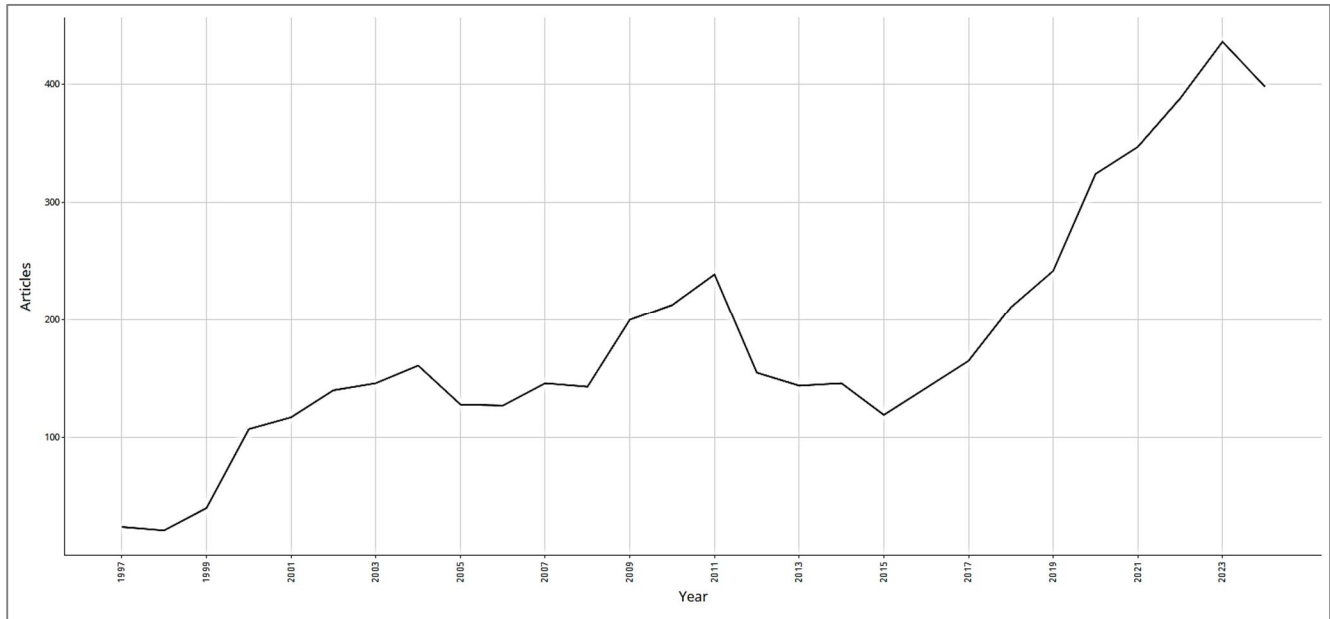
The paper by Chiang et al. (2003), with 1,557 citations, leads the list, emphasizing the optimization of processes in e-commerce models and supply chain management. Following closely is Tsay and Agrawal (2004) research with 890 citations, focusing on distribution strategies in manufacturing and product management environments. The studies by Abhishek et al. (2016) and Buyya et al. (2003), with 738 and 686 citations, respectively, have also significantly contributed to improving supply chain models and optimizing product distribution in e-commerce systems and cloud computing.

Additionally, the works of Shaikh and Karjaluo (2015), Hendricks et al. (2006), and Daskin et al. (2002) focus on distribution models and decision-making in manufacturing and logistics environments, reflecting the increasing demand for optimization methods in complex industries. Research by Brynjolfsson et al. (2011) and Grossmann (2005) has also been influential in studying the impact of information technology and optimization methods on product distribution.

Finally, the paper by Horton and Chilton (2010), with 444 citations, explores the impact of user interfaces and supporting technologies in e-commerce. These highly cited

works have strong connections to prestigious specialized journals and highlight the importance of these studies in

improving the efficiency and productivity of distribution systems in e-commerce.



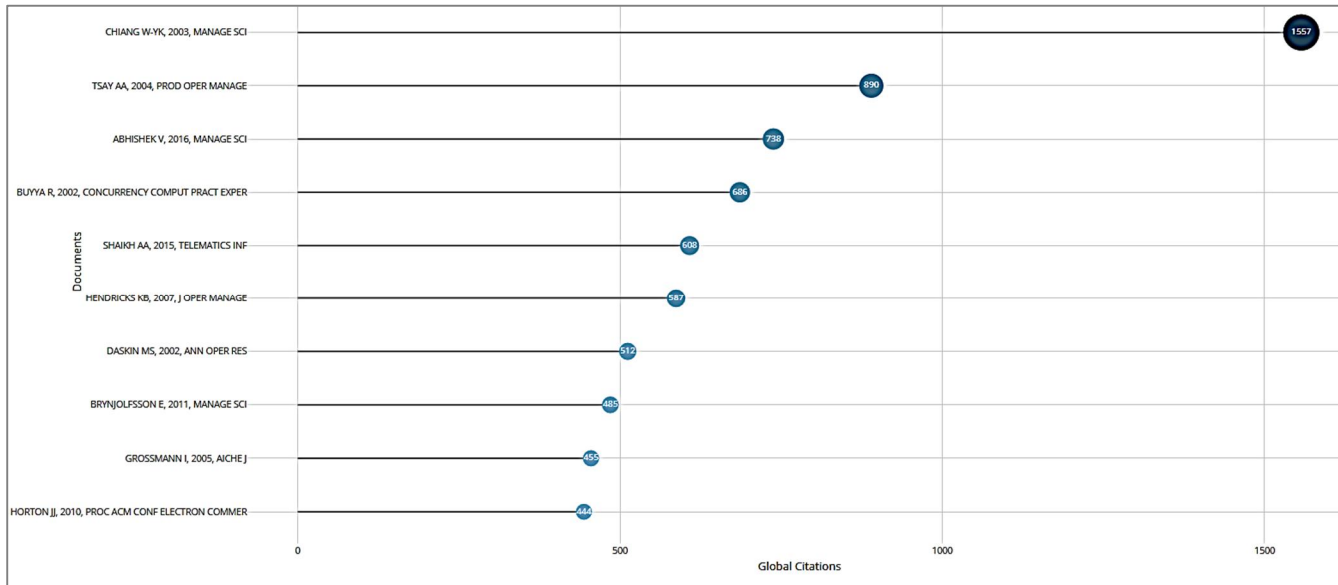
Source: Visual map extracted from Rstudio

Figure 1: The Distribution of Studies over the Years

Table 2: The top 10 most cited papers in the field

Document	Title	Keywords	Citations
Chiang et al. (2003)	Direct Marketing, Indirect Profits: A Strategic Analysis of Dual-Channel Supply-Chain Design	Channels of distribution; Competitive strategy; E-commerce; Game theory; Internet/direct marketing; Supply chain management	1557
Tsay and Agrawal (2004)	Channel conflict and coordination in the e-commerce age	Catalog sales; Channel conflict; Channels of distribution; Coordination; Direct sales; Dual distribution; e-commerce; Game theory; Intermediaries; Internet commerce; Mathematical modeling; Resellers; Retail sales; Supply chain management	890
Abhishek et al. (2016)	Agency selling or reselling? Channel structures in electronic retailing	Cross-channel spillovers; Distribution channel; e-commerce; Game theory; Multichannel retailing; Platform retailing; Retail competition	738
Buyya et al. (2003)	Economic models for resource management and scheduling in grid computing	Grid economy; Resource management; Scheduling; Worldwide computing	686
Shaikh and Karjaluoto (2015)	Mobile banking adoption: A literature review	Literature review; M-banking; Mobile banking; Mobile banking adoption; Technology acceptance model	608
Hendricks et al. (2006)	The impact of enterprise systems on corporate performance: A study of ERP, SCM, and CRM system implementations	Customer Relationship Management (CRM); Enterprise Resource Planning (ERP); Supply Chain Management (SCM)	587
Daskin et al. (2002)	An Inventory-Location Model: Formulation, Solution Algorithm, and Computational Results	Distribution center (DC); Solution Algorithm; Computational Results; Inventory-Location	512
Brynjolfsson et al. (2011)	Goodbye Pareto principle, hello long tail: The effect of search costs on the concentration of product sales	Concentration; e-commerce; Internet; Long tail; Product sales; Product variety; Search cost	485
Grossmann (2005)	Enterprise-wide optimization: A new frontier in process systems engineering	Enterprise-wide optimization (EWO);	455
Horton and Chilton (2010)	The labor economics of paid crowdsourcing	amazon's mechanical turk; crowdsourcing; human computation	444

Source: Author's analysis



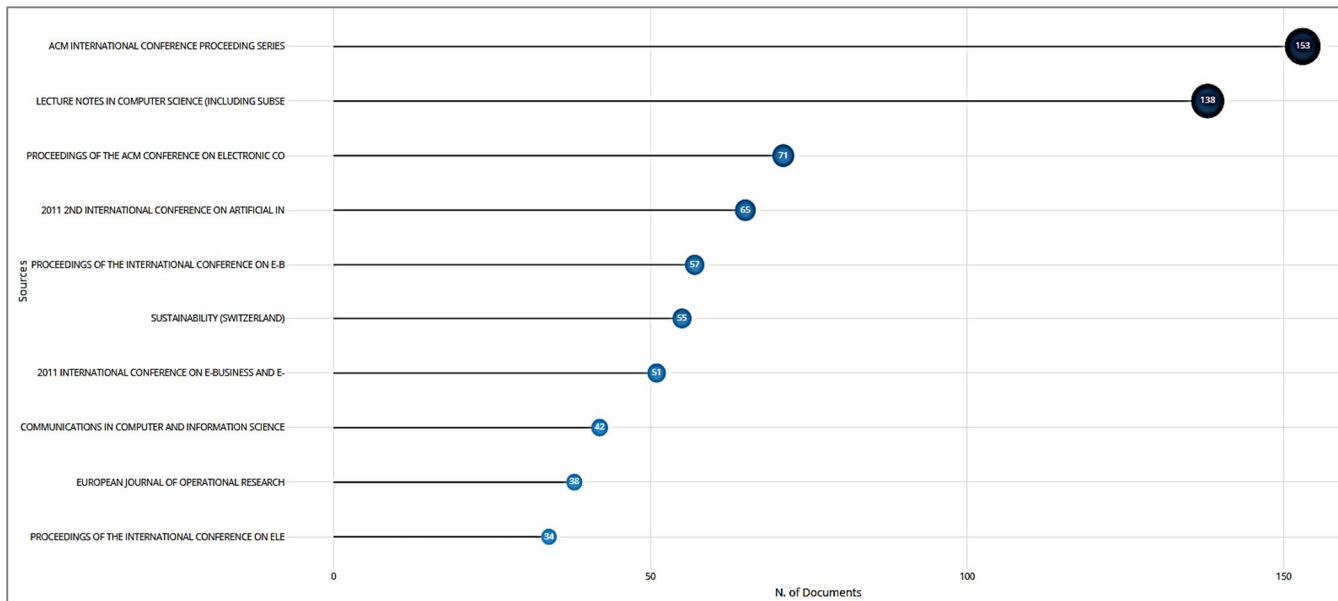
Source: Visual map extracted from Rstudio

Figure 2: Most Cited Publications

3.3. Most Contributing Sources

Research on e-commerce distribution has been widely published in several major international journals and conferences, demonstrating the academic community's strong interest in this topic. The ACM International Conference Proceeding Series tops the list with 153 publications, underscoring its role in advancing technological research related to e-commerce. Following closely are

Lecture Notes in Computer Science, encompassing branches such as Artificial Intelligence (AI) and Bioinformatics, with 138 papers indicating the integration of e-commerce with advanced technologies. The ACM Conference on Electronic Commerce ranks third with 71 publications, focusing on the strategic and technical aspects of e-commerce. International conferences like AIMSEC 2011 (65 papers) and ICEE 2010 (57 papers) also contribute significantly, highlighting the convergence of AI, management



Source: Visual map extracted from Rstudio

Figure 3: Most contributing sources

science, and e-commerce. The journal *Sustainability* (Switzerland), with 55 publications, reflects growing attention to sustainability issues in e-commerce supply chains and logistics. Conferences related to e-government, such as ICEE 2011 (51 papers), also critically showcase the intersection of e-commerce and public policy. Additionally, sources like *Communications in Computer and Information Science* (42 papers), the *European Journal of Operational Research* (38 papers), and the *Proceedings of the International Conference on Electronic Business (ICEB)* (34 papers) continue to expand research coverage, including operational management and business innovation.

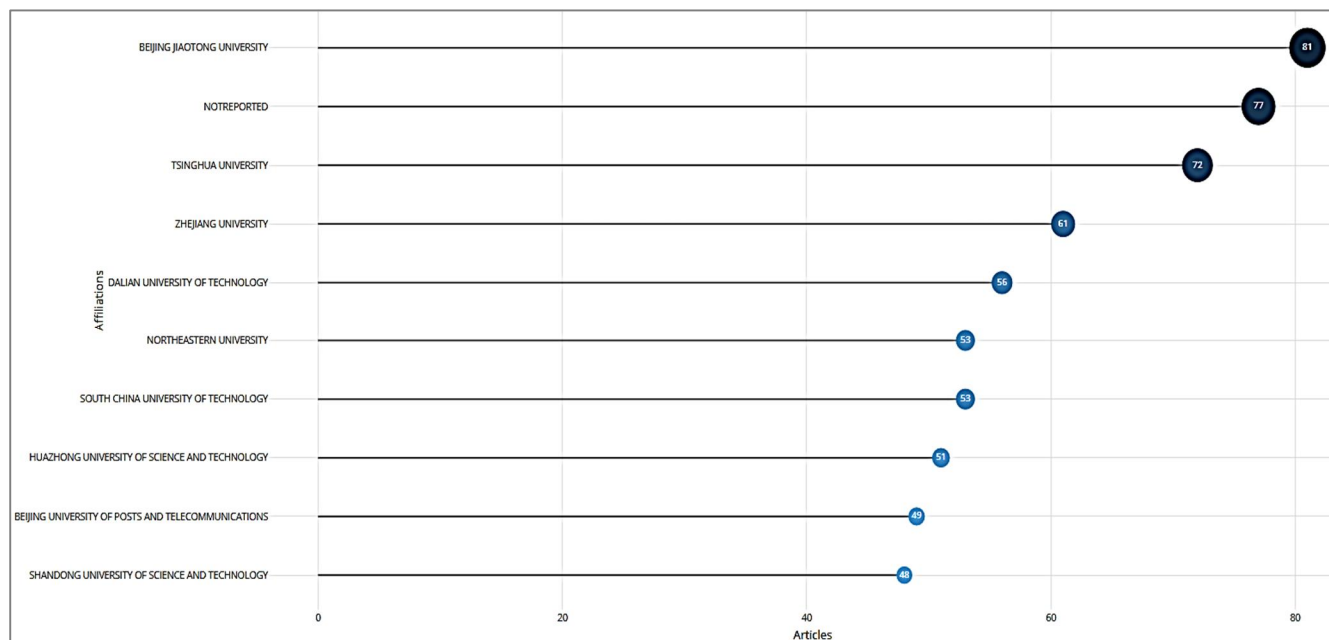
This distribution emphasizes the importance of leading sources in encouraging multidisciplinary research across technology, management, and sustainability to meet difficulties in modern e-commerce distribution and logistics.

3.4. Most Contributing Institutions

The top 10 universities researching distribution in e-commerce are predominantly from China, with Beijing Jiaotong University leading the list with 81 publications. This university excels in studies on smart logistics and optimizing distribution processes in e-commerce. With 72 publications, Tsinghua University has also made significant contributions, particularly in modeling distribution and supply chains, emphasizing the application of AI and big

data technologies. Zhejiang University (61 publications) extensively optimizes last-mile delivery in e-commerce, while Dalian University of Technology (56 publications) specializes in intelligent logistics systems and integrating new technologies into supply chains. Universities like Northeastern University and South China University of Technology, each with 53 publications, contribute to enhancing distribution and transportation efficiency in the global e-commerce environment. Huazhong University of Science and Technology (51 publications) concentrates on applying cloud computing and AI to optimize distribution models, while Beijing University of Posts and Telecommunications (49 publications) explores the application of telecommunications technology in logistics. Shandong University of Science and Technology (48 publications) primarily researches distribution systems to reduce costs and improve transportation efficiency in supply chains.

These universities' dominance reflects China's robust growth in researching and applying technologies in e-commerce, particularly in distribution. Their studies focus on optimizing supply chains and logistics and leveraging advanced technologies such as AI, big data, and cloud computing to develop innovative and efficient distribution solutions. These contributions have a profound impact on driving innovation in the global e-commerce and logistics sectors.



Source: Visual map extracted from Rstudio

Figure 4: Most Contributing institutions

3.5. Most Contributing Countries

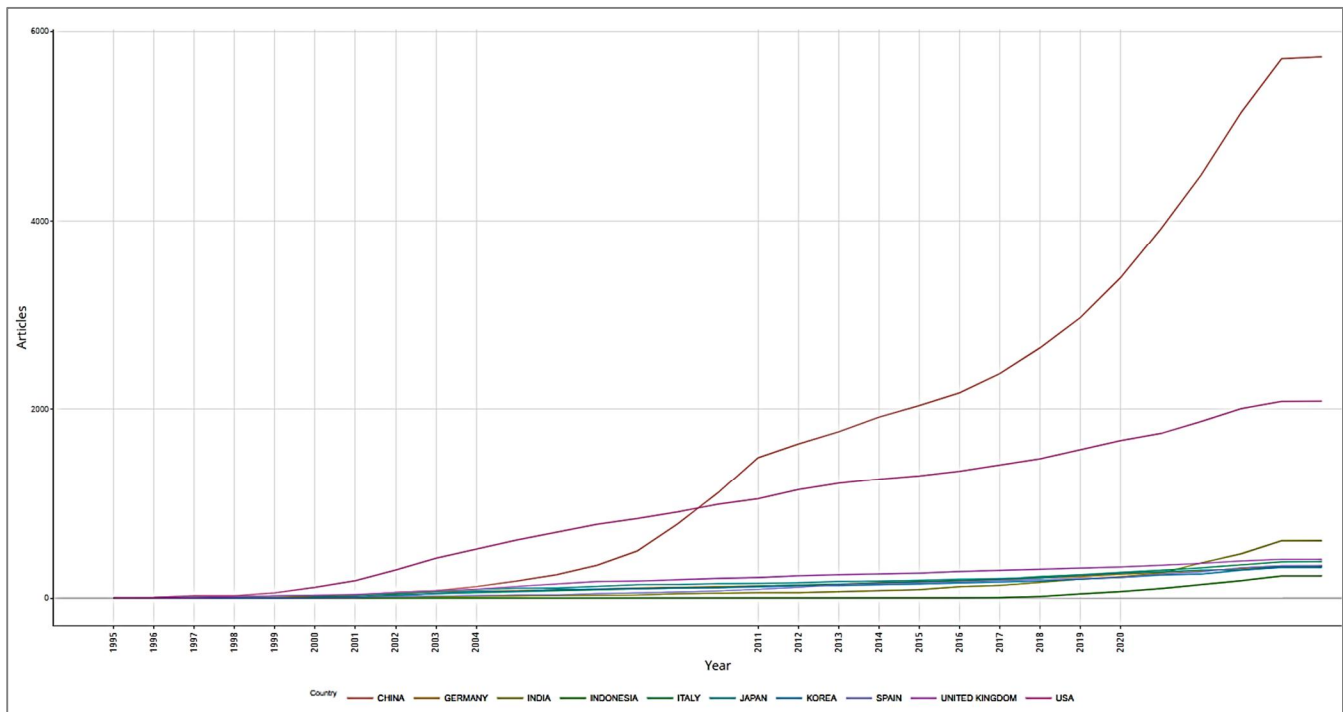
Research on distribution in e-commerce has involved contributions from over 70 countries, with China leading the field, accounting for 1,507 publications or 29.15% of the total. Most of these are domestic studies (1,353 SCP), while international collaborations (154 MCP) comprise 10.22% of China's output. This reflects China's role as a global leader in e-commerce, supported by major platforms like Alibaba and JD.com. Furthermore, other major e-commerce platforms in China, such as Taobao, Douyin, and 1688.com, have substantially contributed to the industry's growth. These platforms demonstrate the broad consumer demands of the Chinese market and promote innovation in logistics, digital payments, and distribution technologies. Their influence explains why China has emerged as a hotspot for e-commerce distribution research and development, supporting innovations that have a global impact on supply chain optimization and technology innovation. The United States ranks second with 425 publications (8.22%). It demonstrates a high level of international collaboration (15.76% MCP), reflecting active participation in multinational studies and leveraging strengths in technology, logistics, and big data. With 116 publications (2.24%), India stands out for its high international collaboration rate (19.83% MCP), indicating its rapid digital economy expansion and robust global academic ties.

Table 3: Countries with the Highest Number of Publications

COUNTRY	N	N%	SCP	MCP	MCP %
China	1507	29,15	1353	154	10,22
USA	425	8,22	358	67	15,76
India	116	2,24	93	23	19,83
Korea	99	1,92	86	13	13,13
United Kingdom	92	1,78	65	27	29,35
Germany	77	1,49	65	12	15,58
Italy	75	1,45	63	12	16,00
Spain	68	1,32	59	9	13,24
Canada	55	1,06	43	12	21,82
Japan	52	1,01	48	4	7,69

Source: Author's analysis

In East Asia, South Korea and Japan play significant roles. South Korea has published 99 papers (1.91%), focusing primarily on domestic research with a smaller share of international collaboration (13.13% MCP). Despite having only 52 publications (1.01%), Japan emphasizes studies on automation and robotics in logistics. Countries like the United Kingdom, Germany, and Italy make noteworthy contributions to Europe. The United Kingdom, with 92 publications (1.78%), boasts an impressive international collaboration rate (29.35% MCP), highlighting its active engagement in multinational projects and European Union initiatives. Germany (77 publications) and



Source: Visual map extracted from Rstudio

Figure 5: Country Production over Time

Italy (75 publications) focus on smart logistics and sustainable supply chains, with collaboration rates of 15.58% and 16% MCP, respectively. Lastly, countries like Spain and Canada also play significant roles. Spain emphasizes last-mile delivery solutions with a collaboration rate of 13.24% MCP, while Canada focuses on sustainable logistics and e-commerce policies, featuring a high collaboration rate of 21.82% MCP. These contributions underscore the global nature of e-commerce distribution research, with each region leveraging its unique strengths to address diverse challenges and innovate within the industry.

Figure 5 presents a time-based bar chart of the number of publications by country. China (orange), the United States (pink), and India (olive green) are the earliest countries to research the topic of distribution in e-commerce. They are followed by countries such as South Korea, the United Kingdom, Germany, Italy, Spain, Canada, and Japan. China continuously leads in the number of studies, which has increased tremendously since 2011. Its research volume and tempo significantly outpace those of other countries, with consistent and significant gains over time.

Meanwhile, other countries have continued consistent efforts in this area, with no indications of slowing. This trend suggests that e-commerce distribution is a global subject that many governments are interested in and exploring. It emphasizes the global relevance of providing new and practical solutions to the issues of modern e-commerce.

3.6. Most Frequently Used Keywords

As shown in Figure 6, this research's most frequently occurring keywords highlight key factors and emerging trends in distribution and e-commerce. Leading the list are "e-commerce" (765 mentions) and "electronic commerce" (260 mentions), underscoring the intense focus on the e-commerce sector in the modern context. "Logistics" (124 mentions) and "supply chain management" (90 mentions) frequently appear, emphasizing the critical role of managing and optimizing transportation and supply chain processes in e-commerce. "Distribution" (84 mentions) reflects the connection between goods distribution and online business activities. Keywords such as "game theory" (59 mentions) and "genetic algorithm" (53 mentions) indicate the application of mathematical and optimization methods in designing distribution strategies and managing supply chains. The prominence of "big data" (48 mentions) highlights the importance of leveraging large-scale data analytics to enhance customer experiences and optimize distribution strategies. Similarly, "online shopping" (48 mentions) and "e-business" (47 mentions) reflect the robust growth of online retail and internet-based business operations. Notably, "COVID-19" (43 mentions) captures the pandemic's profound impact on e-commerce and the surge in online shopping and distribution demands during this period. Lastly, "pricing" (41 mentions) underscores the importance of pricing strategies in optimizing profitability within e-commerce.



Source: Visual map extracted from Rstudio

Figure 6: Treemap of Top 15 Most frequently occurring keywords

These keywords encapsulate the core aspects of distribution and e-commerce research, spanning advanced technological applications, economic considerations, and the transformative effects of global events like the pandemic.

4. Discussion

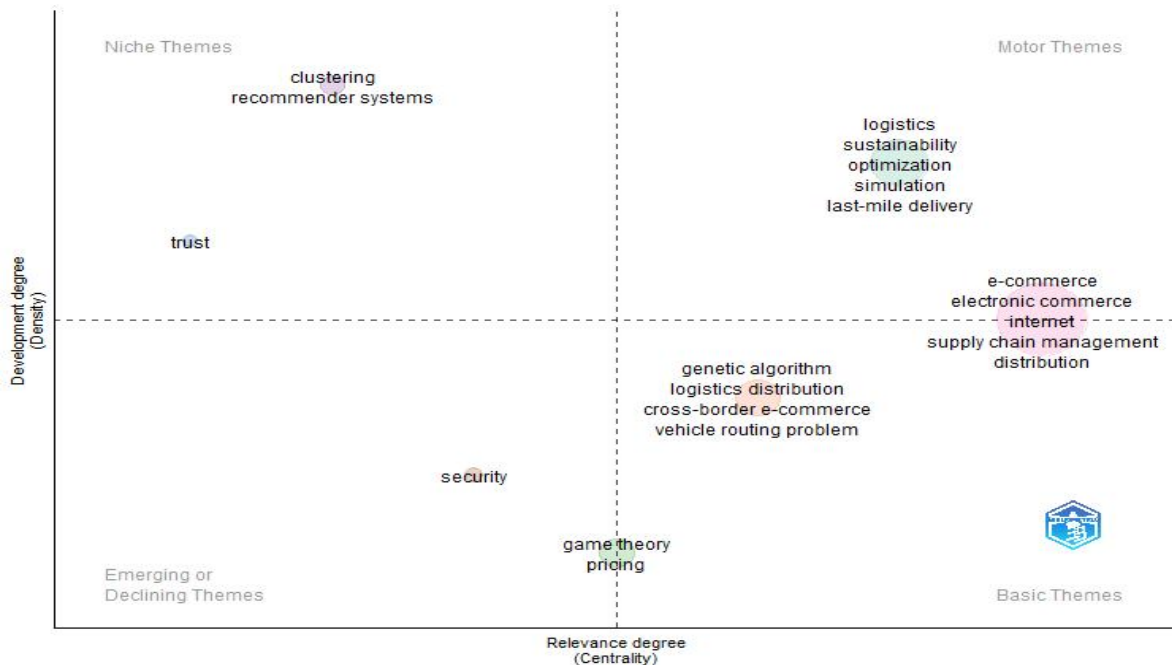
Using the bibliophily technique in the R programming language, a thematic map of keywords (Figure 7) was created, identifying 100 high-frequency keywords related to distribution in e-commerce (each appearing at least 10 times). The thematic map revealed core patterns through co-word analysis (Eduardsen & Marinova, 2020). The results align with previous research by Cobo et al. (2011), indicating that the closer the terms and the darker the connecting lines, the higher the co-occurrence frequency within clusters. This reflects strong relationships among keywords in the broader research context. The analysis uncovered seven primary keyword clusters, each emphasizing a distinct research focus, methodology, or core domain. These clusters delve into various dimensions of the overarching topic, highlighting unique aspects of distribution in e-commerce. The thematic map provides insights into how specific research themes are interrelated, offering a foundation for future exploration and highlighting the multidimensional nature of distribution research in e-commerce.

4.1. E-commerce and Related Factors

The red cluster, the keyword group representing the most prominent topic in the e-commerce distribution network, includes key factors such as e-commerce, logistics, supply chain management, distribution, and online shopping (Gong, 2023; Ruangtip et al., 2024). This cluster occupies a significant portion of the research context on e-commerce distribution, reflecting the core of delivering goods and services to consumers in the digital economy.

Among them, e-commerce is an important term, with a high centrality score of 888.44, indicating its central role in connecting other topics. E-commerce directly links to the internet, supply chains, pricing, and consumer behavior, emphasizing its foundational position in the broader distribution network (De et al., 2023).

Other key terms in this cluster include logistics, which is related to the movement and management of goods in e-commerce systems, and supply chain management, an essential framework for optimizing operations and reducing costs in distribution. The appearance of China in this cluster also highlights the country's central role in global e-commerce distribution networks, which serve as a hub for manufacturing and logistics. There is a significant amount of research related to the keyword "China" concerning cross-border B2C (Giuffrida et al., 2017), Digital platforms (Zhang, 2020), drivers, and barriers to Omni-channel retailing (Ye et al., 2018).



Source: Visual map extracted from Rstudio

Figure 7: Thematic Map

Keywords such as blockchain, game theory, and vehicle routing problems illustrate the growing role of technology and optimization techniques in the distribution process. For example, blockchain is being researched for its potential to improve transparency and security in the supply chain (Tseng et al., 2018), while game theory is applied to optimize decision-making processes in distribution strategies (Anupindi et al., 2001).

Moreover, topics like pricing, trust, security, and distribution channels reflect current concerns related to consumer experience, data protection, and the development of delivery methods (Khoa & Nguyen, 2022). Finally, COVID-19 is also mentioned, highlighting the pandemic's impact on distribution strategies, driving research on how to adjust e-commerce systems to cope with new challenges, such as changes in consumer behavior (Dumanska et al., 2021; Nhung et al., 2023) and supply chain disruptions (Suguna et al., 2021). In summary, this cluster emphasizes the complexity and interconnectedness of e-commerce distribution, where technological advancements, global logistics, consumer behavior, and operational strategies combine to shape modern distribution practices.

4.2. Customer Experience and Sentiment Analysis

The second purple cluster, including keywords like *customer satisfaction* and *sentiment analysis*, revolves around customer satisfaction and sentiment analysis, emphasizing the importance of understanding and improving the customer experience in e-commerce. As businesses strive to differentiate themselves in a competitive market, the ability to assess customer sentiment has become a valuable asset (Muangpan, 2022).

Sentiment analysis, supported by Natural Language Processing (NLP), analyzes customer feedback from product reviews, social media comments, and surveys (Manohar Singh & Singh, 2018). Customer satisfaction is also measured through real-time metrics such as the Net Promoter Score (NPS) and integrated feedback on e-commerce platforms (Chen et al., 2020). This information allows businesses to address issues, drive loyalty, and retain customers proactively.

4.3. Technology and Big Data

This cluster includes keywords such as *big data*, *machine learning*, *artificial intelligence*, and *internet of things*, which play a significant role in e-commerce distribution research. These technologies are crucial in optimizing distribution operations, automating processes, and improving the ability to predict consumer behavior in the e-commerce environment. *Big data* has the highest betweenness in this cluster, indicating its central role in

analyzing and processing large volumes of information. It helps collect and analyze vast amounts of data related to consumer behavior (Wu & Lin, 2018), while *machine learning* and *artificial intelligence* assist in optimizing distribution strategies and predicting demand. The *Internet of Things (IoT)* also contributes to improving warehouse management, transportation, and order tracking, helping to reduce costs and enhance efficiency in e-commerce distribution systems.

4.4. Data-driven Analysis and Clustering

This cluster focuses on applying *data mining* and *clustering* in e-commerce, demonstrating the power of data-driven methods in enhancing decision-making effectiveness. As businesses generate large amounts of structured and unstructured data, data mining has become a key pillar in analysis (Wang et al., 2017), helping to uncover patterns and trends in customer behavior as well as operational efficiency.

Clustering methods, such as *K-means* or *hierarchical clustering*, are used to group customers or products based on common characteristics, helping personalize marketing strategies and optimize inventory (Ali Elsiddig & Mejri, 2022). For example, clustering algorithms can identify customer segments with similar preferences, allowing businesses to tailor products or shipping services to enhance customer satisfaction (Zheng et al., 2023).

4.5. Algorithms and Distribution

This cluster revolves around keywords such as *genetic algorithm*, *logistics distribution*, and *cross-border e-commerce*, emphasizing optimizing logistics processes and addressing challenges in cross-border e-commerce. Applying algorithms like *genetic algorithms* helps solve complex problems related to warehousing and distribution (Hu & Chuang, 2022). *Cross-border e-commerce* adds a layer of complexity, presenting issues related to international regulations, customs clearance, shipping costs (Han et al., 2022), and currency exchange (Mu et al., 2021).

4.6. Sustainability and Last-Mile Logistics

This cluster includes keywords such as *sustainability*, *optimization*, *last-mile delivery*, *last-mile*, *urban logistics*, and *city logistics*, reflecting the growing interest in sustainable development and improving last-mile logistics in e-commerce.

Sustainability is a key factor in developing environmentally friendly logistics models (Nogueira et al., 2021), helping to reduce carbon emissions, optimize operational processes, and protect natural resources. *Last-mile delivery* and *last mile* are crucial concepts, indicating

the most costly and challenging phase in the supply chain, where goods are delivered from distribution centers to consumers. Optimizing this process reduces shipping costs, enhances customer satisfaction, and reduces environmental impact, especially in urban areas. *Urban logistics* (Janjevic & Winkenbach, 2020) and city logistics (Boysen et al., 2020) address solutions to improve transportation systems in urban environments, where fast and efficient delivery is becoming increasingly important. Finally, *optimization* is central to improving last-mile logistics, from optimizing delivery routes, reducing logistics distribution costs in B2C e-commerce, improving distribution efficiency, and increasing the competitiveness of B2C e-commerce logistics distribution to efficient resource allocation (Zhao et al., 2020).

All these factors contribute to a strong trend in last-mile logistics, helping tackle e-commerce challenges and minimize environmental impact. This cluster represents a shift from purely profit-maximizing goals to integrating sustainability and optimization into logistics strategies. This helps businesses achieve operational efficiency and strengthens their responsibility towards the community and the environment.

4.7. Technology Support in E-Commerce

This combined cluster is formed by four smaller groups (*recommender systems*, *e-commerce platforms*, *cloud computing*, and *collaborative filtering*), complementing each other and reflecting foundational technologies and applications in modern e-commerce.

Recommender systems are crucial in personalizing the customer experience and optimizing revenue by suggesting products tailored to users' preferences. *E-commerce platforms* provide an online trading environment, connecting sellers and buyers while supporting sales management, payments, and shipping activities. *Cloud computing* offers flexible and reliable infrastructure, reducing the need for physical infrastructure investment and optimizing processes and data management. Finally, *collaborative filtering* uses community data to predict user preferences, a critical component of recommender systems, improving the accuracy of recommendations and enhancing consumer experience in e-commerce. These elements work together to form an efficient e-commerce ecosystem, supporting businesses in optimizing processes and delivering better customer service.

Niche themes are highly developed topics that focus on specialized areas within logistics and e-commerce. Prominent topics such as Clustering and Recommender Systems primarily relate to data analysis, helping optimize logistics and personalize the user experience. Trust is a critical factor in e-commerce, playing a key role in building

customer loyalty and driving online transactions. Niche Themes represent in-depth research and application fields, providing complementary value to drive more significant trends within the industry.

Motor themes represent key trends and significant logistics and supply chain management development. The central theme is Logistics, which plays a crucial role in supply chain management and is enhanced by technologies like AI, IoT, and Blockchain, improving performance and enabling more intelligent decision-making. Sustainability emphasizes environmentally friendly solutions, reducing emissions, and promoting the use of renewable energy. Optimization and Simulation help optimize transportation and inventory management through modeling and risk prediction. Last-mile Delivery and Urban Logistics focus on fast and efficient delivery solutions, particularly in densely populated urban areas. These trends will shape the future of logistics, providing long-term and sustainable value for the supply chain.

Emerging or Declining themes reflect trends that are either emerging or gradually losing importance. Security remains crucial for protecting data and cybersecurity in e-commerce and logistics but may be gradually replaced by newer technologies like blockchain. Although strong in strategic analysis, Game Theory is seeing a decline in practical applications due to the rise of modern data analytics tools. While not a dominant trend, these topics still hold supplementary value in risk management and strategic decision-making in supply chains.

Basic themes are core topics in e-commerce and logistics, including E-commerce, Supply Chain Management, Internet, Distribution Logistics Distribution, Cross-border E-commerce, Vehicle Routing Problems, and Genetic Algorithms. These themes support industry development, with E-commerce being the primary driver. Supply Chain Management and Distribution help optimize transportation and distribution processes. Cross-border E-commerce expands global business, while Genetic Algorithm addresses optimization problems, such as the Vehicle Routing Problem, helping reduce costs and delivery time. These topics provide a solid foundation, supporting the development of advanced trends in the industry.

5. Conclusion

This study uses bibliometric analysis to organize and evaluate research on distribution in e-commerce systematically. The dataset consists of 5,169 publications (including articles, books, conference papers, conference reviews, editorials, and corrections) extracted from the Scopus database, covering the period from 1977 to 2024 (with no search time limit), authored by 9,284 researchers

from 2,326 sources across 70 countries worldwide. We used the Biblioshiny program in the R programming language to analyze keyword co-occurrence.

The study provided an overview of the topic. The topic has evolved through four development stages (1977-2003; 2004-2011; 2012-2016; 2017-2024), with the 2017-2024 period showing significant growth, peaking in 2023 with 436 publications. 9,284 researchers from 2,326 publication sources across 70 countries worldwide have contributed to the research. China is the leading country with the most publications (1,507 articles, accounting for 29.15% of the total), showing significant interest in e-commerce in general and distribution systems in e-commerce in particular. Other top 10 countries with the most publications on the topic include the United States, India, South Korea, and the United Kingdom (all of which are developed countries), indicating that these countries have more research interest in e-commerce distribution than developing nations. Through keyword co-citation analysis, we also identified 7 main research clusters: e-commerce and related factors; customer experience and sentiment analysis; technology and big data; data-driven analysis and clustering; algorithms and distribution; sustainability and last-mile logistics; technology support in e-commerce.

Several promising avenues for future research emerge from this analysis. First, further investigation is needed to explore the challenges and opportunities associated with emerging technologies in e-commerce distribution, such as blockchain, artificial intelligence, and the Internet of Things. Research could focus on how these technologies are being adopted and integrated into distribution networks and their impact on efficiency, cost, and customer satisfaction. Second, more research is needed on the sustainability aspects of e-commerce distribution, including the environmental impact of last-mile delivery and the development of green logistics solutions. Third, future studies could explore the cross-cultural differences in e-commerce distribution practices and the challenges of managing global supply chains online. Fourth, a deeper dive into specific regional trends, particularly in rapidly developing e-commerce markets, would provide valuable insights. Finally, qualitative research, such as case studies and interviews, could complement the quantitative approach used in this study and provide a richer understanding of the practical challenges and solutions in e-commerce distribution. These themes reflect a dynamic research ecosystem, balancing innovation, operational efficiency, and foundational knowledge, which will guide the future of logistics and e-commerce. Research on distribution in e-commerce is expected to continue growing, driven by technological advancements, environmental requirements, and the need for efficient global supply chains. Trends such as urban logistics, AI-powered operations, and sustainable

methods will continue to lead, opening new frontiers for innovation in logistics and distribution.

This bibliometric analysis has provided a comprehensive overview of the research landscape surrounding e-commerce distribution, revealing key trends, influential contributors, and emerging research clusters. The study makes several significant contributions, both theoretical and practical.

Theoretical contributions: Theoretically, this study contributes to the body of knowledge by systematically mapping the intellectual structure of e-commerce distribution research. By identifying distinct research clusters and their evolution over time, the study offers a framework for understanding the development of this field and its relationship to broader e-commerce research. Analyzing keyword co-occurrence and citation patterns provides insights into the field's underlying theoretical foundations and conceptual connections. This framework can guide future research by highlighting areas where further theoretical development is needed.

Managerial implications: Practically, this study offers valuable insights for businesses operating in the e-commerce space. By understanding the key trends and challenges in distribution, companies can develop more effective strategies for optimizing their logistics operations, reducing costs, and improving delivery times. Identifying influential authors, institutions, and publications provides a roadmap for practitioners seeking to stay abreast of the latest research and best practices in e-commerce distribution. The findings also have implications for policymakers and regulators tasked with creating a supportive environment for the growth of online retail.

This study acknowledges certain limitations. First, the analysis is based on data from the Scopus database, which, while comprehensive, may not capture all relevant publications on e-commerce distribution. Including data from other databases, such as Web of Science, could broaden the scope of the analysis. Second, the study primarily focuses on keyword analysis, which may not fully capture the nuances of the research topics. Further analysis of full-text articles could provide a more in-depth understanding of the research themes. Third, the bibliometric approach is inherently quantitative and may not fully capture qualitative research in this field.

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