

Optimization of Marketing Strategies Employing LLMs: A Systematic Review

*Optimización de Estrategias de Marketing
Empleando LLMs: Una Revisión Sistemática*

*Otimização das Estratégias de Marketing
Utilizando os LLMs: Uma Revisión Sistemática*

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Abstract

This comprehensive systematic review delves into the use of Large Language Models (LLMs) in the field of digital marketing, focusing on their evolution, influence, and current practical applications. Employing a meticulous approach to analyze the scholarly literature in Scopus and Web of Science

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databases, this review ranges from basic implementations of LLMs to their more sophisticated applications in the marketing field. In particular, models such as ChatGPT have transformed the existing customer-salesperson relationship, providing accurate and personalized real-time responses that have significantly improved the customer experience and the effectiveness of marketing strategies. The review focuses on three main areas: the integration of LLMs into chatbots, which has improved the user experience and boosted conversion and retention rates in e-commerce; adaptive content development to optimize social media advertising campaigns; and predictive analytics, which streamlines strategic decision-making by analyzing historical and real-time data. These advances have enabled marketers to design more informed and personalized strategies, refine campaigns and promotions, and improve the overall customer experience.

Keywords: Large Language Models, digital marketing, chatbots, content creation, predictive analytics, customer experience, marketing strategies.

Resumen

Esta revisión sistemática exhaustiva profundiza en la utilización de los Grandes Modelos de Lenguaje (LLMs) en el ámbito del marketing digital, centrándose en su evolución, influencia y aplicaciones prácticas actuales. Empleando un enfoque meticuloso para analizar la literatura académica en las bases de datos Scopus y Web of Science, esta revisión abarca desde las implementaciones básicas de los LLMs hasta sus aplicaciones más sofisticadas en el campo del marketing. En particular, modelos como ChatGPT han transformado la relación existente cliente-vendedor, ofreciendo respuestas precisas y personalizadas en tiempo real que han mejorado significativamente la experiencia del cliente y la eficacia de las estrategias de marketing. La revisión se centra en tres áreas principales: la integración de LLMs en chatbots, que ha mejorado la experiencia del usuario y ha reforzado las tasas de conversión y retención en el comercio electrónico; la elaboración de contenidos adaptativos para optimizar las campañas publicitarias en las redes sociales; y el análisis predictivo, que agiliza la toma de decisiones estratégicas mediante el análisis de datos históricos y en tiempo real. Estos avances han permitido a los profesionales del marketing diseñar estrategias más informadas y personalizadas, perfeccionar campañas y promociones y mejorar la experiencia general del cliente.

Palabras clave: Grandes Modelos de Lenguaje, marketing digital, chatbots, creación de contenido, analítica predictiva, experiencia del cliente, estrategias de marketing.

Resumo

Esta revisão sistemática abrangente investiga a utilização de modelos de linguagem de grande dimensão (LLM) no domínio do marketing digital, centran-

do-se na sua evolução, influência e aplicações práticas actuais. Empregando uma abordagem meticulosa para analisar a literatura académica nas bases de dados Scopus e Web of Science, esta revisão abrange desde as implementações básicas dos LLMs até às suas aplicações mais sofisticadas no domínio do marketing. Em particular, modelos como o ChatGPT transformaram a atual relação cliente-vendedor, oferecendo respostas precisas e personalizadas em tempo real que melhoraram significativamente a experiência do cliente e a eficácia das estratégias de marketing. A análise centra-se em três áreas principais: a integração dos LLMs nos chatbots, que melhorou a experiência do utilizador e aumentou as taxas de conversão e de retenção no comércio eletrónico; o desenvolvimento de conteúdos adaptáveis para otimizar as campanhas publicitárias nas redes sociais; e a análise preditiva, que simplifica a tomada de decisões estratégicas através da análise de dados históricos e em tempo real. Estes avanços permitiram aos profissionais de marketing conceber estratégias mais informadas e personalizadas, aperfeiçoar campanhas e promoções e melhorar a experiência global do cliente.

Palavras-chave: Modelos de Linguagem de Grande Escala, Chatbots, Criação de Conteúdos, Análise Preditiva, Experiência do Cliente, Estratégias de Marketing.

JEL Classification: M31 Marketing; C45 Neural Networks; O33 Technological Change: Choice and Impact of Technology

1. Introduction

Digital marketing has emerged as a novel and useful tool in the contemporary business landscape due to its ability to reach a global audience in an efficient, practical, and customizable way for different types of businesses (Chaffey & Ellis-Chadwick, 2019; Ibáñez Vargas, 2024; Leeflang et al., 2014). Unlike traditional marketing, digital marketing offers the advantage of using online platforms to create targeted and measurable campaigns, as well as the use of new tools such as artificial intelligence (AI), which allows companies to adapt their strategies in real time and maximize their return on investment with several possibilities (Kapoor & Kapoor, 2021). In turn, using promotions through social networks generates more traffic to the sale of different products and services which is beneficial for most marketers. Subsequently, companies can attract, dialogue, and retain customers with the help of digital marketing and its tools (Aswani Thampi & Ambeesh Mon, 2024), specifically, the connections between Large Language Models (LLMs) and the marketing industry will be addressed through a literature review of these fields.

However, digital marketing presents challenges and obstacles, including talent gaps, organizational design, and actionable metrics, highlighting inefficient data management in massive enterprise data (Leeflang et al., 2014). In addition, the need for customer engagement and conversation, and the impact of consumer buying habits on online marketing are significant challenges (Kishore et al., 2023). Privacy and personal data protection have become a major issue, especially in an environment where laws, such as the GDPR (General Data Protection Regulation of the European Union), require rigorous handling of consumer data (Tene & Polonetsky, 2013). Finally, high competition in the digital market suggests more sophisticated differentiation strategies to capture and retain consumers; novel strategies and varied advertising channels are some suggestions for salespeople.

In addressing these challenges, leveraging advanced technologies such as LLMs offers promising potential, these are relatively new technologies, and as a result, the scientific literature on the subject is quite diverse and scattered. Based on the research, only three articles directly related to reviews on LLMs (or some type of AI) and marketing were found. The first article conducted a review of more than 300 research papers from 16 of the top AI journals. It covered a description of current research gaps and fields, as well as providing an overview of the general landscape (Peltier et al., 2024). However, focusing on 16 AI journals may bias the information, as marketing topics are more commonly published in economic or social science journals, which were not included in the study. The second article presents an analysis of the intersection between the use of AI and marketing. This study conducted a systematic review of 522 articles published between 2015 and July 2023 (Labib, 2024). Although the number of articles is considerable, they were extracted solely from the Web of Science (WoS) database, while the highly recognized Scopus database needed to be taken into account. The final article covers the profound influence of emerging technologies on marketing, including AI. It draws from publications released from 2018 to 2023, showcasing the exponential growth of this technology (Kim et al., 2023). However, including articles from 2024 in the search will provide updated and advanced research. Furthermore, incorporating the Scopus database alongside the WoS will ensure a more comprehensive and robust collection of information. Therefore, this comprehensive review is of great importance to improve and contribute significantly to the field, both theoretically by studying the intersection between LLMs together with AI and methodologically by extracting information from 2010 to 2024.

The application of AI and big data models, including LLMs, have shown promising to improve and optimize usual tasks in this area. Among the many applications of LLMs, the use of these technologies can process and analyze data quickly, resulting in accurate customer group classification reports (Priyanga, 2023; Singh et al., 2023), allowing salespeople to streamline customer characterization. They also simplify segmentation and personalization processes (key aspects for connecting with potential customers) and can improve a website's visibility through keyword and metadata optimization (Dumitriu & Popescu, 2020). In addition, they have the potential to significantly improve marketing accuracy, as a study on a hotel chain company demonstrated (Gao & Zhang, 2020). AI in digital marketing can create value for organizations, improve customer engagement, and enable data-driven decision-making (Theodoridis & Gkikas, 2019). Finally, AI-based digital marketing is revolutionizing how organizations create content for advertising campaigns, generate leads, reduce customer acquisition costs, manage customer experiences, target potential employees, and make their consumer base accessible through social networks (Van-Esch & Stewart-Black, 2021).

In this systematic review, the aim is to delve into the scientific production concerning two influential topics: LLMs and their application in marketing. Our goal is to discover and examine the current research patterns, techniques, and uses of AI in marketing. This article is structured as follows: first, the approaches employed to gather and choose pertinent articles will be explained, providing specifics about our search method and inclusion guidelines. Subsequently, the data preprocessing using the Tree of Science (ToS) tool will be delineated, and the generation of graphs for data analysis. This will encompass the authors, countries with the highest number of publications, main journals, lines of research, as well as any gaps found in the study. Following this, the results will be discussed, emphasizing key trends and insights from the literature reviewed. Lastly, the synthesis will conclude with an overview of the implications of our findings for both theory and practice, providing an overview of the main pillars in this field of research.

2. Methodology

In conducting the systematic review, relevant literature was retrieved from the Scopus and WoS databases employing specific keywords such

as “LLMs,” “ChatGPT,” “AI,” “marketing,” and “advertising” in the titles to identify the initial cohort of papers (refer to Table 1). The search criteria specifically focused on subfields within the domain of “social sciences” while explicitly excluding areas such as “physics and astrophysics,” “engineering,” “medicine,” “health sciences,” and “chemistry.” The search encompassed articles published from 2010 to the present. Researchers are recommended to utilize similar parameters when conducting their own inquiries. Notably, a total of 184 documents were retrieved from Scopus and 160 from WoS. It is noteworthy that only articles were included using the search parameters “DOCTYPE” in Scopus and “DT” in WoS to identify the specific document type.

Table 1. Search parameters used in Scopus and WoS databases

Parameter	Web of Science	Scopus
Range	2010-2024	
Date	May 27, 2024	
Document Type	Article	
Words	Title: (“LLMs” OR “ChatGPT” OR “AI” OR “marketing” OR “advertising”) AND Title-Abstract-Keywords: (“branding” OR “merchandising” OR “chatbots” OR “promotion”)	
Results	160	184
Total (WoS + Scopus)	335	

Once the search queries were executed and the relevant articles identified, the next step involved downloading comprehensive information for each document, such as the title, authors, abstract, keywords, cross-references, and DOI. Figure 1 illustrates the overall process, starting from the initial search results to the eventual data analysis. The preprocessing phase is particularly intricate due to the disparate formats of Scopus and WoS. To harmonize these datasets, it was necessary to employ a combination of text mining and web scraping techniques. These methods allowed us to extract the required information and standardize the references across both databases.

The subsequent data analysis is divided into two primary sections. The first section involves a traditional scientometric analysis, leveraging advanced techniques as referenced in recent studies (Robledo et al., 2023). This includes evaluating citation metrics, co-authorship networks, and keyword co-occurrences to provide a quantitative overview of the research landscape. In the second section, the ToS metaphor was

used to identify the main theoretical contributions within the field. This approach, supported by foundational works (Botero et al., 2023; Ruiz et al., 2023), allows us to map out the most influential studies and trace the development of key ideas over time.

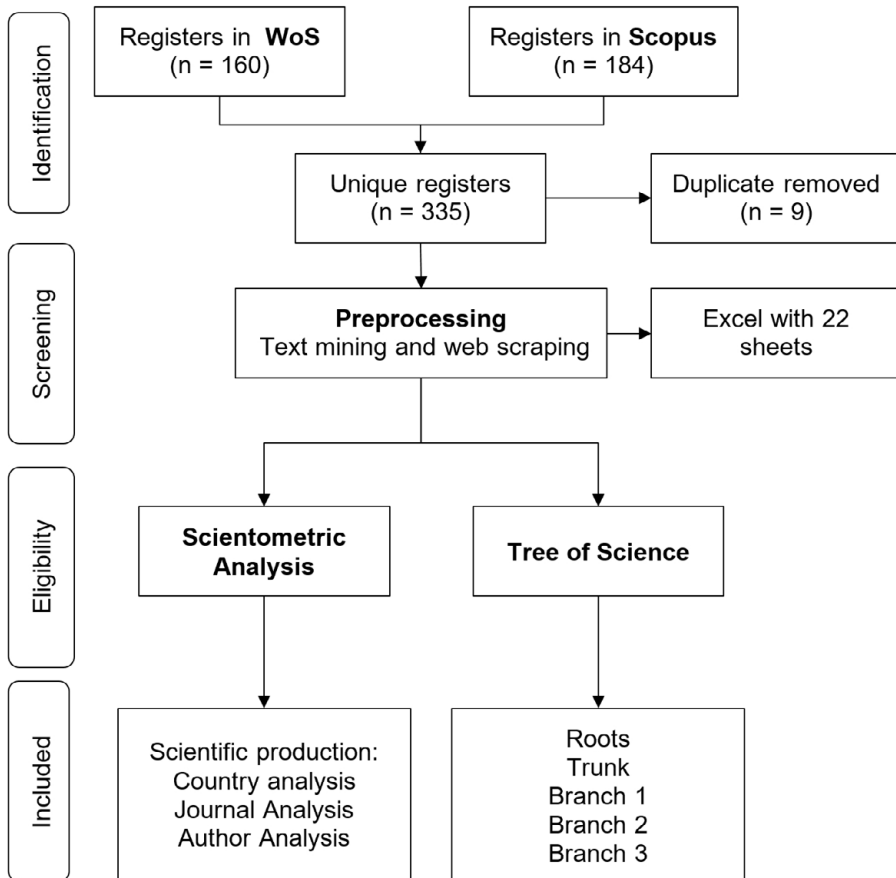


Figure 1. Flowchart of Data Collection and Analysis Process for Scientometric and Tree of Science Studies.

3. Scientometric Analysis

3.1 Scientific Production

The annual analysis of the scientific production on a topic is crucial to identify the most significant moments over time. Figure 2 shows the annual research output on the use of LLMs and AI in marketing over the

last 14 years. Until 2021, more articles were published in Scopus (green bar) than in WoS (yellow bar); however, in recent years, publications in WoS have surpassed those in Scopus. Overall, the figure reflects a changing behavior in the last four years, with an annual growth of 43.16%. Despite 2024 being only 5 months in, it has already reached half of the production of 2023, demonstrating the great current interest of researchers in these new tools and their use in marketing. At this rate, it is expected that many more articles will be produced, with increasingly significant impact.

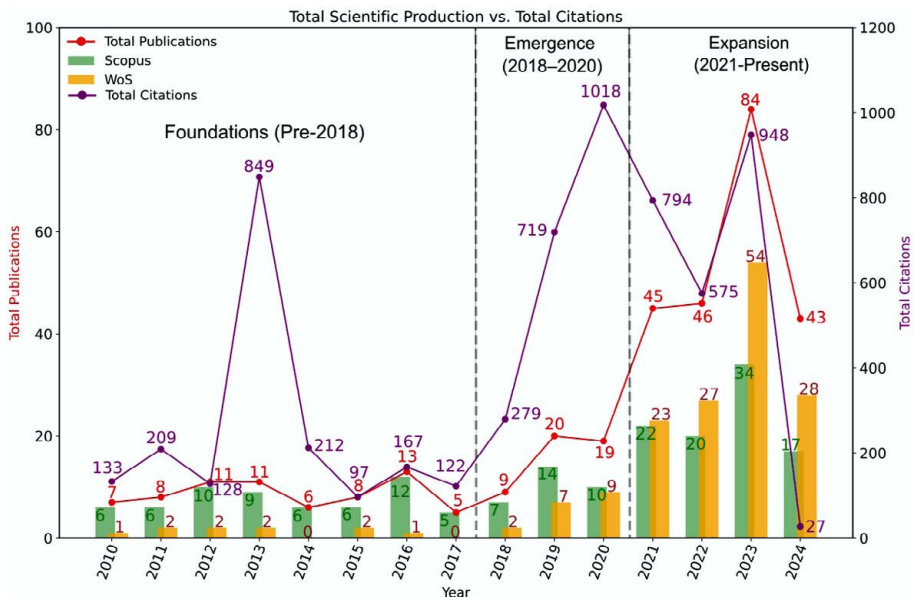


Figure 2. Annual Comparison of Total Scientific Production and Citations in Scopus and WoS between the Years 2010-2024 on LLMs and Marketing

The development of the production has been classified in three stages considering the metrics of the total number of publications together with the total number of citations. The first interval called “*Early Technological Frameworks in Digital Marketing*” where the construction of small algorithms and solid bases of the intrinsic connections between digital marketing and technological tools (Cloud Computing, Computer Algorithms and computational models) prevailed.

The second time interval was selected due to the almost exponential increase in the total number of citations as well as a gradual increase in

the number of publications, being cataloged as a period of *Emergence* and dissemination of these technologies.

Finally, during the *Expansion* period, the advancement of new technologies, AIs, and the rapid development of LLMs led to a significant increase in publications and scientific breakthroughs over the past three years. This growth has been steadily accompanied by an increase in the total number of citations.

Early Technological Frameworks in Digital Marketing (Before 2018)

Throughout this period, there were a total of 69 publications, accounting for 21% of all the scientific output studied. The number of publications in Scopus was consistently higher each year. This period marked the initial adoption of technological tools and the establishment of strong foundations for modern marketing. In 2013, there was a significant surge in citations due to the groundbreaking article by Gupta and his team, which connected cloud computing with its applications in the markets of Small and medium-sized enterprises. This article alone received 493 citations, representing 58% of the citations for that year. Additionally, there was a pivotal study conducted by researcher Lim in 2015, exploring the impact of Internet advertising and electronic word-of-mouth on consumers' perceptions and intentions in e-commerce, particularly in online group purchasing. The findings revealed that both Internet advertising and word-of-mouth had a positive influence on consumers' perceptions of value and risk when using online group buying sites.

Emerging Innovations in Marketing (2018–2020)

Since 2018, there has been a significant increase in the number of publications, totaling 48, which represents 14% of all the scientific production studied. This increase occurred over 3 years compared to the previous period. Notably, there was a surge in publications in the WoS database, accompanied by consistent growth in the total number of citations during this time. Additionally, there has been a growing focus on the utilization of chatbots as a marketing innovation tool. Van Den Broeck and his team (2019) provided valuable insights into how chatbots can blur the boundaries between support and advertising, suggesting that chatbots can effectively promote products or services more subtly and naturally. The concept of chatbots extends beyond

being just a marketing tool and is emphasized as the true path to sales success in Kaczorowska's study (2019). This article discusses the important influence of chatbots on marketing, emphasizing how they improve customer interaction and contentment. It highlights the evolving marketing environment in the digital age, especially the incorporation of chatbots into marketing plans to enrich consumer feelings and interactions.

Exponential Growth and Technological Adoption (2021 - Present)

Throughout this period, a total of 218 publications (which account for 65% of the total scientific production studied) were recorded. During this time, there has been a growing emphasis on researching the obstacles and challenges posed by these technologies. A notable focus has been on the integration of virtual assistants in small and medium-sized enterprises. Works by Kamoopuri & Sengar (2023) and Selamat & Windasari (2021) have shed light on customer perceptions of these new technologies and how the digitalization of the world benefits these innovative marketing strategies.

3.2 Country Analysis

Table 2 illustrates the scientific output concerning the use of LLMs in marketing across 10 countries, accompanied by impact metrics (measured in citations) and quality indicators (measured by Scimago quartiles). The United States demonstrates the highest productivity, accounting for 14.89% of the total, followed by China at 9.68%. In addition to its leading production, the United States also boasts a superior citation impact, accumulating almost double the number of citations compared to China. Regarding journal quality, the United States stands out with a greater number of articles published in journals in quartiles 1 and 2. This field has garnered significance in emerging countries like Malaysia and Australia due to the promising and transformative potential of these new technologies.

A recent noteworthy article from the USA authored by Professor Dogru and his team (2023) delves into the considerable opportunities that Generative AI presents for the hospitality and tourism industry. The article encourages discourse and introspection on the ethical, legal, social, and economic implications of its implementation. Similarly, a recent article from China explores how consumers' perceptions of AI chatbots

impact their cognitive and emotional states, as well as their intentions toward online travel agencies. This study, which surveyed 566 Chinese customers, finds that interactions and the quality of information provided by AI chatbots significantly enhance the trust and purchase intentions of potential tourists (Zhu et al., 2023).

Table 2. Analysis of scientific production and citations by country with quartile distribution of the number of articles in classified journals.

Country	Production		Citation		Q1	Q2	Q3	Q4
	Count	Percentage	Count	Percentage				
USA	60	14.89%	2259	12.42%	37	10	6	1
China	39	9.68%	1279	7.03%	28	2	0	0
United Kingdom	31	7.69%	1027	5.65%	18	5	2	0
India	28	6.95%	1194	6.56%	12	3	2	1
Spain	20	4.96%	750	4.12%	9	4	2	2
Italy	16	3.97%	589	3.24%	6	2	4	1
Australia	12	2.98%	773	4.25%	7	1	1	0
Germany	12	2.98	843	4.63%	4	2	3	0
Malaysia	11	2.73%	666	3.66%	7	2	0	0
U Arab Emirates	9	2.23%	87	0.48%	6	0	0	0

In Figure 3, the scientific collaboration between countries is depicted based on the affiliations of co-authors of the same article. The collaboration network exhibits three main groups, one led by the USA, one by France, and another by Australia. A recent study on collaborations between China and the USA indicates that undisclosed chatbots are just as effective as skilled employees and four times more effective than inexperienced employees in driving purchases during sales calls. However, when the chatbot's identity is revealed before the interaction, purchase rates drop by over 79.7%, as customers perceive the chatbot as less informed and empathetic (Luo et al., 2019). Furthermore, a recent study involving collaboration between Chinese and Austrian researchers introduced a multi-headed deep neural network model aimed at mitigating logical and fuzzy errors in retrieval chatbot models. Evaluation results demonstrated that the multi-headed deep neural network approach marginally outperformed selected state-of-the-art retrieval-based chatbot methods (Zheng et al., 2023).

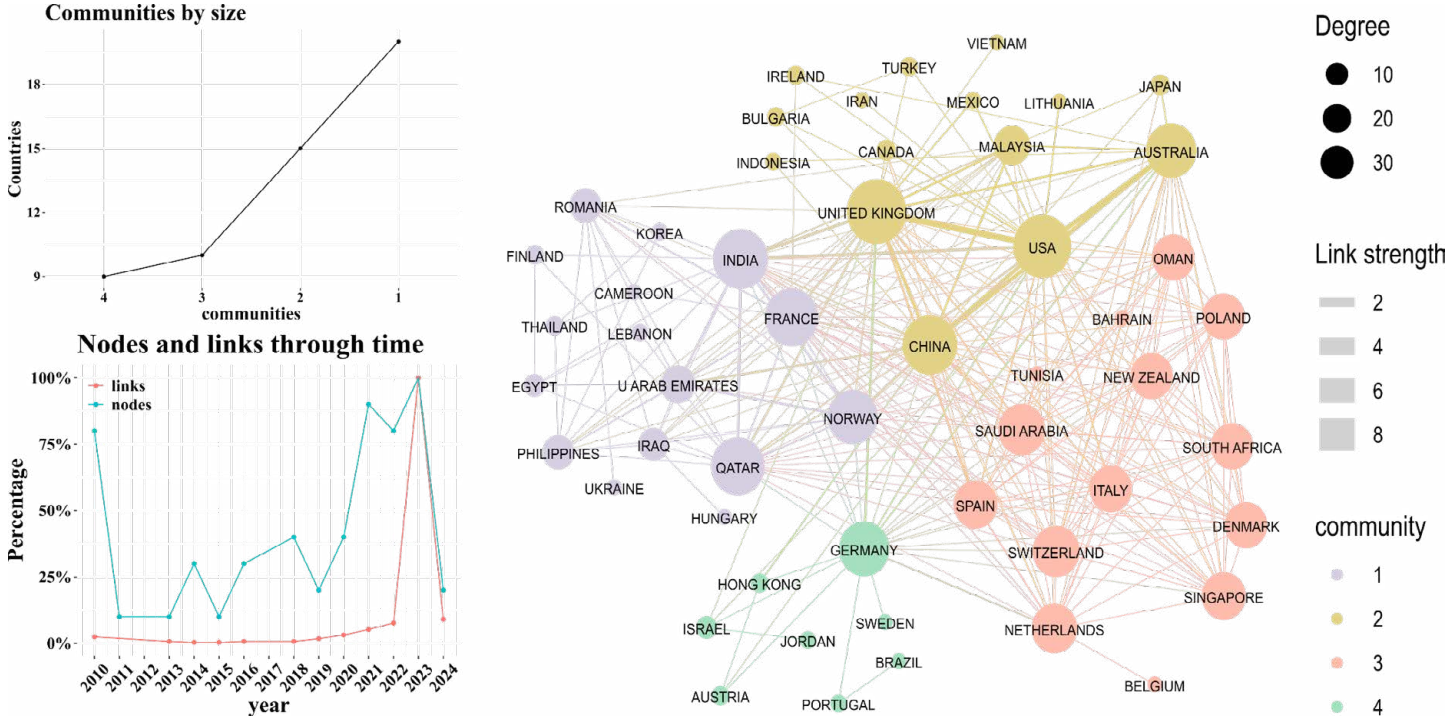


Figure 3. Global Collaboration Network Among Countries in Scientific Research.

In a recent collaborative study conducted by researchers from the United Kingdom and Qatar, an in-depth analysis was performed to investigate the impact of consumer self-concept and the incorporation of AI agents. The study aimed to unveil the influence of these factors on consumer relationships as well as the mental well-being of individuals (Alabed et al., 2024).

3.3 Journal Analysis

In Table 3, the top ten journals with the highest scientific production in the field of uses of LLMs and AI in Marketing are presented. The rankings are based on impact factor, h-index, and quartile, all of which are obtained from the Scimago database. The journal with the highest publication output is the Journal of Retailing and Consumer Services, boasting an impressive h-index of 143 and a Q1 ranking. The most cited paper in this journal is by Salminen et al. (2022), detailing the use of a trained GPT-2 (*Generative Pre-trained Transformer 2*) model for the classification of fake product reviews. Their results demonstrate that an automatic classifier can achieve this goal perfectly, outperforming human raters in accuracy and agreement.

Table 3. Top Journals by Scientific Production on LLMs with Impact Factor, H-index, and Scimago Quartile Distribution

Journal	N.º	%	Country	Impact factor	Quartile	H Index
Journal Of Retailing And Consumer Services	8	2.39%	United Kingdom	2.99	Q1	143
Psychology and Marketing	5	1.49%	United States	2.76	Q1	143
Sustainability	5	1.49%	Switzerland	0.67	Q1	169
International Journal Of Human-Computer Interaction	5	1.49%	United States	1.03	Q1	90
Technology In Society	4	1.19%	United Kingdom	2.25	Q1	88
Econtent	4	1.19%	--	--	--	9
Journal Of Business Research	3	0.90%	United States	3.13	Q1	265
Celebrity Studies	3	0.90%	United Kingdom	0.52	Q1	29
Journal Of Private International Law	3	0.90%	United Kingdom	0.12	Q4	16
Feminist Economics	3	0.90%	United Kingdom	1.53	Q1	71

One of their most recent articles, by Song et al., (2023), explores how the appreciation strategy proves to be more effective than the apology strategy in improving consumer satisfaction after recovery from a failed service in chatbot interaction. In addition, the study examines the con-

ditions under which time pressure moderates these effects, concluding that the politeness strategy has a more significant impact when time pressure is low. *Psychology & Marketing*, the second journal with the most articles in the two databases, presents a recent study investigating the influence of visual focus and anthropomorphism on customers' willingness to share information and their rejection of chatbots. Their results show that when customers perceive warmth and competence, they tend to show more trust and willingness to disclose personal information (Pizzi et al., 2023).

In Figure 4, the inter-journal citation network reveals three main communities of research. The first community delves into online consumer behavior and the impact of digital advertising (Selamat & Windasari, 2021). The second community focuses on user responses to chatbot failures (Liu et al., 2023). Lastly, the third community explores the effects of social network usage on advertising and electronic word-of-mouth (De-Frutos-Torres et al., 2021). The figure illustrates that the proportion of links compared to nodes (each journal) has increased in recent years, indicating that this area of study has gained recognition and support within the international academic community.

In Table 4, the leading researchers at the intersection of LLMs, marketing, and digitalization through technological tools such as AI are highlighted. Professor Yogesh Dwivedi holds the top position with the highest number of articles and the highest h-index. In one of his most relevant studies delves into how chatbots can integrate elements of behavioral psychology and marketing to meet customers' needs at various stages of their buying journey. This study, based on the Elaboration Likelihood Model, examines the impact of cognitive and peripheral cues on chatbot users' recommendation intentions (Balakrishnan & Dwivedi, 2021).

In the second place, Professor Arpan Kumar Kar, with the same number of publications as Professor Dwivedi, has recently researched the factors that aid or hinder the adoption of AI in companies. His study emphasizes the significance of innovation, integration of emerging technologies into organizational theories, and task automation through robotics. Kar also stresses the need to shift the focus of AI research in enterprises (Kar & Kushwaha, 2023).

3.4 Author Collaboration Network

Lastly, Professor Janarthan Balakrishnan is noted, who has collaborated with Professors Dwivedi and Kar on two notable contributions. In one study, they analyze the impact of technologies like ChatGPT not only on business but also on education and society. The authors discuss associated challenges and highlight ChatGPT's capabilities in boosting productivity, concluding by identifying areas of research necessary to address questions about knowledge and ethics in generative AI (Dwivedi et al., 2023).

Table 4. Top Researchers in Large Language Models (LLMs) by Total Articles, Scopus H-Index, and Affiliation.

N°	Author	Total Publications	H- Index	Affiliation
1	Dwivedi Y	4	105	Swansea University, Swansea, United Kingdom
2	Kar A	4	4	Department Of Management Studies, New Delhi, India
3	Balakrishnan J	3	17	National Institute Of Technology, Trichy, India
4	Chernozub O	3	4	Federal Center Of Theoretical And Applied Sociology Of The Russian Academy Of Sciences, Moscow, Russian Federation
5	Mogaji E	3	24	Keele University, Keele, United Kingdom
6	Al-Sharafi M.A	2	21	Universiti Tenaga Nasional, Kajang, Malaysia
7	Bilgihan A	2	42	Florida Atlantic University, Florida, United Estates.

Figure 5 illustrates the collaborative network of select researchers mentioned in Table 4. The network shows personal or ego-networks and is examined by components. The single-component network in Figure 5 indicates that research on LLMs and IA in marketing is currently concentrated within a specific segment of the scientific community. This aligns with the existing connections between some of the researchers presented in Table 4.

Professors Emmanuel Mogaji and Mohammed A. Al-Sharafi present an overview of AI's potential in various areas. Their study emphasizes the increasing interest and advancements in enhancing productivity and operations over the past year (Ooi et al., 2023). Emmanuel Mogaji's independent research focuses on digital transformation and the influence of AI on digital marketing practices. He specifically delves into how AI may compound challenges for financially vulnerable customers with limited access to financial systems. Furthermore, he explores the ethical dilemmas and ramifications of AI in gathering, processing, and disseminating information to these customers (Mogaji et al., 2021).

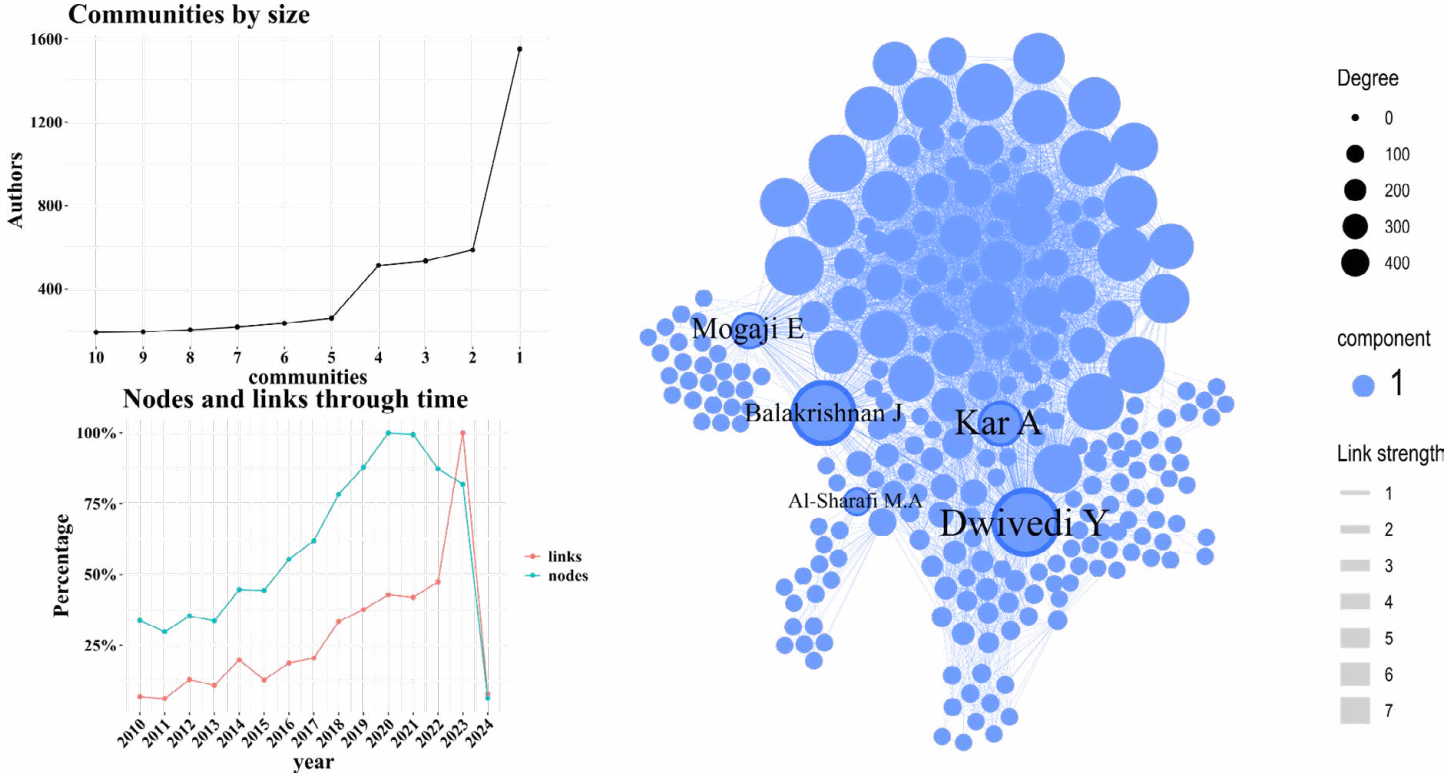


FIGURE 5. Collaborative network of leading authors with links to each other

4. Tree of Science

4.1 Root

AI has revolutionized human activities, streamlining, and improving a wide range of tasks. This study aims to analyze the impact of AI on marketing using relevant primary literature and the metaphor of roots in ToS for insightful understanding.

One of the main topics explored is the impact of chatbots on customer relationship management (CRM). Studies highlight how this customer-salesperson communication channel can function as both an efficient assistant and virtual friend, influencing the perception of brand personality and the quality of customer interaction. For example, Youn & Jin's (2021) research revealed that chatbots can mediate the psychological relationship that customers develop with brands, directly affecting satisfaction and trust in the company. For, in a way, these chatbots can represent certain types of expressions, emotions, and personalities that have an impact on customer interaction. This aspect is crucial in the so-called "sentiment economy," in which emotional connections and parasocial interaction drive the aggregate economy (Xu et al., 2021).

Balakrishnan and Dwivedi, focusing on cognitive absorption theory, highlight how a state of deep involvement and concentration in a technological activity can significantly enhance user experience and build trust in virtual retail environments. The ease of use, enjoyment, and cognitive absorption are essential factors for enhancing the adoption and utilization of chatbots in mobile shopping apps (Balakrishnan & Dwivedi, 2021). Nonetheless, the advancement of AI algorithms, exemplified by ChatGPT, has introduced new avenues for automation and the generation of high-caliber content, and although the use of these models saves time at different scales of business and marketing models, it is important to mention the problems related to their algorithmic bias (Rutinowski et al., 2024; Rozado, 2023; Ferrara, 2023).

Finally, the adoption of AI at the organizational level and its impact on business performance is another crucial issue. Research suggests that process optimization through AI can significantly improve performance in areas such as finance, marketing, and administration. The key to achieving success is contingent upon proficient data management, the presence of specialized talent, and a scalable technological infrastruc-

ture. These elements empower organizations not only to enhance their operational effectiveness but also to cultivate sustainable competitive advantages (Wamba-Taguimdje et al., 2020).

4.2 Trunk

The trunk articles are contributions to the use of LLMs and AI in marketing that support this theme. Zhou et al., (2023) analyzed Twitter posts on ChatGPT and marketing and concluded that generative AI improves marketing management, functionality, and administrative tasks. Benefits identified include support for content creation, campaign personalization, and the ability to predict trends. However, challenges have arisen, such as the need for human oversight to avoid bias and inaccuracies, and the ethical handling of personal data, highlighting the importance of implementing these technologies in a careful and ethical manner.

This part of the tree also has publications with a more specific focus. For example, Zhang & Agnihotri (2024) focuses on the implementation aspects of AI and an overview of how AI can be used in various functions of marketing activities. Chang & Park (2024) conducted an empirical study showing that ChatGPT recommendations and existing AI recommenders have a similar impact on the consumer buying process. However, ChatGPT recommendations are in some aspects superior to other existing AI recommenders.

Furthermore, Kim & Hur (2023) showed that AI personalization and anthropomorphism significantly increase perceived competence and warmth, leading to empathy. This will encourage consumers to use AI chatbots. These insights have practical value for using AI chatbots as marketing communication tools, as they serve as a guide for implementing these technologies to maximize customer satisfaction.

The algorithm developed by Blondel et al., (2008) was used to identify the branches of the ToS. The main branches of research on LLMs use in marketing are represented by the three largest groups, as shown in Figure 6.

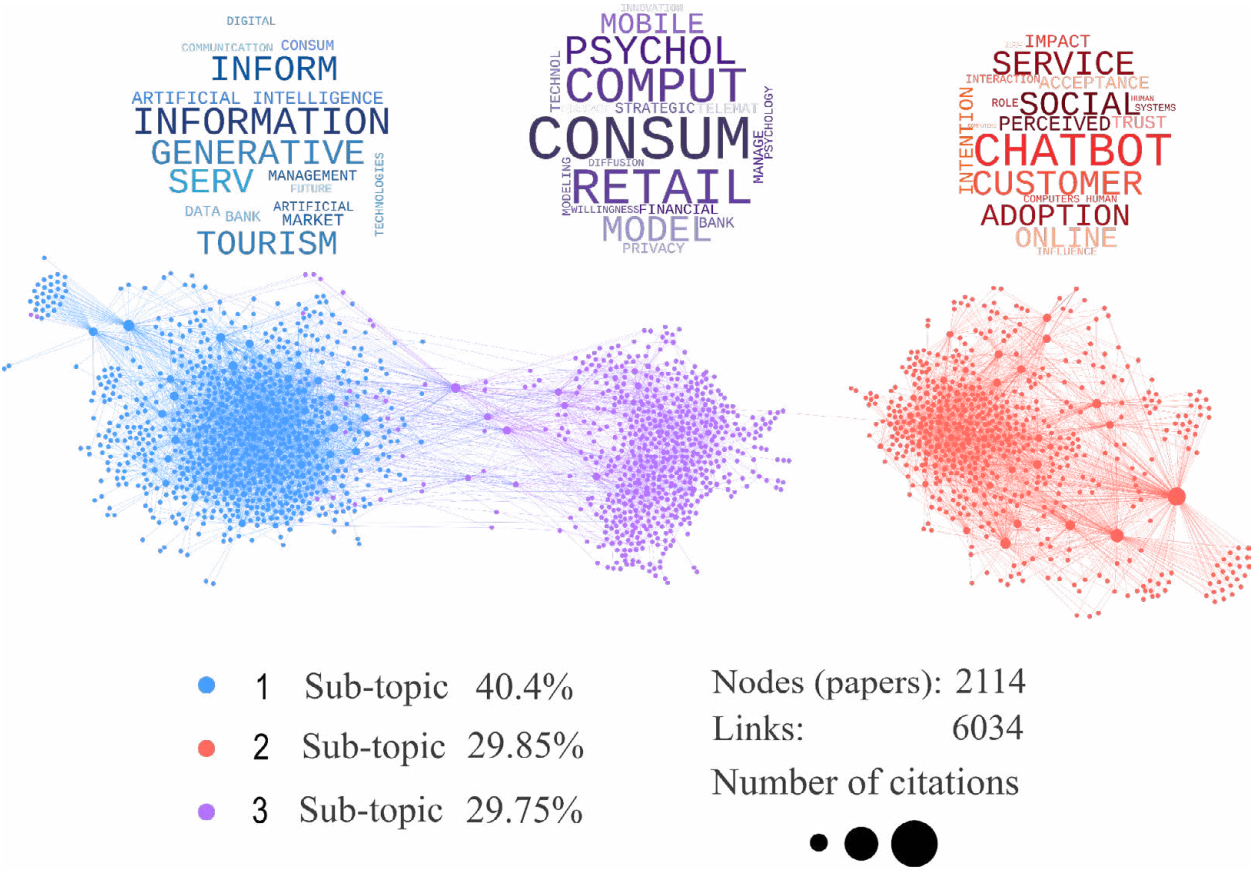


Figure 6. Citation Network Analysis of Sub-Topics in Large Language Model Research.

4.3 Branch 1: Impact of generative AI and chatbots on customer interaction and advertising

The first branch provides a broad overview of the use of generative AI and chatbots in customer interaction, the creation of advertising campaigns, the offering of products and services, and the implications of emerging technologies in organizational, industrial, and marketing environments.

For example, Jenneboer and his team (2022) conducted a systematic review on the impact of chatbots on customer loyalty. The study highlighted that for a correct implementation of this technological tool, three fundamental axes must be met: quality of the system, quality of service, and quality of information. The authors mention that chatbots that meet these guidelines generate trust and satisfaction, which in turn fosters customer engagement, even when alternatives exist. Complementarily, another study analyzes the use of generative AI, such as ChatGPT, in the creation of advertising campaigns, highlighting its potential to generate effective ads with a natural and attractive language for customers, underlining the need to use these tools in competitive markets (Gołab-Andrzejak, 2023). Wang et al., (2022) address the agility facilitated by chatbots in customer service interactions. The study suggests that the use of chatbots improves business performance and promotes the adoption of modern technologies in marketing. Finally, Li et al., (2023) examine how chatbot features influence user continuation intent through value of use, highlighting personalization and user experience as key factors.

4.4 Branch 2: Diverse perspectives on the use of chatbots and artificial intelligence in e-commerce, tourism, and finance

In the second branch, a unique perspective is proposed, covering the e-commerce, tourism, and finance sectors, without neglecting marketing, which remains the field of greatest interest.

Marjerison et al., (2022) conducted a comprehensive study to analyze the acceptance measures of chatbots in online shopping. The results show that factors such as conversational authenticity, convenience, and perceived enjoyment generate a cheerful outlook toward chatbots. However, privacy issues and the immaturity of the technology negatively influence their acceptance. Similarly, another research proposes a predictive model on customer continuity in their interactions with chatbots in

the financial technologies sector, highlighting the importance of service quality and security in maintaining customer trust (Huang et al., 2021). In the travel and tourism sector, a recent study explores the main drivers of innovation and adoption of chatbots, highlighting their potential to improve customer experience. This study highlights the importance of personalization and efficiency in customer service (Jha et al., 2023). In addition, Abdelkader (2023) examines the influence of ChatGPT on immersive customer experience in terms of marketing. His research highlights the importance of business type on customer satisfaction, suggesting that the technology should be tailored to the specific needs of each industry to maximize its effectiveness.

4.5 Branch 3: Deepen the impact of chatbots on purchase intent and customer services

The last branch presents us with an even more comprehensive analysis, determining the implications, influencing power, and effects of the use of chatbots on customer purchase intentions and services.

For example, Tanwar & Verma (2024) conducted a new study in which they conducted a bibliometric analysis of the literature on chatbots and their adoption as necessary tools in various domains. Similarly, another research examines the usefulness of chatbots by analyzing impulse buying behavior as a function of the relationship between the positive influence of chatbots and the ease of use of chatbots (Khoa, 2021). On the other hand, Tafesse & Wood (2024) addresses the use of large linguistic models such as ChatGPT in the marketplace, performing an analysis based on a framework of questions that are entered as text inputs to ChatGPT to guide the generation of results.

Conclusions

This scientometric review provides a comprehensive analysis of the use of LLMs in digital marketing, focusing on their development, impact, and practical applications. The first part of the analysis examines the scientific output, international collaborations, key journals, and author collaboration dynamics. The second part utilizes the ToS algorithm to highlight significant contributions categorized as roots, trunk, and branches.

The primary findings indicate that the academic output of LLMs in marketing has significantly increased, particularly in the last four years,

with an annual growth rate of 43.16%. Even though 2024 is only halfway through, it has already matched half of the production of 2023, indicating a growing interest in this field. The United States leads in research output, representing 14.89% of the total publications, followed by China at 9.68%. Journals such as the *Journal of Retailing and Consumer Services* and *Psychology & Marketing* are prominent, reflecting the interdisciplinary nature of this research area. Researchers from the United States also lead in citation impact and journal quality, highlighting their influential role in advancing the use of LLMs in marketing.

The analysis shows that these tools have been transformative, especially in enhancing customer experience through chatbots, optimizing social media advertising with adaptive content, and improving strategic decision-making through predictive analytics. These insights are crucial for future research and practical applications in digital marketing, indicating a continued growth trajectory and an expanding impact of LLMs in this domain.

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