

Article

Artificial Intelligence in Digital Marketing Within the Framework of Sustainable Management

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Abstract: Artificial Intelligence (AI) is not only revolutionizing digital marketing through personalized customer experiences and optimized advertising strategies, but it is also contributing to sustainability initiatives. As AI reshapes digital marketing, its impact on sustainability is becoming increasingly significant. This dynamic highlights the necessity of exploring how AI can be utilized to foster more sustainable marketing practices. This study seeks to answer the pivotal question: “How does AI impact the sustainability of digital marketing?” A systematic literature review was conducted in this study, following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework to identify various relevant articles in the areas of sustainability and marketing. Furthermore, this study examines the crucial role of AI in enhancing sustainable business practices, highlighting a significant increase in adoption among enterprises. The findings demonstrate that the effective integration of AI into digital marketing enhances environmental sustainability, supports the attainment of economic sustainability objectives, and contributes positively to social sustainability outcomes. This study contributes to the field by providing a comprehensive analysis of the intersection between AI and sustainable marketing practices and offers valuable insights for marketers, businesses, and policymakers.

Keywords: Artificial Intelligence; digital marketing; sustainability; data analysis; marketing strategies



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1. Introduction

Marketing is an organizational function and a set of processes designed to create, communicate, and deliver value to customers while managing customer relationships in ways that benefit both the organization and its stakeholders [1]. Traditional marketing is defined as an approach that aims to create and deliver value to consumers through a combination of products, pricing, distribution channels, and promotional strategies [2]. As the landscape evolved, there has been a transition from traditional marketing methods aimed at reaching broad audiences to digital marketing strategies, thereby adopting a more targeted and interactive communication model. Digital marketing refers to the promotion and sale of products and services through the Internet and other digital communication channels [3]. It is a targeted and interactive communication strategy aimed at engaging and attracting the target audience through digital technologies [4]. However, while the transition from traditional to digital marketing offers several advantages, it also presents certain challenges that organizations must navigate. According to [4], traditional marketing is characterized by one-way communication and broad audience reach, whereas digital marketing employs two-way communication, targeted campaigns, and data analytics to deliver a faster and more personalized approach. It is undeniable that digital marketing has become a cornerstone of modern business today.

Artificial Intelligence (AI) has significantly transformed various sectors, including finance, healthcare, education, and, notably, digital marketing. AI-driven digital marketing is revolutionizing how organizations create campaign content, generate leads, lower customer acquisition costs, enhance customer experiences, attract talent, and convert target

audiences on social media [5]. The global AI market size was valued at USD 638.23 billion in 2024 and is projected to grow to approximately USD 3680.47 billion by 2034, expanding at a CAGR of 19.1% from 2024 to 2034 [6]. This significant growth highlights the increasing reliance on AI technologies across various industries, indicating a strong shift towards automation, data-driven decision-making, and enhanced customer experiences.

In an era where digital marketing has become a cornerstone of modern business, AI is emerging as a game changer that not only improves marketing strategies but also paves the way for sustainability. At its core, sustainability is a multifaceted concept that seeks to balance economic, social, and environmental issues, allowing current needs to be met without compromising the future [7]. Figure 1 illustrates that sustainability requires a balanced approach. The left side shows a typical representation of sustainability as three intersecting circles, emphasizing the interconnectedness of the environmental, social, and economic dimensions. This suggests that true sustainability can only be achieved when these three aspects work in harmony. On the right side, alternative representations are presented: literal “pillars” and a concentric circles approach. The “pillars” imply that each dimension serves as a fundamental support for sustainable development, while the concentric circles highlight that these dimensions are not isolated but rather influence and integrate more cohesively.

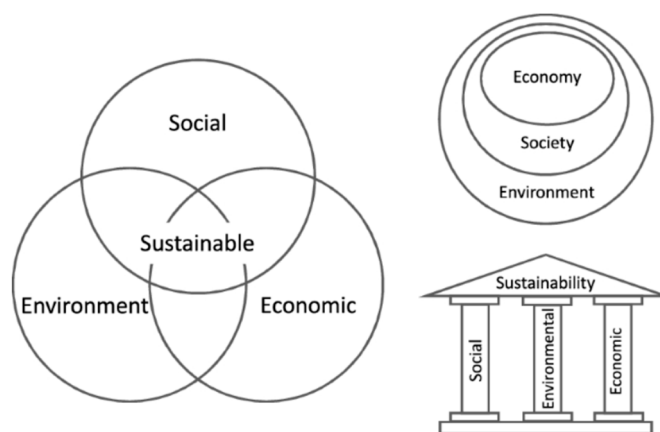


Figure 1. Sustainability triangle [8].

AI has the potential to revolutionize industries and tackle critical societal challenges, including sustainability [9]. As marketing evolves, its role expands from simply managing customer relationships to addressing broader sustainability challenges [10]. This implies that marketing now focuses not only on managing consumer relationships but also takes on the responsibility of addressing larger issues such as environmental and social sustainability. Digital marketing, product innovation, and self-efficacy are essential to achieve business sustainability [11]. Research suggests that corporate sustainability performance (CSP) is a more accurate predictor of stock prices than traditional financial measures [12]. This indicates that a company’s success in sustainability may serve as a more effective indicator for investors assessing its future value compared to financial data. In recent years, sustainable fashion brands have harnessed the power of social media to educate their audiences about environmental initiatives, taking advantage of the platform’s transparency and interactivity [13]. This shift is not limited to sustainable brands; fast-fashion companies are also increasingly using platforms like Facebook, Instagram, and Snapchat, aiming not only to showcase the latest trends but also to communicate their commitment to sustainable practices, thereby highlighting their environmental initiatives and social responsibility efforts [14,15]. This evolution in digital marketing reflects a broader trend where consumer expectations are shifting towards sustainability, necessitating a strategic adaptation from all brands.

Given that marketing and consumption are integral parts of our everyday lives, AI in marketing, following the AI-for-social-good perspective, can strive for and significantly contribute to sustainable development [16]. Sustainable marketing emphasizes that marketing should be environmentally sustainable, socially equitable, and economically viable [17]. By integrating sustainability into marketing approaches, companies can improve their competitive advantage and align more closely with overarching sustainability goals, creating a synergy that benefits both business and society [18]. This integration raises a critical question that forms the core of this study: “How does AI impact the sustainability of digital marketing?” This study aims to investigate the relationship between AI and sustainable digital marketing practices, providing a comprehensive analysis of how AI can enhance sustainability in marketing strategies. A systematic literature review was conducted following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework to identify relevant articles in the areas of sustainability and marketing.

The Materials and Methods section begins with a detailed explanation of the systematic literature review approach guided by the PRISMA framework [19]. This section outlines the criteria for selecting relevant articles on the intersection of AI and sustainability in digital marketing. Following this, the findings are presented, analyzing how AI reshapes digital marketing practices and enhances sustainable business operations while addressing the pivotal question and associated research questions. The subsequent discussion delves into the implications of these findings, exploring how the integration of AI technologies can lead to more efficient and environmentally sustainable marketing strategies. Finally, the conclusion summarizes the key insights and contributions to the field, highlighting the significant increase in AI adoption among enterprises and suggesting avenues for further research, particularly in identifying potential limitations and ethical considerations related to data privacy.

2. Materials and Methods

The main objective of this research is to explore how AI affects the sustainability of digital marketing practices through a systematic literature review. The PRISMA framework was employed to guide the review process, ensuring a structured and transparent approach to identifying and analyzing relevant literature. This framework provided a clear methodology for the review, allowing for the systematic search, selection, and evaluation of articles related to the intersection of AI and sustainability in digital marketing. To initiate the process, a key research question was established: “How does AI affect the sustainability of digital marketing?” To provide a comprehensive analysis, the study employed a qualitative research design and investigated three key sub-questions:

- (1) How does AI impact the efficiency and sustainability of digital marketing practices? This sub-question aims to assess the effects of AI on the efficiency and sustainability of digital marketing applications.
- (2) In what ways does AI contribute to the development of more sustainable digital marketing strategies? This sub-question focuses on exploring AI’s role in creating innovative and sustainable marketing strategies.
- (3) What are the advantages of using AI in digital marketing to achieve sustainability goals compared to traditional marketing practices? This sub-question aims to identify the benefits of using AI to achieve sustainability goals.

To address these questions, a comprehensive literature review was conducted using various academic databases such as Google Scholar, Scopus, and Web of Science, with key search terms including “Artificial Intelligence in Digital Marketing”, “Sustainability in Marketing”, and “Artificial Intelligence and Sustainability”. A total of 60 articles were initially identified through these databases. From these, studies unrelated to the research topic were excluded, and duplicates were removed. To ensure the reliability and quality of the review, only peer-reviewed articles were included. This process resulted in a final set of 60 relevant articles for analysis. The research model for this study, developed using the PRISMA framework, is presented in Figure 2. The review process began with the identifica-

tion and selection of relevant studies, followed by data extraction and thematic analysis. The selected articles were evaluated in terms of methodological quality, relevance to the research questions, and their contribution to understanding how AI impacts sustainability in digital marketing. Finally, the findings were synthesized and presented in the study.

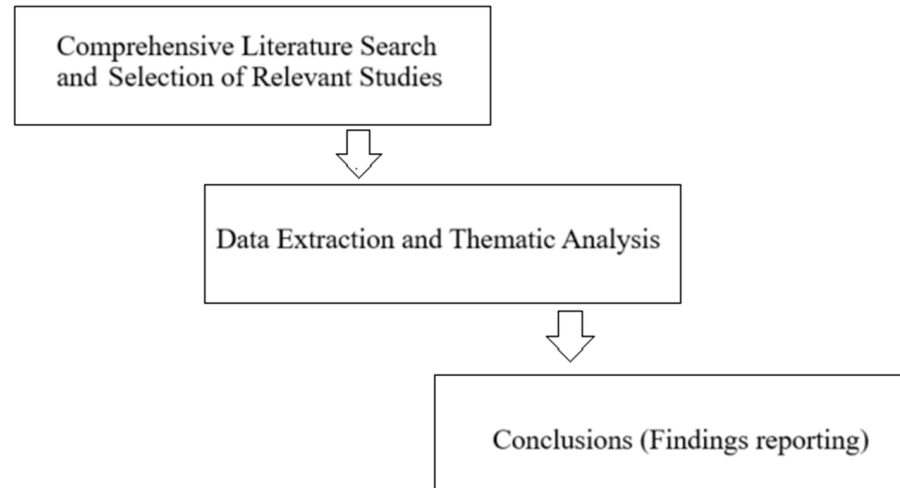


Figure 2. Proposed research model.

This study explored the crucial role of AI in enhancing sustainable business practices, emphasizing the significant increase in its adoption across various sectors. The findings aim to provide valuable insights into how AI can facilitate sustainable practices in digital marketing, contributing to ongoing discussions in both academia and industry regarding the intersection of technology and sustainability.

3. Findings and Discussion

3.1. Transition from Traditional to Digital Marketing

Marketing is being transformed by three major forces: technological trends, socio-economic trends, and geopolitical trends [20]. Traditional marketing often relies on broad, one-way communication channels such as TV, radio, print media, direct mail, and outdoor advertising. It has long relied on classic strategies such as product development, pricing, distribution, and promotion, using mass media channels like television, radio, and print for one-way communication [21]. While these methods can reach broad audiences, they often lack interactive customer engagement and feedback, which limits their ability to personalize content and optimize resource use. Since 2013, digital marketing has become the dominant global approach, significantly transforming the business landscape [22]. This shift leverages digital technologies and the internet, including mobile phones, display ads, and various digital media channels [3], to create more interactive and targeted marketing strategies.

To better understand these differences and their implications for sustainability, it is essential to examine how traditional and digital marketing strategies compare. Table 1 illustrates the fundamental differences between traditional and digital marketing, highlighting how digital marketing aligns with sustainability objectives. Traditional marketing typically involves one-way communication and general data collection, leading to inefficiencies and higher resource consumption. In contrast, digital marketing focuses on two-way communication, targeted campaigns, and data analytics, promoting more sustainable practices by reducing waste and optimizing resource use.

Table 1. Differences between traditional and digital marketing [4].

Marketing Approach	Traditional Marketing	Digital Marketing
Communication Model	One-way communication (advertising, press releases, traditional media)	Two-way communication (social media, blogs, online video)
Audience Reach	Broad campaigns and media buys targeting large audiences	Targeted and personalized campaigns
Market Research	General, non-personalized data; lengthy and costly processes	Data analytics and segmentation for more targeted and faster market research
Pricing	Focus on product or service pricing, price-based competition	Content-driven strategy, value creation, and customer engagement

To fully understand the impact of digital marketing on business strategies, it is important to examine its advantages and disadvantages. Table 2 presents the advantages and disadvantages of digital marketing, as identified by Desai and Vidyapeeth [22], based on the general characteristics of digital marketing, user experiences, and market conditions. These advantages and disadvantages highlight the multifaceted nature of digital marketing, reflecting both its potential to drive engagement and sales as well as the challenges that organizations must navigate to optimize their strategies effectively.

Table 2. Advantages and disadvantages of digital marketing [19].

Advantages	Disadvantages
Real-Time Results: Digital marketing provides the capability to view results in real time.	Internet Dependence: Digital marketing can be ineffective in areas with no internet access or weak connectivity.
Global Reach and Interaction: Digital marketing allows for global reach and interaction with potential customers.	Competition and Clutter: The high volume of advertisements online can make it difficult for ads to stand out and for brands to be noticed.
Personalized Promotion: Digital marketing enables personalized and targeted advertising.	Trust Issues: Many online advertisements may be perceived as fraudulent, impacting customer trust.
Targeting Capabilities: Digital marketing offers better targeting of audiences and precise reach.	Negative Perception: Individuals or small groups can damage the image of well-known brands.
Sales Conversion Challenges: Digital marketing often focuses on disseminating information, which may not always translate into sales due to the lack of purchasing authority among many potential customers.	

3.2. Sustainable Digital Marketing

The advancement of AI technology is shaping the future of marketing strategies [20]. Companies can leverage AI to transform vast amounts of big data into actionable insights, allowing them to develop more effective marketing strategies and achieve a sustainable competitive edge [23]. Many businesses recognize the importance of sustainable development and actively pursue this goal due to various driving forces, including stakeholder expectations, regulatory requirements, supply chain demands, ethical considerations, and potential competitive benefits [24]. Companies that fail to embrace and communicate their commitment to environmental sustainability risk damaging their brand reputation [25]. Obermiller et al. [26] highlighted that sustainable practices significantly influence the competitive positioning of brands. Sustainability marketing represents the culmination of three decades of evolution in the sustainability agenda within marketing [27]. A commitment to sustainability not only enhances public recognition but is also crucial for building a loyal

customer base, which is essential for a brand's growth and success [28]. Consumers play a pivotal role in shaping sustainability marketing strategies, as they are the primary drivers behind these approaches [29]. Guided by sustainability communication, consumers now demand not only high-quality products but also expect brands to engage in sustainable practices [30,31]. Companies need to adopt an ecosystem mindset and collaborate with various stakeholders to deliver sustainably compelling value to customers [32]. Emerging technologies, particularly AI, play a crucial role in advancing sustainability within digital marketing. AI has the potential to transform every stage of the sales process, including prospecting, pre-approach, presentation, and follow-up [33]. However, while AI, digitization, and automation are increasingly shaping key sectors for sustainability, this progress must be balanced with an awareness of potential systemic risks [34].

Digital marketing faces significant challenges in integrating sustainability, necessitating a focused approach to effectively address consumer needs and behaviors. In their study, Diez-Martin et al. [35] stated that digital marketing plays a crucial role in enhancing sustainability by addressing key challenges such as customer orientation, digital consumer behavior, and the integration of green marketing strategies. Table 3 shows that the challenges in integrating digital marketing with sustainability can be categorized into six key areas. The first challenge, Customer Orientation and Value Proposition, emphasizes the importance of understanding what customers value in sustainable products. This knowledge enables researchers to develop metrics that assess sustainability perceptions and enhance consumer experiences through targeted digital strategies, such as mobile augmented reality apps. The second challenge, Digital Consumer Behavior, highlights how sustainability significantly influences consumer commitment. This raises inquiries into which digital marketing actions can effectively encourage green purchasing behaviors and how consumers' environmental values relate to their online buying habits. The third challenge, Digital Green Marketing, focuses on the need to explore how green marketing tools function in digital environments, especially in sectors with high pollution levels. This exploration can reveal the impact of eco-labels and social campaigns on consumers' purchase intentions and loyalty. The fourth challenge, Competitive Advantage, underscores that sustainability has become a competitive advantage. This prompts questions about how digital marketing strategies can leverage sustainability to build trust and foster strong relationships with stakeholders while promoting sustainable business models. The fifth challenge, Supply Chain, points out that digital marketing plays a crucial role in supply chain management in achieving sustainability goals. Researchers can investigate how digital marketing contributes to reducing consumption and enhancing the sustainability of various industries and households. Lastly, the sixth challenge, Capabilities, stresses the importance of examining how digital marketing capabilities can foster sustainable attitudes within organizations. This can help identify which skills and innovations are most effective in driving environmental commitment.

Table 3. Digital marketing and sustainability challenges [35].

Challenge	Description
1. Customer Orientation and Value Proposition	Understanding what customers value from sustainable products is crucial, as it allows researchers to develop metrics that assess sustainability perceptions and enhance consumer experiences through targeted digital strategies, such as mobile augmented reality apps.

Table 3. Cont.

Challenge	Description
2. Digital Consumer Behavior	Sustainability significantly influences consumer commitment, prompting inquiries into which digital marketing actions can encourage green purchasing behaviors and how consumers' environmental values correlate with their online buying habits.
3. Digital Green Marketing	Exploring how green marketing tools operate in digital environments is vital, particularly in sectors with high pollution levels, as it can reveal the impact of eco-labels and social campaigns on consumers' purchase intentions and loyalty.
4. Competitive Advantage	Sustainability has emerged as a competitive advantage, raising questions about how digital marketing strategies can leverage this aspect to build trust and foster strong stakeholder relationships while promoting sustainable business models.
5. Supply Chain	Digital marketing plays a crucial role in supply chain management to achieve sustainability goals, and researchers can explore how it contributes to reducing consumption and enhancing the sustainability of industries and households.
6. Capabilities	Investigating how digital marketing capabilities foster sustainable attitudes within organizations is essential, as it can reveal which skills and innovations are most effective in driving environmental commitment.

3.3. The Role of AI in Enhancing Sustainable Business Practices

It is observed that between 2017 and 2021, ten out of the twenty enterprises studied employed AI, and of these, sixteen utilized AI to obtain benefits associated with sustainable business practices [36]. Factors like globalization have shifted consumption patterns and increased mindless consumption, leading companies such as Coca-Cola, Nestlé, and Statoil to recognize sustainability as an integral part of their business strategy [37]. Sipola et al. [36] stated that the adoption of AI for sustainability purposes has significantly increased among enterprises, with a notable rise in its utilization across various business sectors, including supply chains, production, and marketing. They emphasized the importance of a holistic approach to sustainability performance, highlighting that AI not only contributes to ecological benefits but also enhances employee safety and governance. Furthermore, they argued that the effective management of large data sets through AI is essential to achieve sustainability goals, while ethical considerations and data standards remain critical for ensuring responsible AI use.

The theoretical implications of AI usage for sustainability are summarized in Table 4. According to this table, 68% of the 25 enterprises studied had adopted AI by 2020, with this figure rising to 80% by 2021, indicating a significant increase in AI adoption. Furthermore, AI plays a crucial role in managing diverse business sectors, such as supply chains, production, and marketing, to enhance sustainability. The table also highlights that AI initiatives extend beyond ecological benefits, contributing to employee safety and governance while optimizing heating systems and identifying training needs. Additionally, AI facilitates the management of large data sets, which is essential for improving ecological performance by optimizing raw materials and energy consumption. The need for ethical AI development is

emphasized, calling for auditing and standards to ensure data quality and comprehensive supply chain assessments. Finally, the use of AI enables social impact analyses, allowing enterprises to optimize logistics and materials for improved sustainability outcomes.

Table 4. Theoretical implications of AI usage for sustainability [36].

Theoretical Implications	Summary
AI Adoption	68% of 25 enterprises used AI by 2020; this figure increased to 80% by 2021 (indicating a 12% rise).
Holistic View	AI helps manage diverse business sectors (supply chains, production, marketing) for sustainability.
Beyond Ecological Focus	AI initiatives enhance employee safety and governance by optimizing heating and identifying training needs.
Ecological Sustainability	AI manages large data sets to enhance ecological performance, optimizing raw materials and energy use.
Ethical AI Development	The need for auditing and standards in AI systems to ensure data quality and holistic supply chain assessments.
Enhanced Image and Social Impact	AI enables social impact analysis, optimizing logistics and materials for better sustainability outcomes.

The global dimensions of AI and sustainability are crucial, as AI significantly influences various sectors, including energy, environmental outcomes, productivity, and societal factors, shaping sustainable development [38]. This underscores AI's role in fostering more efficient and environmentally friendly practices that help achieve sustainability goals. However, it is also essential to address regional differences in the adoption of AI and sustainability practices. For instance, the study by Gui and Gou [39] highlighted significant disparities in household water technology adoption between rural and urban areas in New South Wales, Australia. This demonstrated that regional factors, especially socioeconomic contexts, play a vital role in sustainability practices and the adoption of new technologies. Therefore, recognizing these regional needs and conditions is critical for effectively implementing AI and sustainability initiatives, allowing various stakeholders to develop targeted strategies that align with local circumstances and enhance sustainable development outcomes.

Consumer perceptions are pivotal in shaping effective marketing strategies that integrate AI with sustainability. A key marketing task is to create and communicate perceived customer value, which involves measuring this value through marketing-mix elements while also managing the reciprocal value that customers provide through their engagement, ultimately driving satisfaction, loyalty, and profitability [40]. In this context, understanding how consumers perceive AI-driven and sustainable marketing becomes essential, as it influences their perceived value and engagement, shaping the effectiveness of marketing strategies aimed at fostering brand loyalty and ethical consumer behavior.

Consumer acceptance and adoption of AI-driven products, such as autonomous vehicles and digital personal assistants, significantly contribute to the dramatic growth of AI technologies, highlighting the value creation potential in various sectors like retail, e-commerce, and healthcare [41]. Economic, social, and environmental sustainability improves company image, customer satisfaction, and loyalty, with corporate image partially mediating their relationship with loyalty, while customer satisfaction only mediates the link between social sustainability and loyalty [42]. This also highlights the importance of understanding how consumers perceive AI-driven and sustainable marketing in enhancing these positive outcomes. Customer satisfaction is closely tied to a company's quality

management and marketing efforts, significantly influencing its future and customer-based corporate sustainability [43].

AI fosters the dynamic consumer-brand relationships necessary to create sustainable businesses and drive brand growth [44]. Chen et al. [45] provided valuable insights for practitioners looking to develop such strategies by examining how consumers perceive AI-driven and sustainable marketing. The study highlights the critical role of trust within the sharing economy, demonstrating that customer trust significantly influences engagement and loyalty in both online and offline transactions. By exploring the impact of AI on customer experiences, particularly within home-sharing platforms, the research illustrated how AI can enhance trust and foster customer loyalty. It further investigated how consumers' trust in both platforms and hosts affects their interactions, providing essential insights into how AI shapes consumer perceptions. Moreover, the study underscored the importance of integrating sustainability goals into marketing strategies, showing that AI can facilitate the achievement of these objectives.

As consumer awareness of sustainability issues grows, they increasingly expect brands to demonstrate responsible practices, making it crucial for companies to align their marketing efforts with these values. Consumers are becoming more conscious of the environmental and social effects of their fashion choices, leading to a growing demand for clothing that is sustainably and ethically produced [46]. This indicates that consumers are aware of the environmental and social impacts of their fashion choices. This growing awareness appears to drive an increase in demand for clothing produced through sustainable and ethical methods. People now consider not only how stylish they look but also the effects of the products they purchase on the environment and society. Consequently, this shift can prompt brands to adopt more responsible production processes and develop sustainability-focused strategies. In this context, ethical and eco-friendly clothing options are increasingly becoming a preference among consumers.

AI accurately segments customers based on shared characteristics such as demographics, interests, and online behaviors, enabling more precise customer segmentation [47]. This accurate segmentation allows for hyper-targeted marketing campaigns that resonate better with potential customers, ultimately improving the return on investment (ROI) for businesses. Consumers' pursuit of novelty and evolution is a key factor shaping sustainable consumption [48]. Their continuous demand for new products can conflict with the need to reduce material consumption. Therefore, both environmental and emotional needs must be considered for the future of sustainable consumption.

From all of this, the following conclusions can be drawn regarding how consumers perceive AI-driven and sustainable marketing:

- **Consumer Trust and Loyalty:** Consumers' trust in AI-driven sustainable marketing strategies significantly impacts brand engagement and loyalty. Trust enhances customer commitment in both online and offline transactions;
- **Sustainability Expectations:** The growing environmental and social awareness among consumers compels brands to adopt more responsible production processes and sustainable marketing strategies. This serves as a crucial motivation for brands to better meet consumer demands;
- **Targeted Marketing Opportunities:** AI accurately segments consumers based on demographics, interests, and online behaviors, enabling the creation of more targeted marketing campaigns. This, in turn, helps brands improve their return on investment (ROI).

3.4. Case Studies on AI for Sustainable Marketing

This section examines several case studies of companies that have successfully integrated AI into their sustainability marketing strategies. Table 5 provides examples of AI-powered sustainability initiatives from a range of companies. These data in this table highlight specific sustainable material practices, such as recyclable shoes, electric vehicle batteries made from recycled materials, and eco-friendly packaging, as well as the AI

techniques used to optimize these materials and processes. In other words, it focuses on AI-powered sustainability initiatives across industries, covering both their applications and outcomes. For example, Adidas uses machine learning to predict the performance of recyclable materials in running shoes, while Tesla uses AI to enhance battery recycling and efficiency. Companies such as Unilever and IKEA are also contributing to a more sustainable future by using AI to improve the sustainability of packaging and furniture materials across industries.

Table 5. AI-driven sustainability initiatives: examples from various companies [49].

Company	Industry	AI-Driven Sustainability Initiatives	AI Application and Results
Adidas (Herzogenaurach, Germany)	Sportswear	100% recyclable running shoe made from a single material (TPU)	Adidas used machine learning techniques to predict the performance of TPU and other sustainable materials, creating high-performance running shoes made from recyclable materials.
Tesla (Palo Alto, CA, USA)	Electric Vehicles	Use of recycled materials in battery production	Tesla applied AI algorithms to optimize recycling processes and forecast the performance of recycled materials in new batteries, increasing efficiency and reducing environmental impact.
Unilever (London, UK)	Consumer Goods	Use of recycled plastics, biodegradable materials, and paper-based substitutes	Unilever uses AI across its business to drive innovation and increase efficiency, promoting sustainability and meeting customer expectations while paving the way for a sustainable future.
IKEA (Älmhult, Sweden)	Furniture	Recycled wood fibers and agricultural byproducts	IKEA used AI to model and simulate the properties of new sustainable materials, leading to the development of environmentally friendly furniture with lower energy use and waste.

Table 6 presents various AI-driven marketing technologies and applications that illustrate how AI is transforming customer interactions, enhancing personalization, and optimizing business operations across industries. These data in this table outline how different companies are using these technologies to improve customer engagement and operational efficiency. For instance, IBM Watson & Salesforce partnered to automate decision-making processes by using AI to analyze customer preferences and shopping habits, resulting in personalized email marketing. Amazon developed a predictive AI system that anticipates customer needs, enabling cost-effective product distribution and increasing sales. Slice uses an AI system to automate email notifications about shipments, enhancing the customer experience with timely updates. Resonance tracks consumer preferences across devices and applications, providing a comprehensive understanding of consumer behavior to automate actions. Hutoma offers an AI chatbot platform that enables developers to focus on use cases while it provides the underlying neural networks. Neurence created a cloud-based AI engine that helps computers understand and interact with complex, unstructured human environments. Etsy uses AI to improve product discovery by analyzing customer preferences, resulting in more accurate recommendations. Msg.AI delivers a conversational AI platform that allows businesses to communicate with

customers via text messages, a preferred method over traditional phone calls or emails. Twiggle employs AI for e-commerce, enhancing search accuracy and overall user experience through machine learning and natural language processing. Lastly, Afiniti uses AI-driven routing to connect customers with agents in call centers based on behavior, leading to more personalized and efficient interactions. These examples demonstrate the potential of AI to analyze customer behavior, deliver personalized services, automate processes, and enhance business efficiency within sustainable practices.

Table 6. AI-driven marketing technologies and applications [50].

Technology	AI Application	AI Application and Results
IBM Watson & Salesforce	Marketing Automation	Teamed to automate decision-making processes by applying AI to shopping habits, weather forecasts, and customer preferences. Result: Automated, personalized emails to potential shoppers.
Amazon	Predictive AI System	Developed an AI system to predict customer desires and deliver products before they even know it. Result: Cost-effective distribution, increased sales, and predictive modeling.
Slice	Email Automation	AI system that examines customer inboxes and provides real-time information on shipments and default actions. Result: Enhanced customer experience with timely delivery information.
Resonance	Consumer Preference AI	Recognizes and interprets user preferences across devices and applications. Result: Compiles data to create a holistic view of consumer habits and automates connected goods actions.
Hutoma	AI Chatbot Platform	Centralized marketplace and network for AI chatbots. Result: Developers can focus on use cases and consumer experiences, while Hutoma provides the neural networks that power chatbots.
Neurence	AI Cloud Engine	Developed a cloud-based AI engine that understands unstructured human environments. Result: Computers can intuitively understand and interact with complex, real-world settings.
Etsy	Product Discovery AI	Improves product discovery by understanding customer preferences and needs. Result: Better product recommendations and customer satisfaction.
Msg.AI	Conversational AI	Delivers a conversational AI platform for business connections. Result: Enables firms to communicate with customers via text, a preferred method over email or phone calls.
Twiggle	E-Commerce AI	Uses machine learning, natural language processing, and data mining to provide automated solutions for e-commerce challenges. Result: More accurate search and better user experience.
Afiniti	AI-Driven Routing	Combines AI and big data to replace traditional time-based routing in call centers, connecting consumers and agents based on behavior. Result: More efficient and personalized customer-agent interactions.

In addition to these efforts, Unilever is leveraging AI to drive innovation, enhance efficiency, and advance its sustainability goals, particularly by integrating AI into its research and development processes to create smarter, more sustainable products [51]. But perhaps the most notable and effective use case in online marketing involves AI-based

targeting techniques that enable personalized advertising [52]. In online marketing, AI-based targeting techniques enable personalized advertising, while platforms like Amazon similarly use recommendation systems to significantly boost sales by aligning with users' preferences. For example, around one-third of Amazon's sales in the online retail market can be attributed to these recommendation systems [53]. This highlights how AI-driven recommendation systems not only enhance customer experience but also contribute to sustainable business practices by optimizing product discovery, reducing unnecessary returns, and supporting targeted marketing strategies. Shell leverages advanced technologies and innovative approaches to build a sustainable energy future, investing in renewable power sources like wind and solar, as well as low-carbon fuels such as advanced biofuels and hydrogen, to meet the growing demand for cleaner energy solutions [54]. Shell is leveraging Web3 and blockchain technologies to enhance transparency, traceability, and security in its energy transition efforts, particularly by improving the tracking of renewable energy and sustainable aviation fuel (SAF), which supports its broader goal of decarbonization and achieving net-zero emissions [55]. These examples illustrate how AI and advanced technologies not only drive innovation and efficiency but also support sustainable practices by enhancing personalization, optimizing product discovery, and contributing to cleaner energy solutions and decarbonization goals within sustainable business models.

3.5. Discussion

The research underscored the transformative potential of AI in developing sustainable digital marketing strategies. First, the study revealed the significant role of AI in enhancing the efficiency and sustainability of digital marketing practices. The findings confirmed that AI technologies improve targeting accuracy and allow for the creation of personalized marketing strategies, contrasting sharply with the broader, less efficient approaches often seen in traditional marketing. This precise targeting not only leads to more effective campaigns but also minimizes resource waste, aligning marketing efforts with sustainable practices. The review findings emphasized the integration of sustainability principles within digital marketing strategies. Companies are increasingly focusing on eco-friendly practices and ethical sourcing in their campaigns, responding to growing consumer expectations for responsible behavior. This shift is particularly relevant as consumers prioritize sustainability in their purchasing decisions, reflecting a broader trend toward ethical consumption. Businesses that communicate their commitment to sustainability can enhance their brand image and build stronger connections with their audience.

Second, the study highlighted the advantages of digital marketing over traditional methods, specifically in terms of reducing waste and optimizing resource utilization. Digital marketing strategies leverage real-time feedback and data analytics, promoting efficient marketing operations and facilitating rapid adjustments to campaigns based on consumer behavior. This adaptability is critical for businesses aiming to minimize their environmental impact while maximizing engagement and conversion rates.

Furthermore, the research underscored the importance of collaboration among various stakeholders to achieve sustainability goals. As consumers become more interested in the sustainability features of products and services, and as research on AI sustainability grows, there is a need to promote a sustainable AI lifecycle [56]. Companies need to adopt an ecosystem mindset, working alongside suppliers, customers, and communities to create compelling value propositions that reflect their sustainability commitments. This collaborative approach can lead to innovative solutions that enhance sustainability outcomes while addressing consumer needs.

This research sought to answer the pivotal question: "How does AI affect the sustainability of digital marketing?" To provide a comprehensive analysis within this framework, three key sub-questions were formulated:

- How does AI impact the efficiency and sustainability of digital marketing practices? The findings indicated that AI enhances the efficiency of digital marketing by enabling precise targeting and personalization, which reduces resource waste. By leveraging

data analytics, companies can optimize their campaigns in real-time, ensuring that marketing efforts are not only more effective but also more aligned with sustainability goals. This leads to a marked improvement in overall campaign performance while lessening the environmental footprint;

- In what ways does AI contribute to the development of more sustainable digital marketing strategies? AI facilitates the creation of innovative marketing strategies that prioritize sustainability. For instance, AI-driven insights help businesses identify consumer preferences for eco-friendly products, allowing them to tailor their campaigns accordingly. This strategic alignment not only drives engagement but also positions brands as leaders in sustainability, thereby contributing to long-term business success;
- What are the advantages of using AI in digital marketing to achieve sustainability goals compared to traditional marketing practices? The advantages of using AI in this context are substantial. Compared to traditional marketing, AI offers enhanced precision, reduced waste, and improved resource allocation. By adopting AI technologies, businesses can achieve sustainability goals more efficiently, creating campaigns that resonate with environmentally conscious consumers. The ability to analyze vast amounts of data in real time enables companies to make informed decisions, further enhancing their sustainability efforts. As AI continues to advance, its potential to drive more effective and sustainable marketing strategies becomes increasingly apparent. Sustainability is a key priority for technology companies, but little is known about how they can effectively use AI to accelerate sustainability through the development and implementation of targeted strategies [57].

Based on the insights from the three sub-questions, the findings suggested that the pivotal question regarding how AI affects sustainability revealed that AI not only enhances the efficiency of marketing strategies but also fosters the adoption of sustainable practices. Specifically, AI technologies allow for better targeting, leading to less overproduction and waste in marketing materials. Moreover, the ability to analyze consumer behavior in real time enables companies to pivot their strategies quickly, ensuring that their marketing efforts remain relevant and effective. This adaptability not only maximizes engagement but also aligns closely with sustainability goals, ultimately contributing to a more responsible approach to digital marketing. By integrating AI into their strategies, companies can enhance their operational efficiency while demonstrating a commitment to sustainable practices that meet the growing consumer demand for eco-friendly solutions.

AI has the potential to revolutionize business practices and industries while addressing critical societal challenges, such as the need for sustainable solutions to contemporary problems [9]. It has been proven that AI offers numerous benefits in advancing sustainability efforts [36]. AI integration into sustainability strategies offers companies significant potential to enhance both environmental impact and operational efficiency. As seen in case studies from Adidas, Tesla, Unilever, and IKEA, AI enables smarter material use, optimized recycling, and innovation in product development. These efforts help reduce waste, improve resource efficiency, and meet growing consumer demand for sustainable products. Looking ahead, AI's role in driving sustainability will continue to expand, offering new opportunities for businesses to tackle environmental challenges while improving performance and reducing costs. By adopting AI, companies can lead the way in building a more sustainable future. It is clear that the impact of AI on marketing and sustainability has already begun and continues to evolve.

4. Conclusions

This study investigated the transformative impact of AI on digital marketing, emphasizing its crucial role in enhancing marketing effectiveness and sustainability. The transition from traditional marketing, which often relies on broad and less measurable methods, to digital marketing facilitated by AI represents a significant evolution in marketing practices. Digital marketing leverages sophisticated technologies to create targeted, interactive campaigns, optimizing resource allocation and minimizing waste.

The results highlighted several key benefits of integrating AI into digital marketing:

- Precision and Efficiency: AI enhances the precision of marketing efforts by enabling real-time data analysis and targeted campaign optimization. This results in a more effective use of resources, reducing environmental impact compared to traditional marketing methods that often generate substantial waste;
- Personalization and Engagement: AI-driven tools facilitate the creation of personalized customer experiences, fostering deeper engagement and loyalty. By aligning marketing strategies with individual preferences, businesses can move away from broad, ineffective campaigns, enhancing customer satisfaction while minimizing resource consumption;
- Sustainability Integration: The use of AI in digital marketing aligns closely with sustainability goals. By enabling brands to communicate their eco-friendly practices and social responsibilities effectively, AI helps businesses resonate with the growing number of consumers prioritizing sustainability in their purchasing decisions;
- Challenges and Ethical Considerations: While AI presents many advantages, it also raises challenges related to data privacy and ethics. Companies must ensure that their sustainability claims are authentic and transparent to avoid pitfalls like “greenwashing”;
- Continuous Adaptation: The rapid evolution of digital technologies necessitates that businesses remain adaptable in their marketing strategies. By staying attuned to emerging trends and technologies, companies can optimize their marketing practices while addressing sustainability challenges.

The integration of AI into digital marketing not only enhances operational efficiency and effectiveness but also positions companies to better align with global sustainability efforts. Businesses that embrace AI-driven strategies can gain a competitive edge while contributing positively to environmental and social goals.

Future studies could examine the interplay between data privacy, ethics, and sustainability within the context of AI in digital marketing. A thorough investigation into how consumer data are collected, processed, and utilized is essential for building trust and supporting sustainable marketing practices. Transparency in these practices will enhance consumer confidence and foster the adoption of responsible marketing initiatives. Comprehensive studies focused on ethical issues can reveal the complexities surrounding data management. Developing strategic recommendations for brands to establish clear data policies, define explicit consent processes, and empower consumers with control over their data is highly beneficial. Tools that allow users to manage or delete their data can facilitate an ethical approach to data practices. Future studies can expand on these findings by exploring the long-term impact of AI on resource management and energy optimization, especially within the context of digital marketing and sustainability. Emerging technologies like machine learning offer significant potential to transform sustainability practices, helping businesses reduce energy consumption, optimize supply chains, and manage resources more efficiently. For instance, AI can analyze large data sets to predict demand patterns, enabling companies to minimize waste and reduce their carbon footprint. In the realm of energy optimization, AI-driven solutions can allow businesses to monitor and adjust energy usage in real time, resulting in substantial reductions in both energy consumption and costs. Additionally, integrating AI into sustainable marketing strategies can provide more personalized, data-driven consumer experiences that not only cater to individual preferences but also promote environmentally responsible choices. This multifaceted approach has the potential to make a significant contribution to a more sustainable and efficient business environment.

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