

AI ADOPTION IN E-COMMERCE: A LITERATURE & BIBLIOMETRIC REVIEW

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ABSTRACT

Artificial Intelligence (AI) has revolutionized e-commerce by enhancing customer experience, operational efficiency, and data-driven decision-making. As AI adoption continues to expand, understanding its research landscape, key trends, and challenges is crucial. However, existing studies primarily focus on specific AI applications, such as recommendation systems and chatbots, while a comprehensive bibliometric analysis of AI adoption trends remains limited. Additionally, research gaps exist in understanding regional adoption disparities, ethical concerns, and regulatory challenges in AI-driven e-commerce. This study aims to analyse AI adoption trends in e-commerce using bibliometric techniques, identify key research themes, and propose future research directions. A systematic bibliometric review was conducted on Scopus-indexed research articles (2004–2024) using the PRISMA framework for systematic screening. Biblioshiny (R-based tool) and VOSviewer were utilized to analyse citation networks, keyword co-occurrence, and thematic clusters. The findings indicate a significant rise in AI research in e-commerce since 2018, with China, India, and the U.S. leading in publications. Four key research themes emerged: customer experience and personalization, operational efficiency and supply chain, fraud detection and cybersecurity, and ethical AI and regulatory challenges. While AI adoption continues to advance, challenges such as data privacy concerns, algorithmic bias, and regulatory gaps remain critical. This study provides a structured bibliometric review of AI adoption trends in e-commerce and highlights key research gaps and emerging areas, such as Generative AI, sustainable e-commerce, and ethical AI governance. The findings offer valuable insights for researchers, policymakers, and businesses, guiding the strategic implementation of AI in global e-commerce.

Keywords: Artificial Intelligence, E-Commerce, Bibliometric Analysis, Customer Experience, Operational Efficiency, Algorithmic Bias, Fraud Detection, Data Privacy

INTRODUCTION

The incorporation of AI in e-commerce has transformed business operations, improving customer interactions, product recommendations, fraud detection, and supply chain efficiency. AI-powered chatbots, recommendation engines, and extrapolative analytics have facilitated e-commerce firms offer personalized shopping experiences, automate inventory management, and enhance cybersecurity.

The global AI market is expected to grow at a 33.28% CAGR (2023–2028), with AI adoption in e-commerce projected to significantly impact customer engagement and operational efficiency (Statista, 2024). Studies indicate that 80% of businesses will integrate AI into their systems by 2026 (Gartner, 2023).

Businesses have been able to take advantage of new possibilities for efficiency and creativity because of the widespread adoption of AI technology in recent years. Among these

industries, e-commerce is one of the most exciting and fast-changing places to work with AI to boost sales, streamline processes, and provide better service to customers. The rise of mobile commerce, the expansion of middle-class incomes in emerging nations, and the general acceptability of online buying are all contributing to this upsurge.

According to Oberlo, a drop shipping service provider, the worldwide e-commerce sales growth rate will slightly increase to 8.6% in 2026, and online sales are expected to grow at a pace of 8% each year until 2025. According to Statista, a German research organization, the largest growth predictions in retail e-commerce are projected to occur in Philippines and India, with electronic sales expanding by 24.1% and 22.3%, respectively.

The current world is not complete without AI, which is finding applications in a wide variety of fields. A recent analysis by Gartner found that by 2026, 80% of companies would have integrated AI into their systems. Additionally, Gartner's Hype Cycle for AI has outlined new ideas and methods with major, potentially game-changing advantages and disadvantages. A significant competitive advantage may be gained by embracing these advancements early on, as they will make the incorporation of AI models into company processes easier.

E-commerce businesses may benefit from AI in several ways, including better customer knowledge, lower churn rates, more opportunities for upselling and cross-selling via appropriate product suggestions, and cost reduction through automation. Scholars have been researching AI's potential uses in e-commerce for the last 30 years. Consumers and businesses have been the subjects of around four thousand academic research in this field.

Businesses looking to reap the advantages of AI must have a firm grasp of what drives its adoption in e-commerce. Although several studies have looked at the usage of AI in other sectors, a targeted study is needed to determine the factors influencing its acceptance in the e-commerce industry due to its distinct features.

Despite AI's increasing presence in e-commerce, research on factors influencing AI adoption, ethical concerns, and regional variations remain fragmented. Most studies focus on specific AI applications (e.g., recommendation systems, chatbots), but a comprehensive bibliometric analysis of AI adoption trends in e-commerce is missing. Additionally, AI's role in data privacy, algorithmic fairness, and regulatory challenges remain underexplored. A bibliometric analysis can help in mapping key research trends in AI-driven e-commerce, identify leading contributors and highlight research gaps and future directions.

This study aims to analyze AI adoption trends in e-commerce using bibliometric analysis. The specific objectives are to examine research trends in AI adoption in e-commerce, identify key themes, highlight ethical challenges and provide future research directions.

This study contributes to both academic research and business practice by providing a systematic bibliometric review of AI adoption trends in e-commerce, thematic insights on AI applications, ethical concerns, and practical implications for businesses integrating AI-driven solutions.

LITERATURE REVIEW

(Rane, et.al 2023) In this era of Industry 4.0, there is a great deal of data available, and AI is essential for intelligent data analysis and the development of intelligent automated systems. Product suggestions, inventory management, and customized purchasing are the most common applications of AI in e-commerce. (Pai et.al 2022) AI also aids businesses in making use of digital tools for machine learning, deep learning, image recognition, speech recognition,

biometrics, text analysis, and natural language processing (NLP). AI is driving new solutions and pleasant customer experiences in the e-commerce space.

(Adam et.al 2021) to enhance the online shopping experience for consumers, many AI-powered solutions have been launched, including virtual try-on systems (VTOs), recommendation agents, and chatbots. Customers' purchasing decisions are influenced by these technologies, which aim to enhance the technological interaction between customers and brands. (Vinhas da Silva et al. 2022) used structural equation modeling (SEM) to conduct quantitative research that reviewed the impact of AI-based technologies on the electronic experience of buyers after they had the intention to purchase. The results showed that AI is considered a helpful tool. Businesses are expected to increasingly embrace and integrate AI with other state-of-the-art technology soon.

AI can communicate with humans and imitate their skills to generate profit for companies. According to (Song et al. 2019) AI is having a profound impact on people's daily lives and careers. AI has emerged as a powerful tool to improve efficiency and increase sales in the e-commerce industry. In doing so, they emphasized AI's centrality to the e-commerce industry's development. Recommendation engines, smart assistants, intelligent forecasting systems, smart supply chain management, and dynamic pricing are the most prominent AI technologies in the e-commerce space right now.

(Tshepo et al. 2019) used the snowball technique to do a comprehensive study on the topic of AI in e-commerce and its applications in the economic environment of South Africa. 117 publications were cited in this investigation. Moreover, they concluded that several experts have stressed the significance of trust and client loyalty in online commerce. Rules and laws concerning ethical AI, cybercrimes, etc. must be drafted and enacted immediately to meet the critical need for change. South African countries have seen a substantial increase in the use of AI in e-commerce, which has revolutionized online purchasing for consumers.

Examining the effects of AI and the Internet of Things on South Africa's E-Business segment an additional qualitative investigation was carried out by (Malapane, Tshepo et al. 2022). The data for this study came from a systematic review of literature. For their study, a total of eighteen articles that had been peer-reviewed were considered. They concluded that the pace of e-business transformation in South Africa is lower than in other countries.

The use of AI in electronic commerce and information systems (IS) was investigated by (Bawack, et al. 2019) using literature review and bibliometric analysis. The key areas of applicability in e-commerce were recommender systems, sentiment analysis, trust, customization, and optimization. Moreover, it referenced Chinese affiliation as the pioneer in this area of research. According to the conclusions reached, ML, DL, and NLP were among the most heavily examined algorithms in the e-commerce study.

Understanding how management teams in e-commerce enterprises utilize AI-based predictive analytics systems to automate operations and optimize data flows was the major purpose of (Micu, et al. 2021) research, which was done in the Romanian e-commerce industry. Most online shop managers surveyed used AI algorithms developed using third-party toolkits to market their products. The second most popular AI-powered digital marketing tool was Google AdWords. Mobile shopping was gaining traction among Romanian customers. Most Romanian e-commerce companies used push marketing to get people download and use their apps. Considering the COVID-19 epidemic, their study's findings confirmed the role of e-commerce applications in promoting communication between online retailers and consumers. Theoretically, their work laid the groundwork for e-commerce and the use of AI by academics and managers.

Incorporating augmented and virtual reality technology into online retailers might enable more immersive and engaging purchasing experiences, according to (Al Khaldy et al. 2021). This is crucial for the companies to succeed in today's cutthroat e-commerce industry. These technological advancements provide unique, personalized experiences that consider the interests and tastes of each customer. The research sets out to fill gaps in the study's understanding of recent developments in augmented and virtual reality technologies and their possible uses in the e-commerce sector. By allowing virtual try-ons and product visualization, e-commerce has improved the online buying experience of consumers, according to fifty-five magazines. This has resulted in higher customer satisfaction and fewer product returns.

Online shopping assistants (OSA) are interactive and automated applications that facilitate online purchasing for customers. No comprehensive framework of OSA acceptability in e-commerce has been developed yet that incorporates ideas from sociopsychology, information security, and many information system disciplines. The goal of the research by (Singh, C., et al. 2024) was to fill this void by empirically investigating end users' intent to adopt OSAs from four different perspectives: operational, social, interpersonal, and safety. To ascertain the OSA acceptance in e-commerce, a comprehensive literature review was conducted. The study experimentally validated the recommended model using partial least squares structural equation modeling (PLS-SEM). Anthropomorphism, attitude, ease of use, enjoyment, privacy, confidence, and efficacy are some of the aspects that the results showed impact consumers' adoption of OSA. There was a large moderate influence of the respondents' gender and education level on this research.

Financial and e-commerce companies have embraced AI to boost operational efficiency, simplify the supply chain, and enhance customer experience. The main goal is to come up with new ways to correspond with customers and standardized ways to check the quality of products. Two of the most common AI methods used by businesses to get insights from data are Deep Learning (DL) and Machine Learning (ML). The analysis done by (Pallathadka et al. 2023) focused on the applications of AI and ML in banking, commerce, administration, and e-commerce. The main advantages of AI adoption were examined, including sales prediction, revenue maximization, stock control, security, and fraud detection.

The use of AI in e-commerce raises ethical concerns, particularly considering recent advances in the areas of algorithmic bias and data privacy. In conclusion, the rise of e-commerce has been a game-changer for businesses and consumers alike in the digital era. As e-commerce continues to expand, it reflects a societal trend away from impersonal, transactional trades and toward more immersive, customized experiences. At its core, this change is being driven by AI, which is transforming the way customers engage with online platforms, improving the efficiency of business processes, and providing tailored suggestions.

While numerous studies have explored the applications of AI in e-commerce, most existing research has focused on general AI adoption trends, consumer behavior, and specific AI tools such as chatbots and recommendation systems. However, there remains a major gap in identifying the critical elements that influence adoption of AI within the e-commerce industry, particularly from an integrated bibliometric and literature review perspective. Many studies highlight AI's role in enhancing customer experience, streamlining supply chains, and improving fraud detection, but they often lack a comprehensive synthesis of the key drivers and barriers that impact AI adoption in e-commerce.

This study aims to fill this knowledge gap by systematically analyzing past literature to identify and categorize the primary factors influencing AI adoption in e-commerce. Unlike

previous research that primarily focuses on isolated AI applications, this study provides a holistic review of AI-driven transformation in e-commerce businesses. By leveraging bibliometric analysis, the study synthesizes findings across diverse research streams to offer a structured understanding of the determinants shaping AI integration. Addressing this research gap will contribute to both academic knowledge and practical insights, guiding businesses in formulating more effective AI adoption strategies.

DATA AND METHODOLOGY

The research methodology of this comprehensive investigation was well-organized and systematic to confirm a complete and illuminating review of important literature and bibliometric analysis. Stage One of the literature review procedure included finding relevant articles using keywords and then assessing them. Stage Two involved finding related publications by looking at the citations of the identified papers. A set of exclusion and inclusion criteria was established to ensure high-quality articles were considered. Articles that met the inclusion requirements were those that had been peer-reviewed, presented at academic conferences, publicly available, and written in English. Additionally, only articles that were entirely pertinent to the issue were evaluated after reading their abstracts. After removing the papers that did not specifically address the topic of AI adoption in e-commerce, 61 research publications remained.

Inclusion & Exclusion Criteria

The following table explains the Inclusion Exclusion criteria Table 1.

Table 1 INCLUSION EXCLUSION CRITERIA	
Inclusion Criteria	Exclusion Criteria
Peer-Reviewed Publications Academic Conference Papers Public Availability Language: Only articles written in English. Relevance to AI Adoption in E-Commerce: Papers must specifically address AI adoption in e-commerce. Timeframe: Studies published between 2004 and 2024. Database Source: Scopus database. Research Type: Includes journal articles and conference proceedings, excluding books and non-scholarly sources.	Non-Peer-Reviewed Studies Non-English Publications Irrelevant Studies: Papers that did not focus on AI adoption in e-commerce. Subject Area Mismatch: Studies unrelated to AI, customer experience, machine learning, deep learning, chatbots, or e-commerce. Book Publications Title and Abstract Screening: Studies eliminated due to lack of relevance based on their title and abstract.

The PRISMA framework illustrated in Figure 1 represents a systematic and structured approach for selecting relevant research papers for the study. The initial search was conducted in the Scopus database using keywords related to AI, Customer Experience, E-Commerce, Machine Learning, Deep Learning, and Chatbots. This search yielded 135 records out of which 131 were within the timeline of 2004 to 2024. The first exclusion step, which focused on subject areas, removed 58 documents, reducing the count to 73. Further screening led to the elimination of nine documents due to their abstract title. Additionally, documents other than books were excluded, reducing the final number of records to 61.

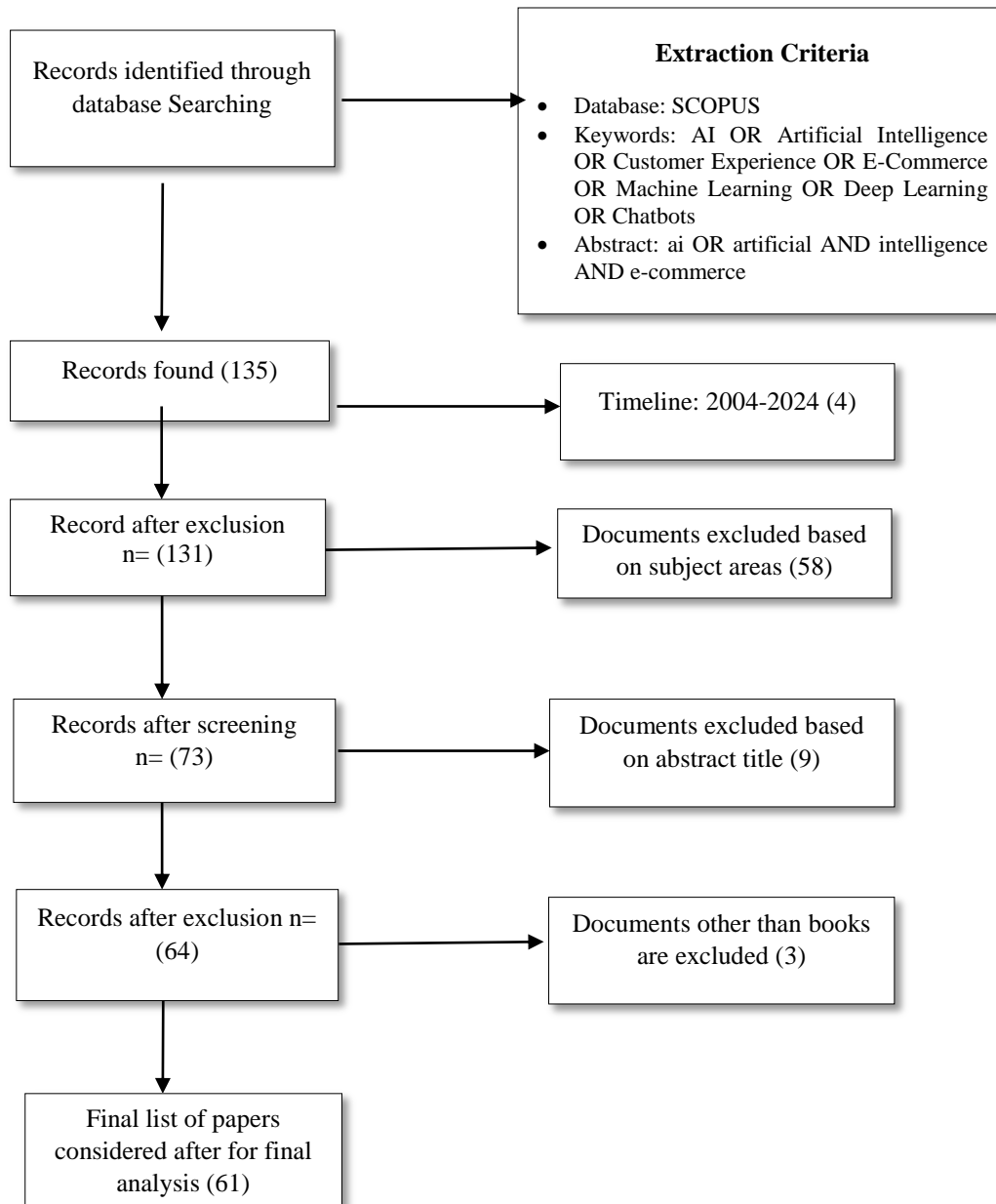


FIGURE 1
PRISMA FRAMEWORK

Biblioshiny (R-based tool) and VOSviewer were used for citation network analysis, co-authorship mapping, and keyword co-occurrence analysis. Thematic clusters were identified using co-word network clustering.

This structured approach ensured a comprehensive review of AI adoption trends, finding research gaps, and emerging areas for future exploration.

FINDINGS AND DISCUSSION

Publication Trends in AI Adoption in E-Commerce

The bibliometric analysis revealed five main types of journals publish research on AI in e-Commerce: Computer Science (51.2% of the total), Engineering (24.0%), Decision Sciences (12.8%), Social Sciences (6.4%) and Business, Management, and Accounting (5.6%). The fact that this study drew from both technical and managerial domains demonstrates the value of interdisciplinary research. Figure 2 shows the classification of literature by topic area and the nature of the documents. Conference papers and Articles make up the bulk of the documents, accounting for 65.3 % and 23.2 % of the total respectively. The book chapters comprise 7.2% and review articles make up 4.3% of the total.

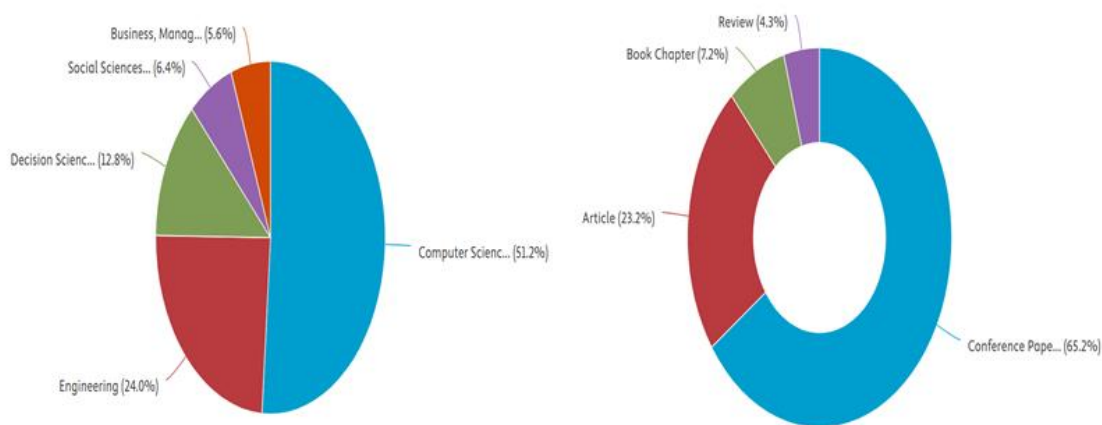


FIGURE 2
CLASSIFICATION OF LITERATURE BY SUBJECT AREA AND NATURE OF DOCUMENTS

As early as the 1990s, articles started appearing on the topic of AI adoption in e-commerce. The distribution of publications by year is shown in Figure 3, and it is evident that there has been a significant growth in the number of journals starting in 2018. The highest number of publications (20) was published in 2024, indicating that the research topic is becoming increasingly important to the researchers.

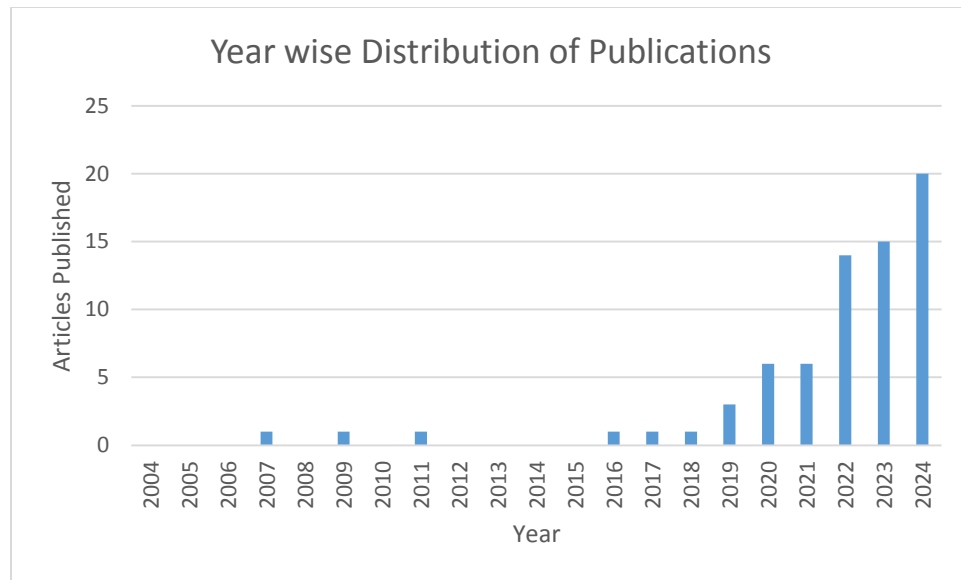


FIGURE 3
YEAR-WISE DISTRIBUTION OF PUBLICATIONS

Most Influential Research Contributions

Table 2 presents the top-cited research papers in AI adoption in e-commerce. Highly cited studies predominantly explore AI-driven personalization, machine learning algorithms, and fraud prevention strategies.

Author(s)	Title	Citations
Khrais, L. T. (2020).	Role of AI in Shaping Consumer Demand in E-Commerce.	112
Vanneschi, L., Horn, D.M., Castelli, M., Popovič, A. (2018)	An AI system for predicting customer default in e-commerce	62
Li, B., Li, J., Ou, X. (2022)	Hybrid recommendation algorithm of cross-border e-commerce items based on AI and Multiview collaborative fusion	31
Patil, M., Rao, M. (2018)	Studying the contribution of machine learning and AI in the interface design of E-commerce site	14

Global Research Collaboration Networks

Research is concentrated in India, China, and the U.S., with increasing contributions from Singapore, Italy, and Saudi Arabia. Institutions such as Symbiosis International University (India), University of Presov (Slovakia), and Prince Sultan University (Saudi Arabia) are among

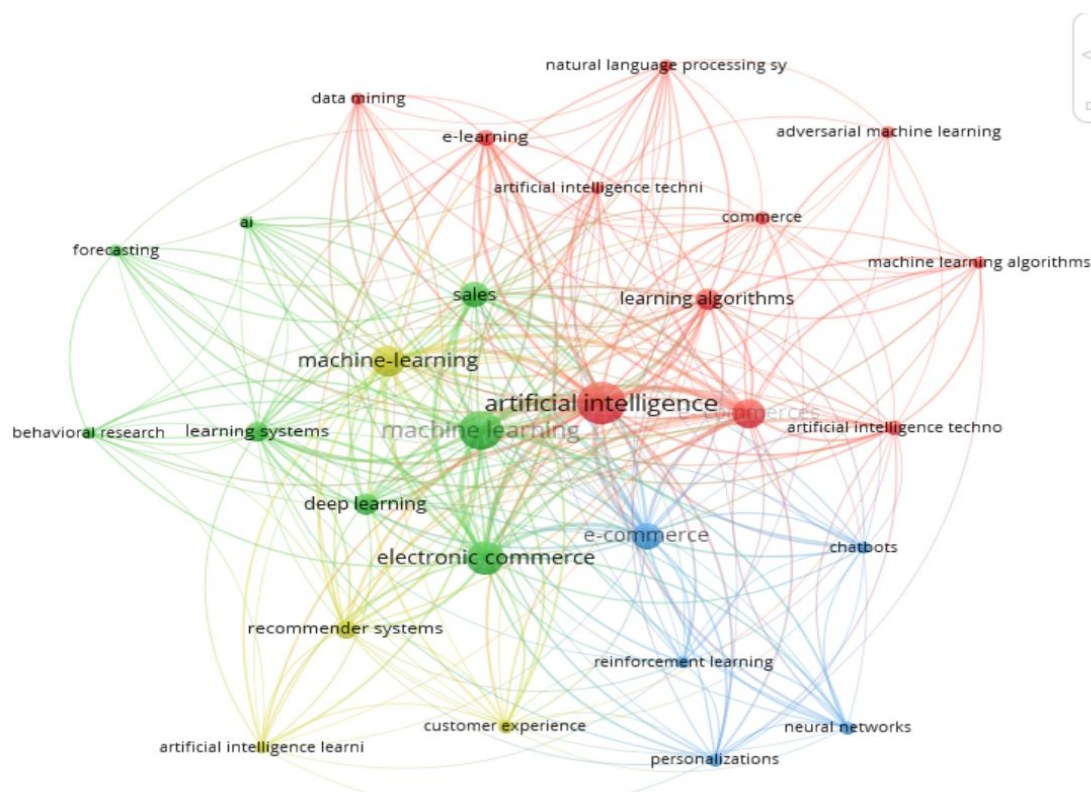


FIGURE 5
CO-OCCURRENCE NETWORK

Thematic Clusters in AI Adoption Research

Thematic maps based on frequently used terms were generated using keywords plus. The system divided the thematic map into four categories which were Customer Experience and Personalization, Operational Efficiency and Supply Chain, Fraud Detection and Cybersecurity and Ethical AI and Regulatory Challenges.

The results highlight four primary thematic clusters in AI-driven e-commerce as shown in Table 3.

Table 3 THEMATIC CLUSTERS IN AI ADOPTION RESEARCH	
Thematic Cluster	Key Topics
Customer Experience & Personalization	AI-driven recommendations, chatbots, predictive analytics
Operational Efficiency & Supply Chain	AI in inventory management, logistics optimization
Fraud Detection & Cybersecurity	AI-based fraud prevention, transaction monitoring
Ethical AI & Regulatory Challenges	Data privacy, algorithmic bias, AI fairness

Factors Contributing to AI Adoption

There are a lot of elements that come into play when companies decide to use AI in e-

commerce, and each of these aspects is important. The following factors are identified as the most important variables leading to AI deployment in e-commerce:

- **Data Analytics and Insights:** Online retailers provide mountains of data that AI systems may sift through for useful information. When it comes to providing personalized, tailored experiences for each client, the gathering and segmentation of consumer data are crucial. Customer happiness is crucial to a company's success, and AI makes it simpler to analyse and predict consumer purchasing habits and market trends. With the use of AI, companies can improve their pricing strategies, increase their competitiveness, and expand faster by making data-driven choices.
- **Enhanced Customer Service:** One of the fastest-growing trends in online customer service is the use of live chat interfaces. Communication between humans and bots and other AI-based interactive software agents, usually built on ML technologies, is the goal of their development. These chatbots and virtual assistants driven by AI can provide rapid customer service, answer inquiries, and help with product selection and purchase choices. They can also decrease costs and save time. Customer satisfaction levels have risen because of enhanced efficiency and responsiveness in customer service.
- **Voice Commerce:** New channels of communication and involvement between buyers and sellers are opened by voice commerce. AI powered voice assistants let customers do tech-enabled transactions without using their physical senses. This new fad in online retail is increasing accessibility and convenience by letting consumers make purchases, monitor their shipments, and get tailored suggestions using voice interactions.
- **Operational Efficiency:** Inventory management, order processing, and customer care are just a few of the e-commerce processes that may benefit from AI-driven automation. Businesses may save time and costs with the aid of AI since it optimizes operations and reduces manual duties.
- **Enhancing Customer Experience:** There has been meteoric growth in the e-commerce industry during the last decade. It is critical to understand the needs and habits of internet users since the number of these people is rapidly increasing. Online retailers are using AI enabled technology to monitor consumers' choices, interests, and purchasing patterns to ascertain their needs and wants in relation to products and services purchased via their platforms. Customized and trouble-free client experiences are made possible with the use of AI technology like chatbots, customized product recommendations, and recommendation systems. To drive engagement, retention, and revenue, businesses know they need to cater to customers' wants and requirements. Adapting services to meet evolving consumer wants via the use of AI insights may help businesses strengthen long-term relationships and client loyalty. The incorporation of innovative technologies like AR and VR has made it much simpler to meet the demands of consumers.
- **Competitive Advantage:** It is essential for organizations to focus on client retention in today's fast-paced business world if they want to remain competitive. If it comes to making predictions, AI models can manage massive volumes of data better than humans. Organizations in the e-commerce sector are capitalizing on the growing popularity of AI to improve customer experience, streamline operations, and anticipate and respond to consumer trends.
- **Personalized Shopping Experiences:** E-commerce platforms can now analyse consumer data and behaviour with the help of AI, allowing for personalized product recommendations, marketing messages, and shopping experiences. Increased conversion rates and happier customers are the results of this customization. The product availability has improved, and prospective purchasers now have access to a wider range of luxurious options thanks to recommendation algorithms. The systems employ machine learning algorithms to determine which goods would be most appealing to customers, and examine data such as search histories, purchase tendencies, and preferences. When it comes to decision-making, consumer happiness, and company performance, AI-powered recommendation engines have proven to be invaluable tools.
- **Predictive Analytics:** The capacity of predictive analytics to enable automated decision-making processes is leading to its increased application in anticipating many elements of corporate

organizations. Analytical algorithms powered by AI may sift through mountains of data in search of patterns in consumer tastes, purchases, and trends. Through better stock management, evaluation of pricing tactics, and promotion campaigns, e-commerce enterprises may boost their sales performance and profitability.

- **Supply Chain Optimization:** Organizations may improve their supply chain with the use of AI technology. This technology can assist with inventory management, demand forecasting, logistics, and distribution. AI helps e-commerce companies streamline operations, reduce inefficiencies, and increase supply chain performance and agility, which in turn improves delivery time, decreases costs, and overall efficiency.
- **Fraud Detection and Prevention:** With the development of e-commerce, the number of online transactions has grown substantially. As a result, fraud using credit and debit cards has become an enormous issue on a global scale. The need for efficient fraud prevention and detection systems becomes apparent when dealing with online transactions involving substantial amounts of money. By analysing transactional data, fraud detection systems driven by AI may spot suspicious behaviour and identify harmful acts like hacking, identity theft, and transaction fraud.
- **Organizational Culture and Leadership:** To drive organizational transformation and overcome obstacles to adoption, it is vital to have strong leadership support and a clear strategic vision for AI integration.
- **Cost-effectiveness:** Although there may be some upfront expenses associated with using AI technology, the advantages usually surpass them overall. Eventually, businesses may save money with AI-driven automation since it cuts labour costs, improves efficiency, and makes better use of resources. Businesses may save money by automating mundane and operational tasks.

Businesses have a lot to gain from the merging of AI with e-commerce, including better customer engagement, more functional efficiency, and the ability to drive development in an increasingly competitive market.

Challenges and Ethical Considerations in AI Adoption

While AI adoption in e-commerce offers significant benefits, it also presents the following critical challenges and ethical concerns that need to be addressed.

- **Data Privacy and Security Risks:** AI-driven platforms collect vast consumer data, raising concerns about security, consent, and potential misuse. Weak regulatory frameworks intensify vulnerabilities.
- **Algorithmic Bias and Fairness:** AI models may reflect biases in training data, leading to unfair pricing, exclusion, and discriminatory recommendations. Transparent development and continuous audits are essential.
- **Ethical AI Decision-Making and Consumer Trust:** Automated decisions in pricing, fraud detection, and marketing raise ethical concerns. Businesses must ensure transparency, fairness, and explainability to maintain trust.

Addressing these challenges requires robust AI governance frameworks, ethical AI practices, and compliance with data protection regulations.

CONCLUSION

This study contributes to the academic literature by systematically reviewing AI adoption trends, identifying key risks related to data security and AI bias, and addressing consumer trust concerns. It also highlights emerging research areas, such as generative AI, sustainability, and regional disparities in AI adoption. It provides a comprehensive bibliometric analysis of AI adoption in e-commerce, highlighting its transformative impact on customer experience,

operational efficiency, predictive analytics, and fraud detection. However, critical challenges remain, including data privacy concerns, algorithmic bias, ethical implications of automation, and regulatory gaps. Businesses must balance innovation with ethical responsibility by ensuring transparency, fairness, and compliance with global data protection laws.

LIMITATIONS OF THE STUDY

This study primarily relies on existing literature and bibliometric analysis, which may not capture the latest advancements in AI, such as generative AI and quantum computing in e-commerce. Given AI's rapid evolution, further empirical validation is needed to incorporate recent industry developments. Additionally, the geographic scope of this analysis is limited. While it highlights major players like China, India, and the U.S., it does not comprehensively examine AI adoption in emerging e-commerce markets in Africa, South America, or Southeast Asia. Factors such as regulatory differences, customer behaviour, and technological infrastructure require deeper cross-cultural analysis. Furthermore, this study prioritizes quantitative bibliometric analysis over qualitative insights. Aspects like data privacy, algorithmic bias, and ethical considerations in AI-driven automation warrant more in-depth exploration through qualitative methods such as expert interviews and case studies.

FUTURE RESEARCH DIRECTIONS

While this study provides key insights into AI adoption in e-commerce, several areas require further exploration. The rise of generative AI has transformed content creation, virtual assistants, and personalized shopping, necessitating research on its impact on consumer engagement, marketing automation, and AI-driven recommendations. Regional differences in AI adoption, influenced by technological infrastructure, regulations, and consumer behaviour, also require comparative studies to identify challenges, best practices, and policy recommendations. Additionally, AI's role in promoting sustainable e-commerce through supply chain optimization, carbon footprint reduction, and improve ethical sourcing to support sustainability goals in online retail require exploration. Finally, growing concerns around AI bias, fairness, and transparency highlight the need for ethical AI frameworks that enhance consumer trust and ensure responsible AI deployment.

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