*I.J. Information Engineering and Electronic Business*, **2025, 5, 42-61**
Published Online on October 8, 2025 by MECS Press (http://www.mecs-press.org/)
DOI: 10.5815/ijieeb.2025.05.04

# Analyzing the Impact of Artificial Intelligence on Shaping Consumer Demand in E-Commerce: A Critical Review

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Received: 02 November, 2024; Revised: 31 January, 2025; Accepted: 23 March, 2025; Published: 08 October, 2025

**Abstract:** The surge in scholarly articles on e-Commerce mirrors its rapid ascent in the market's legitimacy. According to customer product recommendation theory, e-Commerce research may exhibit a bias toward specific customer product recommendations due to its evolving nature. To address this concern, this study examines five of the leading e-Commerce journals. The findings reveal a predominant focus on two main groups: customers and the integration of artificial intelligence (AI) in e-commerce recommendation systems. However, there is a notable lack of attention toward other critical groups, such as suppliers, indirect stakeholders, investors, and regulators. With e-Commerce continuing to mature, it is crucial to explore these neglected themes, sectors, and entities. This paper identifies gaps in current research through targeted keyword searches by aiming to bring these overlooked areas to the forefront. By highlighting persisting challenges in e-Commerce research, this study seeks to raise discourse and innovation in the field by ensuring that emerging topics are not overlooked. The role of AI in e-Commerce, particularly in the development of advanced recommendation systems, is identified as a key area shaping consumer experiences and market dynamics.

**Index Terms:** E-Commerce, Artificial Intelligence, Machine Learning, Recommendation System

## 1. Introduction

Both the integration of information technology-IT and the forces of globalization have fundamentally transformed the landscape of business operations [1]. Virtually every business has invested significantly in its IT infrastructure to

support expansion efforts. With electronic commerce-EC becoming increasingly prominent, there is a heightened focus on its utilization for conducting business transactions. Businesses are keen on leveraging EC to seamlessly connect with their trading partners, thereby enhancing their global strategic capabilities through concepts like (Just in Time production) and (Just in Time) logistics.

However, it's important to note that there isn't universal agreement on the definition of EC [2]. From a communication standpoint, EC encompasses various channels such as phone lines, computer networks, or other mediums to facilitate the exchange of information, services, goods, or online payments. From a business process perspective, EC involves the use of technology to automate corporate transactions and workflows. Additionally, it serves as a mechanism for reducing service costs, enhancing product efficiency, and expediting service delivery, thus catering to the needs of industries, clients, and management alike.

Moreover, EC extends to online shopping, the distribution of products and information, and access to a plethora of online services. The proliferation and rapid advancement of Internet and network technologies have solidified the electronic industry as a pivotal sector for contemporary businesses. Today, a substantial portion of business operations, including sales and purchases of goods and services, are conducted online, underlining the indispensability of an internet connection for certain transactions.

Electronic commerce [3], commonly referred to as e-commerce, denotes the utilization of internet and electronic platforms for conducting transactions involving goods and services. To partake in e-commerce, a business necessitates access to both the internet and Information Technology-IT, encompassing electronic data interchange-EDI. E-commerce entails the direct trading of products or services with customers through an online vendor's website. For facilitating transactions, businesses employ mechanisms such as wireless shopping carts or purchase baskets to accept payments via credit card, debit card, or electronic fund transfer-EFT through a gateway. Moreover, the essence of e-commerce lies in fostering value-generating relationships between individuals and businesses, utilizing digital information processes and electronic communication in commercial dealings. The realm of business-to-business-B2B e-commerce is experiencing rapid expansion globally, attributed to the increasing adoption of Information and Communication Technologies-ICTs, notably the Internet. This expansion empowers customers to compare prices across regions, monitor fluctuations based on demand, and explore substitution options, thereby enabling their active participation in the global market. This accessibility grants customers distinct advantages, as they can easily compare products from various e-commerce platforms, with competitors merely a click away. Additionally, customers can swiftly alter their preferences concerning e-goods, content, pricing, or services if dissatisfied. From the standpoint of vendors, the absence of a physical store is no longer a necessity, further streamlining operations in the digital landscape [4].

E-commerce [5] has experienced significant growth due to the widespread adoption of the internet, impacting various aspects of people's lives, thanks to the ubiquity of smartphones. While the internet serves as an invaluable resource across multiple industries, including those related to horses, carpentry, medicine, and other trades, it also facilitates interactions, transactions, and service delivery. Leveraging digital networks enables streamlined supply chains, leading to reduced pollution and supporting environmentally conscious businesses [6]. The ICT revolution has spurred unprecedented economic growth over the past fifteen years, driven by substantial technological advancements [7]. The internet and its associated services have facilitated the emergence of new markets, transforming the global economic landscape.

The number of internet users saw gradual growth from the 1980s until 1994 when it began to surge with the advent of the World Wide Web and multimedia content. This growth outpaced that of any other media platform. By 2015, the International Telecommunication Union-ITU of the United Nations estimated that 3.2 billion people would be online out of a global population of 7.2 billion. In contrast, in 2000, there were only 400 million internet users worldwide. E-commerce applications now offer various services, including payment transfer, facilitating credit card transactions for traditional brick-and-mortar stores, online retailers, and hybrid businesses. Key determinants of online transactions include the payment methods employed, such as debit/credit cards, electronic fund transfers, and online banking transactions. As society transitions from cash to digital currency, payment gateways play a vital role in ensuring the sustainability of future e-commerce endeavors [8].

The practical procedure of transforming data into actionable insights to inform decision-making is referred to as analytics [9]. Analytics aids businesses in collecting, structuring, assessing, and interpreting customer data. Given the exponential growth in data volume, organizations rely heavily on analytics to comprehend customer behavior. Retailers must accurately gauge returns on online investments and assess channel effectiveness with instantaneous access to data. While e-commerce platforms typically offer rudimentary statistical data, a more comprehensive analytical approach is necessary for deeper consumer insights, including metrics such as average order volume, basket size, conversion rates, and others [10].

Businesses consistently utilize social media platforms to promote their products [11]. Social media encompasses computer applications and online platforms that facilitate internet connectivity and content sharing via computers or smartphones [12]. Social networking assumes a significant role in product advancement, aiding in customer retention by reminding them of different promotions. Moreover, it facilitates receiving valuable feedback on goods or services. It serves as a means to cultivate a reliable consumer community, enabling publishing, word-of-mouth advertising, and other functions. Consumers operating autonomously [13] will find ample opportunity to browse through emails, engage in online shopping, make purchases, and view localized advertisements. Comprehensive understanding of digital media is essential for self-driving vehicles. Therefore, businesses must adapt their marketing approaches to navigate this

evolving market landscape by monitoring shifts in shopping habits and search behaviors [14–17]. While big data is currently highly diverse, its predictive and adaptive capabilities are expected to advance significantly in the coming years, rendering manual alterations obsolete.

AI is revolutionizing the economic landscape, ushering in advancements that promise substantial benefits for both consumers and business owners. Its integration into various business sectors [18], such as marketing, finance, and administration, is increasingly commonplace. AI introduces novel opportunities that reshape entire economic frameworks, enabling swift identification of extensive data patterns and enhanced product development tailored to consumer preferences. E-commerce stands out as a primary beneficiary of AI implementation, leveraging its capabilities to elevate service quality and efficiency. By mitigating human error, AI minimizes operational challenges, offering businesses significant advantages despite potential implications for job opportunities. Notably, artificial intelligence has been instrumental in propelling the growth and prosperity of e-commerce, facilitating electronic transactions, network outreach, and logistical operations.

Kumar and Trakru [19] suggest that artificial intelligence-AI empowers e-commerce by introducing innovative approaches to address customer needs and adapt to changing consumer preferences. In the realm of e-commerce, human intelligence often falls short for tasks like supply chain management and demand prediction. AI steps in to extend and replicate human intelligence, addressing the evolving challenges of e-commerce [20]. For instance, Soni [21] demonstrated how AI assists e-commerce systems in managing and monitoring clients, enabling companies to gather diverse data and evaluate customers to ensure top-notch services. This facilitates e-commerce platforms in understanding the factors influencing both current and prospective customers' purchasing decisions. Furthermore, AI enhances communication between e-commerce enterprises and their clientele through chatbots and messaging systems. Automation techniques streamline operations by eliminating redundant tasks, with AI enabling automatic responses to customer inquiries, as highlighted by Ahmed et al. [22]. Nevertheless, the effectiveness and efficiency of AI are constrained in meeting business expectations. Kumar and Trakru [19] caution against potential risks and hurdles for both customers and e-commerce businesses. Therefore, given the dynamic nature of consumer needs in e-commerce, it is crucial to explore both opportunities and challenges.

Numerous ethical concerns have surfaced surrounding the design, development, and deployment of AI systems, notwithstanding their transformative impact on e-commerce due to their diverse functionalities, such as autonomous functions, natural language processing, video and image recognition, and speech analysis [23–26]. Fairness, auditability, interpretability, and transparency emerge as crucial considerations. Due to the inherent complexity of AI algorithms, which render their decision-making processes less transparent compared to traditional statistical models, they are often labeled as black boxes [27]. Bathaee notes the lack of comprehensive explanations regarding how AI systems arrive at decisions. Under the black box paradigm, AI predictions resemble human decisions, yet lack thorough explication. Despite AI systems being derived from observable human behaviors, understanding them is akin to deciphering other highly intelligent species. Questions regarding culpability and intent of harm also arise, as little insight can be gleaned into the behavior and intentions of such species (AI-systems) [28–33], particularly concerning their behavioral patterns. Ultimately, the challenge lies in establishing transparency in e-commerce settings to regain the trust of targeted users.

The objective of this study was to provide a comprehensive understanding of AI-driven e-commerce recommender systems. We conducted an extensive review of the literature focusing on recommendation systems, with a particular emphasis on artificial intelligence methodologies. Our aim was to fill in the gaps in knowledge regarding commonly utilized techniques, the effectiveness of AI-powered recommender systems, their strengths and weaknesses, and their distinctions from conventional recommendation systems.

## 2. Related Work

Recommender systems are vital tools in e-commerce, utilizing statistical and artificial intelligence-AI techniques to anticipate user preferences [34–37]. These systems play a crucial role in shaping the diversity of overall sales [38–41]. However, their evaluation presents a challenge due to the dynamic nature of user preferences and technological advancements [42–45]. The precision of recommender systems is paramount, as it can dictate their impact on sellers, with studies suggesting both positive and negative effects on sales [46–49]. This uncertainty underscores the need for further research to understand how AI-based recommender systems influence the competitive landscape of the e-commerce industry [46–49].

Moreover, the evolving preferences of users, coupled with increasing concerns about privacy, emphasize the importance of building trust between merchants and consumers [50]. Technologies such as block chain address security and trust issues, while deep learning revolutionizes recommendation systems [51]. Recent advancements have led to the emergence of neural graph-collaborative filtering as a focal point in research [52]. This systematic literature study aims to provide a comprehensive overview of AI-driven recommender systems in e-commerce, encompassing various techniques such as machine learning, deep learning, and virtual assistant technologies [53]. Recent studies suggest that incorporating advanced AI techniques like fuzzy logic and genetic algorithms could enhance the accuracy of recommender systems [52, 53]. Sentiment analysis, optimization, trust, and personalization have emerged as key research themes, predominantly focused on recommender systems [54]. However, there exists a gap in understanding the effectiveness of these AI methods beyond sentiment analysis [54]. Therefore, this study aims to evaluate and

analyze the efficacy of AI-driven recommender systems in e-commerce, addressing this gap and providing insights into future industry trends and user demands. By conducting a thorough review of various AI-based recommender system techniques, this study seeks to offer valuable predictions for the future of the e-commerce industry and provide crucial insights into contemporary user preferences. Fig 1 presents the classification of AI-drive methods, and methodologies about E-commerce product predictions.

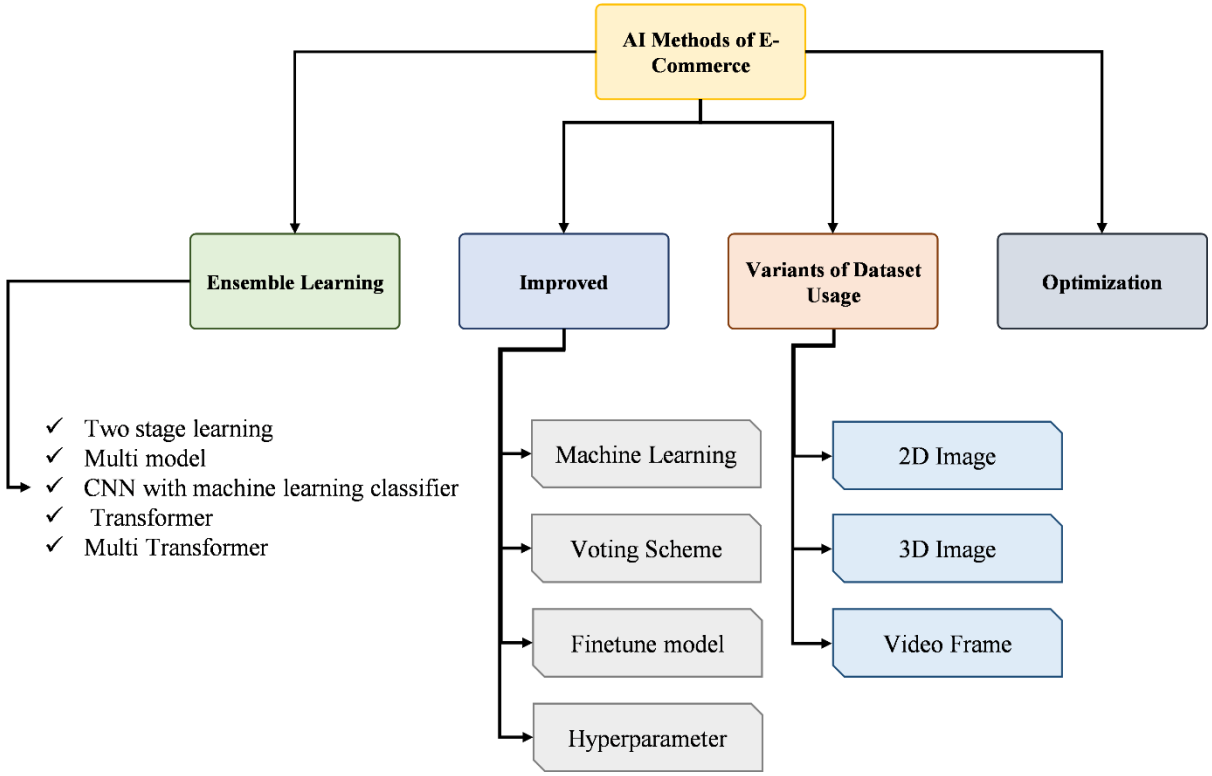


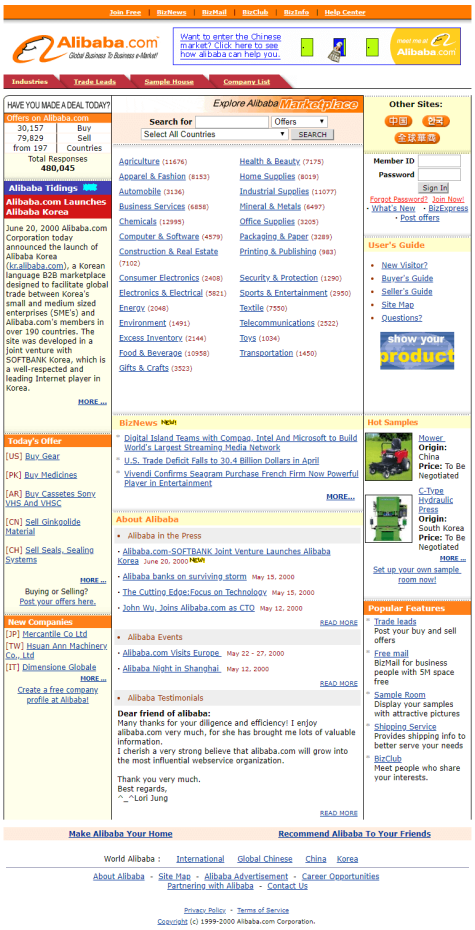

Fig. 1. Classification of AI drive methods, and methodologies of E-commerce

### *2.1. Evolution of E-Commerce Websites*

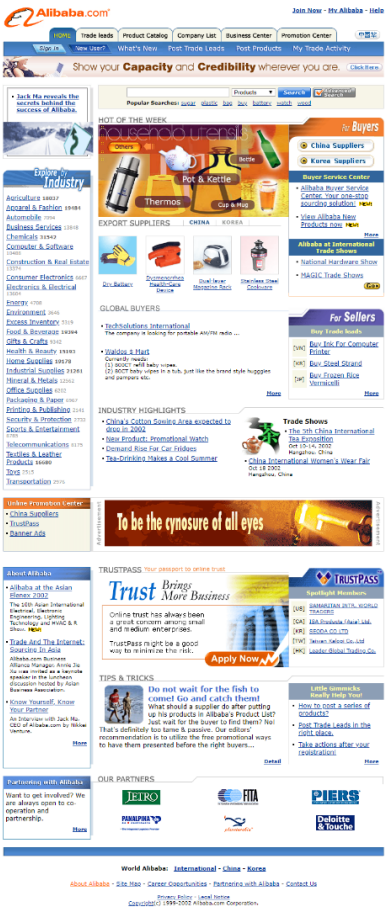
Numerous viewpoints emerged regarding the effective management of businesses as online commerce burgeoned through the information Web [55, 56]. It became increasingly evident that the Web served as a robust medium for conducting various business operations [57]. Scholars such as Ngai and Wat [58] meticulously categorized and analyzed the vast e-commerce research literature spanning the years 1993 to 1999, shedding light on the evolving landscape of digital trade. In this period, initial explorations into the structural frameworks of e-commerce websites were proposed [59, 60], aiming to provide insights into the nascent online trading sector.

Furthermore, a plethora of methodologies for conceptualizing electronic marketplaces were introduced [63], accompanied by the development of diverse reference e-commerce frameworks [61, 62]. These frameworks aimed to offer guidance and standardization for businesses navigating the complexities of online commerce. Concurrently, research endeavors delved into identifying the determinants of website success [64], leading to the creation of tools capable of measuring the myriad factors influencing online business success [65]. In addition to theoretical frameworks, practical research focused on devising optimal business strategies tailored to the online consumer base [66]. Technologies such as Electronic Data Interchange-EDI leveraged the Internet to connect corporate partners, while emerging technologies like XML facilitated the development of agent-based e-commerce [67] and enhanced security measures for web-based services [68]. These advancements reflected the increasing sophistication of online commerce platforms and the growing demand from consumers for seamless, secure transactions. Moreover, scholars emphasized the pivotal role of e-business technologies in fostering collaboration among business partners [69], underscoring the importance of interconnectedness in the digital marketplace. Explorations into emerging markets within the online sphere, including trust-building mechanisms [70], reputation management strategies [71], and techniques for secure information sharing [72], highlighted the evolving dynamics of digital commerce.

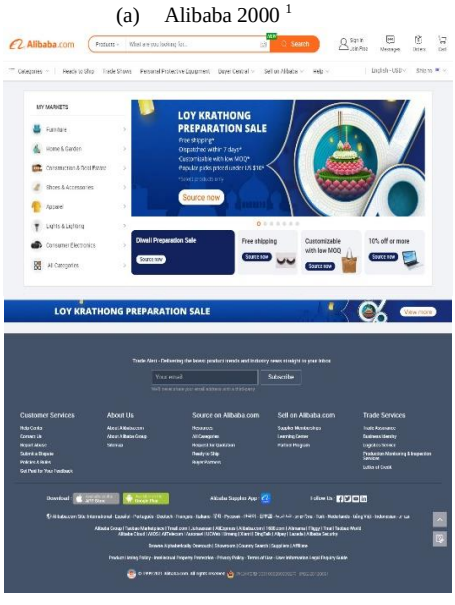
The integration of Artificial Intelligence-AI methodologies into empirical studies allowed for a deeper understanding of the factors influencing website usage patterns [73, 74, 75], with particular emphasis on pricing strategies, consumer trust, and purchasing behaviors [76]. These studies underscored the critical need for customer decision support tools in facilitating informed online transactions. Overall, the evolutionary trajectory of e-commerce websites from 2000 to 2024, as depicted in Fig 2, encapsulates the dynamic evolution of digital commerce, with platforms like Alibaba serving as benchmarks for industry standards and innovation.



(a) Alibaba 2000 [1]



(b) Alibaba 2022 [2]



(c) Alibaba 2021 [3]

(d) Alibaba 2023 [4]

Fig. 2. Visualized the Alibaba E-commerce website evolution: (a) Alibaba website in 2000, (b) Alibaba website in 2002, (c) Alibaba website in 2021, and (d) Alibaba website in 2023

[1] https://www.webdesignmuseum.org/gallery/alibaba-2000
[2] https://www.webdesignmuseum.org/gallery/alibaba-2002
[3] https://www.webdesignmuseum.org/gallery/alibaba-2021
[4] https://www.webdesignmuseum.org/gallery/alibaba-in-2023

*2.1.1. Principal difficulties that e-commerce companies confront*

Electronic commerce, or e-commerce, is confronted with numerous obstacles just like other technologies. These difficulties are primarily experienced by buyers and sellers who conduct business online. Following is a discussion of a few of these difficulties [78]:

- The expansion of both private and public enterprises surpasses the growth rate of the electronic commerce market. Therefore, it is imperative to foster collaboration between these sectors to bolster the development of e-commerce. By working together, individuals can enhance their credibility in internet commerce, paving the way for success.
- Cybersecurity emerges as the foremost concern for e-commerce platforms, where the absence of robust communication protocols, specific requirements, dependability, and system protection renders customers vulnerable to financial loss in the event of a hack.
- Financial institutions and intermediaries, including banks, have demonstrated limited enthusiasm for actively supporting the e-commerce sector in developed countries. Nevertheless, it is imperative for banks to collaborate with retailers to enhance the appeal and expansion of e-commerce while mitigating risks such as theft and credit card fraud. However, financial service providers encounter challenges in regions where traditional credit card options are not prevalent and alternative secure online transaction methods are lacking.
- In rich countries, its common practice to negotiate purchases with suppliers, whereas in developing nations, e-commerce encounters challenge due to inadequate network infrastructure.
- The reduction in internet expenses poses a significant challenge. Regulators are striving to minimize bandwidth charges, yet the high costs associated with network infrastructure upkeep prevent the internet from remaining inexpensive.
- Having faith in electronic payments stands out as a crucial element. A typical document on Baseline Laws and Regulations may cover the authenticity and accuracy of online transactions. The trust of the developed world heavily relies on contemporary laws ensuring fairness in electronic transactions. Despite their significance, laws and legal frameworks that overlook e-commerce transactions can be harmful, whether acknowledged or not. Checks and credit cards face limited acceptance, leaving cash delivery as the predominant method in many developed nations even in present times.
- Legal descriptions, consent, and authorization are essential for implementing new instruments, engaging new service providers, and adopting modern transaction methods. It is imperative to delineate the parameters of an electronic signature and delineate the implications for handwritten signatures. Additionally, it is advisable to examine updated legislative definitions and permissions, such as the definition of a bank and the notion of a domestic border.

*2.1.2. AI Logistics Optimization & Fraud Detection in E-commerce*

AI is revolutionizing the e-commerce industry by optimizing various aspects of operations, enhancing customer experience, and improving security. One of the key applications of AI in e-commerce is logistics optimization [78]. AI-powered algorithms analyze vast amounts of data, including traffic patterns, weather conditions, and inventory levels, to determine the most efficient delivery routes and warehouse management strategies [79]. By leveraging machine learning and predictive analytics, companies can reduce delivery times, minimize transportation costs, and optimize supply chain efficiency. Additionally, AI-driven demand forecasting helps retailers anticipate customer needs and maintain optimal inventory levels, preventing stockouts or overstock situations.

Another crucial application of AI in e-commerce is fraud detection. Online transactions are vulnerable to fraudulent activities, such as identity theft, account takeovers, and payment fraud. AI-based fraud detection systems utilize machine learning models to analyze customer behaviors, transaction histories, and purchasing patterns to identify suspicious activities in real-time [80]. These systems can detect anomalies, flag high-risk transactions, and prevent fraudulent actions before they cause significant financial losses. Unlike traditional rule-based fraud detection methods, AI models continuously learn from new data, improving their accuracy and adaptability against evolving fraud tactics.

Beyond logistics and fraud detection, AI enhances various other aspects of e-commerce, such as personalized recommendations, chatbots for customer service, and visual search. AI-driven recommendation engines analyze customer preferences, browsing history, and purchase behavior to provide personalized product suggestions, increasing conversion rates and customer satisfaction. Similarly, AI-powered chatbots handle customer inquiries efficiently, providing instant responses and improving engagement [81]. In visual search, AI enables users to find products by uploading images instead of using keywords, making the shopping experience more intuitive. As AI continues to evolve, its integration into e-commerce will further enhance efficiency, security, and customer experience, driving innovation in the industry.

## 3. Materials and Methods

We adhered to a systematic approach and established criteria for both inclusion and exclusion as we conducted a thorough examination of the literature. A systematic literature review is a type of secondary empirical study aimed at providing a structured overview of a particular subject area. While the possibility of publication bias in primary studies still exists, the rigorous methodology employed in a systematic literature review helps mitigate this risk. Our study followed the protocol outlined in reference [77], which consisted of three primary stages: organizing the literature reviews, conducting them, and summarizing the findings. This section provides detailed insight into the study's planning, including the chosen classification and evaluation criteria, search methodology, targeted journals, and keywords. Through a comprehensive review of prior research, the objective of this literature review is to assess the current landscape of AI-based methodologies in recommender systems for e-commerce and identify any gaps or areas warranting further investigation.

### *3.1. Available E-commerce Benchmark dataset*

In this section, we will undertake a comprehensive review of the publicly available E-commerce Benchmark dataset. Delving into this dataset, we aim to analyze and interpret key metrics and trends within the realm of electronic commerce. By scrutinizing this rich repository of information, we endeavor to gain deeper insights into consumer behavior, market dynamics, and emerging patterns, thereby facilitating informed decision-making and advancements in E-commerce research and practice.

#### *3.1.1. Clothing Dataset*

Previous research heavily relies on a comprehensive clothing dataset [74] utilized in previous studies, enabling us to develop and evaluate our hybrid learning approach for tasks related to recognizing and categorizing apparel. This dataset encompasses a wide array of clothing items, exhibiting diverse designs, colors, and patterns commonly found in real-world fashion, including dresses, pants, shirts, shoes, and accessories. Each item within the dataset has been meticulously annotated, assigning specific categories to facilitate supervised learning and precise model training. Moreover, the dataset addresses potential challenges in clothing detection, such as variations in posture, lighting conditions, and occlusions. Leveraging the dataset's abundance and diversity, our models can discern robust and distinct features, significantly enhancing the accuracy of clothing item classification. Furthermore, our utilization of this dataset aligns with our objective of refining and validating clothing recognition algorithms, thereby contributing to advancements in computer vision and fashion-related applications. Images of clothing were sourced from the publicly available clothing dataset on GitHub, which showcases various types of clothing articles and served as the foundation for our proposed hybrid learning approach. This dataset is visually depicted in Fig 3.

Fig. 3. Samples images of Clothing Dataset

#### *3.1.2. DeepFashion*

The Deep Fashion dataset [79] is an extensive resource commonly utilized for research across fashion-related disciplines. Comprising over 800,000 images of clothing spanning various categories such as type, style, and attributes, it stands as one of the largest datasets available in this domain. With rich metadata accompanying each image, tasks like garment recognition, landmark detection, and attribute prediction are greatly facilitated. This comprehensive information encompasses clothing classifications, landmarks, and detailed characteristics. Serving as a valuable resource for training and evaluating algorithms in fashion-related tasks, the Deep Fashion dataset has significantly

contributed to advancements in computer vision and fashion analysis research. Its broad array of clothing items, styles, and annotations has been instrumental in driving progress in these fields. **Fig 4,** presents the sample images for Deep Fashion dataset.


Fig. 4. Samples images of Deep Fashion Dataset

### *3.1.3. Fashion Video*

The fashion video dataset [80] comprises a diverse collection of high-resolution videos capturing various facets of the fashion world, including runway shows, photo shoots, designer interviews, behind-the-scenes footage, and trend analyses. Curated from reputable sources spanning fashion weeks, renowned designers, and fashion media outlets, the dataset encompasses a wide spectrum of styles, cultures, and eras, offering rich insights into the evolution and trends within the industry. With meticulous annotation and metadata, each video is categorized by attributes such as garment type, color, pattern, season, and designer, facilitating comprehensive analyses and applications in tasks ranging from trend forecasting to style recognition and recommendation systems. This expansive dataset serves as a valuable resource for researchers, fashion enthusiasts, and industry professional's alike, fostering innovation and exploration in the dynamic realm of fashion. Fig 5 presents the sample images for Fashion Video dataset.


Fig. 5. Samples images of Fashion Video Dataset

### *3.1.4. FashionAI*

The Fashion AI Dataset [81] is created through an iterative process, sourcing images from commercial websites. Each attribute is meticulously defined in collaboration with fashion experts, maintaining a professional standard.

Furthermore, an artificial annotation protocol is devised, incorporating textual descriptions and visual references. However, given the diverse and imaginative nature of online product photos, the obtained data present complexities. Fig 6 presents the sample images for Fashion AI dataset.

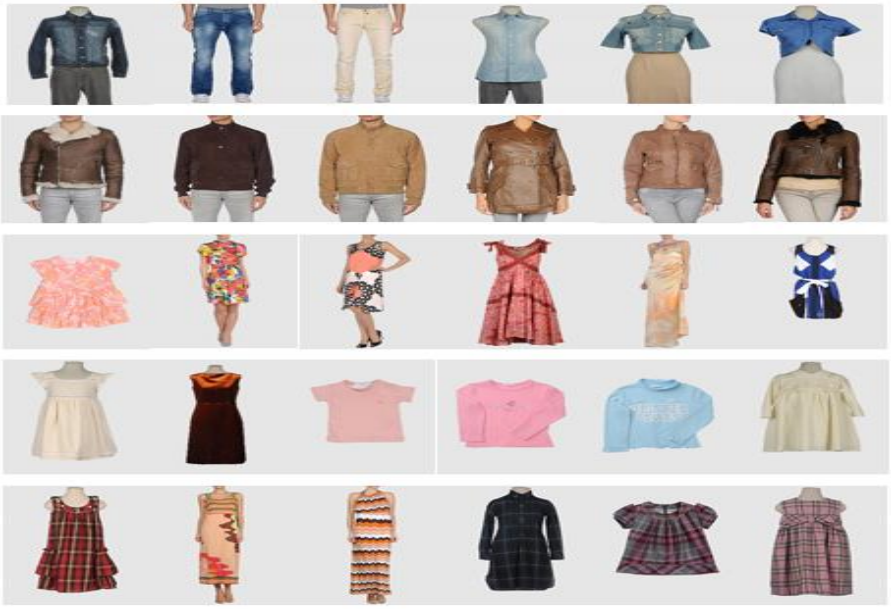


Fig. 6. Samples images of Fashion AI Dataset

### *3.15. Deep Fashion3D*

Deep Fashion3D [82] is extensively annotated, encompassing a significantly broader array of clothing styles and surpassing MGN by an order of magnitude. Delving deeper into the statistical aspects and data collection process, the author elucidates on the methodology. To capture the vast spectrum of clothing encountered in reality, the author amassed a substantial collection of garments, totaling 563 distinct pieces spanning 10 different categories. Utilizing image-based reconstruction tools, dense point clouds are generated from multi-view photographs to produce high-fidelity clothing models. Specifically, the input images are captured in a multi-view studio environment equipped with controlled lighting and 50 RGB cameras. Each garment is randomly draped on a mannequin or actual person to introduce variability and capture genuine deformations induced by bodily movement. Subsequently, the clothing components are manually extracted from reconstructed point clouds. The pipeline yields a total of 2078 3D clothing models through pose augmentation. In addition to the calibrated multi-view photographs, supplementary annotations are provided by the author for Deep Fashion3D to facilitate future research on 3D garment analysis. Particularly, a novel feature line annotation system tailored for 3D clothing is introduced. These feature lines denote prominent characteristics that can serve as reliable priors for precise garment reconstruction, akin to facial landmarks. Fig 7 presents the sample images for Deep Fashion3D dataset.


Fig. 7. Samples images of Fashion Deep3D Dataset

### *3.1.6. VISUELLE*

The Visuelle dataset [83] is a comprehensive collection of images curated for computer vision research and development purposes. Spanning diverse categories and domains, it encompasses a wide array of visual data, ranging from natural scenes to man-made objects. With millions of high-resolution images meticulously labeled and organized, the Visuelle dataset provides a rich resource for training and evaluating machine learning models. Its extensive coverage facilitates tasks such as object recognition, scene understanding, and image classification across various contexts and applications. Leveraging this dataset, researchers and practitioners can explore advanced techniques in computer vision, enabling innovations in areas like autonomous vehicles, augmented reality, and medical imaging. Fig 8 presents the sample images for VISUELLE dataset.


Fig. 8. Samples images of VISUELLE Dataset

### *3.1.7. Challenges and Outlook*

Datasets such as Fashion AI and DeepFashion3D are valuable resources for AI-driven e-commerce [84-91], offering diverse clothing images and rich annotations. However, their effectiveness in addressing real-world challenges remains unclear without a thorough evaluation. The authors provide a descriptive overview of these datasets, highlighting their structure and features but failing to critically analyze their limitations. A key concern is whether these datasets truly reflect the complexities of online fashion retail, including varying lighting conditions, diverse body types, and user-generated content that can introduce noise and inconsistencies. Without such an assessment, it is difficult to determine their applicability in practical AI applications.

One important aspect that the authors overlook is the representativeness of these datasets concerning consumer diversity and regional fashion trends. Many AI-driven fashion recommendation systems aim to personalize shopping experiences, yet datasets often lack inclusivity in terms of gender, age, body shape, and cultural variations in clothing preferences. For instance, DeepFashion3D primarily focuses on 3D garment reconstruction but does not consider how different fabrics and designs behave under real-world conditions. Similarly, Fashion AI, while comprehensive, may not sufficiently capture fashion trends across different demographics. Without addressing these gaps, AI models trained on these datasets might struggle to generalize effectively to diverse user bases.

Another crucial factor is the alignment of these datasets with the challenges of AI-powered e-commerce, such as real-time recommendations, size estimation, and virtual try-on accuracy. While the authors describe the dataset's features, they do not assess their suitability for solving these problems [92-95]. For example, online shoppers often face difficulties in selecting the right size due to variations in brand sizing and material elasticity, but many existing datasets do not include detailed metadata on fabric properties.

## *3.2. Proposed Framework*

In our research approach, we meticulously curated a comprehensive list of e-commerce articles by utilizing a combination of keywords derived from previous studies. These keywords encompassed a wide spectrum of relevant topics, including artificial intelligence, automation, e-commerce, machine learning, cloth fashion, customer relationship

management-CRM, and e-commerce recommender systems. By strategically selecting and combining these keywords, we ensured that our search captured the breadth and depth of research within the e-commerce domain. Subsequently, we employed various academic databases and search engines to gather articles that align with our research objectives. To further refine our investigation, we focused on selecting articles published in the last five years from five well-known journals specializing in e-commerce research. These journals were chosen based on their reputation for publishing high-quality, influential articles in the field. By edge in on these specific publications, we aimed to draw upon the most current and impactful research findings, thereby enriching the validity and relevance of our study. This methodological approach not only ensured the comprehensiveness of our literature review but also facilitated the identification of key trends, insights, and gaps in the existing body of e-commerce literature. Fig 9 presents the overview of proposed review methodology.

*3.3. Operationalized of keyword searches across databases:*

Keyword searches such as "artificial intelligence" and "e-commerce recommender systems" were conducted across several academic databases to identify relevant studies and articles. However, to ensure the reproducibility of this process, it is essential to provide a clear and detailed description of how these keyword searches were operationalized. This includes specifying the particular databases that were searched, such as Scopus, Web of Science, or IEEE Xplore, as well as describing the exact search strategies used in each database. For instance, it is important to clarify the use of Boolean operators, such as "AND," "OR," or "NOT," to refine or broaden the scope of the search. Additionally, the criteria for filtering results, such as publication date ranges, document types, language preferences, or study relevance, should be clearly outlined. The inclusion or exclusion of certain types of publications, like conference papers or reviews, should also be detailed. By providing this level of transparency in how the search was conducted, we can ensure that future researchers are able to replicate the methodology with the same parameters and assumptions. This clarity will not only strengthen the reproducibility of the research but also enhance the trustworthiness of the findings, as others will be able to validate the process and results through consistent search practices.

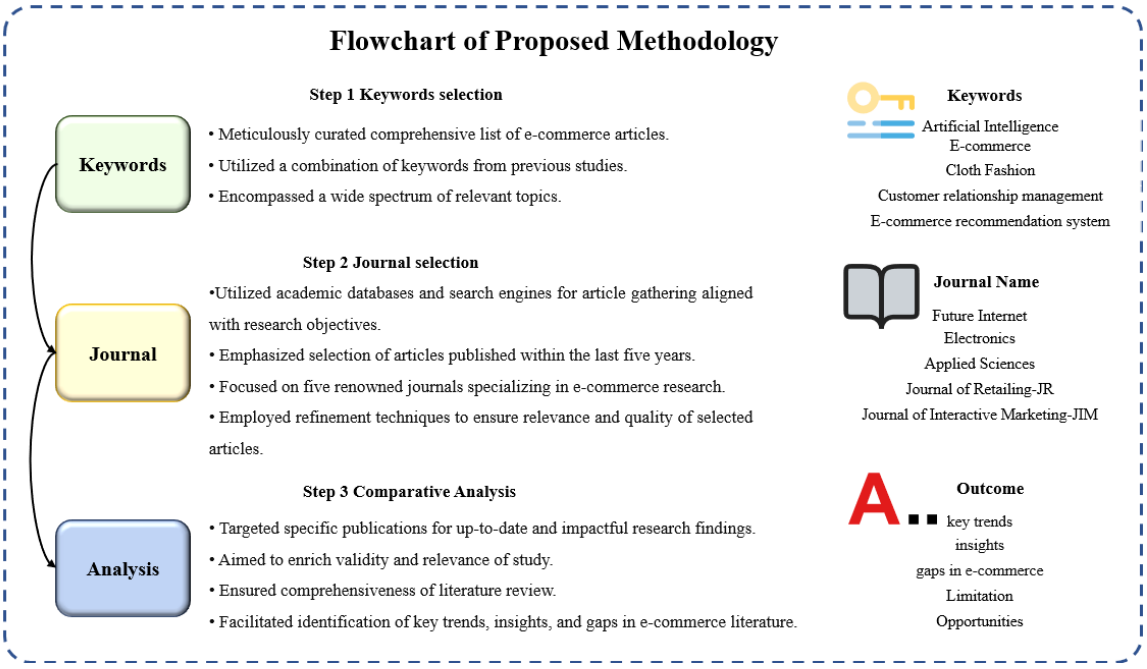



Fig. 9. Overview of Proposed methodology Framework

Table 1 provides a list of selected journals along with their subject areas, coverage history, and countries of publication. We have selected these journals to conduct a review on E-commerce [96-100]. These journals cover a range of multidisciplinary topics including future internet, electronics, and applied sciences, as well as specific areas like marketing with journals such as the Journal of Retailing (JR) and the Journal of Interactive Marketing (JIM). Furthermore, table provides information, including their coverage history. Future Internet, Electronics, and Applied Sciences are multidisciplinary journals based in Switzerland, with coverage spanning from 2009 to 2024 for the former and from 2012 to 2024 for the latter two. In contrast, Journal of Retailing-JR and Journal of Interactive Marketing-JIM focus on marketing and were based in the United Kingdom and the United States, respectively, with coverage histories ranging from 1993 to 2022 for JR and from 1997 to 2022 for JIM.

Table 1. List of selected Journal Names

| Journal Names | Subject Area | Coverage History | Country |
|---|---|---|---|
| Future Internet | Multidisciplinary | 2009-2024 | Switzerland |
| Electronics | Multidisciplinary | 2012-2024 | Switzerland |
| Applied Sciences | Multidisciplinary | 2012-2024 | Switzerland |
| Journal of Retailing-JR | Marketing | 1993-2022 | United Kingdom |
| Journal of Interactive Marketing-JIM | Marketing | 1997-2022 | United States |

The following guidelines served as a basis for the keyword selection:

1. Our objective was to identify pivotal keywords encapsulating the core concepts within our field of study. For instance, given that machine learning falls under the umbrella of artificial intelligence and enjoys widespread usage in academic discourse, we treated the terms artificial intelligence and machine learning synonymously. Likewise, recognizing the interchangeability of recommender systems and recommendation systems in industry parlance, we incorporated both terms. Additionally, to encompass the broader spectrum of online commerce, we also utilized the term electronic commerce.
2. We endeavored to ensure that the articles we searched for would encompass the utilization and ramifications of e-commerce and AI within the realm of e-commerce. By integrating these phrases with other core concepts, we were able to incorporate a diverse array of studies pertaining to the subject, including those examining the impact of AI-driven recommendations on consumer behavior in e-commerce environments.

We believe that our chosen keywords, combined with effective database search capabilities, provide a comprehensive and representative overview of relevant literature, although we acknowledge that no keyword selection process can guarantee the identification of every significant work in the field. Our inclusive search strategy was designed to encompass a wide array of publications while remaining aligned with our research objectives, primarily focused on artificial intelligence and e-commerce. The aforementioned approach to keyword selection was instrumental in facilitating the discovery of pertinent papers for our assessment and enabling insightful analysis of the impacts of e-commerce and artificial intelligence on various aspects, including consumer behavior[101-105]. Table 2 outlines the outcomes of a keyword exploration conducted across five distinct journal platforms, aiming to identify pertinent research concerning the interplay between artificial intelligence-AI), electronic commerce, and their influence on consumer behavior. Employing Boolean operators ||-OR and &-AND within the timeframe of 2020–2023, we sought to enhance the precision and relevance of our search outcomes. It's crucial to note that the efficacy of &-AND varied across databases, potentially impacting the comprehensiveness of the results. Adapting our search strategy to accommodate the diverse functionalities of each database, we aimed to pinpoint the most pertinent publications for our investigation. The table below delineates the databases surveyed, the keywords employed, and the corresponding number of articles retrieved for each keyword search. The table lists selected journal names along with associated search keywords and common words. The search keywords primarily revolve around electronic commerce, artificial intelligence, machine learning, and trends. Common words of interest encompass automation, e-commerce, cloth fashion, customer relationship management, and e-commerce recommender systems, reflecting the interdisciplinary nature of the research topics covered in these journals, which span fields such as technology, business, and consumer behavior.

Table 2. List of keywords utilized in this research

| Journal Names | Search Keywords | Common words |
|---|---|---|
| Future Internet<br>Electronics<br>Applied Sciences<br>Journal of Retailing-JR<br>Journal of Interactive Marketing-JIM | *Electronic commerce*<br>*Automation*<br>*E-commerce*<br>*Cloth fashion*<br>*Customer relationship management*<br>*E-commerce recommender systems* | Artificial Intelligence<br>Machine Learning<br>Trend |

Table 3 presents the outcomes of a keyword inquiry within a selected journal focusing on the intersection of artificial intelligence-AI and e-commerce, along with their impact on consumer behavior. The table delineates the databases where articles were sourced, the quantity of articles discovered through each keyword exploration, and the specific keywords employed in the search process. Fig 10 presents the Overview year wise number of articles found in selected journal along keywords. While Fig 11 presents the Keywords Frequencies during last four years (2020 - 2024).

Table 3. Number of Articles related; Relevant and Beside the Point

| Journal Names | Relevant Articles | Beside the Point |
|---|---|---|
| Future Internet | 33 | 6 |
| Electronics | 82 | 5 |
| Applied Sciences | 101 | 15 |
| Journal of Retailing-JR | 101 | 32 |
| Journal of Interactive Marketing-JIM | 1687 | 450 |

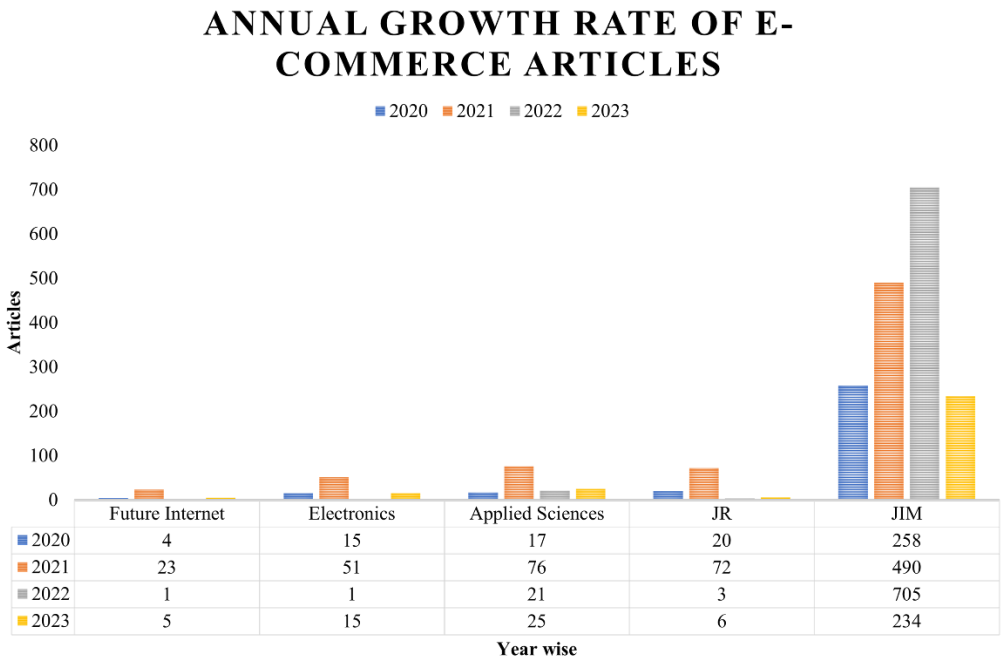



Fig. 10. Overview year wise number of articles found in selected journal along keywords

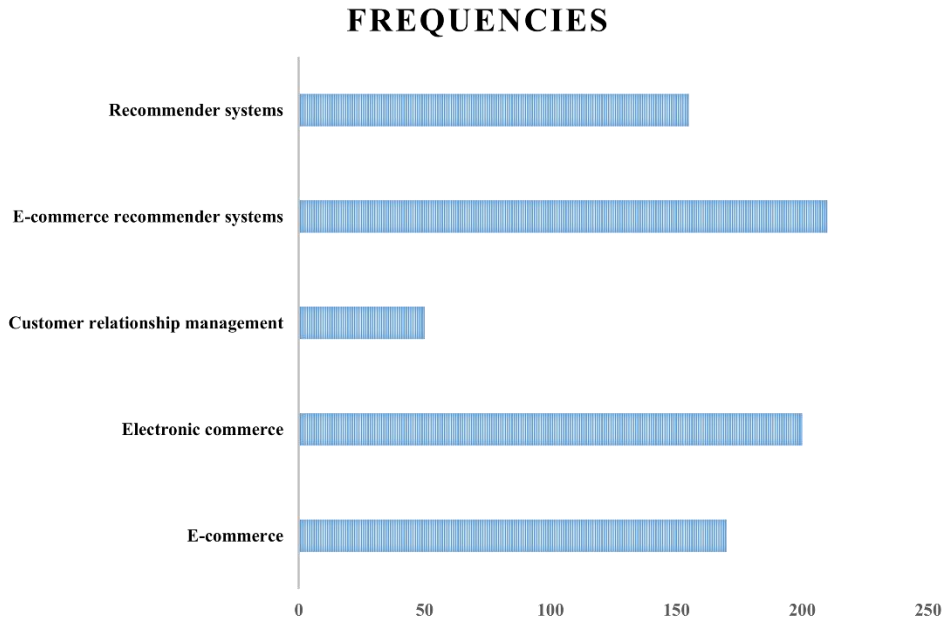



Fig. 11. Keywords Frequencies during last four years (2020 - 2024)

After conducting eligibility screening, Table 4 displays the aggregate count of publications considered for the systematic literature review. The table delineates the quantity of articles retrieved for each keyword search, the duplicates identified, and the search terms utilized. It provides a summary of the papers selected for inclusion in the systematic literature review. The exclusion criteria stipulated that only document in the English language should be included. Twenty items were eliminated from consideration due to their failure to meet this criterion. Following the removal of duplicates and non-English articles, the dataset consisted of 240 articles. The articles listed in Table 4

formed the basis for our systematic literature review, ensuring that our analysis was comprehensive and focused on relevant research concerning the impact of e-commerce and artificial intelligence on consumer behavior. Fig 12 presents the paper selection criteria of this work.

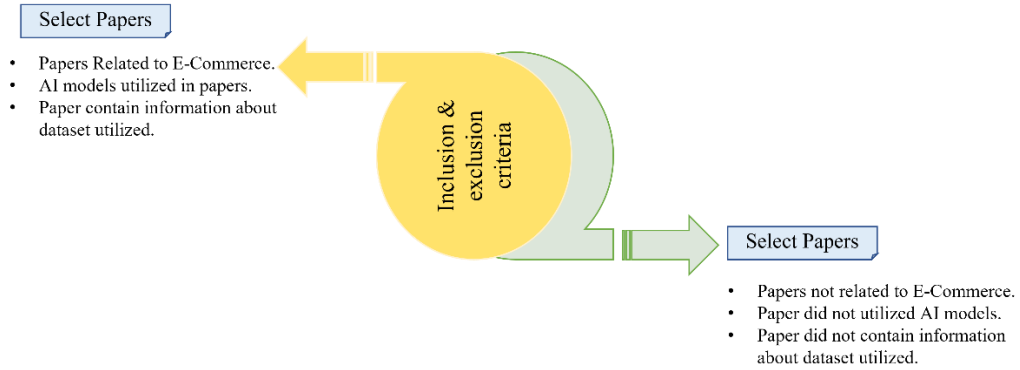



Fig. 12. Paper selection criteria

Table 4. Number of selected articles

| Journal Names | Relevant Articles | Selected Articles |
|---|---|---|
| Future Internet | 33 | 14 |
| Electronics | 82 | 25 |
| Applied Sciences | 101 | 20 |
| Journal of Retailing-JR | 101 | 23 |
| Journal of Interactive Marketing-JIM | 1687 | 35 |

## 4. Outcome of This Work

In this review study, we comprehensively examine the utilization of AI-driven approaches in the e-commerce domain, focusing particularly on advancements facilitated by deep learning techniques. Our investigation delves into the progress made, while also identifying limitations and challenges that persist within CNN-based algorithms. To elaborate on our findings, we outline the primary contributions of this review paper below:

- **Synthesizing Comprehensive Studies**: We meticulously gather and analyze existing literature pertaining to AI-driven methodologies in e-commerce, ensuring a thorough understanding of the field's advancements.
- **Expounding on Process Enhancements**: We elucidate the significant strides achieved through the application of deep learning processes within e-commerce, highlighting their impact on various aspects such as recommendation systems, customer behavior analysis, and fraud detection.
- **Identifying Limitations:** Despite notable progress, we identify inherent limitations within current AI-driven approaches, such as issues related to data privacy, model interpretability, and scalability, which warrant further attention and research.
- **Addressing Challenges:** We delineate the ongoing challenges that confront CNN-based algorithms in e-commerce applications, including but not limited to issues of data heterogeneity, model robustness, and domain adaptation, underscoring the need for innovative solutions.

By offering a comprehensive synthesis of existing research, detailing advancements, acknowledging limitations, and addressing challenges, this review paper aims to provide valuable insights for researchers, practitioners, and stakeholders invested in the intersection of AI and e-commerce.

### *4.1. Conclusion and Perspective*

Many authors highlight challenges such as privacy concerns and the lack of regulations in AI-driven e-commerce without offering deeper insights or concrete solutions. While these issues are undoubtedly critical, their repetitive mention across multiple sections dilutes the discussion's impact rather than strengthening it. Privacy concerns, for instance, are a major challenge in datasets used for AI applications in fashion retail, especially when consumer images or purchase behaviors are involved. However, instead of merely restating this issue, a more constructive approach would be to explore privacy-preserving techniques such as differential privacy, federated learning, or synthetic data generation. These methods could mitigate risks while still enabling effective AI training, offering a more actionable perspective.

Similarly, the absence of standardized regulations for AI in e-commerce is a legitimate concern, but the authors discussion lacks depth regarding its implications for dataset usage. Regulatory gaps can lead to biased AI models, unfair recommendations, and even ethical dilemmas in virtual try-on applications. The authors mention this issue multiple

times but do not analyze how companies currently navigate these challenges or how emerging AI governance frameworks could shape dataset development. A more insightful discussion could explore industry initiatives, such as ethical AI guidelines, and the role of regulatory bodies in ensuring compliance. By engaging with potential policy directions, the paper could provide valuable guidance on bridging the gap between AI innovation and responsible implementation.

Another overlooked aspect is how privacy concerns and regulatory shortcomings impact dataset diversity and quality. Many AI datasets in fashion e-commerce are limited in their demographic representation due to data collection restrictions and ethical concerns. Instead of reiterating the problem, the authors could discuss approaches to balancing privacy with inclusivity, such as anonymization techniques, synthetic data augmentation, or crowdsourced dataset validation. These solutions would address the issue proactively, ensuring that AI models are trained on datasets that reflect real-world diversity without compromising user rights.

## 5. Role of AI in Consumer Demand

AI is playing a transformative role in shaping consumer demand in e-commerce by personalizing shopping experiences and optimizing product recommendations. Traditional e-commerce platforms relied on static catalogs and manual filtering, but AI-driven recommendation systems now analyze user behavior, purchase history, and browsing patterns to suggest relevant products in real time. Machine learning algorithms, such as collaborative filtering and deep learning-based recommendation models, enhance customer engagement by predicting what shoppers are most likely to buy. This level of personalization increases conversion rates, as consumers are more inclined to purchase items that align with their preferences and past behaviors.

Beyond recommendations, AI also influences demand through dynamic pricing and targeted promotions. AI-powered pricing algorithms adjust prices based on factors like demand trends, competitor pricing, and customer purchase intent. For example, retailers like Amazon use AI to implement real-time price optimization, ensuring competitive pricing that maximizes sales while maintaining profitability. Similarly, AI-driven marketing campaigns leverage predictive analytics to identify potential buyers and deliver personalized advertisements through email, social media, and search engines. These AI-powered strategies create a sense of urgency and exclusivity, further shaping consumer purchasing decisions.

Another major impact of AI on consumer demand is its role in enhancing the shopping experience through virtual try-ons and augmented reality (AR). AI-powered virtual fitting rooms allow customers to visualize clothing, accessories, or even furniture in their real-world environment before making a purchase. This reduces hesitation and increases consumer confidence in their buying decisions, leading to higher conversion rates. Moreover, AI chatbots and voice assistants provide instant customer support, answering queries, recommending products, and streamlining the shopping journey. This level of engagement fosters brand loyalty and encourages repeat purchases.

As AI continues to evolve, its influence on consumer demand in e-commerce will only grow stronger. The integration of AI with emerging technologies, such as generative AI for personalized product design or blockchain for secure transactions, will further refine how consumers interact with online retail platforms. By leveraging AI to anticipate and respond to consumer needs more efficiently, e-commerce businesses can not only boost sales but also enhance customer satisfaction, ultimately driving long-term growth in the industry.

## 6. Conclusion

This review study highlights the rapid evolution of e-commerce research, particularly the increasing integration of AI in recommendation systems. However, a notable imbalance in research focus is evident, with significant emphasis placed on customers while other critical stakeholders such as suppliers, investors, regulators, and logistics providers remain underexplored. This narrow focus limits the broader understanding of AI role in shaping the entire e-commerce ecosystem. Through an extensive keyword-based literature review, this study uncovers key research gaps and underscores the need for more inclusive investigations that consider the interests and challenges of all stakeholders involved in digital commerce.

One of the primary findings is that while AI-driven personalization and recommendation systems have received substantial attention, critical infrastructural and operational challenges continue to hinder the seamless adoption of AI in e-commerce. Data privacy concerns, skill gaps, cost constraints, cultural and linguistic diversity, and regulatory ambiguity are persistent barriers, particularly in emerging economies. These challenges not only affect AI adoption but also influence consumer trust and market expansion. Without targeted interventions, AI's potential to enhance operational efficiency, drive market growth, and improve consumer experiences will remain underutilized. Therefore, future research should focus on addressing these obstacles through interdisciplinary approaches, integrating AI with policy frameworks, regulatory innovations, and ethical AI deployment strategies.

To ensure the effective and responsible integration of AI in e-commerce, researchers and practitioners should explore actionable solutions such as the development of privacy-preserving AI techniques, investment in AI-driven supply chain optimization, and the creation of multilingual AI models to cater to diverse global markets. Additionally, regulatory bodies must establish standardized policies to mitigate biases and enhance transparency in AI-driven

decision-making. Future studies should also examine the economic implications of AI adoption for small and medium-sized enterprises (SMEs), ensuring that technological advancements benefit businesses of all sizes rather than consolidating power within large corporations.

By broadening the scope of AI research beyond customer-centric applications, the e-commerce industry can foster more sustainable and inclusive growth. Researchers should adopt a multi-stakeholder perspective, exploring how AI can optimize various facets of e-commerce, from fraud detection and logistics to supplier management and investment strategies. Practitioners, on the other hand, must prioritize ethical AI implementation and cross-sector collaboration to ensure AI-driven e-commerce remains equitable and efficient. Addressing these challenges will not only enhance the effectiveness of AI in e-commerce but also pave the way for a more resilient and consumer-trusted digital economy.

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**How to cite this paper:** Asif Raza, Salahuddin, Ghazanfar Ali, Muhammad Hanif Soomro, Saima Batool, "Analyzing the Impact of Artificial Intelligence on Shaping Consumer Demand in E-Commerce: A Critical Review", International Journal of Information Engineering and Electronic Business(IJIEEB), Vol.17, No.5, pp. 42-61, 2025. DOI:10.5815/ijieeb.2025.05.04