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The new era of Artificial Intelligence in consumption: theoretical framing, review and research agenda

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Abstract
Artificial Intelligence possesses the capacity to reshape brand-consumer dynamics by leveraging its capability to analyze extensive datasets, discern patterns, and customize experiences for individual consumers. This capacity is enabled by a spectrum of features embedded within AI systems, which undergo challenging, continuous, and rapid evolution to accommodate shifts in consumer preferences and behaviors. This paper aims to study the influence of artificial intelligence on consumer behavior. To address this objective, a bibliometric analysis was performed on a dataset comprising 561 publications sourced from two prominent databases, namely the Web of Science and Scopus. Findings reveal that AI influence extends across diverse sectors, as consumers display a preference for AI-driven solutions, attracted by their perceived objectivity and personalized interactions. Additionally, AI-powered tools like chatbots and virtual assistants enhance the quality of customer service and promote heightened engagement. Future research pathways, with themes classified into niche, motor, and basic categories, were outlined. This study pioneers its approach by harnessing resources of two comprehensive databases, enabling a meticulous tracking of publication evolution to discern temporal trends in the literature. In addition, a conceptual model was proposed that advocates the influence of AI on consumer behavior in three dimensions: influence across industries, addressing consumer needs in the age of AI, and optimizing consumer experience through AI-powered solutions. The paper underscores the transformative potential of AI in molding consumer behavior and emphasizes the necessity for businesses to adapt to this evolving landscape.

Keywords Artificial Intelligence · Consumer behavior · Brand-consumer dynamics · Chatbots · Virtual assistants · Research agenda

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1 Introduction

Artificial Intelligence (AI) is revolutionizing the way brands relate to consumers, personalizing marketing strategies to align with individual preferences and behaviors closely. This personalized approach is made possible through the analysis of large amounts of data, allowing marketers to significantly increase consumer engagement and conversion rates (Haleem et al. 2022). The integration of AI into e-commerce platforms has fostered new buying and selling practices, establishing a new cultural norm that prioritizes personalized experiences (Policarpo et al. 2021; Yang et al. 2022). As a result, brands that take advantage of AI for personalized marketing are more likely to influence consumer choices, fostering a deeper connection between the consumer and the brand.

AI's role in improving customer service goes beyond mere interaction; it fundamentally transforms consumers' purchasing behavior. AI-driven customer service tools, such as chatbots and virtual assistants, provide immediate assistance and support, making the shopping experience more efficient and enjoyable (Hoyer et al. 2020). This level of personalized and reactive service strengthens the relationship between the consumer and the brand, encouraging repeat business and promoting brand loyalty. In addition, AI's ability to deliver better customer experiences is a critical brand differentiation factor, distinguishing companies that can provide superior service in a competitive market (Cukier 2021; Mustak et al. 2021).

AI-driven analytics plays a key role in predicting and understanding consumer trends, offering companies invaluable insights into consumer behavior (Mustak et al. 2021). By analyzing consumer data, AI can identify patterns and predict future purchasing behavior, allowing companies to adapt their marketing strategies accordingly (Gkikas et al. 2022; Nair and Gupta 2021). This predictive capability ensures that companies stay ahead of trends by making informed decisions that align with consumer preferences and market demands.

Recent literature has delved into understanding the role of artificial intelligence in shaping consumer decision-making processes (Dellaert et al. 2020; Sharma et al. 2024). Studies have highlighted how AI positively impacts marketers' abilities to analyze and comprehend consumer behavior, providing valuable insights for targeted marketing strategies (Mustak et al. 2021). By utilizing AI technologies, businesses can gain a deeper understanding of consumer preferences, behaviors, and trends, ultimately enhancing their ability to tailor products and services to meet customer needs effectively (Olan et al. 2024; Puntoni et al. 2021). The findings of these studies suggest that AI plays a pivotal role in revolutionizing traditional market research practices, enabling businesses to make data-driven decisions and enhance their competitive edge in the marketplace (Wagner et al. 2022).

One significant area of focus in recent literature is the impact of personalization and recommendation systems powered by artificial intelligence on consumer behavior (Kumar et al. 2019). Personalized recommendations driven by AI algorithms have been shown to have a direct influence on consumer engagement and conversion rates, guiding customers toward products that align with their

preferences and interests (Kumar et al. 2019; Yoon and Lee 2021). Moreover, AI-based chatbots and personalized marketing approaches have been found to evoke positive consumer responses, such as improved attitudes toward websites and brands, fostering deeper connections between businesses and consumers (Sidlauskiene et al. 2023). By leveraging AI for personalized engagement marketing, companies can create more meaningful interactions with customers, leading to enhanced brand loyalty and increased sales.

Ethical concerns surrounding the use of AI in consumer behavior have also been a prominent topic in recent literature (Goncalves et al. 2024). Researchers have explored the implications of AI and machine learning in neuromarketing, focusing on issues of consumer privacy, data security, and the potential for manipulation in marketing practices (Ma and Sun 2020; Ullah et al. 2022). The ethical discourse extends beyond concerns of consumer manipulation to encompass broader questions about granting AI moral agency and ensuring responsible AI deployment in marketing contexts (Bertoncini and Serafim 2023). As AI continues to advance and reshape consumer behavior, addressing ethical considerations and safeguarding consumer privacy will be paramount to maintaining trust and transparency in the evolving landscape of AI-driven marketing strategies (Davenport et al. 2020; Du and Xie 2021).

As seen above, although there are already some studies on AI in consumer behavior, there are still gaps in the literature that have yet to be explored. Exploring the long-term effects of AI on consumer behavior still needs to be studied, mainly due to the lack of longitudinal studies. Longitudinal research is crucial to understanding how consumer attitudes and behaviors evolve in response to ongoing interactions with AI technologies (Chintagunta and Labroo 2020). These studies can provide valuable insights into the dynamic nature of relationships between consumers and AI, revealing patterns and trends that short-term studies fail to capture. Unfortunately, current research often ignores this aspect, focusing instead on immediate or short-term impacts without considering how these effects may change or solidify as consumers become more accustomed to AI in their daily lives (Haque et al. 2023; Polyportis 2024). This gap highlights a critical need for studies that track the evolution of publications in order to identify changes over time in the literature, offering a more comprehensive understanding of AI's influence on consumer behavior. That said, an important question can be asked: Where are studies on artificial intelligence converging in consumer behavior?

Another notable gap in the existing literature is the need for more analysis of how AI affects consumer loyalty and trust. Trust plays a key role in the development of consumer loyalty, especially in the context of AI, where interactions can significantly influence a consumer's perception of a brand (Chen et al. 2022; Rupali et al. 2024). Despite the growing prevalence of AI in consumer interactions, from chatbots to personalized recommendations, there needs to be more depth in understanding how these AI engagements create or erode consumer trust and loyalty over time. This omission is particularly worrying, given AI's potential to revolutionize customer service and retention strategies. Furthermore, the minimal focus on the psychological impacts of AI interactions on consumers represents a significant omission in the literature. While studies have begun to recognize the influence of AI on

consumer behavior in general, there remains to be more examination of the nuanced psychological effects these interactions can have (Kelly et al. 2023). It is crucial to understand these impacts, as they can cover a wide range of consumer reactions, from increased satisfaction and engagement to privacy concerns and mistrust. The psychological dimension of consumer-AI interactions is complex, being influenced by factors such as perceived intelligence and the social behavior of AI technologies (Jain et al. 2024; Song et al. 2022). By neglecting this area, current research fails to capture the full spectrum of consumer responses to AI, limiting our understanding of how these technologies can be designed and implemented to enhance consumer experiences positively. That said, an important question can be asked: How does AI influence consumer behavior?

This paper aims to study the influence of artificial intelligence on consumer behavior. To this end, 561 publications from Thomson Reuters' Web of Science (WOS) and Elsevier's Scopus databases published between 1988 and May 18, 2024 were analyzed.

This study makes six important contributions. Firstly, this study develops knowledge about artificial intelligence and consumer behavior, which are current and relevant topics. Secondly, consumers perceive AI solutions as more impartial compared to humans, due to the absence of biases and emotions in the decisions made by AI. This perception can increase consumer trust and satisfaction with AI-mediated interactions. Thirdly, the advanced personalization capabilities of AI tools allow for a consumer experience that is more tailored to their individual needs and preferences. This can lead to greater customer loyalty and engagement. Fourthly, the adoption of AI tools can significantly improve the efficiency of customer service, providing quick and accurate responses to queries and problems. This improvement in service quality can increase customer satisfaction and retention. Fifth, future research investigating how the introduction of AI into the workplace affects human competencies and skills is crucial. This includes analyzing how AI complements or replaces tasks performed by humans and what new skills are needed to work effectively with AI. Exploring the specific effects of AI's continuous learning capabilities on consumer behavior and engagement can reveal important insights. This includes how AI can anticipate consumer needs and adapt to their preferences in real-time. Finally, companies need to adapt quickly to the transformative potential of AI. This means investing in AI technologies, empowering employees with new skills, and adjusting business strategies to take full advantage of AI's capabilities.

2 Materials and methods

This study employed bibliometric analysis as its core methodology. The choice of this methodology is driven by the growing prominence of bibliometrics as an academic discipline (Milojevic et al. 2011). It establishes robustness against the uncertainties associated with selecting keywords (Zhi et al. 2015) and serves as a rigorous method for scrutinizing vast scientific datasets, elucidating the evolutionary trajectories and emerging facets within specific fields of inquiry (Donthu et al. 2021). Scholars utilize bibliometric techniques to collect bibliographic data and

quantitatively validate categories extracted from the existing works (Zupic and Čater 2015). Moreover, science mapping is increasingly crucial for scholars across scientific disciplines due to the rapid expansion and fragmented nature of publications, making knowledge accumulation more challenging, thereby emphasizing the significance of discerning the intellectual structure and research frontiers within scientific domains (Aria and Cuccurullo 2017). In this study, bibliometrix, an open-source tool developed in R (Aria and Cuccurullo 2017), was utilized to facilitate comprehensive science mapping analyses of scientific literature. This tool provides scholars with flexibility and seamless integration with other statistical and graphical packages, thereby enhancing its utility for conducting thorough research endeavors (Aria and Cuccurullo 2017). This study's analysis follows the classification of bibliometric analysis methodologies as outlined by Donthu et al. (2021), which categorizes them into two main types: (1) performance analysis (presented at Sect. 3.1), which centers on assessing the contributions of research components, and (2) science mapping (presented at Sect. 3.2), which is directed towards exploring the connections between these elements.

2.1 Sample selection procedure and data collecting

For the study's sample selection, six steps were followed. The initial step involved choosing the Thomson Reuters' Web of Science (WOS) and Elsevier's Scopus databases. These two databases were selected, and subsequently merged, to enhance comprehensiveness, robustness, and relevance, The prevalent usage of WOS and Scopus as primary data sources in bibliometric analyses (Mongeon and Paul-Hus 2016) highlights their standing as preeminent and competitive citation databases in the field (Zhu and Liu 2020). The second step entailed selecting the time period, with no temporal constraints imposed (survey conducted on May 18, 2024). The third step involved the studies' collection following the application of specific search keywords: ((("artificial intelligence" or AI or "artificial-intelligence") and consum*) and behavio*) or ((("artificial intelligence" or AI or "artificial-intelligence") and consum* and (consum* and behavio*))). This investigation has commenced with a comprehensive examination of studies related to artificial intelligence and consumer/consumption behavior. This procedure discovered the frequency and pattern of terms keywords, allowing investigators to choose the most appropriate keywords for the study. Sample extraction was carried out in accordance with the procedures of numerous authors. The exploration was conducted by topic, including title, abstract, and keywords (Lopes et al. 2021; Nogueira et al. 2023a). The fourth step removed papers that were not classed as articles or reviews articles (Lopes et al. 2022). In the fifth step, additional criteria were used to identify the study field based on WOS categories (business, management, or economics) (Thirumaran et al. 2021) and Scopus subject areas (business, management and accounting or economics, econometrics and finance) (Gonzalez-Urango et al. 2024). In the sixth level, an additional requirement was that documents be written in English (Nogueira et al. 2023b). Following these steps, was established by integrating datasets and removing duplicates, using R software (Aria and Cuccurullo 2017). As a consequence, 561 articles were

selected as suitable research for inclusion in the final sample. The procedure followed to extract the sample is illustrated in Table 1.

3 Results

The study's analyses were executed using an open-source bibliometrix R-package (Aria and Cuccurullo 2017) for all analytical components, encompassing performance analysis and science mapping.

3.1 Performance analysis

3.1.1 Evolution of publications and citations

The temporal evolution of the number of publications from 1988 to 2024 (Fig. 1) demonstrates a substantial upward trend, particularly in recent years. The dataset begins with the first publication in 1988 by Lin and Perry (1988), titled: A logic programming approach to revealed preference theory. In the first years the publication activity was intermittent with years of no publications, notable instances being in 1991 (two), 1992 (one), 1995 (one), and sporadic publications in 2000 and 2003. From 2007 onwards, there was a gradual increase, with 2 publications in 2007 and 3 in 2009. A consistent rise began in 2013, with 1 publication, increasing to 2 in 2014, and 5 in 2015. The most substantial growth started in 2018, with 15 publications, followed by 10 in 2019 and a significant jump to 37 in 2020. This upward trajectory continued, reaching 68 publications in 2021, 106 in 2022, and peaking at 171 in 2023. By May 18, 2024, when the sample was collected, 121 publications had already been published. Notably, the publications from 2021 to 2024 represent 83% of the total number of publications, underscoring a dramatic increase in research activity during this period. Overall, the data indicates a clear and substantial growth in publications, reflecting increased interest and intensified research activity in the field.

Regarding the citation data from 1988 to May 18, 2024 (Fig. 1), it indicates a significant upward trend, especially in recent years. Initially, there were no citations from 1988 to 1990. The first notable increase occurred in 1991 with 44 citations, followed by 21 citations in 1992. Sporadic citation activity characterized the subsequent years, with counts such as 12 citations in 1995, 16 in 2000, and 11 in 2003. A more consistent rise in citations began in 2007, with 24 citations, increasing to 70 in 2008 and 108 in 2009. A substantial jump occurred in 2010 with 275 citations. After a brief period of no citations in 2011 and 2012, the trend resumed with 33 citations in 2013, 42 in 2014, and 271 in 2015. The most significant growth is observed from 2018 onwards. Citations surged to 1636 in 2018, followed by 669 in 2019, and 2094 in 2020. This upward trajectory peaked in 2021 with 4370 citations, the highest annual count in the dataset. Although there was a slight decline, the number of citations remained substantial, with 2611 in 2022 and 1108 in 2023. As of May 18, 2024, there were 178 citations recorded. In summary, the data demonstrates a clear

Table 1 Sample extraction

Identification	1st Step—Databases selection: WOS + Scopus	
	2nd Step—Time period: no time limitation (survey on May 18, 2024)	
	3rd Step—Key search terms:	
	(artificial intelligence or AI or artificial-intelligence) and consum* and (consum* behavio*)	
	Records from:	
	WOS: 1798 publications	Scopus: 3609 publications
Screening	4th Step—Added criteria: document types: articles or review	
	WOS: 1497 publications	Scopus: 1869 publications
	(301 excluded)	(1740 excluded)
	5th Step—Added criteria: selecting research area	
	WOS categories:	Scopus subject area:
	Business or management or economics	Business, management and accounting or economics, econometrics and finance
	WOS: 339 publications	Scopus: 420 publications
	(1158 excluded)	(1320 excluded)
	6th Step—Added criteria: documents written in English	
	WOS: 336 publications	Scopus: 416 publications
	(3 excluded)	(4 excluded)
Eligibility	Merge databases and remove duplicates	
	Records screened: 561 documents (191 removed)	
	Eligible studies: 561 publications	
Included	Studies included in the study: 561 publications	

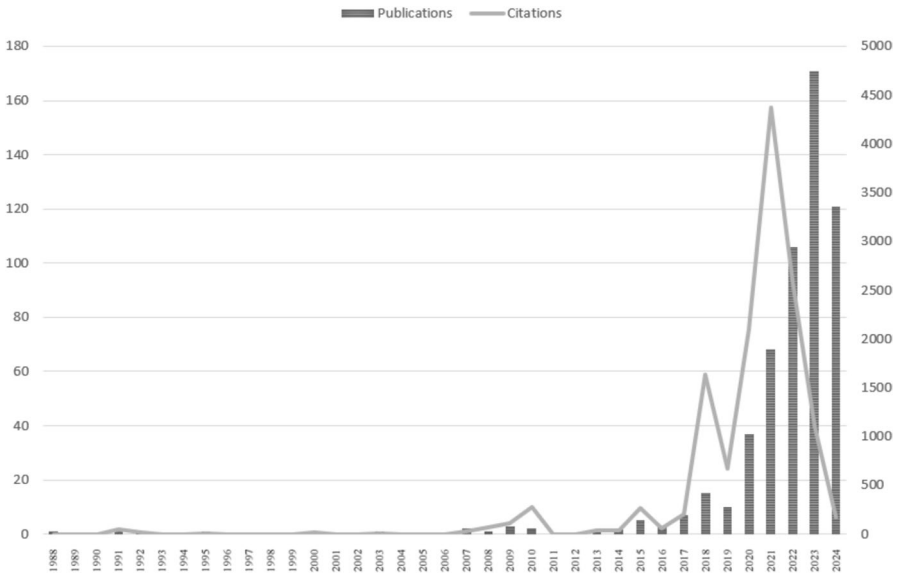

Fig. 1 Evolution of publications and citations

and substantial increase in citations over the years, reflecting the growing recognition and impact of this research within the academic community.

3.1.2 Most relevant sources

This paper sample highlights several key sources that have contributed significantly to the body of research (Fig. 2). These 14 sources collectively account for 38.15% of the total sample. The most prominent source is the *Journal of Retailing and*

Fig. 2 Most relevant sources

Consumer Services, which accounts for 52 articles, representing 9.27% of the total sample. This journal is followed by *Technological Forecasting and Social Change*, with 37 articles (6.60%), and the *Journal of Business Research*, which contributes 30 articles (5.35%). Other notable sources include *Psychology and Marketing*, with 21 articles (3.74%), and the *Service Industries Journal*, contributing 11 articles (1.96%). Additionally, *Psychology & Marketing* is also well-represented with 10 articles (1.78%). The *Journal of Theoretical and Applied Electronic Commerce Research* has nine articles (1.60%), while both *Electronic Commerce Research* and the *European Journal of Marketing* each contribute seven articles (1.25%). The *Electronic Commerce Research and Applications, International Journal of Bank Marketing, Journal of Cleaner Production, Journal of Research in Interactive Marketing* and *Technology in Society* each add six articles (1.07%) to the sample. These sources collectively provide a broad and comprehensive foundation for the research, reflecting diverse perspectives and significant contributions across various domains related to retail, consumer services, technological forecasting, business research, and electronic commerce.

3.1.3 Country scientific production

The regional distribution of publications indicates significant contributions from various countries (Fig. 3). China leads with 129 publications, followed by the USA with 122, and India with 93. The United Kingdom, Spain, Australia, South Korea, and Canada also show notable activity, with 45, 40, 33, 32, and 30 publications, respectively. France (27), Italy (20), Germany (18), Malaysia (18), and Portugal

Fig. 3 Country scientific production

(14) contribute moderately. Other countries with notable but smaller contributions include South Africa (12), the Netherlands (11), Poland (10), Singapore (9), Sweden (9), and New Zealand (8). Countries like Bangladesh, Brazil, Finland, Iran, Romania, and Switzerland each have seven publications. Norway and Saudi Arabia each have six publications, followed by Pakistan and Ukraine with five each. Countries with fewer contributions include the Czech Republic and Thailand (four each), Austria, Belgium, Cyprus, Denmark, Egypt, Indonesia, Morocco, Turkey, and Vietnam (three each). Bahrain, Hungary, Israel, Japan, Lithuania, Qatar, Tanzania, and the United Arab Emirates each have two publications. Several countries, including Algeria, Croatia, Estonia, Fiji, Georgia, Greece, Iraq, Ireland, Jordan, Lebanon, Malta, North Macedonia, Serbia, Slovakia, and Zimbabwe, each have one publication. In summary, the data demonstrates a broad geographic distribution of research activity, with a particularly high number of publications originating from China, the USA, and India.

3.2 Science mapping

3.2.1 Bibliographic coupling using cited references

The clustering analysis presented was conducted through bibliographic coupling using cited references (Fig. 4). The method used a function to calculate bibliographic coupling networks from a data frame, identifying clusters of articles with many shared cited references thereby effectively grouping related articles and uncovering the underlying structure of the research landscape within the dataset (Aria and Cuccurullo 2017). Among the 561 articles included in the sample, 430 were clustered by the program, resulting in the exclusion of 131 articles from the analysis. Figure 4 illustrates the formation of three clusters, each represented by a distinct color. Given the emphasis of our investigation on artificial intelligence and consumer behavior,

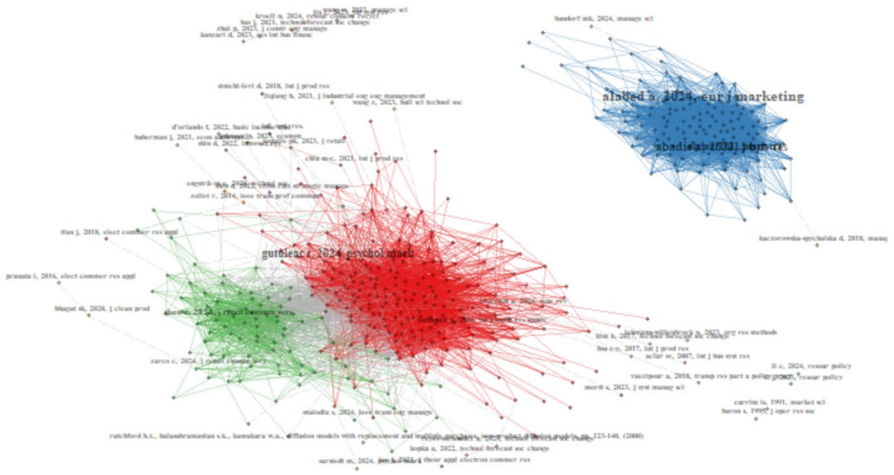

Fig. 4 Coupling network of documents using cited references

the three clusters were delineated as follows: cluster 1 (red)—AI's effect on consumer behavior: Perspectives across industries and states of mind- comprised 212 articles, cluster 2 (blue)—Addressing consumer needs in the age of AI—contained 130 articles, and cluster 3 (green)—Optimizing consumer experience through AI-powered solutions—encompassed 88 articles.

3.2.2 Thematic evolution

For the analysis of the conceptual structure, a network approach was employed via the examination of thematic evolution (using author keywords). The thematic evolution observed from 1988 to 2024 portrays a dynamic progression of research themes within the field (Fig. 5). Initially, artificial intelligence emerged as a predominant topic, enduring from 1988 to 2020, and gradually incorporating additional concepts such as digitalization, technology acceptance model and consumer behavior. Subsequently, spanning from 2021 to 2023, there was a discernible expansion in the scope of research, characterized by the introduction of themes like voice assistants, costumer engagement, digital transformation, consumer neuroscience, customer service, anthropomorphism, deep learning and service failure. By 2024, the thematic landscape continued to diversify, with the emergence of new areas of inquiry such as chatbots, purchase intention, and fintech, alongside the ongoing exploration of artificial intelligence and costumer engagement, digital transformation, voice assistants, consumer behavior and service failure. This evolutionary trajectory underscores the ongoing development and multifaceted nature of research within the realm of artificial intelligence and its associated domains.

For a more in-depth exploration, a thematic analysis was conducted for each time slice (using author keywords) to identify thematic keywords-clusters corresponding to each period, Figs. 6, 7 and 8. These Figures include a graph where: the upper left quadrant themes are niche (highly developed but isolated); the lower left quadrant themes are marginal (emerging or declining); the upper right quadrant are motor

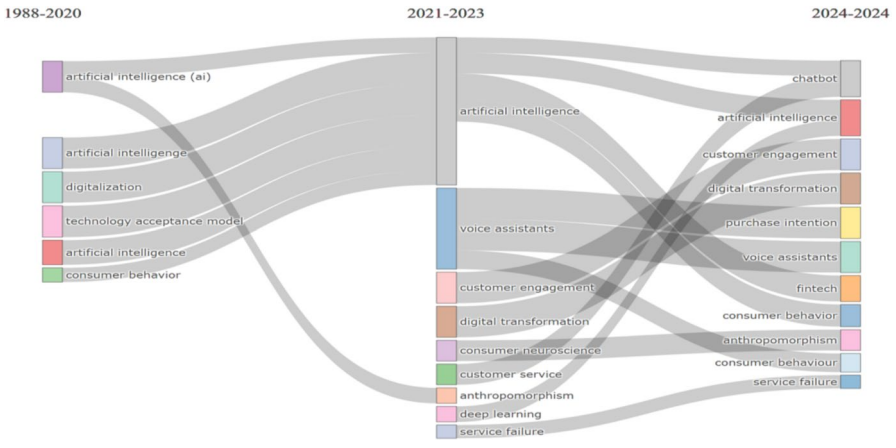

Fig. 5 Thematic evolution

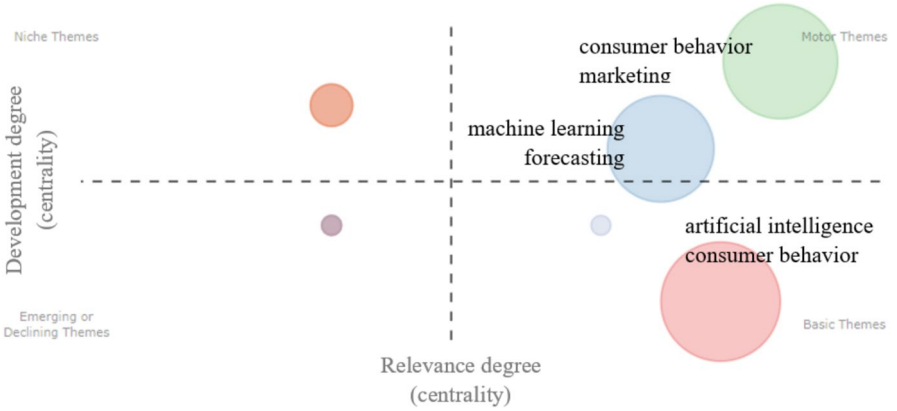

Fig. 6 Thematic evolution 1: 1988–2020

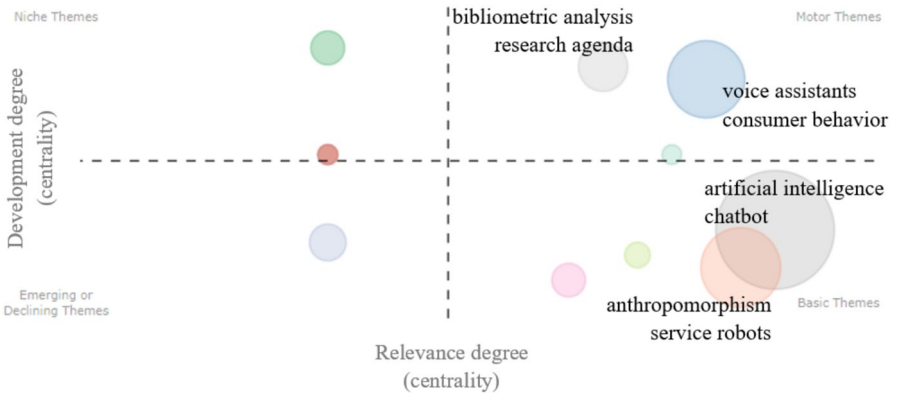

Fig. 7 Thematic evolution 2: 2021–2023

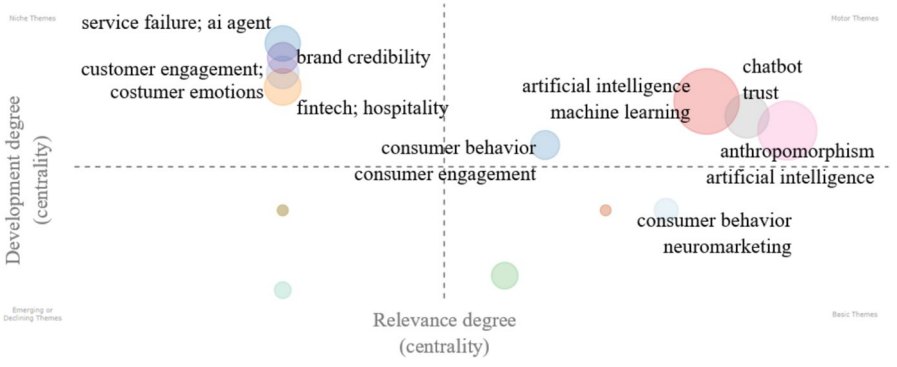

Fig. 8 Thematic evolution 3: 2024

themes (well developed and vital); and the lower right quadrant themes are basic and transversal (essential but not fully developed) (Sharafuddin and Madhavan 2024).

The thematic evolution from 1988 to 2020 (Fig. 6) reveals significant shifts in research focus and thematic prominence within the field. The analysis indicates that artificial intelligence and consumer behavior emerged as a foundational cluster, suggesting that early research efforts sought to explore the intersection between technological advancements and consumer decision-making. This foundational role underscores the increasing integration of AI-driven methodologies in understanding market dynamics and consumer preferences. Over time, machine learning and forecasting evolved as an intermediate cluster, reflecting the growing adoption of predictive models in academic and practical applications. This shift signifies a transition from theoretical explorations to more applied research, where machine learning techniques were increasingly utilized to enhance forecasting accuracy and optimize marketing strategies. Notably, the keywords-cluster of consumer behavior and marketing established itself as a dominant theme, indicating its centrality in shaping research trajectories. As a motor theme, it signifies an area of study that is both well-developed and continuously influencing advancements in the field. This progression highlights the symbiotic relationship between evolving consumer behavior theories and data-driven marketing strategies, reinforcing the critical role of data analytics in modern business practices.

These thematic transitions illustrate the field's gradual movement toward data-centric methodologies, where artificial intelligence and machine learning have become integral in enhancing predictive capabilities and decision-making processes. The observed evolution underscores the dynamic interplay between technological innovation and marketing research, suggesting that future studies will likely continue to explore these intersections to refine consumer insights and strategic implementations.

Regarding the thematic evolution from 2021 to 2023 (Fig. 7), it highlights several key keyword-clusters with varying degrees of development and relevance within the research landscape. During this period, the keywords-cluster of anthropomorphism and service robots is identified as a basic theme, forming a fundamental element of research. This suggests an ongoing interest in human-like interactions with technology, particularly in service industries. Similarly, the keywords-cluster of artificial intelligence and chatbot is also classified as a basic theme, though it exhibits a more advanced level of development compared to the former, indicating a growing reliance on conversational AI for customer interactions and service efficiency.

The keywords-cluster encompassing bibliometric analysis and research agenda is indicative of a mature and robust area of study, reflecting significant scholarly attention and development. This suggests that researchers are increasingly focused on mapping the intellectual structure of the field and identifying future research trajectories. The presence of a well-established research agenda signifies a consolidation of knowledge and methodological advancements that guide further academic inquiry.

Additionally, the keywords-cluster of voice assistants and consumer behavior stands out as another motor theme, showcasing its critical role in shaping research directions and priorities during these years. The integration of voice

assistants into consumer interactions has driven new research questions regarding user engagement, trust, and the impact of voice technology on purchasing decisions. These motor themes underscore the dynamic and evolving nature of research in these areas, highlighting their growing influence in both academia and industry.

Finally, concerning the 2024 thematic evolution (Fig. 8), it reveals the emergence of several niche keyword-clusters with above-average development. Among these, the keywords-cluster comprising fintech and hospitality has begun to gain traction, reflecting the growing intersection of financial technologies and the hospitality industry. This suggests an increasing scholarly and industry focus on how fintech solutions can enhance customer experiences and streamline financial transactions in hospitality settings.

Following this, the keywords-cluster of customer engagement and customer emotions represents an evolving niche, emphasizing the significance of emotional connections in strengthening customer relationships and brand loyalty. The increasing attention to this area indicates a broader shift toward more emotionally intelligent marketing strategies.

Another emerging niche theme is the brand credibility keywords-cluster, highlighting the growing emphasis on the authenticity and trustworthiness of brands in a market where consumers are becoming more discerning and values-driven. This development suggests that brand credibility is becoming a crucial factor in consumer decision-making, requiring businesses to prioritize transparency and ethical branding.

The most developed niche theme in this period is the keywords-cluster of service failure and AI agent. This cluster showcases advanced development, indicating significant research interest and progress in understanding how artificial intelligence can mitigate service failures and optimize recovery strategies. This reflects an increasing recognition of AI's potential in improving service quality and customer satisfaction.

In addition to these niche themes, the period also identifies a basic theme keywords-cluster centered around consumer behavior and neuromarketing. This foundational research area provides essential insights into the cognitive and emotional aspects of consumer decision-making, underscoring the importance of neuroscience in refining marketing techniques.

More central and developed is the keywords-cluster of consumer behavior and consumer engagement, reaffirming its pivotal role in shaping marketing and business strategies.

Finally, the keywords-clusters with significant weight in motor themes for this period include anthropomorphism and artificial intelligence, chatbot and trust, and artificial intelligence and machine learning. These motor themes underscore their critical influence and highlight their importance in shaping research directions and priorities during 2024. They not only demonstrate advanced development but also serve as key drivers of innovation, guiding future research and practical applications in AI-driven consumer interactions and trust-building mechanisms.

4 Discussion

4.1 Cluster discussion

4.1.1 Cluster 1—AI's effect on consumer behavior: perspectives across industries and states of mind

This review explores the intricate psychological aspects of consumer interactions with AI, emphasizing how perceived intelligence and social behaviors of AI influence consumer decision-making. Studies across various industries illustrate AI's deep integration into customer services, revealing its transformative impact on consumer behavior.

The tourism industry exemplifies AI's role in digital transformation, where technology enhances human interactions rather than replacing them. Inversini (2024) highlights how AI facilitates a high-touch approach, enhancing human-to-human connections through advanced digital tools. Interestingly, Christensen et al. (2024) note that consumers often prefer AI-generated tourism plans, despite occasional errors, due to AI's perceived objectivity and ability to offer personalized experiences. This preference underscores a shifting trust in AI-driven solutions.

Beyond tourism, the adoption of AI in customer service extends to multiple sectors. Lalicic and Weismayer (2021) identify four key factors influencing consumer intent to use AI-enabled travel agents, demonstrating the nuanced determinants of AI acceptance in service interactions. Belanche et al. (2024) further explore AI's potential to enhance customer satisfaction, while also acknowledging challenges related to emotional interactions and privacy. In financial services, AI is leveraged for credit scoring and banking applications, with research split between empirical testing of AI algorithms and consumer behavior analysis (Hentzen et al. 2022).

AI-driven virtual assistants also evoke complex consumer responses. Hasan et al. (2021) argue that novelty plays a greater role for consumers with lower brand attachment but higher openness to innovation. Anthropomorphic AI assistants, as shown by Pizzi et al. (2021), can mitigate psychological resistance, making them more acceptable to users. However, heightened realism in virtual influencers can generate mixed reactions. Gutuleac et al. (2024) suggest that social cues help reduce feelings of uncanniness, while Kim et al. (2024) indicate that increased realism enhances emotional engagement and marketing effectiveness. Laszkiewicz and Kalinska-Kula (2023) further emphasize that virtual influencers require alignment with cultural and societal norms, reinforcing the necessity of human oversight in their evolution.

Consumers' cognitive processes in AI adoption present a critical area of study. Anayat et al. (2023) conclude that positive perceptions of AI-based voice assistants have a stronger effect on adoption attitudes than negative concerns. In healthcare, AI-powered information exchange platforms, as discussed by Pattanaik et al. (2024), enhance user engagement when designed with a user-centric approach. Similarly, Giebelhausen and Poehlman (2024) caution against oversimplifying AI's capabilities in marketing, advocating for a customer-experience-driven service design.

Trust and engagement with AI remain pivotal issues. Hsieh and Lee (2021) identify media richness and parasocial interactions as significant factors in fostering consumer trust in AI assistants. Meanwhile, McLean et al. (2021) find that while AI's perceived intelligence and social presence enhance brand engagement, trust concerns can hinder this relationship. Lastly, Wirtz et al. (2018) highlight the ethical implications of service robots, stressing the importance of responsible AI deployment in task automation.

This body of research collectively illustrates the evolving landscape of consumer-AI interactions, highlighting both opportunities and challenges in AI-driven services. The findings emphasize the necessity of balancing technological advancement with human-centric design to foster trust, engagement, and ethical AI integration across industries.

4.1.2 Cluster—addressing consumer needs in the age of AI

Cluster 2 focuses on the complementary relationship between AI and human managers, consumers' readiness to embrace AI, and the impact of AI on consumer behavior and brand engagement. The cluster suggests that AI's effectiveness is not achieved through replacing human administrators, but through enhancing their capabilities (Davenport et al. 2020). This indicates that AI is perceived as a tool that works alongside humans, supporting them in decision-making and operations rather than acting as a complete replacement.

In terms of consumer engagement, it is evident that consumers are open to novel experiences where AI provides a broad range of options and information that can be customized to meet individual needs (Kumar et al. 2019). This is a critical insight, suggesting that consumers expect AI not only to provide a service, but to do so in a way that feels personalized and intuitive. Interestingly, when examining consumer reactions to AI-related service failures, it was found that consumers tend to express less negative feedback about AI failures compared to those involving human employees, despite experiencing similar levels of dissatisfaction (Huang and Philp 2021). This finding is noteworthy because it implies that consumers may be more forgiving of AI failures, possibly due to the understanding that AI is still evolving.

Furthermore, when considering anthropomorphism (the attribution of human characteristics to non-human entities) and consumer engagement, it was discovered that the expectation of effort positively influences users' experiences with voice assistants (Moriuchi 2020). This suggests that when consumers anticipate some level of effort or intelligence in their interactions, they are more likely to engage with these technologies. Ongoing interactions with smart voice assistants are found to induce positive feelings such as pleasure, satisfaction, and interest, which strengthens the relationship between users and the technology, thereby promoting continued engagement with the brand (Hernández-Ortega et al. 2022). However, when it comes to purchasing decisions, voice assistants appear to influence consumers more in low-involvement goods rather than high-involvement purchases (Tassiello et al. 2021).

While there is a hesitance among consumers to utilize voice assistants for transactions, this resistance is linked to cognitive biases, consumer inertia, and

procrastination (Malodia et al. 2022). This reluctance reflects a deeper psychological barrier that needs to be addressed for greater adoption. On a positive note, brand credibility plays an important moderating role, as higher brand credibility alleviates concerns about privacy and strengthens the perceived value of voice assistants (Jain et al. 2022). However, it is important to note that anthropomorphism does not always lead to positive outcomes (Fernandes and Oliveira 2021). Its effectiveness is more apparent when combined with perceived intelligence, which significantly influences the adoption of personal intelligent agents (Moussawi et al. 2021).

Chatbots, on the other hand, present different dynamics. When chatbots initiate interactions with a warm message instead of a competent one, brand engagement tends to increase (Kull et al. 2021). This suggests that the emotional tone of AI interactions plays a crucial role in fostering positive consumer perceptions. User satisfaction with chatbots is largely driven by factors such as perceived accuracy, completeness, and ease of use, while the intention to continue using them is influenced by perceived convenience and satisfaction (Huang and Chueh 2021). Moreover, key factors motivating chatbot implementation include perceived usefulness, playfulness, social influence, and attitude (Gopinath and Kasilingam 2023).

An important aspect to consider is the role of self-directed interaction in shaping the customer experience. This direct engagement has a significant impact on attitudes towards and satisfaction with chatbots (Jiménez-Barreto et al. 2021). Additionally, chatbots' social presence contributes to creating a more innovative retail environment, fostering a deeper connection between consumers and retailers (Jiang et al. 2022).

The cluster 2 also emphasizes that AI's role in customer data processing and shaping future online engagement dynamics is becoming increasingly critical (Perez-Vega et al. 2021). Service robots, similarly, are being integrated into companies' operations, with consumer perceptions of these technologies influencing their behavior and attitudes (Blaurock et al. 2022; Belanche et al. 2021). As AI continues to develop, it is expected to significantly reshape marketing strategies and customer behaviors, driving deeper integration of AI into everyday consumer experiences (Davenport et al. 2020).

This analysis underscores the multifaceted influence of AI on both business operations and consumer interactions. While AI offers immense potential to enhance brand engagement and consumer satisfaction, challenges such as overcoming cognitive biases and ensuring privacy remain key barriers to broader acceptance and usage.

4.1.3 Cluster 3—optimizing consumer experience through AI-powered solutions

Lastly, Cluster 3 highlights the optimization of consumer experience through AI-powered solutions in retail, the importance of adaptive service recovery strategies, and the significance of AI in voice-enabled applications. This cluster emphasizes the need for a deeper understanding of how AI interactions can either strengthen or undermine consumer trust and loyalty over time, highlighting the dual potential of AI to shape consumer behavior positively or negatively. The findings underscore AI's transformative potential in reshaping how businesses approach customer

service and satisfaction, suggesting that companies must adapt to this evolving technological landscape to remain competitive. In this context, designing, developing, and deploying AI entities is crucial for optimizing consumer experiences within AI-driven services (Liao et al. 2024).

In AI-powered retail stores, consumers' optimism and innovativeness are found to positively affect perceptions of ease and usefulness, while insecurity about AI negatively impacts these perceptions (Pillai et al. 2020). This suggests that consumer sentiment plays a significant role in determining the effectiveness of AI tools in retail environments. The intelligence level of high-end luxury shopping environments also influences consumers' willingness to purchase, particularly when customers are oriented towards status consumption (Sestino and Amatulli 2024). This highlights the impact of AI in more exclusive retail settings, where technological sophistication can influence purchasing decisions, especially for status-driven consumers.

AI applications manifest in two primary environments: online retail platforms and physical stores. The showrooming effect is amplified by both AI application and service efforts, especially when AI investment is low. However, consumers' preference for AI technology in retail platforms is independent of in-store service efforts, indicating that AI's role in online platforms can mitigate the influence of in-store service dynamics on consumer behaviors (Wang et al. 2024b). This reveals how AI can function differently in online versus physical retail environments, with a greater impact on consumer behavior in digital spaces.

For online platforms, companies must strategically deploy ChatGPT applications to foster acceptance, adoption, and collaboration with managers (Abadie et al. 2024). User intention to adopt such technologies is influenced by their perceived effectiveness, outstanding qualities, and conversational capabilities, emphasizing the importance of creating AI solutions that are not only functional but also user-friendly and engaging. Current developments aim to enhance chatbots' ability to draw inferences from diverse data sources and adaptively use consumers' knowledge to provide customized solutions (Pantano and Pizzi 2020). This reflects the growing sophistication of AI, which now goes beyond providing responses to actively tailoring solutions to individual consumer needs.

Regarding service recovery, the appropriateness of using an informational self-recovery strategy in response to service failures is contingent on the degree of anthropomorphism in chatbots, while an emotional self-recovery strategy is better suited for addressing service outcome failures (Zhou and Chang 2024). This indicates that the strategy chosen must align with the nature of the failure and the emotional context of the consumer experience, highlighting the nuanced approach required for effective service recovery in AI contexts. AI-powered chatbots and virtual assistants are also integral in streamlining the customer journey by providing immediate responses and product information, enhancing user engagement, and facilitating the purchasing process (Chakraborty et al. 2024).

In the realm of voice assistants, technology companies and advertisers can leverage AI to create a wide range of voice-enabled applications and services designed to improve user engagement, based on the idea that social identification and personification are closely tied to the utility and fun of these interactions (Malodia et al. 2024). This points to the increasing role of personalization and human-like

qualities in the success of voice-enabled AI. Voice assistants can also act as partly autonomous representatives, fostering real-time social relationships with customers (Poushneh 2021b). This suggests that the future of voice assistants is moving towards more interactive and relational roles in consumer engagement.

As AI continues to evolve, managers must adjust their understanding of consumer decision-making processes in the AI-driven market (Klaus and Zaichkowsky 2022). The shift in consumer behavior towards using voice bots in household purchases carries significant implications for the retail industry, emphasizing how AI could transform purchasing patterns in the future (Klaus and Zaichkowsky 2022). Customer satisfaction and continued use of voice assistants are also driven by consumers' investigative behavior, which highlights the importance of ongoing consumer exploration and interaction with AI tools (Poushneh 2021a).

It's worth noting that, in biometric payment systems, perceived risk, trust, and social influence are identified as the most significant variables influencing user adoption, underscoring the importance of trust in AI-driven transactions (Zarco et al. 2024). Furthermore, the exposure of AI agents can increase the likelihood of customers engaging in unethical behavior, suggesting that transparency around AI use is crucial in maintaining ethical consumer interactions (Li et al. 2024).

4.2 Conceptual model

The analysis of the clusters enabled the development of a conceptual model proposal. The AI's influence on consumer behavior model (Fig. 9) explores three distinct dimensions of the influence that AI exerts on consumer behavior. The first dimension focuses on the influence of AI on consumer behavior across various industries. It is divided into subthemes, including the integration of AI into customer-facing services, consumer preference for AI-driven solutions, challenges and opportunities of AI in customer service, and the role of AI in specific industries. Each subtheme delves into specific aspects of AI's influence on consumer behavior in different industry contexts. The second dimension explores how businesses are addressing consumer needs in the era of AI. It consists of subthemes such as the complementary relationship between AI and human managers, consumers' readiness to embrace AI, and the impact of AI on consumer behavior and brand engagement. Each subtheme examines specific aspects of how AI is affecting consumer behavior and the strategies adopted by businesses to meet evolving consumer needs. The third dimension focuses on optimizing consumer experience through AI-powered solutions. It consists of subthemes such as the optimization of consumer experience in AI-powered retail environments, the importance of adaptive service recovery strategies, and the significance of AI in voice-enabled applications and biometric payment systems. Each subtheme explores specific aspects of how AI is utilized to enhance consumer experience and the implications for businesses operating in the retail sector.

Besides the identified three distinct dimensions of how AI affects consumer behavior, it is crucial to understand the relationships between these dimensions, as they are interconnected and address different facets of AI's integration into

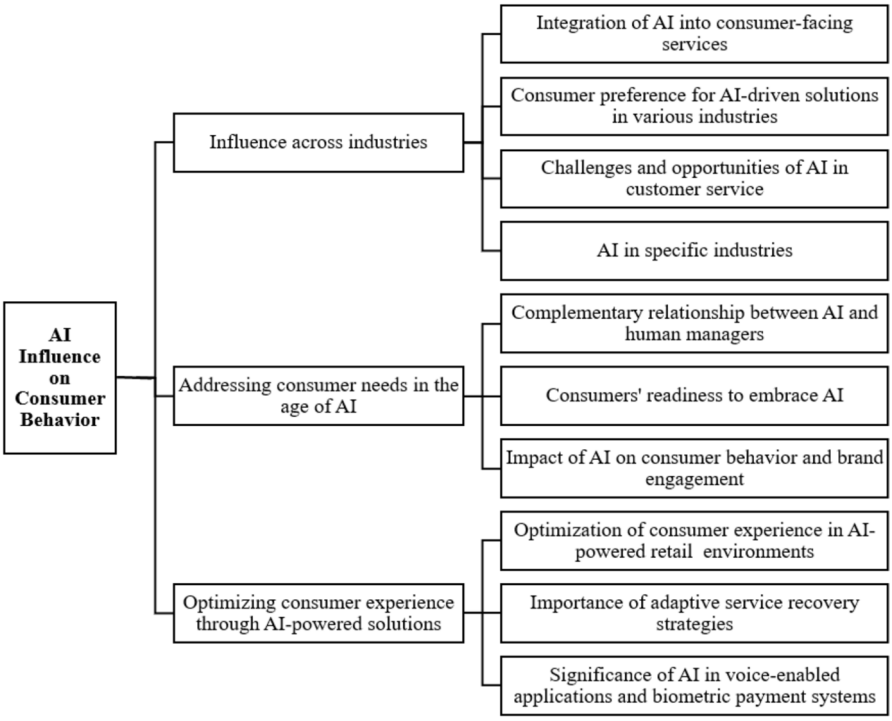

Fig. 9 Conceptual model: AI influence on consumer behavior

consumer-facing services. These dimensions are not isolated; rather, they collectively provide a deeper understanding of AI's impact on consumer behavior. Although each dimension focuses on a distinct aspect, they share the common goal of understanding how AI can be leveraged to meet consumer needs and improve the overall consumer experience.

The relationship among these dimensions is characterized by complementarity, with each dimension offering unique yet complementary insights into the multifaceted influence of AI. The first dimension looks at the broad implications of AI across various industries, providing a foundational understanding of AI's potential. The second dimension focuses on consumer readiness and engagement with brands, exploring how consumers are prepared to adopt and interact with AI technologies. Finally, the third dimension concentrates on optimizing the consumer experience through AI-powered solutions, emphasizing practical applications that enhance user satisfaction. Together, these three dimensions form a cohesive framework that enables businesses to fully grasp AI's role in shaping consumer behavior.

The interconnectedness of the dimensions also highlights the need for integration and adaptation. As AI continues to evolve, businesses must not only integrate AI technologies into their customer-facing services but also adapt to the dynamic consumer landscape. This suggests that businesses need to remain flexible, continuously

adapting their strategies to keep pace with both technological advancements and shifting consumer expectations.

Moreover, there is an implicit relationship of continuous improvement between the dimensions. The dimensions suggest that in order to maintain customer satisfaction and loyalty, businesses must continually refine and enhance their AI-driven services. This aligns with the idea that AI technologies, much like consumer preferences, are constantly evolving, and businesses must stay proactive in improving their offerings.

In conclusion, the relationships between these dimensions emphasize the importance of taking a holistic approach to integrating AI in consumer-facing services. Businesses must consider not only the technological capabilities of AI but also the evolving needs and preferences of consumers. This comprehensive view ensures that AI is used effectively to drive positive consumer interactions, improving both the customer experience and long-term business success.

4.3 Future lines of research

The presented thematic evolution, from 1988 to 2024 (Fig. 5), attends to the critical need of analysis of studies on the evolution of publications identifying the changes in the literature over time, offering a more comprehensive understanding of AI's influence on consumer behavior. Furthermore, the analysis of the 2024 keywords facilitated the identification of several distinct keywords-clusters (Fig. 8). Each keywords-cluster represents a theme that warrants further investigation. These keywords-clusters highlight emerging areas of interest and critical topics within the research landscape, providing a foundation for future studies to explore and expand upon these themes in greater detail. The identification of future research themes starts by the lines of the niche themes, passing to motor themes and then to basic themes (Table 2).

In the niche theme, *fintech and hospitality,* the future research agenda identified by Mogaji et al. (2024) relates to Technology Adoption Model (TAM) in tourism and hospitality focuses on contextualizing TAM, understanding generational dynamics, extending TAM to cover attitudes towards AI-driven technologies, incorporating industry-specific factors, accounting for cultural variations, employing comprehensive measures, adopting new theories for hybrid realities, and exploring social and hedonic motivations. Building on this, further research is suggested to assess the impact of AI on service personalization in luxury versus budget segments of hospitality, examine AI's influence on sustainable behavior among fintech users (e.g., green banking, digital carbon footprints), and study AI-induced service innovation and its effects on reshaping competitive advantage in hospitality markets. These research directions aim to advance our understanding of technology adoption in the dynamic landscape of the hospitality and tourism industry.

Additionally, within the niche theme of *customer engagement and customer emotions,* Zhou and Chang (2024) identified several lines of investigation, as the study of how self-recovery tactics affect customer satisfaction with voice-based chatbots, and the examination of the impact of human variables, such as cultural differences

Table 2 Future lines of research based on authors and other suggestions

	Keywords-cluster	Authors/other suggestions	Future lines of research
Niche themes	*Fintech and hospitality*	Mogaji et al. (2024)	Contextualizing TAM in tourism and hospitality; Understanding generational dynamics in technology adoption; Extending TAM to include attitudes towards AI-driven technologies; Incorporating industry-specific factors into TAM; Accounting for cultural variations in technology adoption; Employing comprehensive measures and mixed methods; Adopting new theories for hybrid technological realities; Exploring social and hedonic motivations in technology adoption
		Suggestions:	Assess the impact of AI on service personalization in luxury versus budget segments of hospitality
			Examine AI's influence on sustainable behavior among fintech users (e.g., green banking, digital carbon footprints)
			Study AI-induced service innovation and how it reshapes competitive advantage in hospitality markets
	Customer engagement and customer emotions	Zhou and Chang (2024)	Study how self-recovery tactics affect customer satisfaction with voice-based chatbots;—Examine the impact of human variables, such as cultural differences and implicit personality traits, on customer perceptions and satisfaction
		Suggestions:	Investigate emotional contagion in AI-human interactions via voice tone and facial expressions in service bots
			Analyze the longitudinal emotional trajectory of consumers engaging repeatedly with AI (e.g., sentiment erosion or strengthening)
			Explore how emotionally adaptive AI can improve outcomes in customer conflict or complaint scenarios
	Brand credibility	Sadiq et al. (2024)	Explore social information processing theory
		Suggestions::	Evaluate the impact of AI transparency (e.g., disclosing AI vs. human authorship) on brand trust and credibility
			Investigate how AI-generated marketing content influences consumer skepticism and credibility judgments

Table 2 (continued)

	Keywords-cluster	Authors/other suggestions	Future lines of research
			Examine the role of algorithmic bias or fairness perceptions in consumer evaluations of brand reliability
	Service failure and AI agent	Yu et al. (2024)	Explore service agent impact post-service failures; Test real-life AI agents for usage insights.; Conduct field experiments for comprehensive understanding
		Suggestions:	Analyze consumer responses to mixed agent teams (AI + human) during service failure recovery
			Explore compassionate AI design: how empathetic scripts and behavior models affect post-failure satisfaction
			Study trust restoration mechanisms post-service failure using different AI apology strategies or compensation offers
Motor themes	*Consumer behavior and consumer engagement*	Elmashhara et al. (2024)	Explore diverse outcomes with gamified chatbots; Consider various motivational drivers, engagement concepts, and gamification styles; Incorporate moderators like human interaction and personality traits; Investigate the impact of different AI settings and communication styles
		Suggestions:	Investigate adaptive engagement tactics based on real-time behavioral analytics (e.g., how AI dynamically alters tone or content)
			Study the influence of gamification elements in AI interfaces (leaderboards, rewards) on sustained consumer engagement
			Examine the interplay between digital fatigue and AI interaction frequency, particularly in high-engagement platforms
	Anthropomorphism and artificial intelligence	Belanche et al. (2024)	AI design; customer dynamics; and service encounters
		Suggestions:	Explore consumer responses to gendered or racialized AI avatars, and how these affect inclusivity and trust
			Investigate how degrees of anthropomorphism (voice-only vs. embodied AI) alter user expectations and perceptions
			Examine intergenerational differences in comfort and attachment to anthropomorphic AI in retail or healthcare

Table 2 (continued)

	Keywords-cluster	Authors/other suggestions	Future lines of research
	Chatbot and trust	Malodia et al. (2024)	Explore alternative theoretical approaches for consumer behavior with voice assistants; Classify voice assistant usage into transactional versus non-transactional categories to study consumption values; Include different moderating variables (e.g., comparing users vs. non-users) to capture changes in consumer behavior
		Suggestions:	Study the impact of emotional intelligence in chatbots on relational trust-building over time
			Examine how chatbot consistency across platforms (web, mobile, social media) influences consumer trust continuity
			Investigate co-creation of knowledge between consumers and chatbots, and its effect on brand relationship depth
	Artificial intelligence and machine learning	Wang et al. (2024a)	Evaluate customer experience on AI-enabled products across cultures; Conduct longitudinal studies on changing customer experiences over time; Explore ways to reduce tensions in human–AI interaction and enhance collaboration; Improve consumer trust in and acceptance of AI-enabled products.; Investigate the human–robot relationship for product innovation and personalization
		Suggestions:	Analyze AI's predictive accuracy in evolving consumer trends, and its effect on perceived service quality
			Explore machine learning transparency and consumer willingness to allow AI access to personal data
			Study feedback loops: how consumer input modifies AI behavior and how that, in turn, shapes consumer learning or loyalty
Basic themes	*Consumer behavior and neuromarketing*	Hollebeek et al. (2024)	Investigate AI learning capacity's impact on consumer engagement, purchase behavior, and brand perception; —Explore how AI tools influence consumer perceptions of task convenience and brand engagement
		Suggestions:	Conduct neurophysiological studies on consumer responses to AI-generated versus human content

Table 2 (continued)

Keywords-cluster	Authors/other suggestions	Future lines of research
		Explore the influence of AI on subconscious decision-making processes during impulse versus planned purchases
		Investigate consumer mental workload and cognitive dissonance when interacting with AI agents in complex purchases

and implicit traits of personality, on customer perceptions and satisfaction. Expanding on this, it is recommended that future studies investigate emotional contagion in AI-human interactions through voice tone and facial expressions in service bots, analyze the longitudinal emotional trajectory of consumers who repeatedly engage with AI (observing potential sentiment erosion or strengthening), and explore how emotionally adaptive AI can be leveraged to improve outcomes in customer conflict or complaint scenarios. In the niche theme of *brand creditability*, Sadiq et al. (2024) suggests the consideration of alternative theoretical perspectives like social information processing theory to comprehensively understand the dynamics between ChatGPT, green purchase intention, and consumer behavior, potentially uncovering novel insights into sustainable purchasing behaviors. Additional research is needed to evaluate the impact of AI transparency, specifically disclosing whether content is AI-generated or human-authored, on brand trust and credibility. Additionally, it's recommended to investigate how AI-generated marketing content affects consumer skepticism and judgments of credibility, and to examine the role of algorithmic bias or perceptions of fairness in how consumers evaluate the reliability of a brand. And, in the final niche theme, *service failure and AI agent,* research pathways underline the importance of investigating how various types of service agents affect customer behavior across a range of scenarios, extending beyond instances of service failure to understand consumers' willingness to engage under conditions that impact trust. Moreover, it is crucial to conduct essential tests with real-life intelligent customer service agents to accurately simulate human-like interactions with chatbots, given the increasing integration of AI in service sectors. Field experiments are indispensable for gathering authentic data and providing thorough insights into the application of AI. To further this line of inquiry, it is suggested to analyze consumer responses to mixed agent teams (AI + human) during service failure recovery, explore compassionate AI design- specifically, how empathetic scripts and behavior models affect post-failure satisfaction—and study trust restoration mechanisms following service failure using different AI apology strategies or compensation offers.

There are four Motor themes that were gathered in the analysis. In the first, *consumer behavior and consumer engagement*, Elmashhara et al. (2024) suggested the exploration of diverse outcomes beyond purchase intention, such as loyalty and positive word-of-mouth, with gamified chatbots. Consider various motivational drivers, customer engagement concepts, and gamification styles for comprehensive insights. Incorporate moderators like human interaction and personality traits to understand their effects on engagement. Investigate the impact of different AI settings and communication styles on engagement and outcomes. Expanding on this, future work could investigate adaptive engagement tactics based on real-time behavioral analytics (e.g., how AI dynamically alters tone or content), study the influence of gamification elements in AI interfaces (leaderboards, rewards) on sustained consumer engagement, and examine the interplay between digital fatigue and AI interaction frequency, particularly in high-engagement platforms. Another motor theme is the *anthropomorphism and artificial intelligence.* Here it can be found the suggestions of Belanche et al. (2024), future research should delve into various aspects of AI design, customer dynamics, and service encounters. This includes exploring the uncanny valley

effect in AI platforms, addressing privacy concerns and cybersecurity risks for customers, and examining the ethical implications of AI in service interactions. Additionally, understanding the impact of AI on human skills and social interactions is essential. Future investigations should explore consumer responses to gendered or racialized AI avatars and how these affect inclusivity and trust, investigate how degrees of anthropomorphism (voice-only vs. embodied AI) alter user expectations and perceptions, and examine intergenerational differences in comfort and attachment to anthropomorphic AI in retail or healthcare. The *chatbot and trust* in other motor theme, were Malodia et al. (2024) suggest that future research should explore alternative theoretical approaches like stimulus-organism-response or behavioral reasoning theory to understand consumer behavior with voice assistants. Additionally, studies should classify voice assistant usage into transactional and non-transactional categories to examine how consumption values affect user behavior. Including different moderating variables, such as comparing users and non-users, can capture changes in consumer behavior. It would be beneficial to investigate the impact of emotional intelligence in chatbots on relational trust-building over time, examine how chatbot consistency across platforms (web, mobile, social media) influences consumer trust continuity, and investigate co-creation of knowledge between consumers and chatbots and its effect on brand relationship depth. The last motor theme is the *artificial intelligence and machine learning*. Here author, such as Wang et al. (2024a), propose that future research could explore the differences in customer experience on AI-enabled products between Eastern and Western cultures by conducting evaluations in different geographical and national contexts. They also suggest that, longitudinal studies could be continued to assess changes in customer experience with AI-enabled products over time. Additionally, future research avenues could focus on reducing tensions in human–AI interaction, enhancing the balance of human–robot collaboration, and improving consumer trust and acceptance of AI-enabled products. Further exploration of the human–robot relationship could lead to innovations in personalization and differentiation of AI-enabled products, ultimately enhancing consumer experience and satisfaction. It is also suggested that future research analyze AI's predictive accuracy in evolving consumer trends and its effect on perceived service quality, explore machine learning transparency and consumer willingness to allow AI access to personal data, and study feedback loops: how consumer input modifies AI behavior and how that, in turn, shapes consumer learning or loyalty.

Finally, concerning the cluster of basic themes, *consumer behavior and neuromarketing,* Hollebeek et al. (2024) suggest that future research directions within the realm of AI-based consumer may delve into several key areas. One avenue of exploration could involve investigating the nuanced impact of AI learning capacity on various facets of consumer engagement, such as purchase behavior and brand perception. Additionally, there is potential for in-depth analysis into how AI-powered tools, such as chatbots and voice assistants, contribute to consumer perceptions of reduced effort and convenience in task execution, thereby influencing their brand engagement. Subsequent research might consider to conduct neurophysiological studies on consumer responses to AI-generated versus human content, explore the

influence of AI on subconscious decision-making processes during impulse versus planned purchases, and investigate consumer mental workload and cognitive dissonance when interacting with AI agents in complex purchases.

The future research directions identified across the niche, motor, and basic thematic clusters underscore the dynamic and multifaceted nature of scholarly inquiry into the expanding influence of artificial intelligence on consumer behaviour. These pathways call for a balanced integration of theoretical advancement, empirical investigation in real-world contexts, and critical engagement with the ethical and societal implications of AI technologies. Collectively, these research avenues aim to foster a more holistic and nuanced understanding of the intricate interplay between AI, consumer decision-making, and the continuously evolving marketplace.

4.4 Theoretical implications

The meticulous examination of artificial intelligence's impact on consumer behavior in this study yields noteworthy theoretical implications. First, this study advances the understanding of the relationship between artificial intelligence and consumer behavior, shedding light on previously unexplored aspects of this relationship. Second, it substantially enriches the body of literature concerning AI product adoption. Particularly through, the analysis of the pros and cons of adopting AI-based products (Anayat et al. 2023). This approach adds depth and breadth to the body of literature by addressing both the advantages and disadvantages associated with AI adoption, thereby enhancing our understanding of the complexities involved in this process. Thirdly, this thorough review serves to provide researchers with a comprehensive overview and analysis of the existing research landscape concerning the influence of artificial intelligence on consumer behavior. Fourth, it sets the stage for further inquiry by delineating potential avenues for future research on the development of AI-based products in consumer interactions. Finally, this research offers insights that stimulate contemplation and discussion regarding a multitude of ethical considerations, as well as the current state of humanity's way of life.

4.5 Practical implications

This study provides a comprehensive analysis of the influence of artificial intelligence on consumer behavior, and provides numerous and highly valuable practical implications for marketing professionals.

First, AI-driven decisions can significantly enhance consumer trust and satisfaction. Customers are increasingly trusting AI systems because they perceive them as more impartial and capable of offering personalized experiences that better meet their individual needs compared to alternative sources (Christensen et al. 2024). This indicates that businesses should leverage AI to foster trust and create more personalized customer interactions, which can lead to higher satisfaction and retention. Second, the advanced personalization features of AI tools allow businesses to deliver highly tailored consumer experiences, precisely aligned with individual preferences. By utilizing AI and personalized customer data, companies can offer products and

services that speak directly to consumer needs. This fosters customer loyalty and engagement, driving long-term relationships. Marketers should focus on utilizing AI to continuously learn from customer interactions, improving product offerings and customer experiences to maintain a competitive edge (Kumar et al. 2019). Third, integrating AI tools in customer service not only boosts efficiency but also improves service quality by providing timely and accurate responses to customer inquiries and issues. AI-driven assistants can assist customers by delivering information promptly, enhancing the customer journey, and enriching the purchasing experience through greater interactivity and engagement (Chakraborty et al. 2024). For marketing professionals, this means investing in AI-powered chatbots and customer service solutions that can enhance both the speed and quality of customer support, leading to improved satisfaction and customer retention. Fourth, future research should investigate how the introduction of AI into workplaces impacts human competencies and skills. Marketers should be aware of how AI may complement or replace human tasks, and what new skills are required for effective collaboration between AI systems and human workers. Additionally, it is important to explore the continuous learning capabilities of AI and how it impacts consumer behavior and engagement, especially in terms of anticipating needs and adapting to preferences in real-time. This research can provide valuable insights for businesses looking to understand AI's evolving role in consumer interactions.

Belanche et al. (2024) highlight several key concerns regarding human–AI collaboration, which are important for marketing professionals to consider. These include the impact on service quality and job satisfaction, the variation in AI perceptions across industries that can influence integration strategies, and the emergence of new job opportunities requiring skill adaptation. Moreover, marketers should be aware of the broader societal implications, including how AI might contribute to economic disparities and the importance of developing ethical policies that ensure fair distribution of AI's benefits and inclusivity.

Finally, companies must adapt quickly to AI's transformative potential by investing in AI technologies and adjusting their business strategies accordingly. This requires understanding the evolving consumer decision-making processes, as AI's influence on these processes is significant (Klaus and Zaichkowsky 2022). Marketers need to continuously update their strategies to incorporate AI tools effectively, ensuring they meet the changing demands of the market while enhancing customer engagement and loyalty.

5 Conclusion

The explosion in the application of AI in different sectors has significantly impacted consumer behavior. The paper examines the influence of artificial intelligence (AI) on consumer behavior, highlighting its profound impact on various sectors such as tourism, financial services, and healthcare. Consumers show a preference for AI-driven solutions due to perceived impartiality and customization. Additionally, AI-powered tools, including chatbots and virtual assistants, enhance customer service and engagement. Future research directions include contextualizing technology

adoption models, understanding the impact of AI on human skills, and exploring the nuanced effects of AI learning capacity on consumer engagement. Overall, the paper underscores the transformative potential of AI in shaping consumer behavior and highlights the need for businesses to adapt to this evolving landscape.

Based on the results, a conceptual model was proposed that advocates the influence of AI on consumer behavior in three dimensions (influence across industries, addressing consumer needs in the age of AI, and optimizing consumer experience through AI-powered solutions). Furthermore, future lines of research were outlined based on keyword clusters, which were organized into niche themes, motor themes, and basic themes.

While this study provides valuable insights, it is important to acknowledge its limitations. The initial search for articles was conducted on the Web of Science and Scopus, the most comprehensive databases of peer-reviewed publications, but it's worth noting that other important databases such as EBSCO exist. The search terms, filtering process, and software usage may have excluded some relevant literature. In the future, it would be beneficial to conduct systematic literature reviews, replicating the methodology used in this study, for each keyword cluster identified in future lines of investigation. Additionally, there is a need for quantitative studies that empirically demonstrate the influence of AI on consumer behavior, particularly in specific sectors (e.g., tourism, financial services, and healthcare), among different generational cohorts (e.g., X, Y, and Z Generations), and considering consumer personality traits and technological characteristics, as well as AI anthropomorphism.

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Data availability The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Declarations

Conflict of interests The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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