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The Emerging Role of Artificial Intelligence in Personalized and Ethical Green Retail Marketing: A Bibliometric Analysis

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Abstract: Artificial intelligence (AI) is transforming retail marketing, reshaping how firms personalize offerings, govern consumer data responsibly, and pursue sustainability goals simultaneously. This study presents a bibliometric analysis of the intersection of AI, personalized marketing, ethical governance, and green retail marketing, a combination not previously mapped as an integrated field. Bibliographic records were retrieved from Scopus (2018 to May 2026), screened using PRISMA, yielding 140 peer-reviewed articles analysed using Bibliometrix, Biblioshiny, and VOSviewer. Findings show a marked acceleration in publication activity from 2024 onward, with India, China, and the United States as the leading contributing countries. Core research themes include artificial intelligence, e-commerce, consumer behaviour, sustainability, machine learning, data privacy, and ethical marketing, with AI and e-commerce terms remaining more central to the field's intellectual structure than sustainability-specific terms. Author co-citation and bibliographic coupling analyses reveal a small number of foundational reference clusters bridged by a few hub studies, while the collaboration network shows research teams working largely in isolated pairs and triads rather than as a connected international community. A thematic evolution map shows the field's vocabulary diversifying from two dominant early terms, artificial intelligence and sustainability, into more specific downstream themes such as responsible AI, data analytics, and digital transformation, with growing conceptual overlap between the AI and sustainability streams. The study contributes the first integrated bibliometric mapping of these four domains and offers a future-research agenda for researchers, practitioners, and policymakers advancing ethical, sustainable, and consumer-centric AI adoption in digital retail.

Keywords: Artificial Intelligence, Personalized Marketing, Ethical Marketing, Green Retail Marketing, Sustainability, Bibliometric Analysis.

Type: Research paper

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1. Introduction

Artificial intelligence (AI) is a game-changing technology, especially in the field of retail marketing, where AI is revolutionizing how organizations engage with their customers, provide personalized experiences, and drive sustainable business goals. Advancements like machine learning, predictive analytics, recommendation systems, and generative AI have propelled the rapid growth and deployment of AI in retail, enabling businesses to gain deeper insights into customer behavior and deliver tailor-made marketing tactics. Personalization powered by artificial intelligence (AI) has become one of the most important aspects of digital retailing, which helps customers make better buying decisions, enhance customer satisfaction and engagement, as well as provide data-driven insights and intelligent automation (Davenport et al., 2020). Meanwhile, the shift towards green retail marketing has been accelerated by the worldwide movement towards sustainability and consumer-friendly environmental protection. Consumer awareness of environmental issues is growing, and alongside it, a growing preference for brands that operate sustainably and in an environmentally responsible manner (Kumar et al., 2021). Green retail marketing focuses on marketing products that are environmentally sustainable, with attention to carbon footprints and ethical consumer behaviour. AI technologies have started to play a role in sustainability efforts, with a focus on supply chain optimisation, waste reduction, energy efficiency and personalised green product suggestions (George et al., 2023).

While AI-powered personalization offers numerous benefits, ethical issues surrounding consumer privacy, transparency, fairness, and trust have become more prominent in digital marketing landscapes. Given the high levels of consumer data collection and analysis of consumer interactions with AI systems, there are concerns over responsible AI governance, data security, and algorithmic bias (Dwivedi et al., 2021). Algorithmic fairness is a technical and ethical issue in particular: Consumers and sellers can be exposed to a bias, or be re-ranked according to it, and/or be treated differently, in retail platforms (Floridi & Cowls, 2019). Recent research on explainable AI (XAI) and fairness-aware system design are starting to tackle such issues and open up opportunities for more transparent, accountable and consumer-centric AI applications in retail settings (Jobin et al., 2019). Thus, the ethical aspect of marketing in the digital age has emerged as a key concern for retailers aiming to reconcile technological advancements with consumer confidence and social responsibility. With regard to sustainable retail marketing success, responsible use of AI, transparent communication and ethical use of data have become important considerations. The field of interdisciplinary research is rapidly evolving in the cross-section of artificial intelligence, personal marketing, ethical aspects, and green retailing. While there have been some recent studies on AI in personalization, sustainable retailing, and ethical marketing, there is a lack of systematic investigation of the intellectual structure and thematic evolution of this multidisciplinary field of personalisation, sustainable retailing and ethics of AI in consumers. Previous bibliometric reviews have focused on only one of the three dimensions, either on AI in retail or sustainable marketing, and knowledge gaps are lacking on how the three dimensions evolve together as a research domain. With the rise of scholarly publication, notably since 2024, there

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is a need for a thorough bibliometric analysis to uncover trends, key authors, prevailing topics, and new research directions in this field.

Hence, this study seeks to perform a bibliometric study on the work that has been conducted about the new application of artificial intelligence in personalized and ethical marketing in green retail. The study draws on peer-reviewed journal articles and review papers retrieved from the Scopus database and analysed by using Bibliometrix and Biblioshiny in RStudio software to assess the evolution of the research area, to highlight research clusters and to suggest opportunities for future research. Its originality lies not in any single bibliometric technique, which follows established procedures (Donthu et al., 2021), but in the decision to map AI, personalization, ethical governance, and green retail marketing jointly within one dataset and one set of thematic and network analyses, rather than treating AI-in-retail and sustainable marketing as separate literatures, as prior single-domain bibliometric reviews have done; this integrated framing is what allows the study to surface the emerging ethical-governance cluster and the AI/e-commerce-versus-sustainability centrality gap reported in Sections 4.8 and 4.9. The findings of this study are expected to contribute to the literature on AI for sustainable retail marketing and offer valuable insights for researchers, practitioners, and policymakers in the fields of AI ethics, green marketing, and digital retail innovations.

2. Literature Review

2.1. Artificial Intelligence in Retail Marketing

AI has made a huge impact on the retail marketing sector, allowing companies to streamline their operations, target customers more effectively, and automate decision-making. To derive insights for marketing strategies, the amount of data collected from consumers is increasingly being analysed using AI technologies like natural language processing, predictive analytics, machine learning and recommendation algorithms. AI applications in retail include inventory optimization, forecasting customer demands, and automating digital interactions with customers through segmentation (Chatterjee et al., 2021). The proliferation of e-commerce and digital retail platforms has further boosted the use of AI in retail operations. AI has improved customer interaction by implementing chatbots, virtual assistants, and intelligent recommendation systems, providing personalized and comprehensive shopping experiences and instant assistance. These technologies are solutions that can help retailers to better understand customers' preferences, predict their buying behaviors and enhance their customer loyalty by offering personalized products and services (Verhoef et al., 2021). As a result, AI is emerging as a crucial strategic asset for retail businesses to competitively thrive in a fast-changing retail environment, consistent with strategic frameworks that position AI capabilities along a continuum from mechanical to thinking intelligence in marketing decision-making (Huang & Rust, 2021).

Additionally, AI's role in automated content production, customized advertising, and client interaction is expanding in the retail business, influencing retail promoting strategies. AI-powered suggestions and automated communication tools have been leveraged by retailers to enhance client

experience, streamline operations, and cut down on marketing expenses (Haleem et al., 2022). Crucially, there are some intriguing field case evidence of how generative AI tools in the retail sector can generate tangible improvements in employee productivity and customer conversion, albeit with some variation depending on the retail type and usage (Brynjolfsson et al., 2023). In conclusion, the use of AI in retail marketing is a part of a larger digital transformation trend that is transforming the way companies interact with their customers and operate.

2.2. Personalized Marketing and Consumer Experience

Personalized marketing is one of the best marketing tactics today in the retail world. With the use of AI and big data analytics, companies have the ability to tailor products, recommendations, and marketing messages to individual consumer likes and dislikes, behaviors and buying habits. Relevant and engaging shopping experiences, resulting from personalized marketing strategies, will enhance customer satisfaction (Grewal et al., 2020). AI-driven recommendation systems become particularly significant when it comes to personalization for consumers, where they can analyze consumer preferences, demographics, and buying patterns to predict their interests. These systems can help retailers tailor their messaging to individual consumers and segment their promotional efforts to improve their conversion rates and build stronger relationships with customers (Shankar et al., 2021). The increasing use of digital platforms and mobile commerce has also increased the relevance of personalisation when it comes to influencing consumers as they make decisions.

However, there are drawbacks to personalization systems. Knowledge graph-based recommendation architectures have shown that they are able to simultaneously improve the recommendation relevance and explainability, which provides a promising direction for retail personalization, combining the accuracy and explainability of recommendations (Ai et al., 2020). Furthermore, the use of large language models (LLMs) to re-rank search results is becoming a new interest to make product search more explainable and fair, as it can be used to present the right products to the shoppers while minimizing systematic exposure biases that exist in traditional ranking algorithms (Hou et al., 2024). Recent studies on personalisation have provided insights on differential effects of personalisation modalities such as feature-based and example-based explanations for different segments of consumers in the context of digital platforms and mobile commerce on consumer satisfaction and purchase intention.

Moreover, personalization plays a significant role in digital retail customer experience management. Today's consumers expect a seamless, personalized experience across every online touchpoint, whether a website, mobile app, or social media platform. Retailers can use AI for personalisation to improve customer engagement, brand loyalty, customer retention rates, and overall shopping experience and efficiency (Lemon & Verhoef, 2016). With regard to the future of AI governance and consumer trust in algorithmic recommendations, explainable personalisation interfaces, where the consumer can understand and question algorithmic recommendations, are a growing research field in the customer experience arena.

2.3. Ethical Marketing, Responsible AI, and Explainable AI

While AI technologies offer significant benefits to retailers, ethical issues with AI marketing are more crucial and technical than ever. The sheer amount of data collected and analysed from consumers has prompted concerns about the protection of consumer privacy, transparency of algorithms, and data security. People are increasingly aware of how their personal data is being gathered and applied by organisations and are increasingly demanding a responsible and transparent approach to AI (Martin & Murphy, 2017). One of the important and well-known ethical issues in AI-driven marketing systems is algorithmic bias and discriminatory outcomes. For instance, AI systems can inadvertently drive unfair treatment or exclusion in advertising, recommendation systems, and customer targeting, if the underlying data is biased (Floridi & Cowls, 2019). Importantly, fairness in AI-powered retail systems manifests in several ways: individual fairness, where similar consumers receive similar recommendations, and group fairness, which considers if demographic subgroups are systematically over- or under-represented in algorithmic recommendations. Recent technical efforts on fairness-aware re-ranking in knowledge graph-based recommendation systems show that fairness and recommendation quality can be optimized simultaneously with constrained learning objectives as a concrete way to achieve ethical retail personalization (Fu et al., 2020). In addition to this, counterfactual approaches to explainable fairness offer contrastive explanations for consumers and/or auditors addressing the question of why a particular item was recommended instead of another, allowing for human oversight of algorithmic decision making in retail settings (Tan et al., 2022).

As a result, explainable AI (XAI) has become an important technical and governance approach to solve transparency problems in retail marketing systems. In neural product search models, attention-based mechanisms provide a model intrinsic explainability approach in which retailers can determine which product attributes and consumer signals most effectively drive product recommendations by focusing on them, thereby enhancing the interpretability and consumer trust (Chen et al., 2022). Leveraging large language models, interpretable re-rankers are now used as a system-level component to re-rank search results in a product search pipeline, providing natural language explanations that can be easily audited for bias and presented to the end user (Hou et al., 2024). The advancements represent a movement towards more responsible and human-centric retail AI systems.

In the context of digital marketing, responsible AI frameworks highlight the need for ethical governance, transparency, explainability, and human-centric decision-making. Regarding governance, explainability is becoming a policy and standards mandate, such as the EU AI Act and ISO/IEC standards for AI risk management that mandate explainability and fairness auditing for high-risk AI systems, including consumer-facing personalization and targeting systems in retail (Adadi & Berrada, 2018). Therefore, ethical practices in marketing are crucial, not just for restoring consumer trust, but also for meeting regulatory requirements and sustaining AI-powered retail systems. Retailers can build a better brand, enhance customer loyalty and mitigate regulatory risks of misusing data and/or unclear ethics regarding algorithms by taking proactive action to ensure the responsible use of AI (Stahl et al., 2021).

2.4. Green Retail Marketing and AI-Enabled Sustainability

Given the increasing environmental awareness of the world, green retail marketing has become a strategic priority, both for the retailers and consumers. The concept of green retail marketing involves strategies that aim to market products that are environmentally friendly, reduce the ecological footprint, and promote consumer behavior towards sustainability (Kumar et al., 2021). As demand for environmentally responsible business practices increases, retailers are turning to a range of initiatives such as making sustainability a part of product assortment, supply chain management, packaging design and consumer communication.

AI technologies are proving to be more critical than ever in empowering and expanding green retail marketing efforts. Machine learning and predictive analytics are used to streamline supply chain logistics, cut down on energy usage, limit product waste, and tailor recommendations for green products to eco-conscious consumer segments (George et al., 2023). In retail, AI-powered demand forecasting will help cut down on overproduction and excess inventory, directly impacting waste reduction and carbon footprint. Additionally, the application of personalized 'green nudges' via individually tailored recommendations based on AI that feature environmental product attributes is a new approach for promoting green purchasing without affecting consumers' autonomy or the quality of the shopping experience.

But the environmental footprint of AI itself is worthy to be considered in the green retail research. As noted, many AI-powered applications, such as recommendation systems and generative AI, are extremely energy-intensive to train and deploy, which could detract from the sustainability benefits of using AI to optimize retail. The focus on life-cycle assessment perspectives on AI-driven personalization systems, which assesses the overall net environmental impact caused by model inference to understand the sustainability impact, is a valuable and under-researched aspect of green retail marketing research.

2.5. Research Gap and Critical Discussion

There has been some work on artificial intelligence, personalized marketing, sustainability and ethical marketing as separate research streams, but limited work that combines these aspects in an integrated analytical framework. Previous bibliometric and systematic literature reviews have focused exclusively on either AI in retail marketing or green and sustainable marketing, but have not considered the intellectual landscape of both AI in retail marketing and green and sustainable marketing with regard to ethical AI governance and consumer personalization in a single study. This is because the field is divided between marketing, sustainability, information systems, and ethics of AI, making it hard to see the commonalities in topics, methods, and concepts. This division has also left several substantive debates unresolved across the separate streams rather than confronted directly: for instance, the personalization literature (Section 2.2) treats deeper data use as generally beneficial for consumer experience, while the ethical AI literature (Section 2.3) treats the same data collection as the principal source of privacy and fairness risk, and the green marketing literature (Section 2.4) has only recently begun to question whether the computational cost of the AI systems used to enable personalization and green nudging might partly offset the

sustainability gains those systems are meant to produce. These streams rarely engage with one another's assumptions directly, and an integrated bibliometric view is one way of showing where such tensions concentrate rather than resolving them.

Specifically, in the field of digital retailing, there are new opportunities and challenges that come from rapidly expanding generative AI, predictive analytics, explainable AI and fairness-aware machine learning applications that have not been systematically captured in existing reviews. Technical aspects of ethical retail AI, such as fairness-aware re-ranking, counterfactual explainability, privacy-preserving personalization, and responsible AI governance are also underrepresented in literature with a marketing focus and directly impact consumer trust, legal compliance, and sustainable retail approaches. Moreover, the environmental effects of AI systems in retail settings have not been extensively investigated in the realm of green marketing.

Hence, it is essential to perform a comprehensive bibliometric analysis to pinpoint publication trends, prevailing themes, key contributors and new research directions in this interdisciplinary and growing field. This research fills the gap by offering a general overview of the research field where AI and personalized marketing meet the ethical governance of AI and green retail marketing, which has not been researched in an integrated manner.

3. Research Methodology

The present study is conducted using a bibliometric research approach in order to address the newfound role of artificial intelligence in personalized and ethical green retail marketing. Bibliometric analysis is a quantitative research method, which is used in the evaluation of scientific publications, discovery of research trends, analysis of thematic developments, and examination of the intellectual structure of a research field (Donthu et al., 2021). The approach is especially relevant for the discovery of new interdisciplinary areas that include AI, sustainability, ethical marketing and retail innovation. The present study adheres to the well-defined procedures of bibliometric analysis as outlined by Donthu et al. (2021) and Aria and Cuccurullo (2017) to ensure the methodological rigor, transparency, and reproducibility of the analysis process.

3.1. Data Source and Search Strategy

Elsevier Scopus database was chosen for bibliographic data for this study due to its wide coverage of high-quality published and peer-reviewed literature in the fields of Business, Marketing, Management and Technology (Baas et al., 2020). Scopus was identified as the only data source because it had the best coverage of marketing, retail and sustainability journals when compared to other databases; however, it must be noted that studies that are indexed only in Web of Science, Dimensions or Google Scholar may not be represented in the data set. A systematic search strategy was adopted to search for peer-reviewed journal articles and review papers that were related to artificial intelligence, personalization, ethical marketing, sustainability, and retail marketing and combined with Boolean operators. At the filtering stage of the database, prior to

record retrieval, conference papers, book chapters, editorials and notes were specifically omitted from the search output.

The following search query was applied within the TITLE-ABS-KEY fields:

TITLE-ABS-KEY (("artificial intelligence" OR AI OR "machine learning" OR "deep learning" OR "generative AI" OR "predictive analytics") AND (personalization OR personalised OR personalized OR "personalized marketing" OR "consumer personalization" OR "customer experience" OR "consumer behaviour" OR "recommendation system") AND (ethic* OR "ethical marketing" OR trust OR privacy OR transparency OR fairness OR "responsible AI") AND (green OR sustainab* OR "green marketing" OR "sustainable marketing" OR "eco-friendly" OR "environmental marketing") AND (retail* OR "retail marketing" OR e-commerce OR "online shopping" OR "digital retail"))

The search query aimed to capture studies extensively that focused on the use of AI for personalisation, ethical marketing, sustainability and digital retail environments. Only English language publications published in the past five years (2018 to May 2026) were searched. It is recognized that the multi-dimensional Boolean query, which has five conceptual filters at once, is designed to be restrictive and may thus miss out on relevant adjacent literature. This is a conscious methodological choice and is explored in greater detail as a study limitation in Section 3.6, in terms of sacrifice in breadth of recall for thematic precision.

3.2. Inclusion and Exclusion Criteria

The relevance of the data and the quality of the data were determined by applying inclusion and exclusion criteria systematically during the screening process. The following inclusion criteria were used:

1. Review papers and peer-reviewed journal articles in English
2. International journals with impact factors and good reputation in their fields of study.
3. Publications that are specific to AI, personalisation marketing, ethical marketing, sustainability and retail marketing.
4. No restriction was placed on the country of the study or the corresponding author's institutional affiliation, so as to capture the full global distribution of research activity in this field.

The following types of documents were explicitly left out of the data set:

1. Conference papers and conference proceedings (including conference proceedings in book series like Lecture Notes in Networks and Systems)
2. Book chapters and edited books
3. Editorials, letters and notes
4. Duplicate records
5. Studies outside of the scope of the two research fields: AI in Marketing and Personalization, or Ethics, or Green Retail Marketing

A few publication series such as Lecture Notes in Networks and Systems (LNNS) and some other book series published by Springer mainly feature conference proceedings and not peer-reviewed journal articles. As a result of the

screening process, any records from such a series were excluded from the final records to ensure consistency with the journal-article only inclusion criterion. The screening was done manually in the title, abstract, and keywords stage.

3.3. Screening and Selection Process

The selection process for the studies followed a systematic approach in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, ensuring transparency and methodological rigor in the study selection process. Using the predefined search query, 209 records initially were identified by using the Scopus database. One hundred and ninety-seven studies were left for title, abstract and key word screening after 12 duplicate studies were removed.

In the screening stage, 57 records were removed because of the following: (i) the research topic was not relevant to the scope of the study (AI, personalization, ethical marketing and green retail marketing); (ii) the record was from a conference proceeding series that do not satisfy the inclusion criterion (journal article); or (iii) the research publication was outside the defined date range (1 January 2018 to 31 May 2026). After that, 140 full-text articles were evaluated for eligibility using the inclusion and exclusion criteria. After reviewing the full text, no additional records were excluded and all 140 studies met the eligibility criteria. As a result, these 140 studies were kept and added to the final bibliometric analysis. The complete study selection process, from initial identification through to the final included records, is summarised in the PRISMA flow diagram (Figure 1).

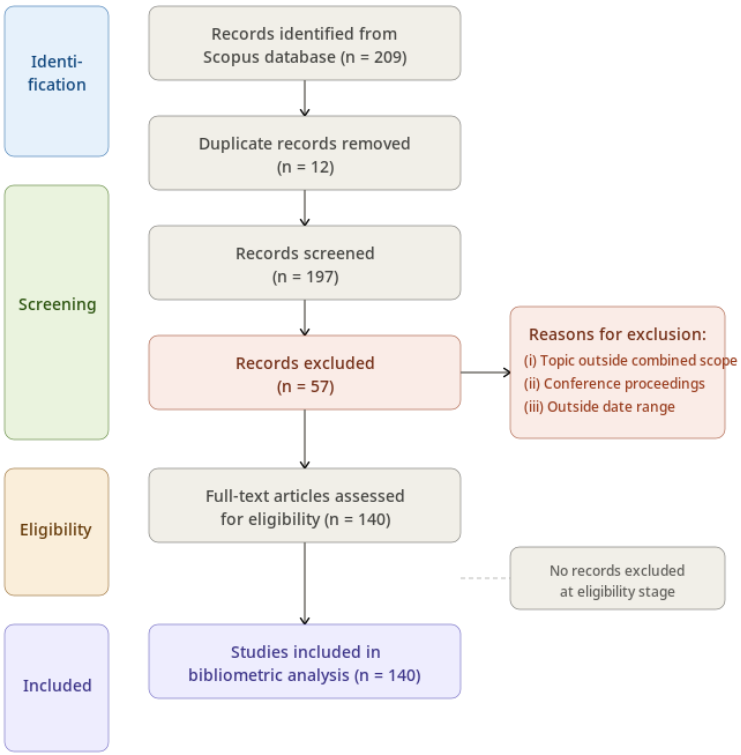


Figure 1. PRISMA flow diagram of the study selection process

3.4. Data Extraction, Cleaning, and Analysis

The bibliographic records selected were exported from Scopus in BibTeX and CSV format and analysed with Bibliometrix (version 4.10) and Biblioshiny in RStudio (version 4.3.1) (Aria & Cuccurullo, 2017). Before analysis, a four-stage data cleaning process was performed to guarantee the accuracy and consistency of the data sets: (i) duplicate articles were detected and deleted by using an automated tool and cross-checked manually; (ii) the author field was checked for completeness and inconsistencies, and where necessary, the article was excluded from the author level analysis; (iii) keywords were harmonised to group together morphological variants and synonymous terms, including notably the combination of "e-commerce" and "electronic commerce", based on a predefined harmonisation table; and (iv) publication sources were also checked to ensure they matched the journal-article inclusion requirements, with any remaining conference proceedings records flagged and removed.

After data cleaning, co-occurrence network analysis (minimum keywords frequency threshold 3), thematic mapping using Callon's centrality and density measures, analysis of scientific production on an annual basis, country and author analyses (full counting method), and citation analysis (based on total global citations) were used in the analysis. In addition, author co-citation analysis, bibliographic coupling analysis, and author collaboration network analysis were performed and visualised in VOSviewer (version 1.6.20), using association-strength normalisation and a full-counting approach, with a minimum threshold of two occurrences per author/document applied to keep the visualisations legible; a keyword-based thematic evolution map (2018–2025 versus the partial-year 2026 sub-period) was also produced to trace how the field's dominant terminology has shifted over time. As a supplementary validation step, the underlying Scopus export was additionally processed independently in Python (NetworkX, Louvain community detection) to compute approximate centrality, density, network-degree, and component statistics for the keyword co-occurrence, co-citation, bibliographic coupling, and collaboration networks; these figures, reported alongside the corresponding Biblioshiny/VOSviewer outputs in Sections 4.8 and 4.11–4.14, are based on 136 of the 140 included records because four records had reference-list fields that were not machine-parseable due to formatting artifacts in the export file, and are intended as a convergent check on the qualitative network interpretations rather than an exact reproduction of the original analytical session parameters. These approaches collectively helped to identify the major research themes, key contributors, research collaboration networks and new research trends in AI based personalized and ethical green retail marketing.

3.5. Research Objectives

This study aims to explore the role of artificial intelligence in personalized and ethical green retail marketing using a bibliometric approach. The specific objectives of the study are:

1. To review the annual publications related to the use of artificial intelligence in personalized and ethical green retail marketing between 2018 and May 2026.

2. To determine the most important authors within the research field, journals, countries and most cited documents world-wide
3. To explore the thematic structure and keyword relationships of concepts related to artificial intelligence, sustainability, ethical marketing and retail innovation
4. To discuss new research topics such as explainable AI, responsible AI governance, privacy preserving personalisation and future research directions in the context of AI for sustainable retail marketing
5. To locate the intellectual architecture of this integrated research field in relation to neighbouring AI-in-retail and green marketing research areas

3.6. Reliability, Validity, and Limitations

To increase the reliability and validity of the study, it was followed by a systematic and transparent process during data collection, screening, and analysis. The use of pre-defined inclusion and exclusion criteria reduced selection bias, and the structured bibliometric procedures and analytical parameters disclosed reduced data analysis and interpretation bias, and ensured consistency and reproducibility.

This subsection addresses the procedural safeguards that support reliability and validity; the specific scope and coverage trade-offs that follow from these procedural choices including the single-database search strategy, the restrictive five-filter Boolean query, and the partial-year 2026 data are discussed comprehensively in Section 5.4, together with their implications for the interpretation and generalizability of the findings, rather than being restated here. Co-citation, bibliographic coupling, collaboration-network, and thematic-evolution analyses, previously flagged as absent, have since been incorporated and are reported in Sections 4.11–4.14.

4. Results and Discussion

4.1. Main Information About the Dataset

A total of 140 articles comprising of peer-reviewed research articles and review papers were retrieved from the Scopus database between January 2018 and May 2026. This data is a testament to the rising interest among academics in the use of Artificial Intelligence (AI) to facilitate personalized and ethical green retail marketing, spanning disciplines like marketing, information systems, sustainability and retail management. The main themes that arose from the keyword analysis were artificial intelligence, e-commerce, consumer behaviour, sustainability, machine learning, data privacy and ethical marketing. Citation patterns identified an increase in the number of research articles related to the responsible use of AI, explainable AI governance, and sustainable retail marketing strategies, consistent with the overall thematic areas identified through co-occurrence network and thematic mapping analysis.

4.2. Annual Scientific Production

Based on the annual scientific production analysis, a clear trend of development and growth is observed in the research of AI in personalized and ethical green retail marketing over the analysed period (Table 1; Figure 2). Between 2018 and 2023 there was very little scholarly work in the field, with only

one publication each in 2018, 2019 and 2021, no publications in 2020, two in 2022 and three in 2023. Research output then accelerated markedly from 2024 (22 publications) and reached 67 publications in 2025, the highest single-year count in the series. Publications recorded for 2026 reflect partial-year coverage (January to May 2026 only) and are not directly comparable with full-year totals for earlier years (43 publications were recorded over this five-month window). A simple linear extrapolation, dividing the five-month count by five and multiplying by twelve, yields an indicative annualized estimate of approximately 103 publications for 2026; this figure is presented only as a rough order-of-magnitude projection rather than a statistically modelled forecast, since it assumes a constant monthly publication rate, carries no confidence interval, and does not account for indexing lag in Scopus, which may under-count the most recent months. Readers should therefore treat the 2026 growth figure as suggestive rather than conclusive. This acceleration, beginning in 2024, is consistent with the broader diffusion of generative AI technologies, tightening sustainability and ethical-governance discourse, and increased regulatory attention to AI systems in digital retail research ecosystems, and it mirrors publication surges reported in adjacent bibliometric reviews of AI-in-marketing research following major generative-AI product releases.

Table 1: Annual Scientific Production (2018–2026)

Year	Articles
2018	1
2019	1
2020	0
2021	1
2022	2
2023	3
2024	22
2025	67
2026	43 Partial year (January–May 2026 only)

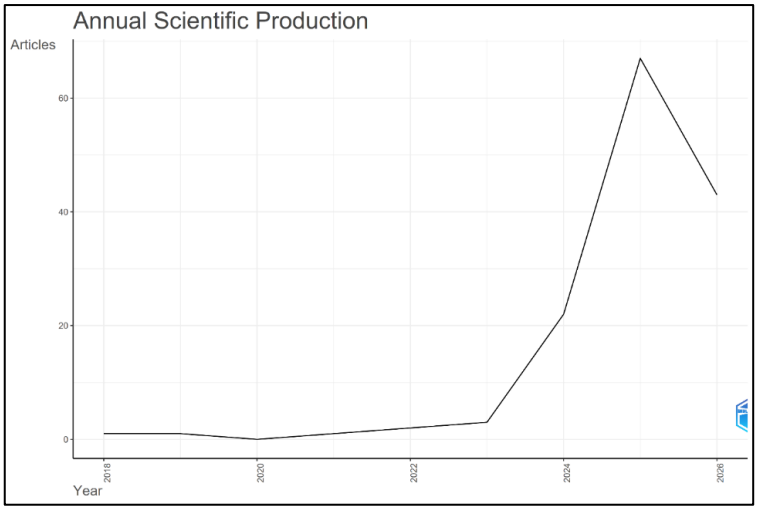


Figure 2: Annual Scientific Production Trend

4.3. Most Relevant Sources

Based on the most relevant sources analysed, the most important outlets for publications contributing to the research on artificial intelligence in personalized and ethical green retail marketing were identified (Figure 3). The most productive outlets of journals were Journal of Retailing and Consumer Services and Sustainability (Switzerland) that each had four papers published, showing the interdisciplinary dimension of this field in relation to retail management and sustainability research. The International Journal of Information Management Data Insights and the International Review of Management and Marketing were also a significant source of data. The diversity of publication sources also reflects the multidisciplinary nature of the AI-driven ethical green retail marketing research field, highlighting the integration of various scholarly traditions from marketing, information systems, sustainability, and digital innovation. This spread across four leading outlets, rather than concentration in one dominant journal, is itself informative: it suggests the field has not yet settled on a single disciplinary "home," and authors are instead routing their work through whichever adjacent journal, retailing, sustainability, or information-systems, most closely matches the specific angle of a given study, which is typical of a pre-paradigmatic, still-consolidating research area.

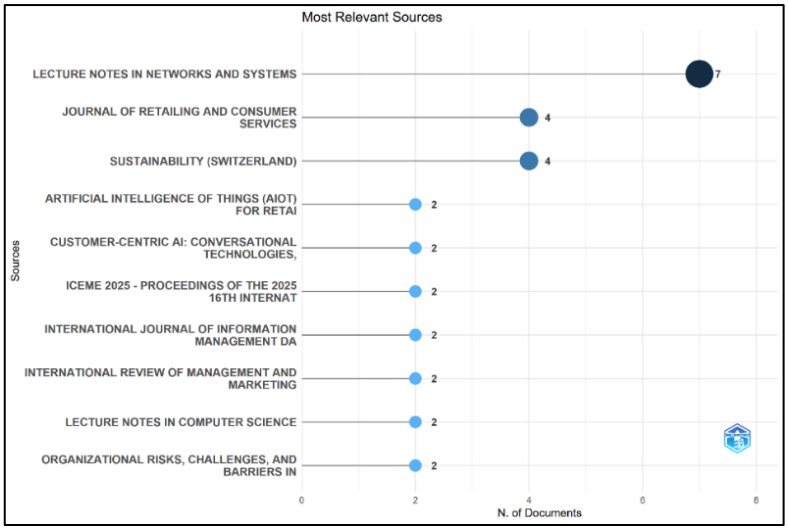


Figure 3: Most Relevant Sources

4.4. Most Relevant Authors

Through the analysis of the most relevant authors several influential authors that have given a contribution to the area of AI in personalized and ethical green retail marketing were detected (Figure 4). Author productivity rankings were calculated after discarding incomplete author metadata records to avoid any analytical error. The results highlight a growing academic interest in AI, sustainability, ethical marketing and digital retail innovation, with contributions coming from a wide spread of individual authors and institutional affiliations rather than a small, established core group. However, as the author collaboration network reported in Section 4.13 shows, this breadth of contributing authors should not be read as evidence of a well-connected collaborative community: co-authorship at present is concentrated in small, mostly isolated teams rather than a single interconnected network. Because no single author or research group accounts for a disproportionate share of the output (consistent with the field's recent emergence, concentrated mainly in 2024 and 2025), no dominant "school of thought" has yet formed around this integrated topic, which leaves room for early contributions, including this study, to help set the field's conceptual agenda rather than simply extending an established stream.

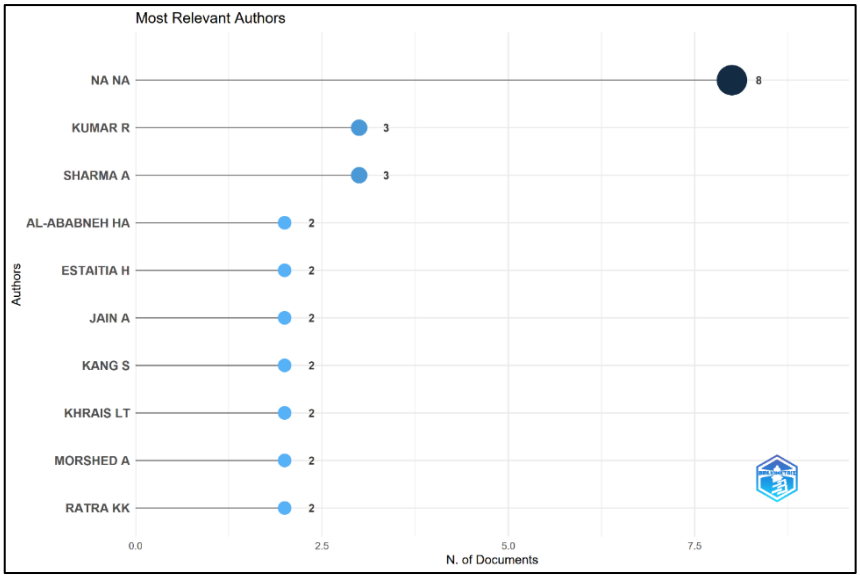


Figure 4: Most Relevant Authors

4.5. Corresponding Author's Countries

The corresponding authors' country analysis highlighted that India has the largest number of publications in the field followed by China and the United States (Figure 5). Among the others big contributors were Malaysia, Thailand, Indonesia and South Korea. Results show that both single-country publications (SCP) and multiple-country publications (MCP) exist, with an increasing amount of international collaboration in this new field. This is driven by the strong representation from Asian countries, especially India, China, Malaysia, Thailand and Indonesia, which may indicate that digital retail markets and AI adoption is growing in the Asia-Pacific region, leaving a good soil for applied research in the nexus of AI, consumer behaviour and sustainable retail. The rising share of MCP in contrast to SCP also points towards a maturational process regarding the increase of networks of cooperation between institutions and across countries, although, as Section 4.13 shows, these cross-country collaborations currently take the form of small, self-contained teams rather than a broad, interconnected collaboration network. This country profile is also notable in contrast to earlier, narrower bibliometric reviews of AI-in-marketing research, which have often reported US- or Europe-led authorship; the Asia-led pattern observed here suggests that, for this particular integrated topic, applied research demand in fast-growing Asian digital retail markets is outpacing the historically dominant Western research centres, though confirming whether this is specific to the green-retail angle or a broader shift in AI-marketing scholarship would require a direct comparative bibliometric study.

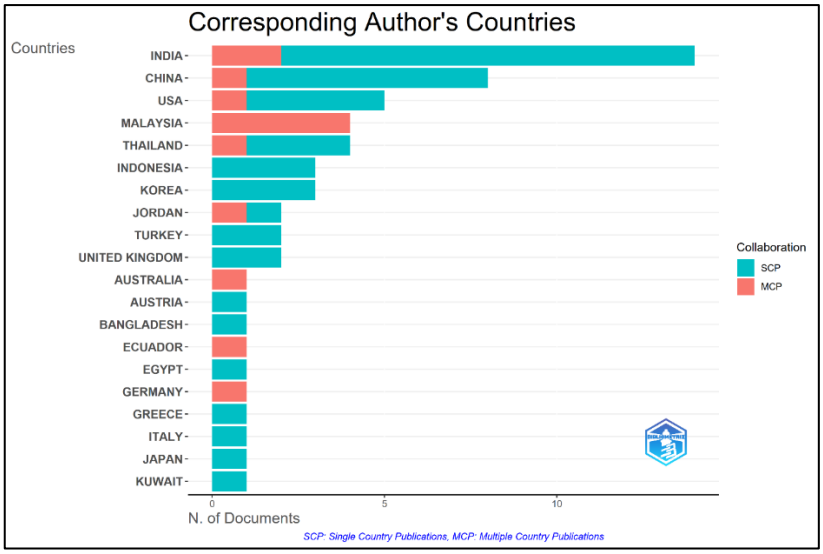


Figure 5: Corresponding Author's Countries

4.6. Words' Frequency Over Time

The words' frequency over time analysis suggests that research attention to artificial intelligence and digital retail marketing has not only grown significantly over the study period, but has also shifted in thematic focus (Figure 6). The highest growth trajectory occurred in the term 'artificial intelligence', especially after 2024, thus establishing its central and dominant position in the research domain. The other top occurring words were "electronic commerce," "consumer behavior," "sustainability," "machine learning," "data privacy," and "decision making." Interestingly, the uptick in "data privacy" and "decision making" starting in 2024 aligns with the rising prominence of ethical governance issues and responsible AI considerations in the broader retail marketing research landscape, mirroring the evolving regulatory landscape for AI transparency and consumer data protection. These ethically-driven terms, alongside the basic AI and e-commerce terms, suggest a shift in the e-commerce landscape beyond performance-based AI, towards more responsible, consumer-centric, and sustainability-focused retail innovation.

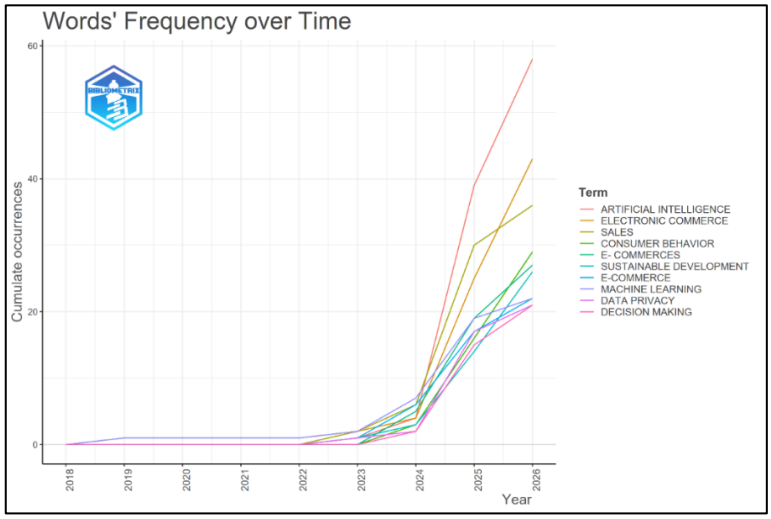


Figure 6: Words' Frequency Over time

4.7. Word Cloud Analysis

Word cloud analysis provides a visual summary of the most frequent words in the selected dataset (Figure 7). The use of terms such as "artificial intelligence," "electronic commerce," "consumer behavior," "sustainability," "machine learning," and "e-commerce" indicates a strong interest in research related to the application of AI in the innovation and sustainable marketing practices within the retail sector. Other associated terms like 'data privacy,' 'decision making' and 'consumer engagement' further highlight the rise of ethical retail and personalized marketing strategies in digital retail environments. Words like sustainability and data privacy, in addition to words concerning core AI technology, are prominently positioned, which points to the fact that the research field has moved from early stage enthusiasm for technology to more governance and critical enquiry, and thus to responsible retail innovation that is focussed on the customer.



Figure 7: Words clouds

4.8. Thematic Map Analysis

Thematic map analysis is performed with the aim of depicting conceptually the structure and thematic development of the research field, by dividing the research field into four quadrants (Figure 8), based on Callon's centrality and density measures. As established drivers of AI retail marketing research, the most highly developed and central areas of research were the themes of 'decision making', 'big data' and 'competition'. The fundamental quadrant themes were basic themes that had high centrality and were considered central themes of the literature, such as "artificial intelligence," "electronic commerce," and "consumer behavior." Emerging and niche themes were "customer experience," "predictive analytics," and "internet of things" – all signs of increased research activity in the area of more advanced digital technologies in retailing and personalized consumer engagement strategies. Moreover, the addition of data privacy and machine learning as relevant background topics is a good sign that fields of ethics and machine learning are no longer side issues but the very heart of academia. The emergence of new technologies such as predictive analytics and customer experience also indicates that intelligent and data-driven as well as sustainable ways of engaging the customer will be increasingly important for retailers' sustainable success. Thematic map themes that are currently underrepresented,

like some of the explainable AI and responsible AI governance themes, and might evolve into niche and motor themes need to be explored as well, for example when the regulatory pressure and consumer trust concerns increase. As a supplementary validation check, an independent keyword co-occurrence analysis was computed directly in Python (NetworkX, Louvain community detection, minimum keyword frequency of 3, matching the threshold reported in Section 3.4) on the underlying Scopus export, covering 136 of the 140 included records – four records could not be machine-parsed for this specific check because of reference-list formatting artifacts in the export file, though they remain part of the full 140-document dataset used elsewhere in this study. This check identified 117 keywords meeting the frequency threshold, connected by 2,204 weighted co-occurrence edges, and resolved into four clusters whose relative Callon centrality and density scores corroborate the quadrant structure described above: a basic-theme cluster built around artificial intelligence, electronic commerce, consumer behavior, and sustainability returned the highest centrality (centrality ≈ 14,380; density ≈ 1,897.6); a motor-theme cluster of decision making, machine learning, big data, and supply chain management followed (centrality ≈ 10,940; density ≈ 1,148.4); a cluster combining data privacy, personalization, and customer experience returned centrality ≈ 11,970 and density ≈ 1,741.7; and the smallest, lowest-centrality cluster grouped the more niche themes of data analytics, digital transformation, internet of things, and competition (centrality ≈ 7,430; density ≈ 935.0). These figures are independently computed validation statistics rather than a reproduction of the original Biblioshiny session parameters, since normalization and clustering-resolution settings may differ slightly, but their rank ordering is consistent with the quadrant placements described above.

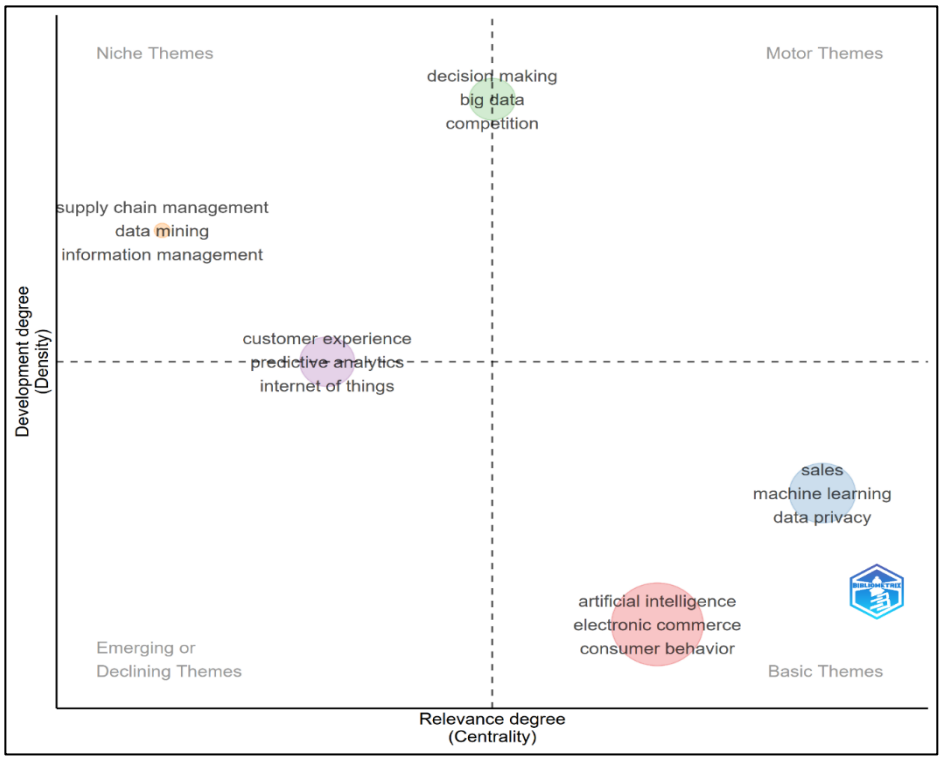


Figure 8: Thematic Map

4.9. Co-occurrence Network Analysis

The most frequent keywords of the data were filtered by the minimum frequency of the keywords and their association strength and made them normalized, then they were clustered using Louvain community detection, and the co-occurrence network analysis was performed (Figure 9). The network points out several thematic areas, which are inter-related, such as "artificial intelligence", "electronic commerce", "consumer behavior" and "data privacy", offering a notion of the interdisciplinary and holistic character of the research area. The synergy between these AI technologies and the themes focused on consumers highlights the intersection of AI, digital retail, ethics, and consumer-centric marketing strategies in the realm of sustainable retail. An interesting discovery is the rise of a new research cluster with the key words “data privacy”, “transparency” and “responsible AI”, indicating that rather than being spread across seemingly unrelated key word clusters, ethical governance topics are starting to form their own cluster. The multi-clusteredness also reflects a paradigm change within the research area, indicating greater collaboration and interdisciplinaryism in the field of ethical green retail marketing with the aid of AI. The thematic clusters are interconnected and show the growing interdisciplinary nature of AI-driven retail marketing, which is more and more intertwined with technology, sustainability and ethical considerations to gain customer trust, make transparent decisions and to ensure sustainable retail development. It is worth noting explicitly that although the search string was constructed to foreground green and sustainability terminology, the co-occurrence and thematic map results (Sections 4.8 and 4.9) consistently position core AI and e-commerce terms as more central and higher-frequency nodes than sustainability-specific terms, which instead cluster more peripherally alongside ethical-governance keywords. Rather than treating this as an inconsistency to be smoothed over, this pattern is interpreted here as evidence that sustainability considerations are, at this stage, more often attached to AI-and-retail research as a secondary framing than as the primary object of study in their own right; this is a substantive observation about the field's developmental stage and a candidate explanation for why "green retail marketing" appears in the paper's title and keyword list without dominating the quantitative structure of the dataset.

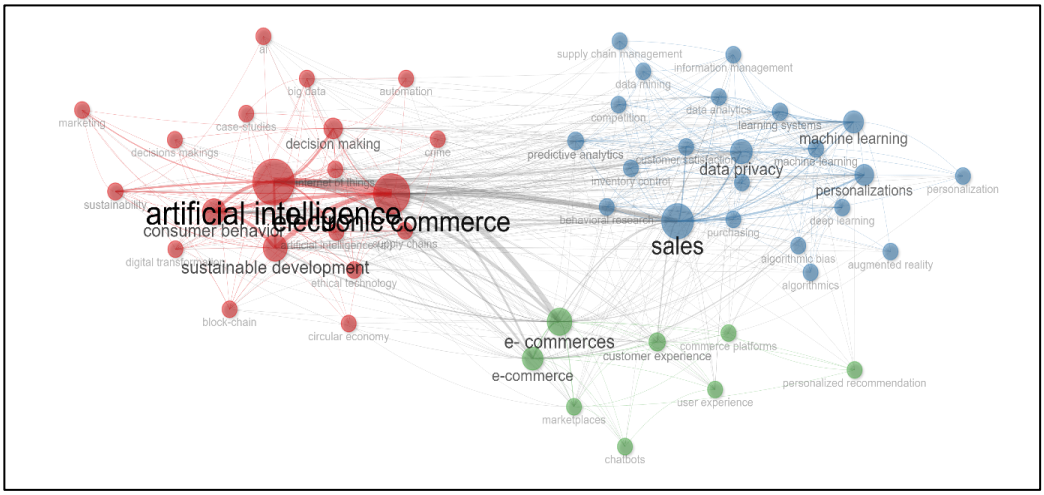


Figure 9: Co-occurrence Network

4.10. Most Global Cited Documents

Most cited documents analysis identified the most influential studies that assisted the research area (Figure 10). International Journal of Information Management Data Insights (2024) had the highest number of citations globally followed by studies by Salhab H. (2025) and Haque A. (2024). Among the other well-cited articles were those on the use of AI in consumer behavior, innovations in digital retailing, and ethical marketing practices. This concentration of highly cited documents in publications from 2024 and 2025, as opposed to previous foundational years, indicates the relative newness of this integrated research field and the quick emergence of new landmark studies. This also means that basic and theoretical principles of the field are still under construction, where there is ample room for researchers to provide basic theory and empirical contributions. Citation networks confirm the increasing relevance of AI-supported sustainable retail marketing research, revealing a growing recognition of the importance of the intersection of sustainable, ethical, and personalized marketing strategies from both a theoretical and practical standpoint.

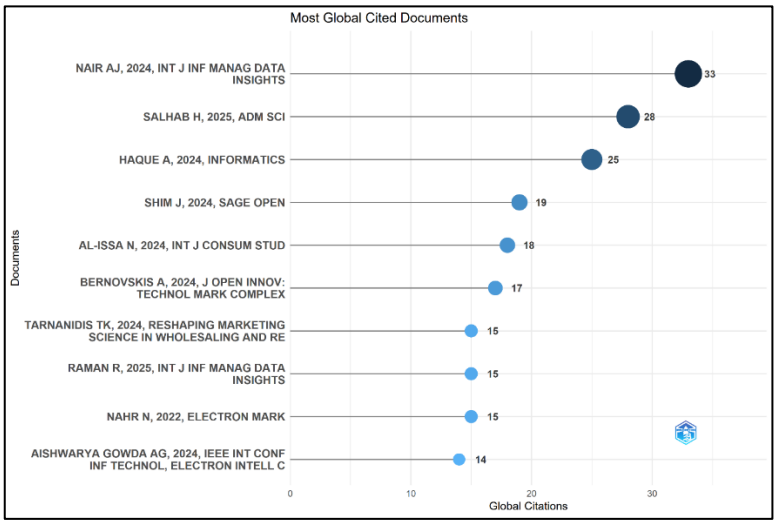


Figure 10: Most Global Cited Documents

4.11. Co-citation Analysis (Cited Authors)

In addition to the keyword-level co-occurrence and thematic map analyses reported in Sections 4.8 and 4.9, an author co-citation analysis was performed in VOSviewer (Van Eck & Waltman, 2010) on the reference lists of the 140 included documents, retaining only cited authors meeting the software's minimum co-citation threshold (Figure 11). The resulting network resolves into four loosely interconnected clusters. A densely linked red cluster, anchored by frequently co-cited authors such as Wang Y., Li Y., Liu H., and Akter S., dominates the centre of the map and points to a well-established, tightly-knit citation tradition around data-driven marketing analytics and AI-enabled decision-making. A neighbouring green cluster grouping authors such as Chen X., Chen L., Kim J., Zhang Y., Wang Z., and Liu Y. reflects a distinct citation lineage rooted in recommender-systems and machine-learning methodology. A third, blue cluster brings together widely cited cross-disciplinary theorists, including Floridi L., Dwivedi Y.K., Rust R.T., McAfee A., Nordfält J., Sarstedt M., and Larcker D.F., whose presence signals that the field draws its conceptual foundations as much

from established AI-ethics, digital-transformation, and methodological literatures as from retail-specific sources. A small, weakly connected yellow pair (Singh R. and Mishra A.B.) sits at the periphery of the network, linked to the core only through a single long-range tie, indicating an emerging citation thread not yet absorbed into the field's dominant citation clusters. Overall, the co-citation structure corroborates the keyword-based finding in Section 4.9 that the field synthesises at least two separate scholarly lineages – a technical AI/recommender-systems tradition and a broader digital-marketing/ethics tradition – rather than growing out of a single, self-contained body of prior work. This qualitative reading is supported by an independent quantitative check: parsing the reference lists of the 136 machine-parseable records in the underlying Scopus export yielded 11,349 unique cited-author entries, of which 219 met a minimum co-citation frequency of five and were retained for network construction (13,971 weighted co-citation edges). By weighted degree, the most central cited authors were Wang Y. (789), Li Y. (687), Liu Y. (681), Zhang Y. (609), Kim J. (539), Wang X. (516), Chen J. (492), and Chen X. (483), closely matching the high-degree nodes visible in Figure 11. Louvain clustering of this network returned three clusters of comparable size (85, 84, and 50 authors), one anchored by Wang Y., Zhang Y., Liu Y., and the Chen-surname cluster; one anchored by Kumar S., Grewal D., Akter S., and Dwivedi Y.K.; and one anchored by Li Y., Kim J., and methodology-focused authors including Sarstedt M., Ringle C.M., and Hair J.F. This three-cluster solution is a close, though not exact, match to the four-cluster VOSviewer solution shown in Figure 11, a discrepancy attributable to differences in clustering resolution and normalization between the two independently run analyses rather than to a substantive disagreement in the underlying co-citation structure.

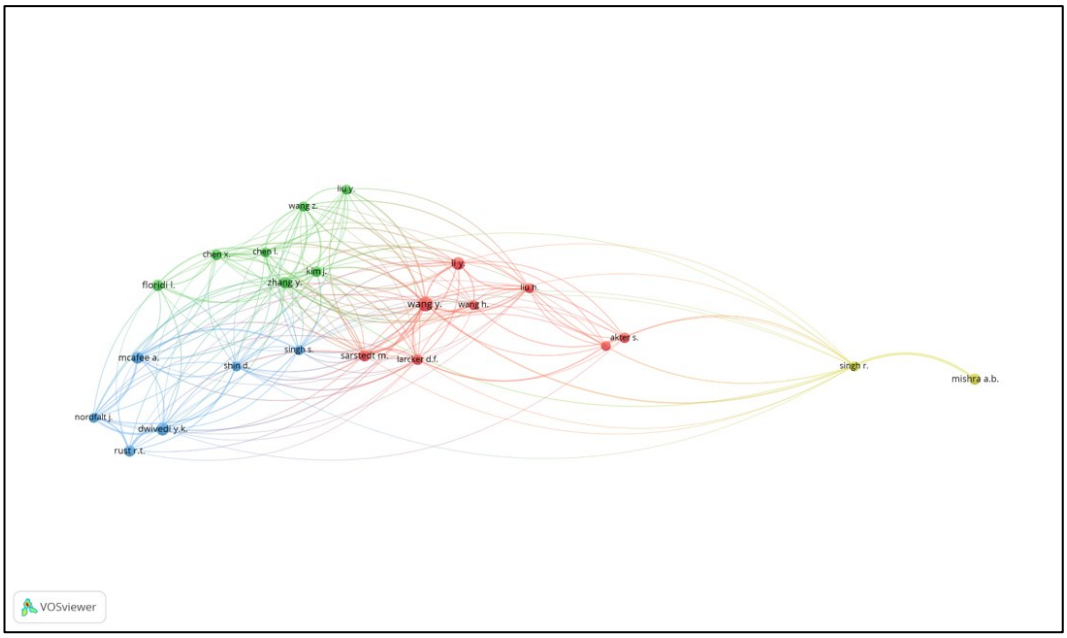


Figure 11: Author Co-citation Network

4.12. Bibliographic Coupling Analysis

A document-level bibliographic coupling analysis was also performed in VOSviewer to identify which of the 140 included studies share overlapping reference lists, an indicator of similarity in underlying knowledge base rather than direct citation between the papers themselves (Figure 12). The coupling network is more loosely connected than the co-citation network, consistent with a still-emerging field in which recent studies draw on partially overlapping but not identical reference bases. Haque (2024) and Tarnanidis (2024) function as the two most connected hub documents, each linking outward to multiple other 2024–2025 studies, including Al-Issa (2024), Shim (2024), Gao (2025), Bhalla (2025), and Phuangsuwan (2025), suggesting these two papers draw on a reference base that is broadly representative of the wider field. A secondary chain connects Khan (2025a), Qadri (2026), Panya (2025), and Aishwarya Gowda (2024), indicating a more specialised sub-set of studies coupled to one another but only loosely tied back to the two central hubs. Raman (2025) and Pakharuddin (2023) form a smaller, largely self-contained pair at the periphery, while Nahar (2022), the earliest document in the network, is connected only to Haque (2024), consistent with its role as an early, relatively isolated antecedent to the more recent literature. This structure – a small number of highly-coupled 2024–2025 hub papers surrounded by a longer tail of more loosely coupled recent studies – mirrors the rapid, still-consolidating growth of the field reported in Section 4.2, rather than a mature literature organised around a small number of canonical reference sets. A supplementary quantitative check, built by matching normalised author-year reference tokens across the 136 machine-parseable records in the underlying Scopus export, found that 124 of these 136 documents share at least one reference with another included document, forming 431 coupling ties that resolve into one dominant connected component of 105 documents plus one small isolated pair; the remaining 31 documents share no reference with any other included study. By coupling strength, the leading hub documents were Deng K. (2026) (coupling strength 66, linked to 31 other documents), Haque A. (2024) (46, linked to 31 documents), Aydin S. (2026) (46, linked to 21 documents), Qadri U.A. (2026) (40, linked to 21 documents), and Gao Y. (2025) (39, linked to 26 documents). The independent identification of Haque (2024) as one of the two strongest hub documents corroborates its role in the VOSviewer-based coupling map in Figure 12, while Deng K. (2026) and Aydin S. (2026), which fall outside the more conservative visualisation threshold used in Figure 12, indicate that the underlying coupling structure is somewhat denser than the curated network diagram alone suggests.

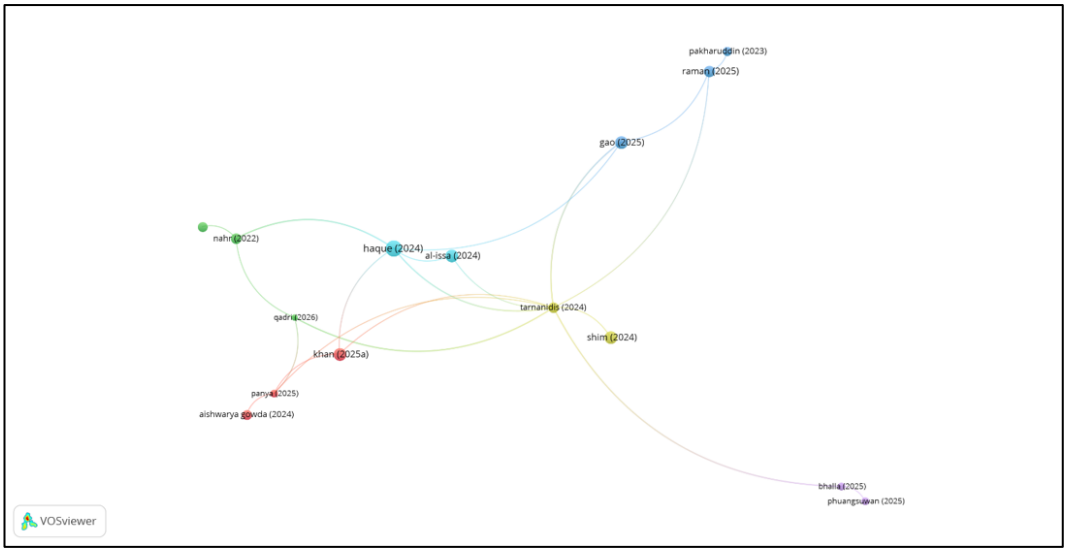


Figure 12: Bibliographic Coupling Network of Included Documents

4.13. Collaboration Network (Co-authorship) Analysis

Author-level collaboration (co-authorship) network analysis was performed in VOSviewer to map research collaboration patterns among the authors of the 140 included documents (Figure 13). In contrast to the co-citation and coupling networks, the collaboration network is sparse and highly fragmented: it consists of several small, mutually disconnected clusters of two to four co-authors each, with no cross-cluster collaboration ties observed at the applied threshold. The largest identified team, comprising Estaitia H., Morshed A., Khrais L.T., and Zoubi M., forms a single, densely interconnected four-author group, while the remaining clusters are limited to co-author pairs or triads (for example, Gao Y. and Liang J.; Kumar R., Ahmad Saany S.I., and Al-Haithami W.A.; Wang J., Yadav A.K., and Jain A.; Sharma A. and Aggarwal K.; Al-Amin M. and Akhter M.N.; Agarwal K. and Akther N.). The absence of any inter-cluster bridging authors indicates that, despite the rising multiple-country publication share reported in Section 4.5, collaboration in this field is currently occurring within isolated small teams rather than through a broader, interconnected research network; no single author or research group yet occupies a structurally central, bridging position of the kind typically seen in more mature collaborative fields. This finding qualifies the international-collaboration interpretation offered in Section 4.5: cross-country publications appear to reflect co-authorship within existing small teams that happen to span institutions or countries, rather than the emergence of a broader, interconnected international collaboration network. This qualitative picture is confirmed, and sharpened, by an exact reconstruction of the co-authorship graph from the underlying Scopus export (136 of 140 records were machine-parseable for this check): the 136 documents involve 408 unique authors linked by 689 co-authorship ties, forming 125 connected components (network density 0.0083; average degree 3.38). Critically, 121 of these 125 components are confined entirely to a single paper's own author list, with no tie to any other included document, and only 4 components connect authors across more than one paper. Only 7 of the 408 unique authors (1.7%) appear as a co-author on more than one of the 136 documents, and the single largest connected component (10 authors) corresponds exactly to one paper's full author team rather than to any

cross-paper cluster. In other words, essentially none of the apparent collaboration structure in this field currently extends beyond individual project teams: authors who publish once in this area very rarely publish again in it with a different set of collaborators, at least within the window covered by this dataset.

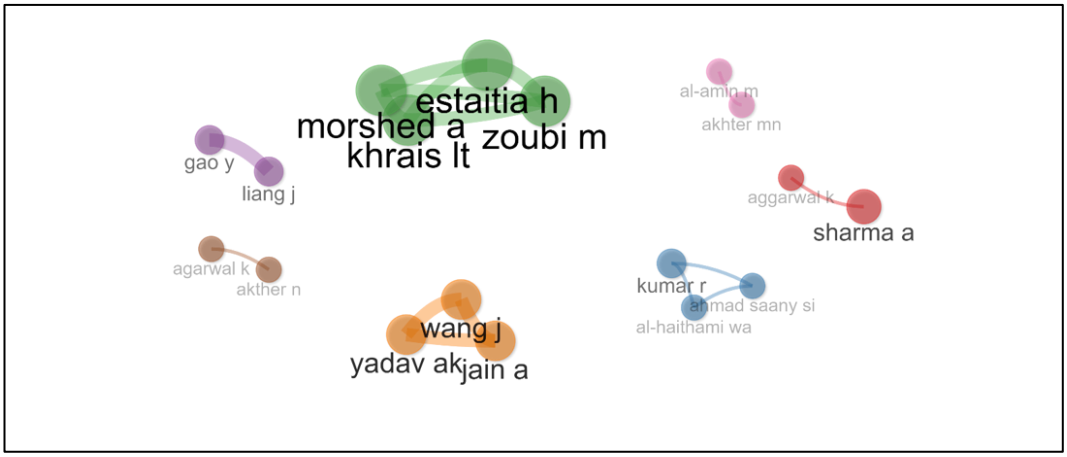


Figure 13: Author Collaboration (Co-authorship) Network

4.14. Thematic Evolution Analysis

To examine how the field's core themes have evolved over time, a thematic evolution analysis was performed by splitting the dataset into two sub-periods, 2018–2025 and 2026 (the partial year), and tracking keyword-cluster flows between them using Bibliometrix's thematic evolution mapping, visualised as a Sankey diagram (Figure 14). Artificial intelligence remains the single largest and most persistent theme across both periods, evidenced by the thick red flow connecting it directly across the two sub-periods, confirming its role as the field's stable core theme (consistent with Sections 4.6–4.8). Sustainability shows a comparable pattern of persistence and, in fact, becomes the single largest theme in the 2026 sub-period, overtaking artificial intelligence in relative share, consistent with the growing centrality of ethical-governance and sustainability framing discussed in Section 4.9. Several 2018–2025 themes that lacked strong independent identity in the earlier period – algorithmic bias, machine learning, the separate keyword variant "artificial intelligence (ai)", and e-commerce – do not persist as standalone themes into 2026; instead, their associated literatures appear to have been absorbed into, or superseded by, four newly consolidated 2026 themes: data analytics, digital transformation, consumer behavior, and responsible AI. This convergence pattern suggests the field is moving from a stage in which AI applications and their ethical or technical sub-components were discussed as separate, fragmented themes towards a stage in which they are integrated into broader, applied constructs (responsible AI, digital transformation) that combine the technical, ethical, and consumer-facing dimensions of the field within unified themes. This thematic consolidation is consistent with the field's transition, identified throughout Section 4, from an early exploratory stage to a more integrated and governance-aware research area. A simplified, keyword-frequency-based validation check supports this picture, though it is worth noting this check tracks raw keyword shares rather than the full Callon-cluster inclusion-index calculation underlying the original thematic evolution map. Splitting the 136 machine-parseable records into the same two

sub-periods, artificial intelligence and electronic commerce each appear in a near-identical share of documents in both periods (43% and 37% of the 95 pre-2026 documents, versus 44% and 44% of the 41 2026 documents, respectively), confirming their persistence as the field's stable core. Sustainability-related terms rise in relative share, from sustainable development appearing in 15% of pre-2026 documents to 27% of 2026 documents, and sustainability itself rising to 24% of 2026 documents from outside the pre-2026 top-ranked terms. Consistent with the convergence pattern described above, data privacy, machine learning, and customer experience all drop out of the top-ranked keywords by 2026, while digital transformation, predictive analytics, and data analytics newly enter the top-ranked 2026 keywords, corroborating the absorption of earlier fragmented themes into these broader constructs.

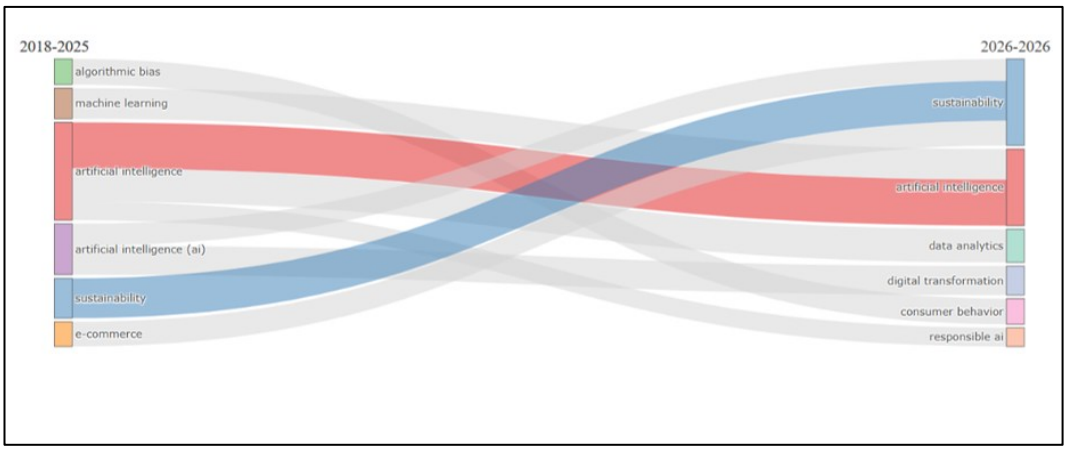


Figure 14: Thematic Evolution, 2018–2025 to 2026

5. Conclusion

5.1. Summary of Findings

This bibliometric study provides a systematic and comprehensive overview of the emerging role of artificial intelligence in personalized and ethical green retail marketing, based on 140 peer-reviewed journal articles and review papers retrieved from the Scopus database between January 2018 and May 2026. Bibliometrix (v 4.1.0) and Biblioshiny in RStudio (v 4.3.1), together with VOSviewer, were used to analyze and map the intellectual structure and evolution of the field, including co-occurrence network analysis, thematic mapping, annual scientific production analysis, citation analysis, keyword frequency analysis, author co-citation analysis, bibliographic coupling analysis, collaboration network analysis, and thematic evolution mapping.

The results highlight a swift surge in literature focused on the intersection of AI technologies, sustainability, and ethical governance, especially since 2024. The main research areas that emerge from the keyword, thematic and network analysis are artificial intelligence, electronic commerce, consumer behaviour, sustainability, machine learning, data privacy and ethical marketing. The thematic map analysis also showed that customer experience, predictive analytics and the internet of things are three developing themes that may present opportunities for future research, whereas decision making, big data and

competition are well-established motor themes that are pushing the field. The co-occurrence network analysis identified an emerging and coherent cluster of data privacy, transparency, and responsible AI, indicating that ethical governance is evolving from a peripheral to a structurally central aspect of AI-supported retail marketing research. The author co-citation and bibliographic coupling analyses (Sections 4.11–4.12) show that this literature draws on at least two distinct intellectual traditions, a technical AI/recommender-systems lineage and a broader digital-marketing/ethics lineage, connected through a small number of highly-coupled hub studies, while the thematic evolution map (Section 4.14) shows the field's vocabulary consolidating from broad, separate early-period terms into more integrated applied constructs such as responsible AI and digital transformation.

The country level analysis revealed that India, China and the United States accounted for the most publications in the field, and multiple country publication ratios are increasing, indicating a growing amount of cross-border co-authorship. However, the collaboration network analysis (Section 4.13) shows that this cross-border activity currently takes the form of several small, mutually disconnected co-authorship teams of two to four researchers rather than a broader, interconnected international research network, so the rising multiple-country publication share should be read as evidence of individual teams spanning countries rather than of field-wide collaborative integration. Author-level analysis, done after systematically removing incomplete metadata records, revealed that Kumar R. and Sharma A. were the most productive contributors, and that there was an increasing number of authors from a wide array of disciplines, including marketing, information systems, sustainability, and AI ethics. Citation analysis confirmed that the most influential documents in the field are mainly from 2024 and 2025 publications, showing that this integrated research domain is very recent and develops at an extremely quick rate.

5.2. Theoretical Contributions

This study is important in a number of ways in terms of theory. First, it is the first systematic bibliometric mapping covering the integrated intersection of artificial intelligence, personalized marketing, ethical AI governance, and green retail marketing, which has not been collectively focused upon in previous bibliometric reviews that have individually analyzed AI-in-retail or sustainable marketing. Second, the results of the thematic and co-occurrence analyses clearly indicate that topics related to ethical governance, such as data privacy, transparency, algorithmic fairness, and responsible AI, are coalescing into a cohesive research cluster within the vast and fragmented literature on AI in retail marketing, as opposed to being spread throughout the literature in unrelated groupings of related key words. Third, the study provides evidence of a shift from an early stage of technological performance optimization towards more critical, governance-oriented, and sustainability-driven inquiry, a shift with significant implications for how researchers conceptualise the role of AI in retail marketing. Fourth, the study highlights that explainable AI, responsible AI governance, and privacy-preserving personalization are emerging themes and not consolidated ones, thereby providing a forward-looking theoretical agenda for the field, beyond the existing reviews. Fifth, by combining co-citation, bibliographic coupling, collaboration-network, and thematic-evolution analyses (Sections 4.11–4.14) alongside the keyword-based mapping in Sections 4.6–4.9, the study offers a

more complete account of the field's intellectual structure than keyword analysis alone would provide, showing specifically that the literature's conceptual integration (converging themes, thickening ethical-governance clusters) is currently running ahead of its social integration (a fragmented, largely disconnected co-authorship structure) — a distinction that keyword-only bibliometric reviews of this field have not previously been able to draw.

5.3. Practical Implications

It is worth distinguishing, at the outset of this subsection, between implications drawn directly from the bibliometric patterns reported in Section 4 (the growth trajectory, thematic clusters, and country/author distributions) and broader recommendations that draw on the underlying literature reviewed in Section 2; the former are supported by the dataset analysed here, while the latter reflect the wider scholarly consensus this bibliometric mapping sits within. The results of this study are of great practical relevance for AI innovators and sustainable retailers, technology developers and retail sector policy makers. It's a reminder to retail practitioners that when investing in AI, they should focus on applications that will have a direct impact on consumer behaviour, like recommendation systems, nudging around green products, and AI-powered tools that engage consumers directly. The world has become more aware of data privacy and responsible AI, and retailers can no longer afford to think of ethical AI governance as merely a compliance question; the ability to make proactive efforts around designing algorithms that minimize unfairness, to communicate clearly with consumers, and to protect privacy is increasingly key to consumer trust and brand reputation.

Such results indicate the need for explainable and fairness-aware retail AI systems, which are paramount to the efforts of technology producers and AI system designers. The market opportunity and growing regulatory demand are for recommendation and personalisation technology that is able to explain algorithmic decisions to consumers in a human-readable way and test for biases across demographics and inequities across exposures. The study highlights the importance of establishing governance frameworks that prioritize innovation facilitation alongside consumer protection, transparency of algorithms, and sustainability responsibility in AI-powered retail settings for policymakers and regulators.

5.4. Limitations

The current study has a number of limitations, which must be clearly stated to help the readers contextualize the results. First, the search was based only on the Scopus database; other studies might not be covered because they are only indexed in Web of Science, or Dimensions, or Google Scholar, which can lead to coverage bias. Second, the five-conceptual filter multi-dimensional Boolean search query used simultaneously is intentionally limiting, and can decrease the recall of the relevant adjacent literature on XAI in retail, algorithmic fairness, or green marketing. Third, 2026 data on publication is limited to January 2026 to May 2026 and is assumed to be partial-year data; the annualized projection given is a rough indicative estimate rather than a statistically modelled forecast (see Section 4.2 for the projection method and its caveats). Fourth, bibliometric analysis concentrates on quantitative trends in publications and does not

necessarily reflect the methodological excellence, theoretical richness, and practical importance of particular studies. Fifth, co-citation, bibliographic coupling, and author collaboration network analyses have now been incorporated (Sections 4.11–4.13) and partially address the earlier gap in this respect; however, Bradford's Law and Lotka's Law source- and author-productivity analyses were still not applied and remain a methodological limitation for future bibliometric reviews interested in a fuller picture of the field's productivity distribution. Sixth, the English-language filter used in the study might prevent the inclusion of pertinent non-English literature, especially publications by new research communities in Asia where the area is rapidly expanding. Seventh, approximate centrality, density, and network-degree statistics have now been added to Sections 4.8 and 4.11–4.14, computed independently in Python (NetworkX) from the underlying Scopus export; however, these are supplementary validation figures rather than an exact reproduction of the original Biblioshiny/VOSviewer session parameters (normalization method, clustering resolution, and visualisation thresholds may differ slightly between the two), and they are based on 136 of the 140 included records, since four records in the export had reference-list fields that were not machine-parseable due to formatting artifacts. Readers requiring exact replication of the original Biblioshiny/VOSviewer coordinate values should treat the figures reported here as a convergent, independently computed check rather than a substitute for the original analytical session output. Eighth, the keyword-based inclusion strategy foregrounded green and sustainability terminology in the search string, yet the resulting thematic and co-occurrence structures show core AI and e-commerce terms occupying more central positions than sustainability-specific terms; this keyword-to-content emphasis gap is itself treated as a substantive finding about the field's current developmental stage (see Section 4.9) rather than a methodological flaw, but it does mean that readers should not assume sustainability constructs are as structurally central to the literature as the search query's framing might imply. Collectively, these limitations mean that the results should be interpreted as an indicative, database- and query-specific map of a fast-moving and still-consolidating research field, rather than as an exhaustive or definitive account of it, and that the country, author, and thematic rankings reported here may shift as coverage is broadened in future replications.

5.5. Future Research Directions

The results of the current research outline some of the most significant and under-researched paths of research that should be the priority of future scholarship. The results of the thematic gaps identified in the bibliometric analyses are organized to form a future research agenda as stated in Table 2.

Table 2: Structured Future Research Agenda

Research Direction	Key Questions	Suggested Methods
Privacy-preserving personalization	How can federated learning and on-device inference deliver personalized green product recommendations while maintaining measurable privacy guarantees?	Experimental design; federated learning simulations; differential privacy benchmarking
Fairness–sustainability trade-offs	How can recommender systems balance equitable exposure across consumer and seller groups with the promotion of eco-friendly products?	Algorithmic fairness evaluation; exposure parity metrics; carbon-footprint-aware utility modeling

Research Direction	Key Questions	Suggested Methods
Explainable AI in retail	Which explainability modalities feature-based, example-based, or natural language justifications most effectively improve consumer trust and purchase intent?	Randomized controlled trials; conjoint analysis; eye-tracking studies
Responsible AI governance adoption	How are retailers adopting responsible AI frameworks and complying with emerging AI Acts and ISO standards? What maturity models best capture governance progress?	Case study research; survey-based maturity modeling; regulatory compliance auditing
Causal field experiments on green nudging	What are the causal effects of AI-generated green nudges and explainable product justifications on conversion rates, consumer trust, and long-term retention?	Field experiments; A/B testing; longitudinal consumer panel studies
Life-cycle environmental impact of AI	What is the net environmental impact of deploying large-scale AI personalization systems in retail, accounting for model training and inference energy costs against sustainability outcomes achieved?	Life-cycle assessment (LCA); energy consumption benchmarking; carbon footprint modeling
Consumer trust in ethical AI retail	How do algorithmic transparency, fairness disclosures, and explainable recommendations jointly influence consumer trust formation across different demographic segments?	Structural equation modeling; cross-cultural survey studies

In addition to these particular guidelines, future studies might be enhanced by diversification of methods using qualitative case studies, mixed-methods designs, and longitudinal field experiments and bibliometric methods of developing a more comprehensive and more causally substantiated model of the role of AI in ethical green retail marketing. The interdisciplinary cooperation of marketing scholars, AI researchers, sustainability scientists, and legal professionals will be required to further the development of the unified theoretical and governance frameworks that this rapidly changing field requires.

5.6. Concluding Remarks

In retail marketing, AI can now be regarded as a powerful enabler of personalisation, sustainability, and ethical consumer engagement. This bibliometric study has mapped the intellectual structure and thematic evolution of AI-enabled green retail marketing, tracing the field's trajectory from early, largely technology-focused work towards a more governance-aware and sustainability-integrated research area. Responsible AI, explainable systems, green marketing, and consumer-centric personalisation stand out as some of the most consequential developments in retail today. As regulation grows more complex and consumers increasingly demand transparency, green retailing and ethical AI governance are likely to become inseparable priorities in an era where sustainability is increasingly central to competitive advantage. Continued research, practice, and policy work on this convergence will be needed to build the theory, empirical evidence, and governance tools required to shape a responsible, sustainable, and consumer-centred future for digital retail.

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