



Exploring the Applications of Artificial Intelligence in Marketing: A Topic Modelling Analysis

Explorando as aplicações da inteligência artificial no marketing: uma análise de modelação de tópicos

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Abstract

Integrating Artificial Intelligence (AI) into marketing has revolutionised this field, offering new avenues of innovation and efficacy. This study aims to unveil the prevailing trends and patterns within the current academic literature about AI applications in Marketing and propose future research directions. The study conducted a comprehensive review by analysing 2,255 articles from the Scopus database from 1980 to 2022, employing a Text Mining approach and Latent Dirichlet Allocation (LDA) topic modelling. The findings suggest trends in research topics of Learning Models, Expert Systems, Natural Language Processing, Social Media, and Consumer Centricity. Outlier topics related to Health, Market Forecast, and Technology Impact on Youth have caught the researchers' attention. The associated challenges and risks, ethical considerations, and practical implications were presented for each topic. This study develops literature on AI-driven marketing by unearthing the trend topics and suggesting a research agenda. At the same time, it offers actionable insights for businesses to enhance consumer engagement and ethical AI adoption in marketing practices.

Keywords: Artificial Intelligence; Marketing; Literature Analysis; Text Mining; Topic Modelling.

Resumo

A integração da Inteligência Artificial (IA) no marketing revolucionou este campo, oferecendo novos caminhos de inovação e eficácia. Este estudo tem como objetivo desvendar as tendências e padrões na literatura académica sobre as aplicações da IA no Marketing e propor direções de investigação futura. O estudo analisou 2.255 artigos Scopus de 1980 a 2022, empregando uma abordagem de *Text Mining* e *Latent Dirichlet Allocation* (LDA). Os resultados sugerem tendências em tópicos de investigação de modelos de aprendizagem, sistemas especialistas, processamento de linguagem natural, redes sociais e centralização no consumidor. Tópicos atípicos relacionados com a saúde, previsão de mercado e impacto da tecnologia na juventude chamaram a atenção. Os desafios e riscos associados, as considerações éticas e as implicações práticas foram apresentadas para cada tema. Este estudo desenvolve literatura sobre o marketing orientado por IA, revelando os tópicos de tendência e sugerindo uma agenda de investigação. Ao mesmo tempo, oferece visões práticas para as empresas melhorarem o envolvimento do consumidor e a adoção ética da IA nas práticas de marketing.

Palavras-chave: Inteligência artificial; Marketing; Análise da Literatura; Mineração de Texto; Modelação de Tópico.

1. Introduction

Technological growth has brought significant changes, with Artificial Intelligence (AI) emerging as a crucial component for developing marketing strategies (Cui et al., 2022). AI-driven technologies such as Google Assistant and Amazon Echo have amplified the performance of companies like Google, Spotify, and Amazon, enhancing consumer interaction and improving market forecasting and automation (Vlačić et al., 2021). Further, disruptive technologies, such as the Internet of Things (IoT), blockchain, big data analytics (BDA), and AI, have changed consumer behaviour, societal expectations, and the way businesses operate (Verma et al., 2021). AI market has a current value of approximately \$100 billion and is anticipated to flourish twenty times by 2030, approaching \$2 trillion (Bloomberg, 2022).

1.1. Background of AI in Marketing

AI can transform operational marketing activities and lead to successful marketing and sales strategies by translating big data into useful information and knowledge (Paschen et al., 2020). AI's importance in marketing is evident as it enables scalable personalised consumer relationship management and effective decision-making, maximising the use of technology and information to provide consumer satisfaction and generate new "AI-designed" products (Stone et al., 2020). While research on digital and technological evolution has rapidly evolved, only recently has research analysed the intersection of AI and



Marketing (Davenport et al., 2020). Big data and AI became a top priority for developing the marketing industry, especially after 2017, when it began to experience exponential growth in adoption by marketing managers (Mariani et al., 2022). AI is highly relevant to modern marketing. Academics acknowledge AI as a critical element not only in advertising dimensions (advertising process, advertising operation, advertising design, advertising production, and advertising execution) (Lee et al., 2020) but also in each phase of digital marketing (e.g., programmatic advertising) (Kietzmann et al., 2018). Further, AI in marketing research has generated comprehensive insight into its application in marketing. For instance, AI-driven chatbots can improve consumer experience (Nguyen et al., 2022). The accelerated growth of intelligent advertising was driven by big data, cloud computing, and algorithms, which can orient large-scale personalised activities (Esch et al., 2021). AI can also create innovative retail stores, which enhance consumer experience (Sujatha et al., 2019). AI precision, efficiency, and effectiveness are the key aspects that leverage accurate marketing activities.

1.2. Review-on-review analysis on AI in Marketing

Prior reviews contributed significantly to applying AI in marketing by investigating the effectiveness of Machine Learning (ML) and bringing up issues with model transparency (Ma & Sun, 2020). They also analysed sentiment analysis and advertisement optimisation (Verma et al., 2021). The rapid advances of AI in marketing research revealed ten themes applicable to the current business environment in a multifaceted manner (Mustak et al., 2021). The research only offered insight into the possibilities of using AI and not real-world examples. However, the ability of AI to mimic human actions and mannerisms was investigated to unveil potential uses when conducting intelligent operations (Vlačić et al., 2021). Further, more researchers established the necessity for thorough evaluations of AI solutions while acknowledging limitations in their review (Chintalapati & Pandey, 2022). Others clustered AI facets and connected research across areas, but they needed a thorough, real-time overview (Mariani et al., 2022). Discovery of the different AI tools and techniques that assist consumers to make better decisions without revealing the model that can be implemented to achieve that, limiting their detailed analysis to AI techniques applied to consumer-related issues (Vaid et al., 2023). The revealing of the mystery of AI through understanding its history, current boundaries, and its effect on interactive marketing is facilitated by Peltier et al. (2023). However, they failed to present the results from over 300 empirical research studies that could have elaborated on AI core elements and interactive marketing. A synthesis of the previous literature reviews is listed in Table 1.

Table 1- Synthesis of AI in Marketing Literature Reviews

Article	Ma and Sun (2020)	Verma et al. (2021)	Mariani et al. (2022)	Mustak et al. (2021)	Vlacic et al. (2021)	Chintalapati and Pandey (2022)	Peltier et al. (2023)	Vaid et al. (2023)	Present Review
Topic	The role of ML and AI in marketing	AI in marketing	AI in marketing from consumer research and psychology perspective	AI in marketing	The evolving role of AI in marketing	AI in marketing and advertising	Conceptual framework of AI in interactive marketing	AI and empirical consumer research	Exploring AI applications in marketing field
Aim of the review	Reviews application of ML for AI in marketing research	Reviews extant literature on AI in marketing research	Integrates knowledge on AI research in marketing, consumer research and psychology	Analysis the AI in marketing research	Presents an overview of the development of AI in marketing field	Explores the implications of AI in marketing	Reviews marketing literature and develops an AI framework	Investigates and understands the AI techniques in consumer study	Unearths the existing academic literature patterns and trends about AI applications in Marketing field
Time frame	Indefinite	1982-2020	1966-2021	1960-2019	1987-2020	2015-2022	Indefinite	1955-2022	1980-2022
N.° of papers	Indefinite	1,580	4,488	214	164	57	300	119	2,225
Method	Systematic review	Bibliometric analysis	Bibliometric analysis	Bibliometric analysis and Topic modelling	Systematic review	Systematic review	Systematic review	Topic modelling	Topic modelling



Contributions	Highlights opportunities to connect ML methods to human insights and marketing	Identifies AI in marketing research sub-themes and suggests future research directions	Advances knowledge on AI in marketing, consumer research and psychology while integrating cross-fertilisation of theories	Provides valuable insights for future research related to consumer behaviour, market performance and marketing strategies	Outlines a future research agenda regarding theory, context, characteristics and methods	Proposes a new framework for marketing mix and identify the areas of study related to AI in marketing such content marketing	Pinpoints the manifold functions of AI in diverse industries, underlining the fundamental design factors, core foundations, and settings for AI application in marketing	Offers a comprehensive review of evolution of AI in consumer-focused literature and incorporates consumer psychological framework	Suggests research agenda by providing real-time and In-depth assessment of AI in marketing landscape
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Source: Own elaboration.

Our study presents a comprehensive analysis using Latent Dirichlet Allocation (LDA) for topic modelling, expanding beyond previous reviews focusing on psychology, sentiment analysis, and ML. By incorporating insights from diverse fields, our approach addresses the oversight of essential perspectives that contribute to a comprehensive understanding of AI applications in marketing. We provide interdisciplinary insights that surpass traditional marketing or AI-specific contexts, identifying key topics and revealing latent patterns. This analysis offers practical advice, emphasises cross-disciplinary uses, and highlights the importance of developing trustworthy AI systems. Additionally, we detail AI's practical effects and marketing professionals' challenges and offer actionable recommendations.

1.3. Importance of the current research synthesis

The study enhances AI in marketing literature, offering unique insights and practical advice for the multi-disciplinary use of AI in marketing. It addresses key topics, including ethical implications and the need for trustworthy, explainable AI (XAI). The paper outlines AI's practical effects and challenges in modern marketing applications. It contributes significantly to the AI in marketing debate by identifying issues and proposing solutions. Additionally, it serves as a step-by-step guide for marketing professionals navigating the evolving AI landscape.

Therefore, this study attempts to fill the gap through an automated literature analysis on AI in the marketing research domain and answering the following research questions:

- RQ1: What are AI in marketing research topics, and the relationship between them?
- RQ2: What are the research trends and opportunities for future research directions for adopting AI in Marketing?

2. Method

2.1. Selecting Articles

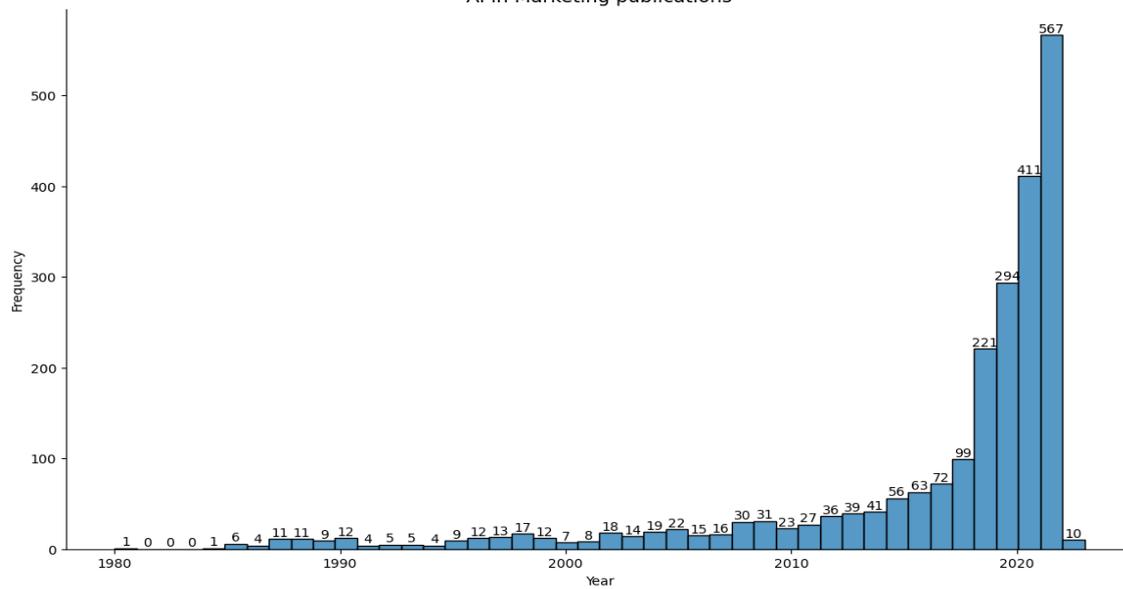
Scopus is one of the most reputed publication databases for discovering relevant literature, has broader coverage, and includes more than 20,000 peer-reviewed journals from different publishers (Fahimnia et al., 2015). Due to the broader coverage, advanced search filters, and data analysis grids, it is considered the most organised database with the highest quality standards for data collection, justifying the preference for this study (Kumar et al., 2020; et al., 2024; Ramos et al., 2024) It is internationally recognised as one of the most relevant indexed researched publication databases in social sciences (Biscaia et al., 2024; Ramos et al., 2019).

Researchers utilised the keywords "marketing" and "artificial intelligence." Additionally, synonyms (e.g., machine learning, deep learning, natural language processing) were used for AI (Chintalapati & Pandey, 2022; Martínez-López & Casillas, 2013; Verma et al., 2021; Vlačić et al., 2021). Researchers operated the search query in the Scopus database on January 26, 2023, to retrieve the AI in Marketing published research. In the first screening, the researchers limited the search query to "title, abstract, and keywords" fields; initially, 5,861 documents were returned, and subsequently, focused the search on articles written in English. Articles are considered the most current and advanced knowledge sources (Rojas-Lamorena et al., 2022). This restriction reduced the search results to the final dataset. In total, 2,255 articles were selected for analysis.

Figure 1 reflects the publication trend under AI and Marketing. Since 1980, 2,255 articles have been published, an average of 51.25 articles per year. However, between 2019 and 2022, 1,493 articles were published, an average of 373.25 articles per year. These results reveal the increasing interest of researchers in this topic.



Figure 1- Number of Publications per Year
AI in Marketing publications



Source: Own elaboration.

2.2. Data analysis

Automated literature analysis uses text mining to parse documents and extract text contents into an organised structure (term matrix). This term matrix comprises two dimensions, the words/terms (composed of n - words) and the documents. The intersection of each word pair and document reveals the frequency of a word in the document (Delen & Crossland, 2008). Such an approach permits us to analyse extensive bodies of literature, efficiently detecting underlying thematic structures, trends, and emerging concepts (Moro et al., 2023). However, automated methods rely on statistical patterns and cannot fully capture qualitative judgments, contextual subtleties, or the richness of diverse perspectives presented in the dataset.

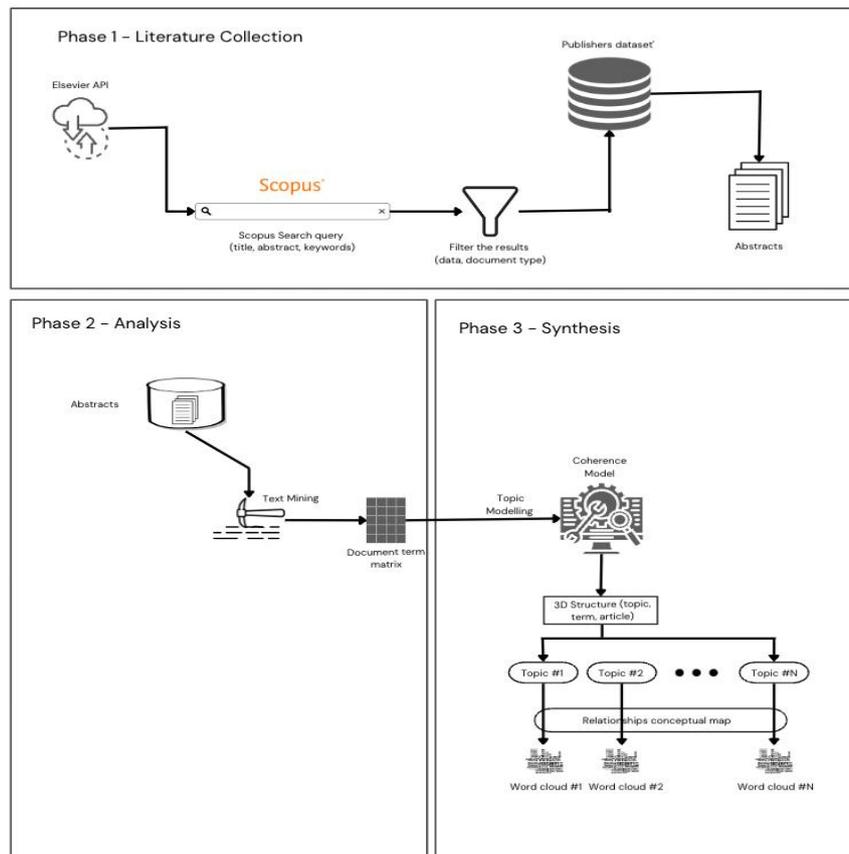
Topic modelling was performed for data analysis, particularly LDA. It permits gathering massive amounts of textual information on topics (Ramos et al., 2019). As an input, the text mining structure contains the relevant terms with their frequency in an organised structure where the documents are categorised by topic (Blei, 2012). To conduct the topic modelling analysis, we built a corpus that included the abstract of every article collected. This approach is consistent with other literature analyses using Topic Modeling (Moro et al., 2023). Preprocessing was implemented to reduce subjectivity (Ribeiro et al., 2024). The preprocessing involved eliminating stopwords, articles, and adverbs, transforming all words to lowercase, applying stemming, and lemmatisation to reduce similar words into one.

Furthermore, we used the coherence score evaluation in this study, which calculates each category score by measuring the semantic similarity degree between the most likely words, which means that when more words in each category appear in the same texts together higher, the coherence score (Abdi et al., 2021). The Model uses the Coherence score as a metric to vary α and β to train the Model and get the best accuracy possible. We started with a DA coherence score of 0.417 and, at the end of the model training, with a coherence score of 0.431, representing a 1,4% improvement over the baseline model when setting the α to 0.2. Finally, we adopted an Intertopic Distance Map (IDM) to visualise the topics in a two-dimensional space, where the area of each topic circle is proportional to the number of words belonging to each subject. This map is conceived using a multidimensional scaling algorithm that converts a considerable number of dimensions to a reasonable number of dimensions. It places the more strongly correlated topics (Bing-Xin Du, 2021).

Figure 2 consists of a visual scheme of the adopted approach in this study.



Figure 2 -Proposed Approach



Source: Own elaboration.

All experiments were conducted in Python (programming language). Python is widely used for data science and statistical analysis. It includes a vast collection of data analysis and visualisation packages and can analyse many data to solve complex problems (Calderón-Fajardo et al., 2024; Song et al., 2021). Python Natural Language Toolkit package was used to conduct the preprocessing, and the Sklearn package was used for the LDA analysis (Bird et al., 2009). For the coherence, score evaluation used the Gensim and the pyLDAvis packages for the IDM (Shetty & Ramesh, 2021).

3. Results and Discussion

3.1. RQ1: Marketing research topics and relationships among them

To acknowledge the research topics under the interest of researchers and answer RQ1, topic modelling, notably the LDA algorithm, was performed. We tested the outputs to find optimal topics until a reasonable number of aggregated documents by topic was attained (Ramos et al., 2019). The model was trained by applying several alpha and beta values to get the best coherence score without creating a cognitive load regarding the number of topics. Figure 3 represents a visual representation of the eight topics uncovered by the analysis. The size of each word indicates its relative frequency and importance within a given topic, with larger words appearing more frequently in the analysed abstracts. This allows for a quick interpretation of the central themes and key terms associated with each topic.



Figure 3 - Topic's Word Cloud



Source: Own elaboration.

For each topic, associated risks, challenges, ethical considerations, and practical implications were discussed.

Learning models (Topic 1) represent 28% of the tokens and 732 articles, emphasising terms like “model,” “data,” “method,” and “prediction” linked to ML applications in marketing (Wang & Lin, 2023). Advances in data availability and hardware drive their evolution, with developments with attack models, domain adaptation, and complex neural networks adapting to modern AI demands (Ma & Sun, 2020). Generative AI enables highly personalised content and advertisements, dynamically responding to consumer behaviour in real time, as seen in BERT and GPT applications (Hamacher & Buchkremer, 2022). Reinforcement learning refines decision-making, improving consumer journey mapping and product recommendations, as implemented in Amazon’s recommendation engine and dynamic pricing models (Ruiz-Lacaci et al., 2024). Data clustering and analysis further enhance consumer insights and targeted strategies. However, such models risk limiting product diversity by proposing similar options (Amariles & Baquero, 2023). Despite their strengths, learning models face limitations in capturing consumer behaviour complexities, including emotions and cultural factors, undermining prediction consistency in dynamic real-world conditions (Blomster & Koivumäki, 2022; Christen et al., 2022). Bias from unrepresentative data can lead to unfair outcomes, as seen in Amazon’s recruiting tool (Kasem et al., 2023). Scalability is constrained by the need for highly skilled professionals, and transparency issues erode trust, particularly in targeted advertising (Biswas et al., 2023). Domain adaptation and advancements in human-robot interaction reduce errors and improve automated retail experiences (Licardo et al., 2024). Smaller companies lacking AI access risk exacerbating inequalities (Amariles & Baquero, 2023). To address these issues, learning models should enhance explainability, ensure ethical compliance (e.g., GDPR, CCPA), and avoid unfair advantages while fostering inclusivity (Ferrario et al., 2020). Combining data science, marketing expertise, and ethical oversight can improve customer trust. Tools like Google Analytics 4 provide insights while adhering to ethical standards (Omran et al., 2024). Ensuring high-quality,



diverse datasets, robust training techniques, and continuous feedback systems enhances reliability. Regular audits and interactive refinements maintain trust and model accuracy.

Expert systems (Topic 2) account for 22.5% of tokens and 639 articles, highlighting terms like “expert,” “system,” “marketing,” and “intelligence,” reflecting their role in decision-making based on preset rules and specialised knowledge (Kanchanapoom & Chongwatpol, 2023). Their evolution has been driven by integrating AI, including hybrid models combining expert systems and deep learning for tasks like consumer lifetime value prediction (Huang & Rust, 2022). AI-powered frameworks like IBM’s Watson enable real-time, adaptative marketing strategies by merging predictive and prescriptive analytics for content optimisation and campaign automation. These systems enhance decision-making by automating segmentation, pricing, and personalised recommendations, boosting campaign precision and ROI (Flament et al., 2022; Schiessl et al., 2022). However, expert systems struggle to adapt to rapidly changing behaviours and markets, relying on static rules that limit creativity and uniqueness in strategies (De Bruyn et al., 2020; Paschen et al., 2019). Their dependency on data quality can lead to ethical and contextual risks, as seen in Target’s sensitive data misuse (Paschen et al., 2019) and Kodak’s inability to adapt to digital trends (Mortara et al., 2010). High costs and integration challenges, such as those faced by Procter & Gamble (Schafermeyer & Hoffman, 2016) and L’Oreal (Flament et al., 2022), further limit accessibility for smaller enterprises. Bias in training data can perpetuate discriminatory practices, making transparency and explainability vital for trust and compliance (Brkan & Bonnet, 2020; Malthouse & Copulsky, 2023). Building trustworthy AI requires ethical standards that balance efficiency with fairness, ensuring inclusivity and avoiding manipulative practices (Schmidt et al., 2020). Brands can enhance performance by using tools like real-time ad optimisation, AI chatbots (e.g., Sephora’s Visual Artist), predictive analytics (e.g., Starbucks), and fraud detection systems (e.g., PayPal), tailoring offerings to consumer trends while maintaining trust.

Natural Language Processing (NLP) (Topic 3) represents 12.2% of tokens across 246 articles, focusing on terms like “sentiment,” “analysis,” “product,” “text,” “image,” and “review.” Advances in computational power, datasets, and algorithms have driven NLP’s growth, enabling efficient textual and visual data analysis to uncover consumer insights. Transformer models like GPT and BERT enhance sentiment analysis and contextual understanding, improving consumer feedback interpretation and targeted marketing (Shankar & Parsana, 2022). Companies like Salesforce use NLP to analyse social media interactions and boost engagement. Integrating NLP with visual recognition enables multimedia content analysis, providing deeper insights into consumer attitudes and enhancing campaigns (Choo & Kim, 2023; Nadeem et al., 2019). NLP also supports multilingual markets, bridging language gaps and expanding global reach (Liu et al., 2021). However, limitations persist. NLP struggles with vague or out-of-context responses, algorithmic bias, and ethical issues, such as manipulative consumer influence (Liu et al., 2021; Wu et al., 2022). For instance, biased training data in chatbots can produce offensive outcomes (Rajesh, 2023). Addressing these concerns requires transparent processes, inclusive datasets, and explainable AI (XAI) technologies to enhance trust and accountability. Ethical practices should prioritise meaningful interactions and avoid over-optimization, which harms consumer-brand relationships (Gloor et al., 2022; Meskó & Topol, 2023). Innovative approaches like integrating NLP with IoT devices and leveraging quantum computing improve data gathering, analysis, and application efficiency. Real-time data from IoT sensors enhances sentiment analysis, while quantum computing accelerates processing, boosting NLP’s marketing effectiveness.

Social Media (Topic 4) accounts for 10.7% of the topics and 183 articles, focusing on terms like “user,” “advertising,” “content,” and “network.” This topic highlights AI applications in social media, enabling sophisticated analysis of user-generated content (Ghouri et al., 2022). AI-powered sentiment analysis detects emotions in social media posts, helping marketers tailor strategies to consumer preferences (Nichifor et al., 2023; Taherdoost & Madanchian, 2023). AI integration with AR/VR, as seen in Instagram and Snapchat’s AR filters, creates immersive advertising, boosting engagement and insights into user interactions (Omran et al., 2024). Content creation tools generate customised ads and posts, improving engagement while saving time and resources (Schiessl et al., 2022). AI also refines campaigns by comparing strategies and optimising content performance (Alsayat, 2023). AI enhances storytelling and forecasts patterns, enabling marketers to develop forward-looking strategies, improve satisfaction, and build brand loyalty (Gao et al., 2020). However, biases in training data can lead to discriminatory practices, and insensitive content may harm reputations (Aker et al., 2022). Transparency in data collection is essential, with tools like XAI improving algorithm accountability and GDPR ensuring data protection. Protecting user data through anonymisation and encryption further enhances trust (Amariles & Baquero, 2023). Trustworthy AI prioritises content quality and avoids exploiting emotional triggers or fostering platform dependency (Čartolovni et al., 2022). Ethical strategies include tools like Sprout Social and Brandwatch for behavioural insights and leveraging IoT devices for real-time personalisation. Regular algorithm updates ensure alignment with consumer trends and market conditions, as exemplified by fashion brands using AI to analyse preferences and boost sales.

Consumer Centricity (Topic 5) accounts for 10.3% of tokens and 196 articles, focusing on terms like “consumer,” “service,” “brand,” and “value,” emphasising consumer-focused marketing strategies (Meyer-Waarden et al., 2023). AI-driven personalisation engines, like those used by Amazon and Netflix, employ deep learning to predict preferences and provide intuitive recommendations (Nazir et al., 2023). AI-powered sentiment analysis assesses public sentiment in real-time, enabling brands to adapt strategies quickly



(Ying et al., 2022)- Dynamic pricing models, such as those used by Uber and Airbnb, adjust prices in real-time based on demand, behaviour, and competition, maximising profitability while maintaining perceived value (Huang & Rust, 2022). Brands like IKEA and Sephora use AR to enhance the shopping experience, fostering engagement and loyalty (Berman & Pollack, 2021). Integrating AI into consumer journey planning creates seamless, personalised experiences, enhancing satisfaction and fostering long-term loyalty. However, hyper-targeting risks consumer fatigue, eroding confidence and autonomy (Bedenkov et al., 2021; Latinovic & Chatterjee, 2019). Algorithmic bias, such as Amazon's recruitment tool exhibiting gender bias, highlights fairness and discrimination concerns, potentially harming brand reputation. When perceived as unfair, dynamic pricing can alienate consumers and impact trust (Nunan & Di Domenico, 2022). As seen with Meta, data privacy issues underscore the importance of GDPR compliance and transparency in AI-driven marketing (Binns, 2017). Trustworthy AI should balance personalisation with fairness, strengthen consumer trust, and prioritise ethical practices, such as using XAI for transparency and ensuring unbiased decision-making (Panch et al., 2019; Shaban-Nejad et al., 2018). Advanced applications include integrating multimedia data for enhanced targeting, predictive analytics for inventory management, AR for immersive shopping experiences, and continuous feedback loops to refine strategies dynamically.

Health (Topic 6) accounts for 6.7% of tokens and 110 articles, highlighting terms like "drug," "health," "report," and "safety." This topic reflects AI applications in consumer health. AI advancements enable precision marketing based on genetic data, exemplified by 23andMe's personalised health recommendations (Secinaro et al., 2021). Dynamic health risk assessments, such as Apple Health's heart rate monitoring, forecast health issues early, while emotion AI detects consumer emotions during health interactions for real-time strategy adjustments (Ellahham et al., 2020). Behavioural modelling, used by forms like Novo Nordisk, predicts responses to interventions, and virtual health assistants like DeepMind provide personalised health guidance (Lommatzsch, 2024; Shannon et al., 2019). These developments enhance targeting in wellness and pharmaceutical campaigns, aligning marketing with consumer needs (Panch et al., 2019). However, challenges persist. AI-driven marketing can blur informative and persuasive content, raising data privacy concerns and ethical issues (Gaczek et al., 2023). Sensitive health data is at risk of misuse, and biases in training data can exacerbate inequities, limiting access to fair treatment (Al Kuwaiti et al., 2023). High costs and skill requirements further create disparities in AI adoption for health marketing (Secinaro et al., 2021). Transparency is essential as consumers often lack awareness of how their data is used, undermining trust (Vollmer et al., 2020). Insufficient consent, algorithmic bias, and opaque decision-making processes highlight the need for explainable XAI to ensure fairness and accountability (Felzmann et al., 2019). Ethical AI health marketing should prioritise informed decision-making, avoid exploiting anxieties, and emphasise consumer well-being over manipulation. Data protection measures like encryption and anonymisation, adherence to GDPR, regular bias audits, and resource allocation for model updates are crucial. Collaborations and cloud-based solutions can improve cost efficiency while supporting responsible, transparent, and trustworthy AI-driven health marketing.

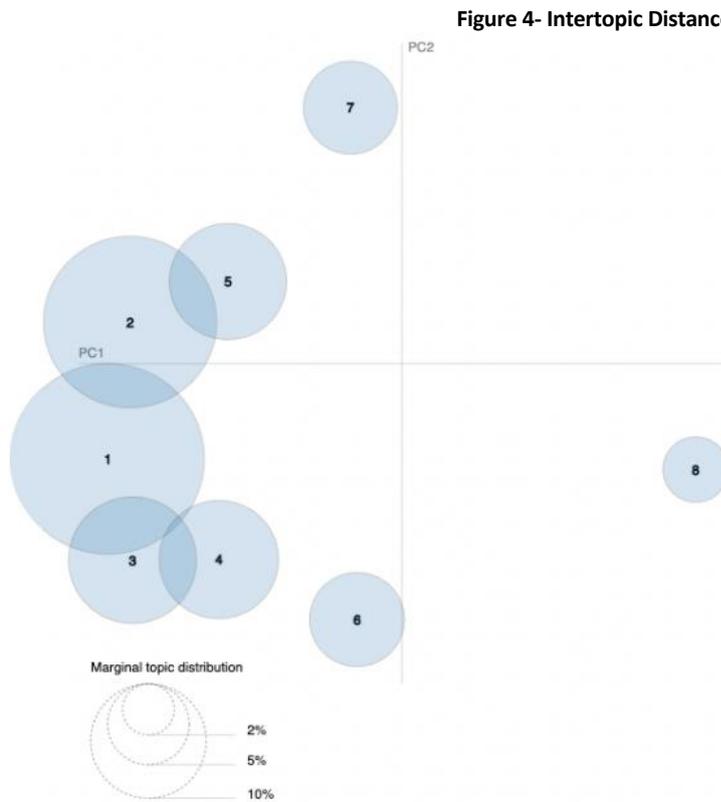
Market Forecast (Topic 7) accounts for 6.6% of tokens and 113 articles, emphasising terms like "market," "sale," "strategy," and "forecasting." This topic highlights AI's role in predicting sales and shaping marketing strategies (Yim et al., 2023). AI-driven market forecasting supports decision-making by offering insights into consumer trends, demands, and market fluctuations, optimising resources, sales strategies, and campaigns (Akter et al., 2022; Gera & Kumar, 2023). Advanced AI models enable precise consumer behaviour and market pattern predictions, streamlining marketing efforts (Habel et al., 2023; Sohrabpour et al., 2021). However, reliance on historical data limits adaptability to sudden shifts, such as geopolitical events, and fosters uniform strategies, reducing market differentiation (Ferreira et al., 2021; Kempitiya et al., 2020). Integrating diverse datasets like satellite imagery and social media sentiment is crucial for accurate forecasts but presents challenges in reliability and data provenance (De Bruyn et al., 2020). Compliance with international laws such as GDPR complicates cross-border data handling (Anshari et al., 2023). Ethical concerns include manipulative predictions, exploitation of vulnerable groups, and opaque decision-making, undermining trust (Stone et al., 2020). To ensure fairness and transparency, AI models should balance predictive precision with adaptability and social considerations (Shaban-Nejad et al., 2018). Generative and quantum AI can simulate market scenarios and process complex datasets for strategic planning, as platforms like Kavout and Numeria demonstrate, providing businesses with actionable insights for sustainable growth.

Technology Impact on Youth (Topic 8) accounts for 6.6% of tokens and 113 articles, focusing on AI's influence in marketing to youth. Frequent terms include "market", "sale," "strategy," and "product," emphasising AI's role in predicting sales and shaping strategies (Yim et al., 2023). AI has shifted from simple content targeting to complex strategies that personalise experiences, enhance engagement, and shape youth behaviour and preferences. For example, Nike's Training Club app uses AI for customer fitness programs, boosting brand loyalty, while Amazon's recommendation systems improve shopping experiences (Gera & Kumar, 2023). AI significantly influences youth culture and consumption habits, necessitating continuously adapting marketing approaches to novel platforms. However, large-scale data collection poses misuse risks, as seen in the Cambridge Analytica scandal, emphasising the need for robust privacy laws (Kim & Song, 2023). Concerns also arise about promoting harmful behaviours, such as e-cigarette ads and targeting teens, which can exacerbate health issues (Popova et al., 2021). Ethical frameworks are critical to prevent exploiting young consumers' vulnerabilities, as demonstrated by Google's reduced unhealthy food ads in children's



programming (Lara-Mejía et al., 2022). Trustworthy AI in youth marketing should enhance positive engagement while avoiding manipulation. Ethical policies must promote informed decision-making, discourage passive consumption, and support mental health and knowledge growth (Olstad & Boyland, 2023). Transparency in data usage is vital, as exemplified by Apple’s privacy controls. Educational initiatives should foster digital literacy (Calderón-Fajardo et al., 2024), enabling youth to evaluate online content critically. AI tools like DreamBox Learning personalise learning experiences in education but must be balanced to avoid reducing physical and social activities. Responsible AI integration should prioritise youth development and well-being.

IDM (Figure 4) illustrates the link between marketing and AI and the topic’s similarity. Circles represent the topics, and their proximity reveals their degree of similarity (Shetty & Ramesh, 2021). The size of each circle reflects the predominance and number of articles associated with each topic (Bing-Xin Du, 2021). The IDM divides the topics into Principal Component 1 (PC1) and Principal Component 2 (PC2) to describe the differences and resemblances between topics. Axis X represents PC1, and axis Y represents PC2. Each topic is mapped at a point in the bi-dimensional dispersion graphic, and its position is determined by its PC1 and PC2 score. According to their distribution, the topics can be grouped into clusters. These clusters can help to identify patterns and relationships between the topics under analysis.



Topic Number - designation	N. ° of articles
Topic 1 – Learning Models	732
Topic 2 – Expert systems	639
Topic 3 – Natural Language Processing	246
Topic 4 – Social Media	183
Topic 5 – Consumer Centricity	196
Topic 6 – Health	110
Topic 7 – Market Forecast	113
Topic 8 – Technology's Impact on Youth	36

Source: Own elaboration.



In turn, topics 6, 7, and 8 reveal a low association with other topics and are outliers in this analysis. This result suggests areas that have been of interest to researchers. However, they have been understudied, suggesting potential gaps and future research opportunities (López-Duarte et al., 2016).

The IDM results provide valuable insights for researchers and industry, guiding future research directions.

3.2. RQ2: Trends and opportunities for future research

The topic modelling and the IDM have allowed us to identify directions for future research and answer RQ2. Considering that a comprehensive research agenda should encourage researchers to endeavour in new directions to contribute to the literature (Hulland & Houston, 2020), we suggest different future research directions (Table 2).

Table 2 - Gaps and Future Research

Topic	Research Gap	Future Research	Reference
Learning Models	Limited research on multimodal data integration, Insufficient research on real-time dynamic adaptation using integrated data	<ul style="list-style-type: none"> Future research should explore how combining diverse data types (text, images, and video) can enhance marketing strategies. This involves studying how integrated multimodal data can improve consumer insights, personalisation, and campaign effectiveness. How AI systems can better utilise integrated multimodal data to adapt real-time marketing strategies. This includes investigating methods to optimise AI-driven responses to evolving consumer behaviours and preferences as they happen. For example, consumer engagement could be analysed on platforms like Instagram or TikTok, which contain different data such as text product photos or advertising videos—for instance, analysing how text-related product/service descriptions, observations, and visual content impact buying decisions. Besides, AI algorithms are being developed that concurrently process product descriptions, client sentiment in reviews, and video content for real-time adaptation of marketing plans. Examining such cases facilitates discovering effective multimodal learning models in capturing the multidimensional nature of consumer decision-making. 	Shoumy et al. (2020); Daskalakis et al. (2022); Calderón-Fajardo et al. (2024)
Expert Systems	Limited exploration expert system in different contexts/perspectives	<ul style="list-style-type: none"> Considering limited sources, examine how expert systems can be implemented and scaled in small and medium enterprises (SMEs). For instance, by installing a cloud-based expert system for inventory control, SMEs could adopt platforms like OpenAI Codex to automate stock forecasts. Future research could inspect how cost-effective cloud solutions diminish needing on-site infrastructure, which ensures affordability and ease of implementation. Determine how expert systems can be adopted in diverse cultures, regional variations, and markets. For example, AI-driven chatbots can be designed to be tailored to a specific area and incorporate regional languages, preferences, and decision-making patterns. 	Hansen and Bøgh (2021)
NLP	Lack of NLP-AI integration	<ul style="list-style-type: none"> Explore how reinforcement learning algorithms can optimise real-time marketing campaigns based on NLP analysis insights. Investigate the impact of generative models in creating personalised content that resonates with target audiences, leveraging NLP to understand and predict consumer preferences. For instance, Integrating NLP with chatbot communications on retail websites evaluates how these systems understand consumer queries to identify real-time preferences and adapt product recommendations. This approach could gain deeper insights into consumer desires and improve personalised marketing plans. 	Shaik (2023); Shankar and Parsana (2022)
Social Media	Static personalisation techniques using historical data.	<ul style="list-style-type: none"> Researchers should study how to overcome AI complexity in information to meet a significant target audience by evaluating causation and correlation in datasets in decision-making. For example, an investigation could examine how short-duration videos or infographics compare to traditional text posts through different audience groups. This will help marketers simplify target audiences. Leveraging social media platforms from AI can offer impactful and tailored content. 	Kim and Park (2023)
Consumer Centricity	Fulfilling consumer expectations	<ul style="list-style-type: none"> Exploring the potential impact of supply chains and marketing discipline by investigating the effect of consumer rationality in AI-mediated market interaction to provide the base for consumer engagement and retention. Emphasizing the pivotal goal of customising AI applications to holistically serve and understand the consumers' needs, ensuring companies' marketing focuses is on consumers' needs and preferences. For instance, Zara could use AI to predict fashion trends and elevate inventory. It could enhance consumer engagement by implementing AI for personalised recommendations, like informing clients about new models based on past buying/browsing behaviour. Another example from Sephora is that the AI-powered 	Haleem et al. (2022); Volkmar et al. (2022)



Health	Real-time adaptive health marketing strategies, predictive health marketing for emerging trends	<p>"Virtual Artist" feature allows clients to try makeup immersively, so it could integrate AI into supply chains to forecast products that will be more popular grounded in virtual try-on experiences.</p> <ul style="list-style-type: none"> Investigate the creation and efficacy of algorithms designed for real-time adaptation of health marketing strategies based on continuous data inputs from wearable devices, sentiment analysis, and contextual factors. Assess the technical challenges, implementation processes, and effectiveness of such adaptive systems. Conduct empirical studies to evaluate the impact of real-time adaptive health marketing on consumer engagement and health outcomes. Compare these dynamic strategies with traditional static approaches to determine their relative effectiveness in improving consumer interaction and health metrics. Examine the effectiveness of AI-driven predictive marketing in addressing emerging health trends. This includes analysing the impact on consumer awareness, behaviour changes, and health outcomes and comparing these results with those from traditional reactive marketing approaches. For example, Fitness brands like Nike can integrate AI to analyse real-time data from wearable devices and offer personalised product recommendations and preferences, such as sportswear augmented for a consumer's specific action level or recovery phase. So, if consumers notice minimal activities, they could get motivational messages/discounts on fitness lessons to make them re-engage with them; ultimately, this will reflect on brand loyalty and long-lasting consumer-brand relations. 	Sivarajah et al. (2023); Bedenkov et al.(2021)
Market Forecasting	Lack of integration of quantum AI models, limited AI role in the virtual economy	<ul style="list-style-type: none"> Research should explore the integration of quantum computing with hybrid AI models to boost market prediction. Combining quantum algorithms with neural networks and traditional econometric methods could improve prediction accuracy in unstable markets, leveraging quantum computing power to handle complicated datasets for new boundaries in financial forecasting. Exploring using AI to predict market influence by imitating human behaviour in virtual contexts, analysing economic activities in virtual worlds to predict their impact on real-world financial markets, and offering visions into the intersection of virtual and fundamental economics. As an example, Target company can employ AI quantum computing to forecast future purchasing activities by analysing sophisticated client data patterns, like sporadic trends, economic elements, and social media emotions. 	Davenport et al. (2020); Buitrago-Esquinas et al. (2024)
Technology Impact on Youth	AI supports youth mental health and well-being and shapes youth brand preferences.	<ul style="list-style-type: none"> Investigate how AI-driven marketing can be designed to support positive mental health/well-being among youth, including strategies that promote healthy behaviours and self-image. Examine how AI-driven marketing shapes the development of brand preferences among youth, including the role of algorithms in creating and reinforcing brand identities and loyalty. Examine how exposure to AI-driven marketing, mainly through educational apps and platforms, impacts youth educational outcomes and cognitive development. For instance, TikTok incorporated AI algorithms into its content design based on user engagement, subjecting young audiences to repeated product advertisements by influencers and driving brand recall and preference among youth. Analysing how specific brands, such as fitness/beauty products, influence emotional reactions for building stronger connections with youth. This would illustrate the dual impact of technology on mental well-being and brand engagement, providing insights into marketing practices. 	Inkster et al. (2018); Williamson and Eynon (2020)

Source: Own elaboration.

4. Conclusion

Integrating AI into marketing activities is multifaceted and requires a nuanced interpretation to understand how AI can fully influence contemporary marketing activities. Insights gained from this research on the implications of integrating AI modelling topics like learning models, expert systems, NLP, social media, consumer centricity, health, market forecast, and technology's impact on youth in marketing, together with their impact, challenges, and risks associated with each topic, will shape, and transform the marketing landscape used in brand promotion. The present research evaluates the scope of AI in marketing research topics and the potential influences of these AI research topics on marketing activities. The study also establishes AI's existing trends and future opportunities in marketing activities. While the integration of AI in marketing is promising, it is essential to consider the risks associated with each topic and plan accordingly how these risks can be circumnavigated effectively. Data privacy concerns risks, user security, ethical considerations, and the susceptibility of these AI systems to algorithmic bias necessitates future research to ensure AI systems do not pose severe threats to brand reputation following their integration into marketing activities. Conversely, integrating AI modelling topics in marketing will shift the original marketing approach from rule-based expert systems to data-



driven. AI systems in marketing will redefine the theoretical marketing landscape by providing marketers with a nuanced understanding of market dynamics that impact marketing activities, including target market segmentation, data-driven marketing strategies, and hyper-personalization marketing insights. AI will foster the customisation of marketing activities to resonate with consumer preferences. It will also allow marketers to use algorithmic reasoning to navigate the dynamic landscape of marketing trends and increase the brand's organic reach to other target audiences. In addition, integrating AI in marketing will undoubtedly impact the organisation's development and training marketing activities, boosting the brand's reach to consumers through data-informed marketing strategies.

4.1. Theoretical Implications

Integrating AI in marketing will undoubtedly redefine the marketing landscape by enhancing marketers' theoretical understanding of their consumers and providing them with informed insights, hyper-personalisation strategies, and market segmentation initiatives. Additionally, this incorporation will inform the development of well-established marketing theories of making informed marketing decisions based on data-driven feedback, enabling them to engage in agile marketing strategies. AI in marketing promotes the generation of deeper consumer insights for researchers. These insights help in the development of innovative and strategic imperatives. Deeper consumer insights will also become relevant in shaping advanced marketing theoretical frameworks for allocating resources efficiently for marketing activities. The insights will help implement necessary adjustments to the ever-changing dynamics of the target market. The theoretical implications associated with AI usage in marketing will be redefined by resourceful research that minimises algorithmic bias, enhances the privacy concerns related to the use of AI, and improves the transparency metrics of AI usage in marketing activities. The paper's findings provide a better understanding of the mechanisms behind AI applications. It calls for restructuring marketing theories to mirror the effective combination of data and algorithms in developing better insights.

4.2. Limitations

The literature analysis methodology used in this study does not have the objective of substituting the critical analysis of the literature because it does not cover different perspectives on the same topic nor the qualitative judgment of the literature. Although it has a large-scale potential for literature delimitation, pinpointing the main topics and keywords and even potential multidisciplinary overlaps and research rigidities help discover possible remedial actions. Hence, in the present moment of big data, where there are many sources of information online to analyse, this method is more efficient in terms of performance than an in-depth critical analysis. This method's concern was to develop a holistic approach to augment the trust of the no dictionary usage and its appropriateness to complex multidisciplinary research fields, as shown in its application to AI in marketing. Also, conceiving an IDM provides a better perception of the trends and eventual problems in literature. Additionally, the dataset was limited to the Scopus database. Future studies could be extended to other databases (e.g., Web of Science). However, it should be mentioned that every database has its limitations (Falagas et al., 2008). Finally, a dictionary creation can help limit the analysis to a managerial list of terms (Ramos et al., 2019), allowing the focus of the study on a particular topic under AI in marketing research.

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Credit author statement

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