**ARTIFICIAL INTELLIGENCE ON E-COMMERCE: A SYSTEMATIC REVIEW ON UNDERSTANDING CURRENT SCOPE AND FUTURE RESEARCH AVENUES**

**Roshan Panditharathna\***

*University of Westminster, United Kingdom*

*r.panditharathna@westminster.ac.uk*

**Yang Liu\***

*University of Westminster, United Kingdom*

*y.liu2@westminster.ac.uk*

**Jesyma Mohamed Nasir\*\***

*University of Westminster, United Kingdom*

w2010855@westminster.ac.uk

**Alessandra D’elia\*\***

*University of Westminster, United Kingdom*

w1766724@westminster.ac.uk

**Muna Rai\*\***

*University of Westminster, United Kingdom*

w1981240@westminster.ac.uk

**Abdul Khader Khan Mujawar\*\***

*University of Westminster, United Kingdom*

w1981574@westminster.ac.uk

**Abstract**

Artificial Intelligence (AI) represents a paradigm shift, emulating human cognitive functions such as learning, problem-solving, and decision-making. AI's integration into e-commerce has revolutionised online business operations, impacting customer interactions and supply chain logistics. This systematic review aims to provide a comprehensive understanding of AI in e-commerce, utilising the Scopus citation database and the PRISMA framework to ensure rigorous selection. The review identifies seven thematic clusters: advanced computational techniques, intelligent systems, AI-driven personalisation, supply chain optimisation, data-driven e-commerce, innovative consumer retail, and data-driven online systems. These clusters highlight AI's profound impact on operational efficiency and customer experience. Practical recommendations for e-commerce firms include leveraging AI-driven personalisation, optimising supply chains, utilising big data analytics, adopting innovative AI applications, and promoting sustainable practices. Future research should explore ethical AI, quantum computing, consumer trust, sustainable AI practices, AI integration with emerging technologies, and longitudinal studies on AI impact. This study contributes to the theoretical understanding of AI's role in e-commerce and offers actionable insights for enhancing service quality and profitability in the evolving market.

***Keywords:*** *Artificial Intelligence, E-Commerce, Personalization, Supply Chain Optimization, Big Data Analytics*

\* Staff partners

\*\* Student partners

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**Introduction**

AI represents a paradigm shift in how technology can emulate human cognitive functions, such as learning, problem-solving, and decision-making (Ertel, 2018; Rodriguez & Peterson, 2024). AI is progressively becoming an integral part of various industries, with the e-commerce sector being a significant beneficiary (Bawack et al., 2022; He & Liu, 2024). The rapid development and adoption of AI have revolutionised the way businesses operate online, influencing everything from customer interactions to supply chain logistics.

In the flourishing industry of e-commerce, AI's impact is profound and multifaceted. The nature of online shopping and customer-buying patterns are continually evolving, driven by the capabilities of AI technologies to analyse vast amounts of data and make informed decisions (Arachchi & Samarasinghe, 2024). AI applications in e-commerce are not just enhancing operational efficiency but also transforming customer experiences by providing personalised recommendations and customer service (El Abed & Castro-Lopez, 2024), which were unimaginable a few years ago.

The dynamic landscape of e-commerce is characterised by constant change and innovation. AI stands at the forefront of this transformation, enabling businesses to engage with consumers more effectively and optimise their operations with unprecedented precision. The advances in AI technologies have paved the way for e-commerce platforms to offer highly personalised shopping experiences, streamline supply chains, and make data-driven decisions that significantly boost efficiency and profitability (Deng et al., 2024). Notable examples of AI in e-commerce include Alibaba's Taobao Live, which uses AI to enhance live-stream shopping experiences, Amazon's recommendation engine that tailor’s product suggestions to individual users, and H&M's chatbot on Kik that provides personalised customer service (Si, 2021; Ayyapparajan & Sabeena, 2022).

AI's role in e-commerce extends beyond enhancing consumer interactions to redefining the operational frameworks of businesses. AI-driven technologies like virtual streaming, recommendation systems, and chatbots are significantly influencing consumer buying behaviour and the nature of interactions between customers and online business platforms (Li et al., 2023; Xie et al., 2024). These technologies enable businesses to understand and predict consumer preferences with greater accuracy, thus tailoring their offerings to meet specific needs and preferences.

The comprehensive examination of AI in e-commerce requires an exploration of both B2C and B2B aspects. B2C e-commerce involves direct transactions between businesses and consumers, where AI can enhance user experiences through personalised recommendations, targeted marketing, and efficient customer service. On the other hand, B2B e-commerce involves transactions between businesses, where AI can optimise supply chains, improve inventory management, and facilitate better business decisions through advanced data analytics.

Despite the substantial exploitation of AI in the e-commerce sector, existing research has predominantly focused on specific areas such as customer service (Fotheringham & Wiles, 2023), marketing capabilities (Manis & Madhavaram, 2023), and marketing strategies (Wu & Monfort, 2023). This narrow focus leaves a gap in understanding the broader implications of AI across various facets of e-commerce, including online retailing, business-to-consumer (B2C), and business-to-business (B2B) interactions. To bridge this gap, it is essential to adopt a more holistic approach to studying AI's impact on e-commerce. To explore the broader impact of AI in e-commerce, this systematic review aims to address the following research questions:

**RQ1.** What is the current state of research in the field of artificial intelligence in e-commerce?

**RQ2.** What are the next research opportunities for artificial intelligence in e-commerce?

**Methodology**

To achieve a comprehensive understanding of the current scope of AI in e-commerce, a systematic review was conducted using the Scopus citation database. This database was chosen for its extensive coverage and credibility in indexing high-quality, peer-reviewed academic literature across a multitude of disciplines. The selection of Scopus ensured that the review would encompass a wide array of studies, thereby providing a robust and holistic overview of the field.

A detailed and carefully constructed search string was employed to gather relevant literature. This search string was designed to capture all pertinent studies by including a combination of keywords related to AI and e-commerce. Keywords such as "Artificial Intelligence," "Machine Learning," "E-commerce," "Online Retail," "Recommendation Systems," "Chatbots," "Supply Chain Optimisation," and "Personalisation" were used. Boolean operators and wildcards were also incorporated to broaden the search and include variations of these terms. This approach ensured that the search was both comprehensive and precise, capturing a wide range of studies that directly or indirectly addressed the application of AI in e-commerce. The bibliometric analysis not only provided a quantitative overview of the research landscape but also facilitated a deeper qualitative understanding of the key themes and trends in the field.

To ensure a rigorous selection process, the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework was utilised. The PRISMA framework is a widely accepted methodology for conducting systematic reviews, ensuring transparency and reproducibility (PRISMA Group, 2021). The framework involves a four-phase process: identification, screening, eligibility, and inclusion.

*Identification:* In this initial phase, clear and stringent inclusion criteria were established to ensure that only relevant and high-quality studies were included in the review. This helped in maintaining the focus on AI applications in E-commerce and excluded studies that did not meet the academic rigour or relevance. The detailed search string was applied to the Scopus database, yielding a total of 10,154 articles.

*Screening:* The next phase involved screening the titles and abstracts of the retrieved articles to eliminate duplicates and irrelevant studies. The screening and eligibility assessments were conducted by multiple independent reviewers. Discrepancies between reviewers were resolved through discussion and consensus, ensuring a balanced and unbiased selection of studies. This step reduced the pool of articles to 453.

*Eligibility:* The remaining articles underwent a review to assess their eligibility based on predefined inclusion and exclusion criteria. The inclusion criteria focused on studies that specifically addressed the application of AI in e-commerce were peer-reviewed and provided empirical or theoretical insights. Articles not meeting these criteria, such as those focusing solely on technical aspects of AI without an e-commerce context, were excluded. This rigorous review process resulted in the retention of 299 articles.

*Inclusion:* In the final phase, these 299 articles were included in the systematic review. This collection represented a comprehensive body of work authored by 839 researchers across 38 countries, spanning from 1996 to 2024. The temporal span of the included studies ensured that the review covered both historical perspectives and the latest advancements in the field.

Following the selection process, we performed the bibliometric analysis using Biblioshiny and VOSViewer software. Biblioshiny, an R-based web interface for bibliometric analysis, and VOSViewer, a software tool for constructing and visualising bibliometric networks, were employed to gain deeper insights into the selected literature.

A performance analysis was first conducted to provide an overview of the publication trends, including the number of publications per year, the geographic distribution of the research, and the most prolific authors and institutions. This analysis helped in understanding the growth and distribution of research on AI in E-commerce. Keyword co-occurrence analysis was then carried out to identify major themes and research areas within the field.

By combining the PRISMA framework's rigorous selection process with advanced bibliometric tools, the systematic review achieved a comprehensive and in-depth understanding of the current scope of AI in e-commerce, laying a solid foundation for future research and practical applications.

**Findings and Discussion**

Table 1. presents the results of the descriptive analysis based on 299 documents. The descriptive analysis revealed an average citation count of 36.43 per document in the sample, indicating a significant impact of the selected publications on the academic community. The collaboration index of 2.97 suggests a moderate level of international and interdisciplinary collaboration among researchers. There are around 3 authors per document, with 839 authors in total. In total 1133 author keywords and 15,383 references are included in the datafile.

|  |  |
| --- | --- |
| Description | Results |
| Timespan | 1996:2024 |
| Documents | 299 |
| Average citations per document | 36.43 |
| References | 15,383 |
| Author’s keywords (DE) | 1,133 |
| Authors | 839 |
| Co-authors per documents | 3.21 |

**Table 1.** Descriptives analysis

***Performance Analysis***

The performance analysis shows an increasing trend of publication on this topic between 2018-2022, which indicates the novelty of the topic. In 2003, more than 60 relevant articles have been published. In terms of most relevant institutions, National University of Singapore contributes most articles (13) followed by the Hongkong Polytechnic University (11) and Tsinghua university (11). The country that has most citations is USA with the number of citations equals to 1837, followed by China (1317) and Canada (1224). United Kingdom ranks number 7 with 529 citations. Lastly, decision Support System journal has most citations regarding this topic (2531) followed by MIS quarterly Management Information Systems journal (1053) and Electronic Commerce Research and Applications Journal (972). Based on these results, it shows that although scholars are paying more attention, this topic is still at a niche stage which requires further investigation.

***Thematic Clusters in AI and E-Commerce Research***

Seven thematic clusters emerged from the co-occurrence analysis of keywords (Fig. 1), highlighting the diverse applications and research directions in the field of AI and e-commerce. The detailed discussion on each cluster is presented below.

*Advanced Computational Techniques:* This cluster encompasses studies on algorithms and computational models that drive AI applications in e-commerce. Research in this area focuses on developing and refining algorithms for tasks such as recommendation systems, fraud detection, and predictive analytics (Gandomi & Haider, 2015). For example, Pettenati et al. (2008) investigated how AI-boosted system can influence consumer trust in e-commerce applications. Future research should explore the integration of emerging technologies like quantum computing to enhance the computational capabilities of AI systems in e-commerce.

*Intelligent Systems and Machine Learning:* This cluster includes research on machine learning models and intelligent systems that facilitate decision-making processes in e-commerce. The focus is on improving the accuracy and efficiency of AI systems in understanding consumer behaviour, forecasting demand, and automating customer interactions (Rust & Huang, 2014). Future research should investigate the ethical implications of AI-driven decision-making and develop frameworks for ensuring transparency and accountability.

*AI-Driven Personalisation:* Personalization is a critical aspect of e-commerce, and this cluster highlights studies on AI-driven approaches to customise user experiences. Research explores techniques for tailoring product recommendations, marketing messages, and website interfaces to individual preferences (Davenport & Ronanki, 2018). Future research should examine the long-term effects of personalisation on consumer behaviour and investigate methods for balancing personalisation with privacy concerns.

*Intelligent Optimisation in Supply Chains:* Efficient supply chain management is crucial for e-commerce success, and this cluster focuses on AI-driven optimisation techniques. The research addresses challenges in inventory management, logistics, and demand forecasting (Bock et al., 2020). Future research should explore the integration of AI with Internet of Things (IoT) technologies to enable real-time tracking and adaptive supply chain strategies.

*Data-Driven E-Commerce:* Data is the backbone of AI applications in e-commerce, and this cluster highlights research on data collection, analysis, and utilisation. Studies focus on harnessing big data to derive actionable insights and drive business strategies (Nguyen et al., 2024). Future research should investigate the potential of blockchain technology to enhance data security and integrity in e-commerce transactions.

*Innovation in Consumer Retail:* This cluster explores innovative AI applications in consumer retail, including virtual assistants, augmented reality, and voice commerce. The research examines the impact of these technologies on consumer engagement and purchasing behaviour (Paredes & Olander Roese, 2024). Future research should evaluate the scalability of these innovations and their implications for traditional retail models.

*Data-Driven Online Systems and Product Design:* This cluster focuses on the role of AI in designing online systems and products. Research investigates how AI can enhance user interface design, improve product development processes, and facilitate user feedback mechanisms (Akhtar et al., 2024). As shown in Fig.5 (orange cluster), this cluster is under investigated comparing with other clusters. Future research can explore the potential of AI to support sustainable and inclusive design practices.

A close-up of words

Description automatically generated

**Fig. 1** Keywords

**Future Research Avenues**

Based on the identified clusters and existing research gaps, we propose several avenues for future research:

*Ethical AI in E-Commerce:* Investigate the ethical implications of AI applications in e-commerce, focusing on issues such as data privacy, algorithmic bias, and transparency. Develop frameworks for ethical AI deployment that balance innovation with consumer protection.

*Quantum Computing for E-Commerce AI:* Explore the potential of quantum computing to enhance the performance of AI algorithms in e-commerce, particularly in areas requiring complex computations and large-scale data analysis.

*AI and Consumer Trust:* Examine the impact of AI-driven personalization and automation on consumer trust and loyalty. Identify strategies for mitigating potential negative effects and enhancing positive consumer perceptions.

*Sustainable AI Practices:* Investigate how AI can support sustainable practices in e-commerce, including eco-friendly product recommendations, efficient resource utilization, and sustainable supply chain management.

*AI Integration with Emerging Technologies:* Study the integration of AI with emerging technologies such as IoT, blockchain, and 5G to create more robust and secure e-commerce ecosystems. Assess the potential benefits and challenges of such integrations.

*Longitudinal Studies on AI Impact:* Conduct longitudinal studies to understand the long-term effects of AI applications on e-commerce businesses, consumer behaviour, and market dynamics. Provide insights into the sustainability and evolution of AI-driven strategies.

**Contributions to Theory and Practice**

This systematic review makes significant contributions to both the theoretical and practical domains of AI and e-commerce. By systematically mapping the existing research landscape, the review provides a detailed and comprehensive understanding of how AI technologies are currently being utilised within the e-commerce sector. The identification of key thematic clusters not only organises the vast body of literature but also reveals the primary areas where AI has the most substantial impact, thus contributing to the theoretical framework of AI in e-commerce.

**Theoretical Contributions**

*Mapping the Research Landscape:* The review offers a thorough mapping of the existing research on AI applications in e-commerce, categorising studies into distinct thematic clusters. This mapping is crucial for understanding the breadth and depth of AI's impact on e-commerce and serves as a foundational reference for future research. By delineating areas such as advanced computational techniques, intelligent systems, AI-driven personalisation, supply chain optimisation, data-driven e-commerce, innovative consumer retail, and data-driven online systems, the review provides a structured overview of the field.

*Identifying Research Gaps:* One of the significant theoretical contributions of this review is the identification of research gaps. While substantial progress has been made in certain areas, others remain underexplored. For instance, the ethical implications of AI in e-commerce, the long-term effects of AI-driven personalisation on consumer behaviour, and the integration of AI with emerging technologies like blockchain and IoT are areas that warrant further investigation. Highlighting these gaps guides researchers towards fruitful avenues for future inquiry.

*Framework for Future Research:* By outlining the current state of research and pointing out gaps, the review effectively sets an agenda for future studies. It encourages researchers to adopt a more holistic approach to AI in e-commerce, considering not only the technical and operational aspects but also the ethical, social, and long-term business implications. This comprehensive framework can help in developing a more integrated understanding of AI's role in e-commerce.

**Practical Contributions**

*Enhancing Service Quality:* The review provides practical recommendations for e-commerce firms on leveraging AI technologies to enhance service quality. For instance, AI-driven personalisation techniques can be employed to tailor product recommendations and marketing messages to individual preferences, thereby improving customer satisfaction and loyalty. Businesses can implement advanced machine learning models to understand and predict consumer behaviour, enabling more effective customer engagement strategies.

*Optimising Supply Chains:* AI applications in supply chain management can lead to significant improvements in efficiency and cost-effectiveness. The review highlights how AI-driven optimisation techniques can address challenges in inventory management, logistics, and demand forecasting. E-commerce firms can use AI to streamline their supply chains, reduce operational costs, and enhance overall service delivery. The integration of AI with IoT technologies can further enable real-time tracking and adaptive supply chain strategies.

*Data Utilization:* The review emphasises the importance of data-driven decision-making in e-commerce. By harnessing big data, businesses can derive actionable insights that drive strategic decisions. AI can analyse vast datasets to identify trends, predict market shifts, and optimise business operations. The potential of blockchain technology to enhance data security and integrity is also highlighted, offering a pathway for businesses to secure their data transactions and build consumer trust.

*Innovation in Consumer Engagement:* AI-powered innovations such as virtual assistants, augmented reality, and voice commerce are transforming consumer engagement. The review discusses the impact of these technologies on consumer behaviour and purchasing patterns. E-commerce firms can leverage these AI applications to create more interactive and engaging shopping experiences, thereby attracting and retaining customers. Evaluating the scalability of these innovations can help businesses understand their long-term viability and integration potential.

*Sustainability and Inclusivity:* AI can also support sustainable and inclusive practices in e-commerce. The review suggests that future research should explore how AI can facilitate eco-friendly product recommendations, efficient resource utilisation, and sustainable supply chain management. Businesses can adopt these practices to meet the growing consumer demand for sustainability and inclusivity, thereby enhancing their brand image and market competitiveness.

**Recommendations for E-Commerce Firms**

*Leveraging AI-Driven Personalisation:* Businesses should invest in AI technologies that enable personalized customer experiences. This includes implementing sophisticated recommendation engines, personalised marketing campaigns, and customised website interfaces. By doing so, firms can increase customer satisfaction, loyalty, and, ultimately, profitability.

*Implementing AI in Supply Chain Management:* E-commerce firms should explore AI-driven solutions for supply chain optimisation. This includes using AI for demand forecasting, inventory management, and logistics planning. The integration of AI with IoT can further enhance supply chain visibility and efficiency.

*Utilising Big Data Analytics:* Companies should harness the power of big data analytics to inform their business strategies. AI can process large volumes of data to uncover insights that drive decision-making. Firms should also consider blockchain technology to enhance data security and build consumer trust.

*Adopting Innovative AI Applications:* E-commerce businesses should stay abreast of emerging AI applications such as virtual assistants, augmented reality, and voice commerce. By adopting these technologies, firms can offer more engaging and interactive shopping experiences to their customers.

*Promoting Sustainable Practices:* Businesses should explore how AI can support sustainable practices. This includes using AI to recommend eco-friendly products, optimise resource utilisation, and manage sustainable supply chains. By adopting these practices, firms can meet consumer demand for sustainability and enhance their market position.

**Conclusion**

AI's role in e-commerce is transformative, influencing both operational efficiencies and customer experiences. As AI technologies continue to evolve, their applications in e-commerce will expand, offering new opportunities and challenges. By understanding the current research landscape and identifying future directions, this study aims to contribute to the ongoing dialogue on how AI can best be leveraged to drive innovation and growth in the e-commerce sector.

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