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RESEARCH ARTICLE

The Rising Trends of Smart E-Commerce Logistics

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ABSTRACT Smart Logistics (SL) offers a competitive advantage for e-commerce by utilizing Information and Communication Technologies (ICT) such as IoT, AI, Blockchain, Cloud computing, 5G, etc. This technology automates, optimizes, and enables real-time tracking and monitoring of shipments, predicts, and prevents delays, and optimizes delivery routes and schedules. It also provides greater visibility and control, allowing e-commerce businesses to react quickly and efficiently to changes in demand or supply. The purpose of this study is to investigate the impact of digitalization on trade logistics in e-commerce, emphasizing the significance of smart logistics for the e-commerce industry. We reviewed 288 articles published in the last decade in the Scopus database to assess the maturity of research in this area. For researchers, this study provides a better understanding of smart e-commerce logistics and identifies research gaps in the literature. For e-commerce professionals, it can help them adopt the latest technological trends in their logistics. Through a systematic literature review and network analysis approach, the study has contributed by identifying 5 clusters related to ICT application fields in e-commerce and 5 clusters related to important ICT enablers in smart logistics. We also identified several research gaps and areas for future study, including the underutilization of computer vision technology and the need for further research on product quality inspection and accessibility for people with disabilities. Additionally, we suggest exploring the power of deep learning to solve Vehicle Routing Problems (VRP) and optimizing sensing data volume for minimizing costs associated with data storage and transfer. This study provides a comprehensive overview of the state of the art in smart logistics for e-commerce and serves as a guide for future research in this field.

INDEX TERMS Smart logistics, SL, smart e-commerce logistics, ICT, trends, supply chain, information and communication technologies, artificial intelligence, e-commerce logistics, cloud computing, 5G, blockchain.

I. INTRODUCTION

In recent years, e-commerce retail sales have grown rapidly, making it difficult for professionals to keep up with customer demands and stay competitive in the global market [1] Traditional logistics methods have hindered the development of e-businesses, as costs and delays have become major issues that customers cannot afford [2] To address this, e-businesses need to enhance their logistics by adopting sustainability enablers to increase their agility [3] The emergence of information and communication technology (ICT) has attracted significant attention from industry and academia worldwide, leading to a major shift towards digital transformation in many areas, including global supply chain management [4]. An intelligent supply chain provides e-commerce companies with a competitive advantage by prioritizing customer expectations, such as security, personalization, reasonable costs, and on-time delivery (OTD) [5]. However, there are currently no systematic reviews that focus on intelligent e-commerce logistics, with most researchers only exploring the application of ICT in supply chain management [1], [4], [6] cloud computing [7], big data and artificial intelligence [8], or IoT technology [9]. Recently in 2021, Issaoui et al performed a literature analysis of 108 articles in the field of Intelligent Logistics, including articles from Springer, IEEE, Science Direct, and Google Scholar databases in this study, authors extensively discussed the contribution of information technology in logistics, however, their research does not focus on e-commerce logistics context [10].

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In this paper, we present a comprehensive exploration of the latest trends in the application of digital technologies in e-commerce logistics. Our research aimed to answer two primary research questions:

1) What are the hottest trends in smart logistics (SL) literature in e-commerce, and what are the different Information and Communication Technologies (ICT) used in e-commerce logistics?
2) How has smart logistics (SL) evolved within e-commerce literature since its emergence, and what are the main countries and international collaborations contributing to its growth?

This paper presents a comprehensive analysis of the latest trends and insights in smart logistics within e-commerce, aiming to encourage new researchers to contribute to the field and to aid practitioners in developing effective e-commerce logistics strategies. Our approach involves a combination of systematic literature review and bibliometric analysis to identify influential researchers, articles, and countries, cooccurrence keywords, and high-impact journals in the field, also to give a full vision of these technologies contribution. To achieve these goals, we used the PRISMA framework for paper selection and the VOSviewer software package for bibliometric and network analysis. The methodology is detailed in the second section of the paper, and the results of the SLR and network analysis are presented in the third section. Finally, the paper concludes with a discussion of the limitations of the study and suggests future research initiatives in the fourth section.

II. SYSTEMATIC LITERATURE REVIEW AND NETWORK ANALYSIS

Literature reviews play a crucial role in advancing research in positivist approaches [11]. To achieve this, it is necessary to critically reflect on current positivist practices and carefully consider interactions within the supply chain domain [12]. One effective method for studying a topic under investigation is systematic literature and network analysis (SLNA) [13]. By combining the methods of systematic literature research (SLR) and bibliographic network analysis, as proposed by Colicchia and Strozzi [14], this methodology is well-suited to the strategy developed for answering research questions in the previous section.

The SLNA methodology consists of two steps. In the first step, visualization and analysis of the bibliographic network are performed, and the PRISMA framework for paper selection is used to enable readers to assess the quality of methods and validity of findings, as shown in Figure 2 [15]. Instead of the CIMO method used in the SLNA demonstration by Colicchia and Strozzi [14], the PRISMA framework is employed. In the second step, visualization and analysis of the bibliographic network are performed using the VOSviewer software package, which facilitates bibliometric analysis and provides clear visualization [16]. By combining these two methodologies, the aim is to maximize the benefits of delivering high-quality results, optimizing analysis objectives, and ensuring consistent results. However, both qualitative and quantitative features are combined to evaluate existing theories.

The SLR method is a valuable tool that allows for analysis with minimal bias and summarizes the state-of-the-art of a specific subject by systematically evaluating relevant findings from recent research studies [17]. Furthermore, SLR enables the selective collection of databases by including the sequential identification, screening, clustering, and evaluation of the dataset [18]. Its replicability as a method-driven approach has motivated the authors to adopt it as a pillar of this study, in addition to bibliometric analysis. SLR provides a reliable and robust method that can be readily applied to a broad field of research to select the most appropriate contributions.

To answer the second research question, authorship, keyword, citation, and co-citation analyses were conducted. The frequency of citations reflects the quality or academic influence of articles and authors [19]. The citation network analysis enables the identification of the journals and papers that have made the most significant contributions to theory-building in a specific research field.

A. SCOPE OF THE STUDY

This study provides literature analysis and insights on smart e-commerce logistics and answers the two RQs in the previous section. There are numerous literature reviews on the smart logistics context. However, all of them sidelined the hottest trends of smart logistics for e-commerce. Beyond the pandemic covid 19 and the Russian-Ukrainian Crisis in 2022; Cyber-attacks, frauds, and the difficulty of managing a very large number of orders become a concern for the e-retailer who needs to take an urgent decision at every stage of the process [20]. Fortunately, technological progress is moving forward at a fast pace, reflected by scientific research in this field. Since our study focuses on the latest trends in information and communication technologies (ICT) solutions for E-commerce. Taking into consideration the accelerated technological revolution in many fields of ICT within the last decade. The rise of artificial intelligence (AI) is notable, with the creation of the chatbot "Eugene Goostman," which passed the Turing test in 2014 [21], and the release of Microsoft Tay, an AI-powered chatbot that can mimic human-like conversations on Twitter in 2016 [22]. Deep neural networks have also shown their capabilities, as demonstrated by the creation of Alpha-Go, which defeated humans in the game of GO due to increased computational power, enabling machine learning algorithms to handle a vast number of input variables and make fast and precise decisions [23]. The period has also seen significant advancements on the Internet of Things (IoT) technologies, such as the invention of the smartwatch with embedded sensors that can recognize objects in 2012 [24]. Blockchain-as-a-service and cloud-based IoT were launched respectively in 2015 and

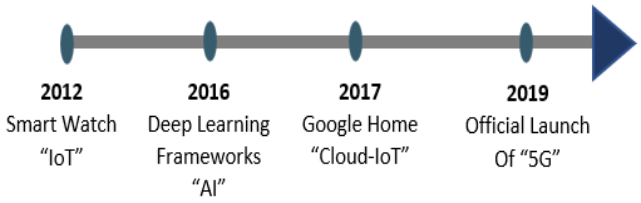

FIGURE 1. Timeline of ICT innovations (2012-2022).

2016. The appearance of Google Home in 2017 as an ecosystem of sensors and AI to serve humans is an excellent example of collaboration between AI and IoT [25]. The development of deep learning frameworks such as Google TensorFlow in late 2015 and Meta PyTorch in late 2016 has made it effortless to develop deep learning models, without starting from scratch. Google Tensor Processing Units (TPUs) have been available since 2018 [26]. The emergence of 5G, which officially launched in 2019, is expected to activate the full potential of IoT and cloud computing, with extended coverage, lower latency, and connection density of massive bandwidth. The ICT technology revolution of the last decade, as shown in Figure 1, motivated our team to investigate literature on this topic exclusively during this period, and this paper focuses on literature from 2012 to 2022.

Our systematic literature review (SLR) focused on collecting datasets from the Scopus database, which provides almost 60% more coverage than the Web of Science database [27]. Scopus is known for its extensive and authoritative content, which includes records from reputable publishers such as Elsevier, Springer, and IEEE, instead of mass publications [28]. Given the comprehensive nature of Scopus, we determined that an additional review of other databases would not significantly contribute to our study. To ensure that our SLR was valuable to users, we followed the PRISMA method 2020 proposed by Matthew et al. to capture all relevant information [29] Figure 2. To identify relevant literature, we used a keyword approach that crisscrossed keywords related to the five emerging ICT areas (AI, IoT, Cloud Computing, Blockchain, 5G) and Smart Logistics with keywords related to e-commerce. To further limit our search to this field, we screened article titles, abstracts, and keywords in the subject areas of "engineering," "business, management, and accounting." We limited our search to conference papers, conference reviews, articles, or reviews to ensure that only high-quality studies were considered. The final meta-search query was formulated as follows: TABLE 1: TITLE-ABS-KEY (IoT OR AI OR "Artificial Intelligence" OR "Internet of Things" OR Blockchain OR "Cloud Computing" OR 5G OR "Smart Logistics" AND e-Commerce) AND (LIMIT-TO (DOCTYPE, "cp") OR LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "cr") OR LIMIT-TO (DOCTYPE, "re")) AND (LIMIT-TO (SUBJAREA, "ENGI") OR LIMIT-TO (SUBJAREA, "BUSI")) AND (LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015) OR LIMIT-TO (PUBYEAR, 2014) OR LIMIT-TO (PUBYEAR, 2013) OR LIMIμT-TO (PUBYEAR, 2012)) AND (LIMIT-TO (LANGUAGE, "English"))

TABLE 1. Characteristics of the search string.

Keyword 1	Keyword 2	Include	Exclude	Type[1]
Artificial Intelligence	E-Commerce	English	Other languages	CP
Internet of Things		2012 - 2022	Before 2012	RE
Cloud Computing		Scopus	Other Databases	AR
Blockchain				CR
Smart Logistics				
5G				
AI				
IoT				

To ensure the accuracy of our dataset, we categorized the identified records into three groups based on their relevance to the topic, following the approach suggested by Woschank et al. [18]. To obtain clear research results, we carried out a two-step screening process. In the first step, we examined the title and abstract of the studies to eliminate the least relevant records. In the second step, we conducted a thorough reading of the full text to identify articles that provide significant contributions to ICT in smart e-commerce logistics, while excluding those that only discuss general topics or inspire literature reviews.

B. LITERATURE SURVEY APPROACH

This study used a systematic literature review and bibliometric analysis to investigate the application of digital technologies in e-commerce logistics from 2012 to 2022. The systematic literature review analyzed 48 papers to identify the latest trends in smart logistics literature, specifically exploring the most interesting uses of cloud computing, blockchain, AI, IoT, and 5G in smart logistics and measuring their impact on e-commerce businesses. The bibliometric analysis examined 288 selected papers to investigate the growth and evolution of smart logistics in e-commerce literature, with the aim of quantifying the research in this field. It analyzed how smart logistics has evolved within e-commerce literature since its emergence, and identified the main countries, influential researchers, and articles in this field, also cooccurrence network analysis to identify potential collaboration between these technologies to empower the logistics capabilities.

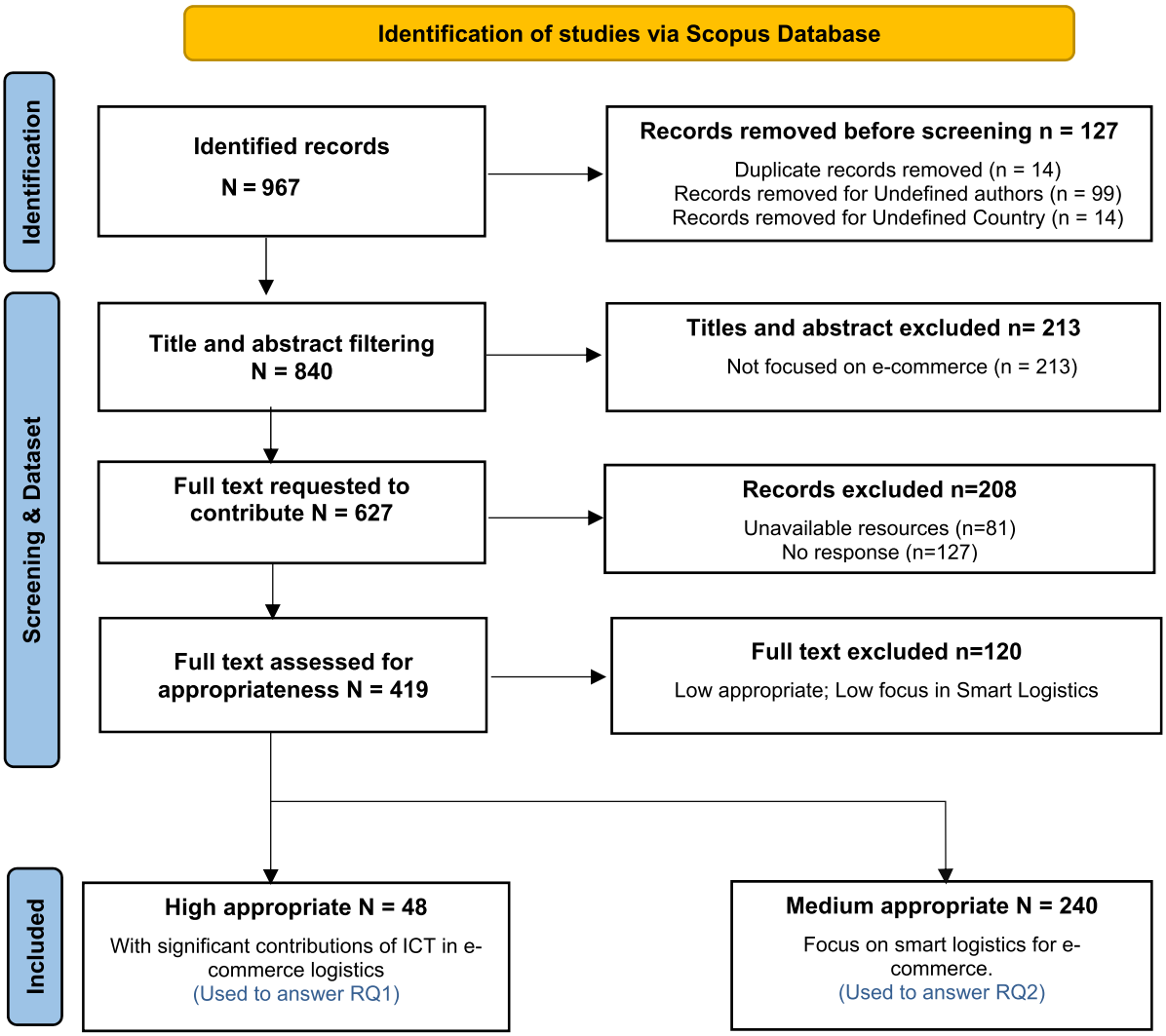

FIGURE 2. Dataset collection map (PRISMA).

III. FINDINGS AND DISCUSSION

A. RQ1: WHAT ARE THE HOTTEST TRENDS OF SMART E-COMMERCE LOGISTICS IN THE LITERATURE

To advance research in the field, the authors focused on 48 articles that made significant contributions and conducted a thorough analysis of each application area along the value stream. Most of these contributions were in the form of case studies, as shown in Figure 3. Through this analysis, the authors identified five clusters related to the use of digital technologies in e-commerce logistics. These clusters are described in the following paragraphs and summarized in Table 2.

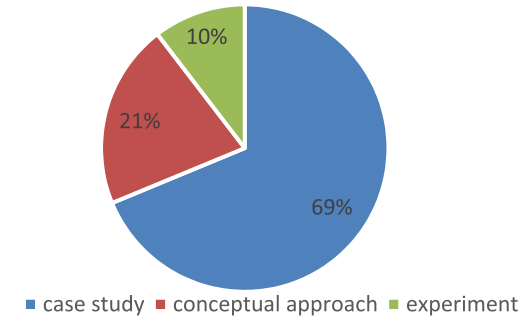

FIGURE 3. Classification of the dataset by type of study.

1) PROCUREMENT

Online retail requires special agility toward demand variations, seasonal fluctuations, the bull-wipe effect, and stockless policy. To increase profitability and avoid shortfall or over-storage by ensuring an optimal inventory turnover. The promoting factor is forecast reliability and digitalization of the procurement process [78]. Only 13% of the identified articles were assigned to the cluster "Procurement" application field. 2 papers are targeting demand forecasting, and the others are targeting Negotiation Competency. Although

TABLE 2. Clustering of the identified studies.

No.	Application areas	References	Records	Records (%)
1	Procurement	[30]–[35]	6	13
2	Warehousing	[36]–[45]	11	23
3	Marketing	[46]–[56]	11	23
4	Sales and after-sales service	[57]–[70]	13	27
5	Shipment and Reversed logistics	[71]–[77]	7	15

some works dealt with this topic, this application area is still an emerging research field with much need for further investigation and case study applications especially in demand forecasting, as it is one of the most important pillars in e-commerce businesses. e.g., to deal with the bull-wipe effect to ensure tangible benefits across the whole supply chain.

Demand forecasting (2 contributions): Terrada et al. proposed a demand forecasting system based on deep learning to deal with regression problems. Long Short-Term Memory (LSTM) shows a better result compared to ARIMA in this case study [30]. The use of neural networks for this purpose is also confirmed by Aci et al. in their study, who proposed LSTM as an effective model for demand forecasting among 26 algorithms of DL and ML [31].

Negotiation Competency (4 contributions): More et al. was one of the very first researchers to propose an agent-based negotiation system using cloud computing for an effective e-negotiation with better security and low resource consumption [34]. Vij et al. Propose rule-based and case-based reasoning algorithms for bilateral and multilateral accurate E-Negotiation with win-win strategy [33] in the same field as other contexts, Simkova and Smutny proposed a digital form of negotiation (E-Negotiation) based on Genetic Algorithm (GA) method for online dispute resolution more practical solution to replace traditional e-mail negotiation [32]. Jiang et al. Proposed a privacy-preserving business protocol based on private smart contracts (Blockchain) in the negotiation phase [35].

The Procurement cluster in online retail requires agility towards demand variations and stockless policies. It is an emerging research field with a need for investigation, especially in demand forecasting. Two articles propose demand forecasting systems based on deep learning and neural networks, respectively. The other articles focus on Negotiation Competency, with four contributions proposing agent-based, rule-based and case-based reasoning algorithms, digital forms of negotiation, and privacy-preserving business protocols based on private smart contracts.

2) WAREHOUSING

Inventory management has got a strategic place in the e-commerce value stream. It has a strong link with procurement and demand forecasting. The main warehousing activities are receiving goods, storage, and orders preparation including some value-added tasks (picking, kitting, packaging…) [79]. Operational efficiency and proactivity are the key factors for this important link in the e-commerce value stream. The warehouse is a large field of automation, route optimization, and digitalization. A total of 23% of the identified articles were assigned to the cluster ''Warehousing'' most of these articles dealt with reliability because reliable and real-time data is a key competitive advantage for e-commerce businesses.

Inventory reliability (5 contributions): In e-commerce logistics, hazards impact the schedule smoothness, and the risk of human errors in manual tasks increases consequently, reliable inventory and real-time data are the keys to business success. In this context, Kalkha et al. proposed a new concept of picking areas, equipped with load cells to communicate real-time inventory to reinforce RFID solutions for small items (SKUs) in picking areas enhancing inventory reliability and procurement visibility to avoid inventory shortage [43]. Shouborno et al. suggest a new concept of moving conveyors that sort e-commerce items with the help of sensors to gain more precision for small e-commerce systems to eliminate the risk of placing a wrong entry in packaging and predict inventory shortage [40] The Warehouse environment is exposed to a set of constraints (luminosity variation, dust…) and the activity in many of e-commerce warehouses and Hubs is extended to night shift. Chen et al. worked on the problem of QR codes in uneven illumination in warehouse automatic sorting systems. They proposed Otsu's method to binarize the QR code. The detailed process of binarization is to use the window selected adaptively to divide the QR code image. Then, each piece of image is binarized by the Otsu method and combined sequentially to reconstruct the QR code. The method can eliminate the impact of the uneven illumination of the QR code effectively [39] The ensure full-time data transfer under adverse conditions, Emil et al. 2021 proposed a management system based on 5G networks that can be used more efficiently for an IoT-enabled supply chain, this paper proposed a system for proactively using NS to adapt the 5G network elements along a Smart Logistics distribution chain. 5G communication technology features ultralow latency, high-speed broadband, and massive access, enabler of cloud computing and big data solutions for logistics [58]. Guo et al. 2021 studied the acquisition, storage, and transfer of sensory data from sensors in e-commerce, and they propose a storage method for massive sensing data processing, which makes full use of the IoT storage

resources. The authors Compare the localization effect using 6 algorithms. AHSL0 has a better result among the 5 algorithms tested in the experience of trajectory tracing and forecasting [37].

Order Picking Route Optimization (3 contributions): Xu et al. proposed an algorithm based on Ant Colony Optimization (ACO) to improve the data picking system; their experiment shows that the optimized picking path is 8,34 % shorter than the WMS route [42]. In the same context Xin et al. 2019 proposed an algorithm based on text clustering and correlation analysis called BTC for storage location-allocation, this algorithm determines the storage location of SKUs in the warehouse, and the positions of related products (items usually shipped together) are close to each other. Which reduces the total order picking distance and improves the efficiency of warehouse operation. The algorithm clusters SKUs using text analysis, and the clusters undergo a correlation leading to SKU location-allocation. BTC shows a better result compared to (COL) policy and the class-based storage location (CBSL) policy to allocate the storage location [41]. Issaoui et al. proposed (LSTM) model to optimize resource allocation and enhance task scheduling in a smart logistics framework. The approach based on the LSTM model is more convenient for real-time resource allocation (response time 50s) and the proposed approach is suitable for real-time scheduling [38].

Minimize inventory cost (3 contributions): To minimize the overall inventory cost. Preil et al. proposed The Monte Carlo tree search (MCTS) to tradeoff between backorders (inventory shortage) and extra storage cost approach by eliminating the bullwhip effect. The objective function focuses on minimizing overall supply chain costs, by absorbing the bullwhip effect. MCTS Showed a better result compared to reinforcement learning (RL) and Genetic Algorithm (GA) by analyzing lead times and customer demand dataset [36]. Wanganoo to Proposed a conceptual framework to integrate IoT in WMS in the context of 3PL e-commerce to reduce inventory cost and time in the return management process by enhancing the real-time visibility of Warehouse operations in Reverse logistics, using cloud IoT (Internet of Things) and RFID, the system connects WMS and TMS for reversed logistics [44]. Zhang et al. proposed a new concept of smart durable packaging management. Using sustainable and cost-effective packages for logistics tasks distribution in e-commerce. Clustering customers' orders and optimizing the box fulfillment. In the context of physical internet PI and 3PL e-commerce increase logistics efficiency [45].

Operational efficiency and proactivity are vital in this area, and there is a growing trend towards automation, route optimization, and digitalization. Reliable and real-time data is essential for successful e-commerce businesses. The most significant focus in warehousing is inventory reliability, where several proposals aim to minimize human error and prevent inventory shortages. Additionally, there are efforts to optimize order picking routes and minimize inventory costs. These proposals include algorithms based on ant colony optimization and text clustering, a model based on LSTM, and a conceptual framework that integrates IoT in WMS.

3) MARKETING

To sell via e-commerce, there must be customers and therefore bring them to your store website. The goal is to increase the traffic to your e-commerce (number of visits), encourage the visitor to navigate your site (bounce rate), and convert the visitor into a customer (conversion rate). ICT had manifested in selecting niches, identifying needs, and providing customized content to visitors privately. Marketing is a major strength of e-commerce compared to brick-and-mortar. Many studies on ICT have been conducted to unlock the full potential of digital marketing. A total of 23% of the identified articles were assigned to the cluster ''Marketing'' Our sample covered several digital marketing types. Researchers should focus more on product marketing and pricing accuracy to get exceptional performance.

Strategic marketing (2 contributions): Zhao et al. proposed a model based on blockchain and LSTM to analyze and treat customer feedback transparently. Using blockchain for data storage, and long short-term memory (LSTM) network to mine reviews data for emotional tendencies analysis. LSTM better understands text data such as reviews containing idioms. Regulators handle problematic users based on the information recorded in the blockchain. The user receives feedback through smart contact [47] Minjing et al. Proposed Ant Colony Algorithm to predict customer intentions; Ants represent users, and pheromones represent user intent. User intents of browsing, collecting, cart shopping, and purchasing behavior are obtained from ant responses to pheromones. The algorithm shows a better accuracy compared to Neural networks (NN) [54].

Operational Marketing (7 contributions): Zhang et al. proposed a probabilistic generative model that recognizes customers' intentions from time and geographical data using a machine learning algorithm. This solution is appropriate for recommendation to present the right product/service categories to the right people at the right time and right locations [56]. Hanafi et al. Built a recommendation model based on the classification method using CNN for classification issues, combined with a probabilistic method using Matrix Factorization (PMF) for regression to ensure prediction by the proposed recommendation model [52]. Lou proposed an accurate and faster recommendation system in E-commerce based on collaborative filtering and cloud computing [48] Bosri et al. Proposed a recommendation system through the integration of AI and blockchain. artificial intelligence (AI) processes user data without taking his consent. Blockchain allows AI to perform permissionless data storing and recommendation sending is done cryptographically to ensure privacy [50]. Duong et al. used a machine learning approach (SVM and Random Forest) to predict the gender of viewers by investigating categories/product features, they hypothesize that the relation between categories/products viewed during a single session may reflect the gender of the viewer [55].

Koehnet al. proposed an RNN-based sequence classifiers to predict user conversions with better accuracy. They have developed a framework to measure the profitability of a conversion classifier. GRU performs better than LSTM to predict customer conversion [51]. Nursetyo et al. propose an intelligent chatbot system based on Artificial Intelligence Markup Language (AIML) smarter, faster, and more accurate chatbot. Input questions from users will be processed through three stages, namely, parsing, pattern matching, and crawling data using AIML. It can answer all user requests well, with an average response time of 3.4 seconds which is significantly fast [53].

Product marketing (1 contribution): Rangu et al. identify issues with a product through reviews and comments and Use text mining SVM to detect a quality problem with a product throw customer review [46].

Pricing accuracy (1 contribution): Gao et al. proposed KNN-BPNN algorithm optimized with (PSO) to predict customer purchases to optimize pricing and increase profitability. the swarm optimization algorithm is used to optimize the binomial function coefficient and the K-value of the nearest neighbor algorithm, to predict customer purchase intention with the highest accuracy of 94,2% [49].

Researchers have proposed various solutions for operational marketing, including recommendation systems based on machine learning, classification methods, and chatbots. Strategic marketing solutions have also been proposed, such as using blockchain and LSTM for customer feedback analysis and predicting customer intentions using the Ant Colony Algorithm. One study used text mining SVM to detect quality issues with products through customer reviews. Another proposed an algorithm optimized with PSO to predict customer purchases for pricing optimization. Overall, ICT has provided various tools for e-commerce businesses to improve their marketing strategies and increase profitability.

4) SALES AND AFTER-SALES SERVICE

Nowadays, the success of e-commerce sales depends mostly on IT advancement to enhance and support downstream logistics as an important part of the value stream. That good feedback matters. Many studies have discussed the benefits of adopting ICT to improve customer experience by adapting the platform content to their needs; safety, accessibility, interactivity…etc. A total of 27% of the identified articles were assigned to the cluster ''Sales and after-sales service'' dealing with traceability, security, and sales forecasting. thus, an important focus on treatability and security as they are the major brake on the development of e-commerce.

Traceability and Anti-counterfeit (6 contributions): Gai et al. propose a novel scheme named Anti-Counterfeit Deterministic Prediction Model based on MCM Monte Carlo Model to address counterfeit problems in e-commerce. the proposed algorithm can examine the correlations between two features of the products to find out the products that do not match the benchmark and detect malicious information [69]. With the advancement of blockchain research, Guo et al. proposed corresponding techniques and methods to achieve product and transaction traceability based on blockchain to Combat counterfeit e-commerce, by scanning a code to verify the origin of the product, companies can build its traceability system or can chose to cooperate with third parties [62]. Vanneschi et al. proposed an algorithm based on genetic programming (GP) to prevent customers' defaults. The application of credit scoring (CS) is employed to identify customers' default probability. the GP's performance is compared to that of three state-of-the-art). The GP model shows a higher discriminatory power compared to machine learning methods, specifically logistic regression (LR), support vector machines (SVMs), and boosted trees (BTs) [67] Mishra et al. compared extant Fraud detection techniques and their merits and demerits and proposed LR-k-fold machine learning technique to obtaining data from various sources on the cloud and IoT are preceptors. ML trains and infer to decide whether fraud or a safe transaction [60]. Ali et al. Compared 3 Deep learning models ''NN, NB, and GAN'' for Fraud detection. The overall performance of the neural network (NN)is better than GAN and NB for Fraud detection. Considering GAN to over-sample minority class in the data by generating example instances from noise value and combining these examples with the training set to train a binary classifier, and train NN using the backpropagation algorithm [66]. Chen et al. proposed an encryption algorithm for the e-commerce payment method to increase security using blockchain [61].

Security and Accessibility (4 contributions): Tiwari and Sharma proposed an e-commerce framework based on the cloud model, offering many advantages such as Scalability, Interoperability, Security and Trust, Redundancy in Cloud Services, Cost Reduction, and Speed [57] Narayan et al. Proposed a new concept of smart cart with malpractice detection features and other miscellaneous auxiliary functions such as admin database, customer following mechanism, and a recommendation and payment system. They implement this cart using Arduino, a smart cart with three verification methods of the product: Pi-cam, load cell, and RFID System. A payment link/dynamic QR code with the total price is created which can be used for payment [80]. Sohaib et al. propose a framework for the integration of IoT and cloud computing to integrate the potential of disabled people in the context of e-commerce. The integration of IoT and cloud computing can enable smart devices of sensing data stream to support many disabled people for online shopping in a reliable manner with the help of interceptors such as RFID, VR, and other smart devices connected to cloud e-commerce platforms [68] Cloud computing demonstrated a large field of application not only in security but also in investigations. Guimaraes et al. proposed a model to investigate user satisfaction and its impact on loyalty with the test of user satisfaction and conversion into customer loyalty using SaaS applications [70].

Sales forecasting (3 contributions): Chen et al. propose the Neural Network forecasting model, using TensorFlow and Kera's frameworks to train their model and experiments show the proposed NN model performs better than the Linear

Regression algorithm and SVM algorithm. They utilized shape to interpret and evaluate its performance [64] Pacella et al. Proposed a demand forecast model based on bidirectional LSTM (BLSTM), which can process data in both directions with two separate hidden layers. Augments the accuracy of the baseline LSTM [63]. Vallés-Pérez et al. develop three alternatives to tackle the problem of forecasting sales with precision (day/store/item) using deep learning techniques. Seq-to-Seq encoder, decoder, and transformer architecture capable of solving the problem of sales forecasting. they have also introduced random max time steps that allowed to train the model to adapt to different time steps, to avoid training the model in every use [59].

The use of ICT in e-commerce has greatly improved downstream logistics and customer experience. In the ''Sales and after-sales service'' cluster, 27% of the identified articles focused on traceability, security, and sales forecasting. Several contributions have been made in these areas. In terms of traceability and anti-counterfeit, researchers have proposed algorithms based on Monte Carlo models, blockchain, and genetic programming to detect malicious information and prevent fraud. In terms of security and accessibility, cloud computing has been used to provide advantages such as scalability, interoperability, and redundancy, and to investigate user satisfaction and its impact on loyalty. In terms of sales forecasting, researchers have proposed neural network forecasting models and demand forecast models based on LSTM and transformer architectures, to forecast sales with precision. Overall, ICT has contributed significantly to improving sales and after-sales services in e-commerce.

5) SHIPPING AND REVERSE LOGISTICS

Shipping orders from a warehouse to a set of customers and taking decisions with multiple constraints require a certain level of accuracy and real-time data sharing. The promoting factors in this physical link with a customer are time, quality, and cost. A total of 15% of the identified articles were assigned to the cluster ''Shipping and Reverse logistics'' dealing with security, and Route optimization. Transport is highly affecting price, and it is an important element to be optimized.

Security enhancement (2 contributions): Ossamah et al proposed enhanced security with blockchain for Drones. Blockchain uses the peer-to-peer (P2P), Which is solid and secure. Each peer in the P2P network avails part of its computing resources such as disk storage and processing power, to other participants in the network. This decentralized information element is used to secure drones, Digital Fingerprint, Consensus Mechanisms, and access Control [72] Shih et al. Proposed 8 algorithms for every step in reverse logistics based on ETH smart contracts to provide a certain degree of transparency in the return process [71].

Route optimization (5 contributions): Huang et al. proposed an ACO Ant colony Optimization algorithm to solve the VRPD showing better performance compared to traditional VRP for trucks, ACO is used to effectively solve the VRDP for different size instances and different customer location distributions, for large instances they've got an average of 30% cost-savings on VRPD compared to VRP with the truck only [77]. Gu et al. proposed depot clustering and combination with MDVRP Multi-Depot-VRP based on artificial bee colony algorithm (ABC) algorithm for route optimization. By degrading MDVRP to multiple single VRP problems with depot clustering and combination. The proposed algorithm achieves up to 70% advantage over the Greedy Algorithm and a 3% advantage over the Genetic Algorithm [76]. Liu et al. proposed VRP based on Ant Colony Optimization with improved default parameters. ACO was improved to suit last-mile distribution by modifying the heuristic information [74]. Wanganoo et al. improve visibility and optimize last mile delivery parcels in e-commerce by integrating technologies such as GPS, IoT, and TMS which will provide the delivery operator with real-time visibility. The server will notify the customer of containing GPS location of the parcel and the QR code to unlock the parcel automatically [73]. Issaoui et al. Proposed a prediction model-based LSTM followed by an optimization model based ACO-PSO to Reduce delivery time and costs in 2 phases: 1st Predict the delivery time using LSTM in 4 steps collection, update, processing, and prediction of routes or real-time anomalies. 2nd phase they optimize the model a combination of Ant Colony Optimization (ACO) and Particle Swarm Optimization (PSO) is proposed instead of Dijkstra for more accurate optimization [75]. Information and Communication Technology (ICT) has made significant contributions to shipping and reverse logistics. In the cluster of ''Shipping and Reverse logistics,'' 15% of identified articles were focused on security and route optimization. In terms of security enhancement, blockchain to enhance drone security and smart contracts to provide transparency in the return process have been proposed. In terms of route optimization, various algorithms such as ACO, MDVRP, and LSTM-ACO-PSO have been proposed to solve the VRPD and reduce delivery time and costs for last mile delivery. These algorithms have shown significant performance improvements over traditional approaches, resulting in up to 70% cost savings for large VRPD instances. Technologies like GPS, IoT, and TMS have also been integrated to improve visibility and optimize the last-mile delivery process for e-commerce. Overall, ICT has played a crucial role in optimizing shipping and reverse logistics by providing real-time data sharing, enhancing security, and improving route optimization.

In addition to upstream, downstream, and internal logistics, we also examine the role of marketing and sales which are closely linked to logistics and benefit from the advantages of information and communication technology (ICT). Our table presents an overview of the different technologies used in smart logistics, revealing a surprising lack of research on product quality with AI, despite the vast potential of IoT in this area. We also note a low focus on accessibility, with only one article proposing a solution for people with disabilities, despite the significant market share they represent. AI emerges as the most used technology in smart logistics,

TABLE 3. Clustering of the identified studies.

No.	Application areas	Artificial Intelligence	Cloud Computing	IoT	Blockchain	5G
1	Security, Privacy, and traceability	7	2	-	6	-
2	Data reliability, and forecast accuracy	10	-	-	-	-
3	Operational efficiency, and accuracy	10	1	5	-	1
4	Accessibility and Ergonomics	5	2	1	1	-
5	Quality	1	-	-	-	-

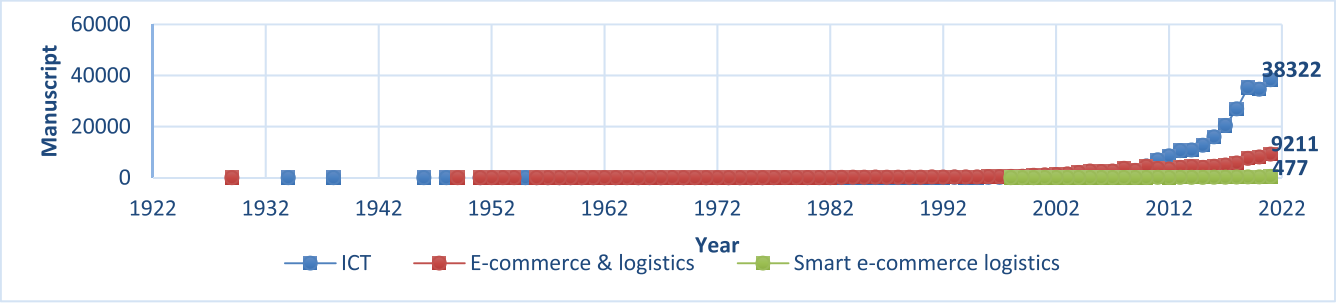

FIGURE 4. Number of papers published in Scopus database 'before 2022.'

with 32 articles in our dataset highlighting its potential to enhance data reliability and operational efficiency. Collaboration between AI and other ICTs, such as IoT, blockchain, and cloud computing, is also explored to enhance efficiency, security, and accessibility, respectively. While 5G technology is still in its early stages, its potential impact on smart logistics connectivity is already being studied. Operational efficiency and security are the primary areas of focus in current ICT research, as shown in Table 3, detailed in Appendix B.

B. HOW HAS SMART LOGISTICS EVOLVED WITHIN E-COMMERCE LITERATURE SINCE ITS EMERGENCE?

We are primarily interested in utilizing statistics to provide an answer to this question by analyzing the development of research in the areas of ICT, e-commerce, logistics, and smart logistics applications for e-commerce using descriptive statistics. Our analysis covered the periods 2012-2022, and we found that there has been a significant research lag in the field of Smart Logistics for e-commerce, as shown in Figure 4. This discovery has motivated our team to explore this topic further. We observed that there were only 2565 articles related to this field in the Scopus database since 1998, whereas there were much larger numbers of articles for ICT (238282 articles since 1934) and e-commerce research (89566 articles since 1929) in the same database.

In the first decade (2000-2010), the research in E-commerce and logistics has been growing insignificantly in terms of quantity, overpassing the ICT. However, in the second decade (2010–2020) The number of publications in ICT followed an exponential trend, reflecting the global interest in this world, whereas the E-commerce and logistics one keeps growing with ups and downs, with an apparent increase in the last four years. As of the time of writing (June 2022), We have eliminated the data of 2022 in order, not to fake results. The number of publications for both e-commerce logistics and ICT was the highest. Demonstrating strong indications of scholar production and interest in ICT and logistics. Smart logistics (SL) evolved slowly within ICT and logistics literature in the first decade. The topic of SL exhibited a gradual increase with ups and down in the second decade. We suppose that the significant growth of smart logistics publications (+795%) is due to the need for powerful logistics to satisfy customer demand in a globally competitive market with internet facilities TABLE 5 Requiring smart logistics for e-commerce with the technological background to tackle the weaknesses of brick-and-mortar logistics. The number of publications has doubled in the last 3 years.

TABLE 5 displays the 6 journals with the greatest impact in publishing smart logistics articles. Combined, these 6 journals account for 172 articles, making up 60% of the total 288 articles in the study, and receiving 81% of the total citations. Elsevier Ltd ranks first in the list, with 15 published papers and a total of 705 citations, while the Institute of Electrical and Electronics Engineers (IEEE) Inc. is the most prolific, having published 78 articles. Springer published 65 articles and Elsevier published 4 high-quality articles. Most of the papers are in the form of articles and conference papers, as detailed in TABLE 7.

In TABLE 8, the top 10 countries in terms of research productivity in Smart Logistics (SL) for e-commerce are presented, with China having the highest number of published papers, followed by India and the USA. These three countries not only have high productivity, but they are also among the most collaborated co-author countries, leading research

TABLE 4. The evolution of research in smart logistics '2012-2022'.

Year	ICT	E-commerce and Logistics	Smart e-commerce Logistics
2012	8531	3383	60
2021	38322 (+449%)	9211 (+272%)	477 (+795%)

TABLE 5. Most frequently cited journals '2012-2022'.

Journals	Nb. Of citations (1)	Cumulative % (1)	Nb. of Publications (2)	Cumulative % (2)
Elsevier Ltd	705	37.1	15	5.2
IEEE	335	54.6	78	32.3
Springer	191	64.6	65	54.9
Emerald Group Holdings Ltd.	129	71.4	9	57.9
Elsevier	102	76.7	4	59.3
Blue Eyes Intelligence Engineering and Sciences Publication	87	81.3	1	59.7
Subtotal	**1549**	**81 %**	**172**	**60 %**
Others	355	19	116	40
Total	**1904**	**100 %**	**288**	**100 %**

TABLE 6. Classification of papers by type of studies.

Documents type	Records	Records %
Article	131	45
Conference Paper	148	51
Review	9	4
Total	**288**	**100 %**

TABLE 7. Top 10 influencing scholars in this research field '2012-2022'.

Country Name	Documents	Citations
China	109	1002
India	39	499
United States	19	314
South Korea	11	22
Australia	8	121
Hong Kong	8	247
Germany	7	23
Spain	7	42
Greece	6	20
Taiwan	6	47

TABLE 8. Top 10 countries working in this research field '2012-2022'.

Authors	Documents	Citations
xu y.	2	296
su z.	1	296
xu h.	1	296
zhang d.	1	296
choi t.-m.	2	181
butala r.	1	176
dutta p.	1	176
somani s.	1	176
liu z.	2	108
li z.	2	106

in Asia, Australia, Europe, and America. This indicates that SL research for e-commerce is being conducted worldwide, with a concentration of research in developing countries like India and China, reflecting their focus on ICT and global e-commerce. It should be noted that only papers published in English were included in this study, and no African or Arabian affiliations were represented. The most influential researchers are also listed in TABLE 6.

TABLE displays the most frequently used keywords in smart logistics research, with "Electronic commerce" being the most used due to its relevance to the study's framework, along with "supply chain" ranking second. The keywords "blockchain" and "IoT" follow closely, highlighting the significance of these technologies in the field of smart logistics. Scholars consider IoT a groundbreaking technology for automating physical processes [13], [81]. In e-commerce, trust is a critical issue, and researchers have proposed integrating blockchain technologies such as "smart contracts" in the fintech context to ensure safety and privacy [35], [82]. Other keywords ranked in order are artificial intelligence, big data, cloud computing, machine learning, data mining, recommender systems, advanced analytics, information management, learning systems, and decision making. These technologies underscore the importance of data science in the logistics context of e-commerce, where data accuracy is a key success factor. In the highly competitive market, proactive matching of customer needs with the right product at the right time and place at a reasonable cost is critical to achieving high sales volume and benefits.

TABLE 9. Top 20 frequent keywords in the SL research.

keyword	Occurrence
electronic commerce	215
block-chain	70
internet of thing (IoT)	69
artificial intelligence	49
big data	41
cloud computing	39
supply chain	34
sales	27
machine learning	26
data mining	23
mobile commerce	13
recommender systems	12
competition	12
costs	12
advanced analytics	12
information management	12
learning systems	11
smart contract	11
decision making	10
Automation	10

The authors utilized network analysis with keyword co-occurrences to identify research foci by generating clusters [1]. To conduct the analysis, all keywords were extracted from each paper and preprocessed, replacing redundancies with their conventional semantics. The minimum number of keyword occurrences was set at 5 using Vosviewer. The analysis yielded five distinct clusters, as presented in FIGURE 5. To represent each cluster, the most frequent keywords were retained and summarized in TABLE 10.

Cluster 1 'Automation' Many researchers have proposed systems based on Internet of Things (IoT) technologies to enhance logistics automation and enable logisticians to make proactive decisions. The basic architecture of an IoT system includes four layers [10]:

- The perception layer is responsible for collecting data, such as through RFID technology. Various systems have been developed using this technology, such as intelligent shelves, which can obtain real-time data in warehouses and ensure inventory reliability [43]. Narayan et al. proposed an intelligent cart that utilizes load cells, pi-cam, and other sensors to reduce payment malpractice and improve the billing process [65].
- The network layer is responsible for forwarding the packets obtained from the perception layer to the internet. This layer includes keywords such as 5G mobile communication systems, which improve the speed and reliability of data transfer and enhance automated control [58].
- The storage layer is responsible for data security storage. Guo et al. proposed a storage method for processing massive sensing data that optimizes storage and packet size during transfer [37].
- The application layer serves as the interface between the IoT device and the network, processing data globally or partially using APIs in cloud computing cases. By integrating a machine learning algorithm, an intelligent sorting conveyor was proposed to avoid the risk of placing wrong entries in packaging and predict inventory shortages [40].

Researchers propose collaboration between ICT technologies, such as machine learning, IoT, and 5G, to enhance management systems and ensure precision in both physical and information flow. A new concept revealed in this cluster is the ''Internet of Robotic Things'' (IoRT), Esenogho et al. believe that the Massive Internet of Things (MIoT) will play a significant role in the development of the 5G/6G network infrastructure, integrating communication infrastructure, artificial intelligence (AI), and Internet of Things (IoT) support. In other words, MIoT will enable the connection of a massive number of devices, allowing for real-time data collection, analysis, and decision-making [83].

In this cluster, one possible area of improvement could be the development of more advanced and efficient perception technologies for data collection, such as using advanced sensors and computer vision techniques. Additionally, there could be research on developing more robust and scalable storage and data processing methods to handle the large amount of data generated by IoT systems. Another area of improvement could be exploring the use of blockchain technology to enhance data security and prevent fraudulent activities in logistics automation.

Cluster 2 'Personalization This cluster focuses on the application of Artificial Intelligence to Customer Relationship Management (CRM). The primary keywords in this cluster are electronic commerce, artificial intelligence, and sales. Researchers have proposed using artificial intelligence and data mining to create intelligent systems for marketing, such as recommenders' systems that use collaborative filtering to increase sales [48]. Other proposed applications of AI in this field include predicting customer behavior to optimize Quality, Cost, and Time and improve profitability [84], as well as using deep learning algorithms to predict demand with high accuracy [30]. Additionally, AI can be used to reduce storage costs [36]. Overall, the goal of this cluster is to enhance operational efficiency and increase customer satisfaction. there could be research on developing more advanced AI algorithms for customer behavior prediction and personalization, as well as investigating the potential of using natural language processing and chatbots to improve customer interaction and engagement. Additionally, there could be research on developing more efficient and accurate recommender systems for product recommendations.

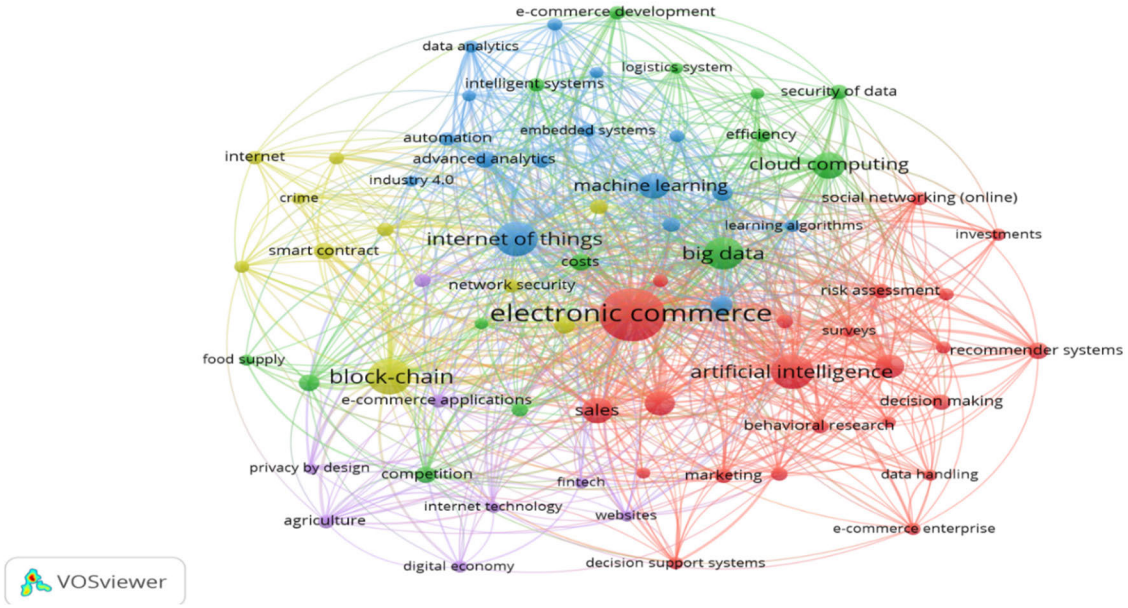

FIGURE 5. Keyword co-occurrences map with Vosviewer.

TABLE 10. keyword co-occurrences clusters.

No.	Cluster 1 'Automation'	Cluster 2 'Personalization '	Cluster 3 'Efficiency'	Cluster 4 'Privacy and Safety'	Cluster 5 'Digitalization'
1	Internet of things (IoT)	electronic commerce	big data	block-chain	e-commerce applications
2	machine learning	artificial intelligence	cloud computing	information management	sustainable development
3	mobile commerce	sales	supply chain	smart contract	digital economy
4	advanced analytics	data mining	competition	digital storage	fintech

Cluster 3 'Efficiency' This cluster is closely related to Cluster 2, and it highlights the potential for a robust and intelligent CRM system to reduce various costs. Moreover, cloud computing is regarded as a more efficient means of processing large amounts of data generated and collected through e-commerce supply chain networks, utilizing cloud resources [57]. The cluster emphasizes the need for organizations to explore opportunities for technological innovation to optimize transportation costs in supply and shipping by integrating intelligent VRP solutions based on deep learning. Additionally, efficient resource allocation and task scheduling in e-commerce are important considerations. The cluster also notes research on economic order quantity by AI and optimizing routes using deep learning for VRP. one possible area of improvement could be developing more advanced optimization algorithms for logistics and transportation, such as using genetic algorithms or swarm intelligence to improve resource allocation and task scheduling. Additionally, there could be research on developing more efficient and scalable cloud computing methods for processing large amounts of data in e-commerce supply chain networks.

Cluster 4 'Privacy and safety' It is noteworthy that in this cluster, there is no mention of the keyword ''blockchain'' or discussion of its potential to replace cloud-based data storage. Similarly, there is a lack of discussion about the role of AI in fraud detection, which could enhance information transparency, secure payment, and prevent customer defaults. However, this cluster does contain keywords related to crime and counterfeit, which highlights the importance of customers' trust in e-commerce. One potential research gap in this cluster is the lack of discussion on the integration of blockchain technology for data storage and its potential to enhance information transparency, secure payment, and prevent fraud in e-commerce. Additionally, there is a focus on crime and counterfeit, but more research could be done on the specific types of fraud that are prevalent in e-commerce and how AI can be utilized to detect and prevent them. Furthermore, while there is a mention of customers' trust in e-commerce, more research could be done on how trust can be built and maintained in the digital marketplace.

Cluster 5 'Digitalization' The digitalization of financial transactions in e-commerce holds the promise of a better future for trading, and this cluster focuses on some keywords that reflect this trend. These include sustainable logistics and the semantic web, which may be explained by the fact that the next generation of the web, based on blockchain technology,

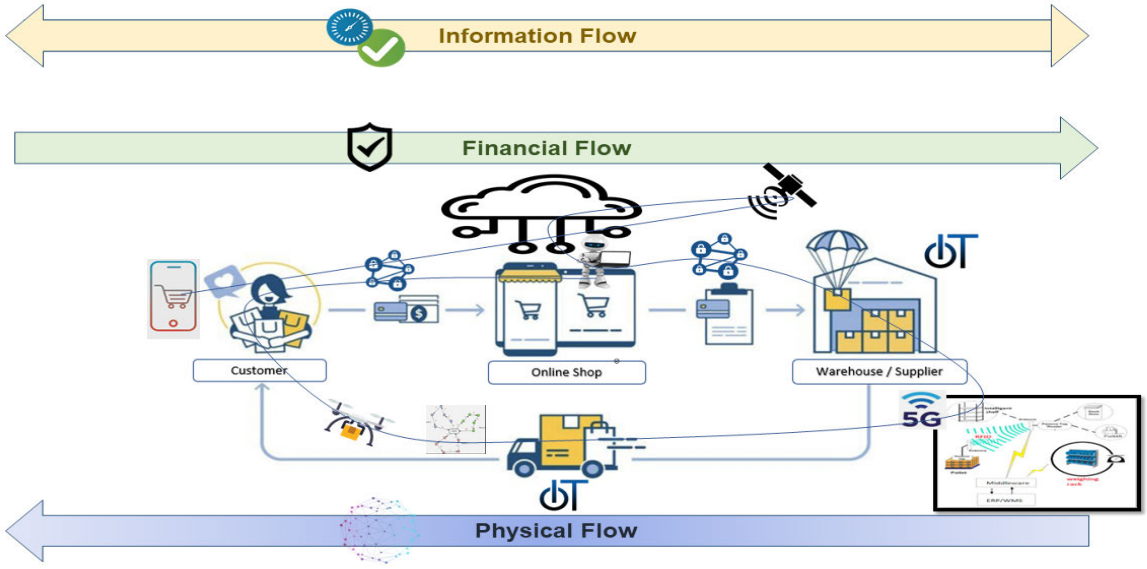

FIGURE 6. Intelligent e-commerce scenario.

TABLE 11. Keyword co-occurrences clusters.

No.	Application areas	Artificial Intelligence	Cloud Computing	IoT	Blockchain	5G
1	Security, Privacy, and traceability	[32] [33] [47] [67][60] [66] [69]	[34] [57]	-	[35] [47] [61] [62] [71] [72]	-
2	Data reliability, and forecast accuracy	[30] [31] [36] [56] [49] [54] [55] [59] [63] [64]	-	-	-	-
3	Operational efficiency, and accuracy	[37] [38] [39] [40] [41] [42] [74] [75] [76] [77]	[45]	[40] [43] [44] [69[73]	-	[58]
4	Accessibility and Ergonomics	[48] [50] [51] [52] [53]	[68] [70]	[68]	[50]	-
5	Quality	[46]	-	-	-	-

is expected to revolutionize e-commerce by solving issues related to trust and traceability. while there is mention of the semantic web and sustainable logistics, more research could be done on the specific ways in which blockchain technology and digitalization can revolutionize e-commerce, especially in terms of enhancing traceability and supply chain transparency. Additionally, research could be conducted on the potential drawbacks and challenges associated with the increased digitalization of financial transactions, such as the risk of cyber-attacks and the potential for increased financial exclusion.

In conclusion, our bibliometric analysis shows a significant growth of smart logistics publications (+795%) is due to the need for powerful logistics to satisfy customer demand in a globally competitive market with internet facilities, requiring smart logistics for e-commerce with the technological background to tackle the weaknesses of brick-and-mortar logistics. China has the highest number of published papers in smart logistics, followed by India and the USA, indicating that SL research for e-commerce is being conducted worldwide, with a concentration of research in developing countries like India and China, reflecting their focus on ICT and global e-commerce. The most frequently used keywords in smart logistics research are ''Electronic commerce,'' ''supply chain,'' ''blockchain,'' and ''IoT,'' highlighting the significance of these technologies in the field of smart logistics. The most cited journal in smart logistics is Elsevier Ltd, with 15 published papers and a total of 705 citations. The study also lists the most influential researchers in smart logistics. Some of the most frequently cited influencers include Haiyan Wang, Chunguang Li, and Xiaohua Liu.

Our network analysis identifies five clusters of keywords cooccurrence related to the application of technology in e-commerce logistics, marketing, operations, and security. Overall, the study demonstrates the potential for technological innovations to enhance efficiency and customer satisfaction in e-commerce, while also highlighting the importance of trust and security in these systems. Through this network analysis we suggest several areas of improvement and research for each cluster, such as developing more advanced perception technologies, improving recommender systems and customer behavior prediction algorithms, exploring the use of blockchain technology to enhance data security, developing more advanced optimization algorithms for logistics and transportation, investigating how trust can be built and maintained in the

TABLE 12. Keyword co-occurrences clusters.

N°	Ref.	Authors and Year	Type of Study	Cluster	Problem addressed	Target	Tool	Key contribution
1	[30]	Terrada et al. 2022	experiment	Procurement	Reduce the Bullwhip effect in demand forecasting	Data reliability, and forecast accuracy	AI	Build a demand forecasting system based on LSTM with better accuracy compared to ARIMA.
2	[31]	Aci et al. 2022	experiment	Procurement	Increase accuracy and responsivity to face demand variation in retail e-commerce	Data reliability, and forecast accuracy	AI	Proposed LSTM as the best model for demand forecasting among twenty-six algorithms of DL and ML tested.
3	[32]	Simkova et al.2021	case study	Procurement	Resolve disputes in B2B relationships	Security, Privacy, and traceability	AI	Proposed E-Negotiation based on GA for online dispute resolution.
4	[33]	Vij et al. 2019	case study	Procurement	Make e-negotiation more accurate for a Win-Win strategy	Security, Privacy, and traceability	AI	Propose rule-based and case-based reasoning algorithms for bilateral and multilateral E-Negotiation
5	[34]	More et al. 2014	Survey	Procurement	increase the efficiency of the E-negotiation process	Security, Privacy, and traceability	Cloud Computing	Propose an agent-based negotiation system using cloud computing for better security and low resource consumption.
6	[35]	Jiang et al. 2019	case study	Procurement	privacy protection in e-commerce platforms	Security, Privacy, and traceability	Blockchain	Proposed privacy-preserving business protocol based on private smart contracts in the negotiation phase.
7	[36]	Preil et al. 2022	case study	Inventory management	minimizes overall inventory costs	Data reliability, and forecast accuracy	AI	Using Monte Carlo tree search (MCTS) to tradeoff between backorders (inventory shortage) and extra storage cost.
8	[37]	Guo et al. 2021	case study	Inventory management	Improve the processing of sensory data of IoT in e-commerce	Operational efficiency, and accuracy	AI	Proposed fast screening and accurate sorting links in a multi-attribute sorting system.
9	[38]	Issaoui et al. 2021	case study	Inventory management	Resource allocation and task scheduling in e-commerce	Operational efficiency, and accuracy	AI	Proposed (LSTM) model to optimize resource allocation and enhance task scheduling in a smart logistics framework
10	[39]	Chen et al. 2019	case study	Inventory management	solve the problem of QR code uneven illumination in warehouse automatic sorting systems	Operational efficiency, and accuracy	AI	Proposed Otsu's method to binarize the QR code for a fast and accurate scan.
11	[40]	Shouborno et al. 2019	conceptual approach	Inventory management	Reduce the risk of placing a wrong entry in packaging and predict inventory shortage	Operational efficiency, and accuracy	IoT and AI	Proposed IoT-based automated packaging
12	[41]	Xin et al. 2019	case study	Inventory management	Minimize order picking distance in warehouses	Operational efficiency, and accuracy	AI	Propose an algorithm based on text clustering and correlation analysis (BTC) for storage location allocation
13	[42]	Xu et al. 2014	case study	Inventory management	optimizes the order picking route	Operational efficiency, and accuracy	AI	improve data picking system with Ant Colony Optimization (ACO)
14	[43]	KALKHA et al. 2022	conceptual approach	Inventory management	improve inventory reliability	Operatıona efficiency, and accuracy	IoT	integration of load cells in picking shelves to get real-time inventory.
15	[44]	Wanganoo et al. 2020	conceptual approach	Inventory management	Reduce inventory and time in the return management process	Operational efficiency, and accuracy	IoT	Proposed a conceptual framework to integrate IoT in WMS in the context of 3PL e-commerce to reduce the item return time
16	[45]	Zhang et al. 2016	conceptual approach	Inventory management	Reduce packaging cost	Operational efficiency, and accuracy	Cloud Computing	use of sustainable and cost-effective packages based on Physical Internet (PI) and product–service system (PSS) and cloud computing (CC) to optimize packaging costs.
17	[46]	Rangu et al. 2017	case study	Marketing	identify issues with a product through reviews and comments	Quality	AI	Use text mining SVM to detect quality problems with a product throw customer review
18	[47]	Zhao et al. 2022	Case study	Marketing	obtain the users' emotional tendency for a specific product	Security, Privacy, and traceability	AI and Blockchain	Proposed a model based on blockchain and LSTM to analyze and treat customer feedback transparently
19	[48]	Lou F et al. 2022	Case study	Marketing	Improve speed and accuracy of recommendation system in the E-commerce	Accessibility and Ergonomics	AI	Proposed an optimized CF (Collaborative filtering) recommendation based on K-fold cross-validation.
20	[49]	Gao et al. 2022	case study	Marketing	The Influence of Price on Purchase Intentions in e-commerce.	Data reliability, and forecast accuracy	AI	Proposed KNN-BPNN algorithm optimized with PSO to predict customer purchase intention (price variation)
21	[50]	Bosri et al. 2021	case study	Marketing	Preserve privacy in the recommendation system	Accessibility and Ergonomics	AI and Blockchain	Proposed recommendation system through integration of AI and blockchain
22	[51]	Koehnet al. 2020	case study	Marketing	predict customer conversion in e-commerce	Accessibility and Ergonomics	AI	Proposed a method capable of unlocking the full potential of clickstream data using RNN
23	[52]	Hanafi et al. 2019	conceptual approach	Marketing	Build an Effective Product Recommendation for e-commerce	Accessibility and Ergonomics	AI	Built a recommendation model based on the classification method using CNN combined with Matrix Factorization (PMF)
24	[53]	Nursetyo et al. 2018	case study	Marketing	provide an accurate and fast response by chatbot System for E-Commerce	Accessibility and Ergonomics	AI	proposed an intelligent chatbot system based on Artificial Intelligence Markup Language (AIML)
25	[54]	Minjing et al. 2017	case study	Marketing	Recognize customer's intentions to improve recommendations in E-commerce	Data reliability, and forecast accuracy	AI	Proposed ANT colony algorithm to predict customer intentions
26	[55]	Duong et al. 2016	Experiment	Marketing	Recognize customer's gender to provide a personalized experience in E-commerce	Data reliability, and forecast accuracy	AI	Proposed machine learning (SVM and Random Forest Bayes) algorithms to recognize gender by investigating categories/products viewed during a single session
27	[56]	Zhang et al. 2016	Experiment	Marketing	Recognize customer's purchase intentions based on time and geographical data in e-commerce	Data reliability, and forecast accuracy	AI	Proposed a probabilistic generative model; CSM (Consumer Search Model) based on a machine learning algorithm

TABLE 12. *(Continued.)* **Keyword co-occurrences clusters.**

28	[57]	Tiwari et al. 2022	conceptual approach	Sales and after-sales service	Improve security and speed of data transactions with low coast	Security, Privacy, and traceability	Cloud Computing	Proposed an e-commerce framework based on cloud computing
29	[58]	Emil et al. 2021	case study	Shipping and Reverse logistics	Enhance data transfer in adverse conditions	Operational efficiency, and accuracy	5G	Proposed a management system for 5G networks that can be used more efficiently for an IoT-enabled supply chain
30	[59]	Vallés-Pérez et al. 2022	case study	Sales and after-sales service	Approaching sales forecasting	Data reliability, and forecast accuracy	AI	Deep learning model Seq2Seq with transformers to improve forecasting accuracy
31	[60]	Mishra et al. 2021	case study	Sales and after-sales service	credit/debit card fraud detection	Security, Privacy, and traceability	AI	Develop logistic regression k-fold machine learning technique for fraud detection/prevention in a cloud-IoT-based distributed environment
32	[61]	Chen et al. 2021	case study	Sales and after-sales service	problems with transaction information security in e-commerce	Security, Privacy, and traceability	Blockchain	proposed an encryption algorithm for e-commerce
33	[62]	Guo et al. 2021	case study	Sales and after-sales service	Combat counterfeit e-commerce	Security, Privacy, and traceability	Blockchain	proposed corresponding techniques and methods to achieve product and transaction traceability based on blockchain.
34	[63]	Pacella et al. 2021	case study	Sales and after-sales service	Improve accuracy in final customer demand forecast	Data reliability, and forecast accuracy	AI	Proposed demand forecast model based on bidirectional LSTM
35	[64]	Chen et al. 2021	case study	Sales and after-sales service	Improve sales prediction accuracy	Data reliability, and forecast accuracy	AI	Propose a Neural Network forecasting model using the Shape tool to interpret its performance
36	[65]	Narayan et al. 2020	Experiment	Sales and after-sales service	Automate the billing process to reduce waiting time.	Operational efficiency, and accuracy	IoT	Create a smart cart (IoT) with malpractice detection for a recommendation and payment system.
37	[66]	Ali et al. 2020	case study	Sales and after-sales service	increase security for online payments	Security, Privacy, and traceability	AI	Proposed NN as the best DL algorithm for Fraud detection technique among GAN and NB.
38	[67]	Vanneschi et al. 2018	case study	Sales and after-sales service	Prevent customers' default	Security, Privacy, and traceability	AI	The application of genetic programming (GP) to credit scoring (CS) is employed to identify customers' default probability
39	[68]	Sohaib et al. 2018	conceptual approach	Sales and after-sales service	Intelligent e-commerce for people with disabilities	Accessibility and Ergonomics	IoT and Cloud Computing	Propose a framework for the integration of IoT and cloud computing to enable the potential of people with disabilities in e-commerce.
40	[69]	Gai et al. 2016	case study	Sales and after-sales service	counterfeit detection	Security, Privacy, and traceability	AI	¨Propose an anti-Counterfeit Deterministic Prediction Model (ADPM) based on monte Carlo simulation
41	[70]	Guimaraes et al. 2014	case study	Sales and after-sales service	Investigate user satisfaction and impact on loyalty	Accessibility and Ergonomics	Cloud Computing	Improve user satisfaction with a test of user satisfaction and conversion into customer loyalty using SaaS applications.
42	[71]	Shih et al. 2021	case study	Shipping and Reverse logistics	Return fraud preventing	Security, Privacy, and traceability	Blockchain	Proposed 8 algorithms for every step in reverse logistics based on ETH smart contracts to provide transparency in the return process.
43	[72]	Ossamah et al. 2020	approach	Shipping and Reverse logistics	Drone security	Security, Privacy, and traceability	Blockchain	Enhancing drone security with blockchain technology
44	[73]	Wanganoo et al. 2020	conceptual approach	Shipping and Reverse logistics	Improve visibility and optimize last mile delivery parcels in e-commerce	Operational efficiency, and accuracy	IoT	Integrated technologies like GPS, IoT, and TMS in e-commerce systems for real-time visibility, and reliability in last-mile delivery.
45	[74]	Liu et al. 2020	case study	Shipping and Reverse logistics	solve the last-mile distribution of rural e-commerce	Operational efficiency, and accuracy	AI	Proposed VRP based on Ant Colony Optimization with improved defaults parameters
46	[75]	Issaoui et al. 2022	case study	Shipping and Reverse logistics	Order dispatch optimization	Operational efficiency, and accuracy	AI	Proposed a prediction model-based LSTM followed by an optimization model-based ACO-PSO to Reduce delivery time and costs.
47	[76]	Gu et al. 2022	case study	Shipping and Reverse logistics	VRP Optimization with multi depots	Operational efficiency, and accuracy	AI	Proposed depot clustering and combination with MDVRP based on ABC algorithm for route optimization
48	[77]	Huang et al. 2022	case study	Shipping and Reverse logistics	Vehicle Routing Problem with Drone (VRPD)	Operational efficiency, and accuracy	AI	Proposed an ACO algorithm to solve the VRPD showing better performance compared to normal VRP.

digital marketplace, and researching the potential drawbacks and challenges associated with increased digitalization. Figure 6 présents an intelligent e-commerce logistics scenario.

IV. LIMITATION AND FUTURE RESEARCH

This study is subject to certain limitations. Firstly, the scope of our systematic literature review was limited to significant contributions, with no consideration given to existing literature reviews. Furthermore, our dataset was limited to the Scopus database, and we only analyzed data from 2012-2022, in order to identify trends. It is important to note that some papers were excluded from our analysis due to copyright restrictions or unavailability.

Our discussion highlighted several areas for future research. We found that blockchain technology not only

improves transaction security, but can also enhance physical security, such as drone security. We suggest extending this solution to other logistics nodes, such as parcel lockers. Although AI has successfully solved many optimization problems, deep learning techniques, such as LSTM, have not been fully utilized in optimization, and are still mostly limited to forecasting. To address this, we suggest exploring the power of deep learning to solve Vehicle Routing Problems (VRP). In addition, we found that computer vision technology is underuitilized, and the quality of product verification and inspection needs further attention from scholars, as it has implications for customer trust. Finally, we recommend optimizing sensing data volume and relying on deep learning for interpretation and completion of missing data with the help of time series forecasting, in order to minimize costs associated with data storage and transfer.

V. CONCLUSION

Our systematic literature review and network analysis of 288 research articles from the Scopus database published between 2012 and 2022 reveal that the field of smart logistics for e-commerce is still in its early stages and has significant potential for growth. Our analysis highlights the increased interest in this field of study in recent years, which corresponds to the growth of e-commerce demand.

In summary, our study focused on the trends and research gaps in the field of smart logistics for e-commerce.

Our systematic literature review identified a lack of research on product quality inspection with AI and low focus on accessibility for people with disabilities, despite their significant market share. We found that AI is the most used technology in smart logistics, with many articles highlighting its potential to enhance data reliability and operational efficiency. Our discussion identified several areas for future research, including exploring the power of deep learning in solving Vehicle Routing Problems, improving product verification and inspection with computer vision technology, the use of blockchain to enhance physical security and optimizing sensing data volume and transfer.

Additionally, our bibliometric analysis provided insights into the research trends and hot topics in this field, as well as the most influential researchers and journals. We found that the number of publications in this area is increasing, particularly in the last four years. AI applications in supply chains and smart logistics are receiving significant attention, and new themes such as the emergence of WEB 3.0 and the Physical Internet are being explored. This study provides a roadmap for future researchers to identify research gaps and contribute to the development of smart logistics for e-commerce.

Although our study is subject to certain limitations, such as the exclusion of existing literature reviews and the limitation of our dataset to the Scopus database, we hope our findings will encourage new researchers to contribute to this growing field of study and to focus on research gaps to further advance smart logistics for e-commerce.

APPENDIX A

See Table 11.

APPENDIX B

See Table 12.

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