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The impact of green marketing strategies on the accounting performance: the moderating role of AI utilization

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Abstract

This paper seeks to discuss green marketing strategies that are becoming particularly popular as organizations strive to boost sustainability and accounting performance. As well as, exploring the moderating role of AI in green marketing strategy's impact on firms' accounting performance (return on assets, return on equity, and profit margins). A parallel research approach was used: a survey of firms' annual reports and content analysis of interviews with marketing managers of different companies operating in different industries. It concluded that green marketing practices, in particular the use of AI, greatly enhance the competitive performance and accounting capabilities of a company. As a powerful technology, AI can be employed to enhance green marketing practice and enable the organization to achieve sustainable growth. This research bridges the gap between sustainability and technology and demonstrates how the relationship between accounting performance and green marketing is moderated using AI in order to maintain competitor and financial advantages. This research advises organizations to emphasize being sustainable and make greater investments in AI development to improve their marketing strategy. These two concerns with sustainability and technology adoption can determine the success of organizations in the long term.

Keywords: Green Marketing, Firm Performance, Artificial Intelligence, Sustainability, Business Strategy, Accounting Performance.

1. Introduction

Over the past three decades, sustainability has become a key issue affecting business practices across the world [1]. Climate change, natural resource depletion, and pollution have generated extra pressure on organizations to turn greener [2]. This is not a fad, but a robust paradigm changes in the strategies of corporates and managing external stakeholders [3]. At the center of this change is the concept on green marketing, which is the act of marketing environmentally friendly actions like reducing carbon emissions, conserving energy, and utilizing eco-friendly material in the packaging and production processes [4].

Green marketing has emerged as a priority strategy for companies seeking to enhance their financial performance while responding to growing consumer demand and differentiating themselves in competitive markets as green businesses [5]. The adoption of green marketing approaches enhances corporate brand reputation and customer loyalty, resulting in improved financial performance [6]. However, the successful adoption of green marketing is not without challenges as it requires an integrated approach across product development, sustainable sourcing, and an open communications policy to avoid charges of "greenwashing" [7]. Meanwhile, artificial intelligence (AI) has emerged as a revolutionary instrument that optimizes the effectiveness of green marketing efforts [8]. AI assists businesses in collecting and processing vast amounts of data with a view to identifying consumers' demands and developing targeted green marketing campaigns [9]. Despite the individual impacts of green marketing and AI on business performance [10], there is limited research that investigates their combined impact on firms' financial performance [11]. This study aims to bridge this gap by developing a conceptual framework that illustrates how AI enhances the effectiveness of green marketing communication in influencing firms' financial performance.

Including AI in business processes, even in marketing, is a qualitative shift in consumer interaction [12]. AI technologies are able to provide tools that will help companies identify consumer behavior and tendencies [13]. This will help in coming up with products that meet the rising demand for environmental products, hence connecting financial performance enhancement to sustainable development goals [14]. Therefore, emerging technologies have the ability to redefine marketing strategy rules to meet the inherent objectives of sustainability programs. Various issues in marketing, sustainability, and emerging technologies like artificial intelligence converge in affecting the financial performance of firms [15]. From the legitimacy theory perspective, a company's success depends on society's acceptance and support, which can be achieved by improving the company’s image in front of stakeholders [16]. Green marketing strategies contribute to strengthening relationships with stakeholders, thus legitimizing the company's operations, and indicating that the company's practices are compatible with societal requirements regarding environmental conservation, which contributes to improving its profitability [17].

To leverage emerging technologies, including AI, to enhance financial performance, companies must understand how they can benefit from using AI technologies in their operations [18]. Although the integration of AI technologies has a positive impact on corporate performance, this requires balancing the goal of enhancing financial performance with the ethical concerns surrounding the use of AI technologies [19]. Therefore, the importance of the study is highlighted in several aspects. First, by exploring the role of AI in green marketing strategies that support companies in their quest to enhance sustainability and accounting performance, sustainable marketing practices can be promoted, and new environmentally friendly marketing models can be uncovered. Second, this study provides useful insights into how AI can be leveraged to enhance marketing practices aligned with the Sustainable Development Goals without compromising companies' financial performance. Third, this study may demystify innovative marketing practices and allay companies' concerns about the consequences of using AI, thus helping companies adapt their operations to the major shifts in emerging technologies.

1. Literature review

1.1 The importance of sustainability in modern business

The contemporary business environment changes have led to the promotion of sustainability to the level of business strategy because of its importance in resolving global issues [20]. Organizations are gradually concentrating; realizing sustainable approaches are not only moral responsibilities but also business requirements [21]. Sustainability is about the future and is a source of competitiveness, growth opportunities, and the creation of tailored long-term solutions [22]. Especially, consumers tend to pay attention to the environmental impact when it comes to buying goods and services by associating certain perks with the eco-friendliness of the products and the brands they consume [3]. In this shift, can observe many industries, including consumer goods and retail, automotive, and advanced technology [23]. Most writers have discussed consumer demand for sustainability in the recent literature. For example, a Nielsen Global Survey published in 2018 showed that 81 percent of consumers across the globe had a firm belief that businesses should act to protect the environment [24] (. These factors and increased awareness in the community bring with them the change in preference of customers for such products and subsequently force companies to incorporate green factors into their business models to entice customers. Moreover, sustainable business interactions can generate greater customer loyalty since customer-oriented people seek to accomplish their objectives with companies that do not cause harm to the external environment [3]. Governments and other regulatory bodies are now putting in place policies that force organizations towards sustainability in emissions, waste, water and energy policies provide a good example by the EU and emission carbon and energy productivity standards [25]. Sustainability creates innovation by promoting the efficient use of resources, developing sustainable products, and reducing potential costs, thus enhancing financial performance [26]. Similarly, Al-Okaily et al. [27] highlight that advanced digital technologies play a crucial role in enhancing sustainability within supply chains, improving operational efficiency, and driving financial growth. Amidst these challenges, it also fuels technological innovations since firms adopt new sustainable strategies [28].

Sustainability assists firms in coping with environmental issues such as climate change and scarcity of resources. It is important to understand that sustainable companies are more effective at getting back on track after disruptions, according to Zraqat et al. [29], market shareholders start paying attention to environmental and social governance factors in business operations and associate them with higher returns. Singhania et al. [30] explores the relationship between sustainability performance and financial performance of private companies using market and accounting performance measures, the study finds that sustainability performance is positively related to financial performance.

2.2 Green marketing strategies

Green marketing has emerged as a popular trend in the recent past as organizations pay attention to environmental issues and consumers' awareness of sustainable products [4]. This approach entails emphasizing the environmental impact of the concerned products and services which can include energy conservation as well as the use of green energy, matters of sustainability, and bio-degradable packing among others as prevailed [3]. Green marketing has various objectives that incorporate the promotion of a firm's corporate image, appeal to consumers with environmental concerns, and being in line with the appropriate legal frameworks [31]. Through well-implemented and efficient green marketing strategies, customer loyalty is enhanced coupled with boosted sales and improved financial performance [23]. For example, Meet et al. [32] examine that the green marketing had a positive impact on consumer purchase intentions where consumers are conscious of the environment. This is endorsed by Yadav and Pathak [33] who pointed out that consumers are instigated to pay extra costs towards green products, this coincides with the financial implication of green marketing strategies. Besides, green marketing can be a major source of competitive advantages through using Techniques that help a firm to stand out of the competitors. Based on the insights from Leonidou et al. [34], the implementation of green marketing concepts in the marketing strategy of any firm benefits the firm in attaining a better market portfolio and sustainable corporate profits. However, the major problem is to ensure that these green claims are genuine and do not fall under the category of the false green image also known as greenwashing, which harms the company and consumers [25, 32].

2.3. Green marketing & financial performance metrics

Financial performance is linked to achieving maximum results by improving returns to ensure the facility's ability to achieve its financial goals [35]. Improving financial performance depends directly on the ability of the organization to benefit from available resources and follow strategies that ensure their superiority over competitors [22, 36]. Research has also revealed that the firms who have successfully integrated the green marketing strategies can receive enhancements in these financial indicators [5]. Al-Okaily [37] shows that e-satisfaction boosts e-loyalty, suggesting that AI-driven green marketing can similarly enhance customer trust and financial performance. For instance, in a study by Amoako et al. [4], the authors concluded that companies adopting green marketing strategies aligned with the SDGs improve brand loyalty and hence financial sustainability. Organizations implementing sustainability policies can realize improved performance since sustainability enables a company to reduce costs of resource use while also expanding its market share in products from sensitive consumers to environmental conservation [38]. In addition, Lozano [39] posits that it is possible to generate economic and social value by embedding sustainability into the firm’s development plan. Still, green marketing may in general have different effects on financial performance depending on the industry, size, or the overall conditions in the market. For example, using primary data, Kumar [40] states that it is difficult for small firms to implement superior green marketing strategies and gain remarkable financial returns compared with larger firms.

2.4. Role of artificial intelligence in marketing

Marketing is rapidly impacted by AI comprising of tools such as machine learning, natural language processing, and predictive analytics [41]. Similarly, Al-Okaily [42] highlights how digital transformation has played a crucial role in sustaining the adoption of FinTech products post-COVID-19. This supports the argument that AI-driven innovations can enhance marketing strategies, making green marketing more effective and financially viable. Regarding the usefulness of AI in marketing, it is possible to note the ability of machines to process vast amounts of data to identify customer needs, ways to improve marketing initiatives, and trends in the market that may become clear in the future [43]. In the field of marketing, AI can help to increase the efficacy of the campaigns by giving messages to the right audience. In research conducted by Kumar et al. [7], it was revealed that marketing through artificial intelligence results in high engagement and customer stick rates. AI can also enhance advertising budgeting because it can detect and analyze which channels and at which time of the day are the most appropriate for advertising communication [44]. Thus, concerning green marketing AI can enable firms to target and appeal to more environmentally conscious consumers better [45]. Through evaluating data on consumers’ preferences, their past purchases, and their social media activity, AI can categorize the market and deliver green marketing messages that are relevant for audiences that will find them persuasive [46]. This targeted approach can improve the effectiveness of green marketing initiatives and improve the monetary value of these kinds of communications.

The use of AI in green marketing is, therefore, a favorable opportunity through which firms can achieve the enhancement of their financial performance while also embarrassing the tenets of sustainable environmental marketing [47]. AI-driven green marketing strategies enhance firms' sustainability efforts and ensure long-term consumer engagement [41]. The real-time tracking of the green marketing campaign performance would be beneficial for firms since they can use this feature of AI to adjust and enhance the marketing campaigns’ effectiveness on a regular basis [11]. Furthermore, in the study by Wedel and Kannan [48], it is stressed that AI can help to optimize the role of marketing strategies because of increased targeting and personalization possibilities. From the perspective of green marketing, AI can assist firms in ascertaining the appropriate consumer segments that would likely respond to messages revolving around the benefits to the environment of firms’ products [5]. This can lead to higher conversion rates and increased sales of the products by the business organization. In addition, AI can assist firms with managing their resources well, since they can get useful information on customers, markets, and competitors. This assists the firms to be able to distinguish on the best strategic position to make them when it comes to issuing out their marketing budget thus being in a position to attain better return on investment [31]. All in all, AI must be embraced by firms to help improve the effectiveness of green marketing strategies while increasing the firms’ ultimate financial performance.

2.5 Research hypotheses

H1: The level of green marketing strategies used has a positive impact on firms’ accounting performance.

H2: AI moderates the relationship between green marketing strategies and firms' accounting performance in a positive manner.
H3: A significant level of transition on customer touch-point interaction and sales increment for the firms using AI-based green marketing themes as compared to the firms that do not use AI is expected.

2. Research methodology

3.1. Research design

The research uses both secondary and primary ways of data collection, which include surveys and financial data analysis to assess the effectiveness of green marketing strategies and the use of AI in firms' financial performance. This opens a way to receive the deeper and numerical data of the research problem along with the qualitative information from the industry's practitioners.

3.2. Data collection

3.2.1. Quantitative data

Recorded data in this study is mainly obtained from the annual financial statements of firms in different industries. Thus, the set of all analyzed organizations consists of enterprises that have implemented green marketing strategies and applied AI. These firms are known through industry reports, sustainability rankings, and surveys of the adoption of AI. The financial ratios considered in this study are, therefore, Return on Assets (ROA), Return on Equity (ROE), and profit margins. These indicators offer an overall assessment of the firm's financial health and performance. The time frame of data collection is from 2018 to 2022, to ensure that both short-term and long-term consequences of green marketing and AI are included.

3.2.2. Qualitative data

In addition to quantitative information, qualitative information is sought from semi-structured interviews with the sampled firms' marketing managers and executives. Such interviews are meant to identify the strategic objectives of adopting green marketing and AI, the problems encountered, and the expected advantages. The interviews also aim to determine how and whether AI is applied in green marketing communication and its efficiency in the campaigns. The purposive sampling methodology is adopted concerning the interview participants, to increase the variability of the coverage of industries and firms. The interview questions cover aspects of the implementation process, applied AI tools, and the effects of green marketing activities.

3.3. Analytical framework

3.3.1. Quantitative analysis

The quantitative analysis entails the use of regression analysis to evaluate the impact that green marketing has on the company's performance. Financial performance measures are contained in the regression analysis as dependent variables while green marketing activities as independent variables. Controlled variables such as firm size, industry, and market conditions are included to account for external factors that may influence financial performance. The moderating effect of AI is examined by incorporating interaction terms between green marketing strategies and AI adoption in the regression model [49] emphasizes the role of big data analytics in enhancing financial decision-making, supporting the use of AI-driven models to assess the impact of green marketing on firm performance. This allows the study to determine whether the presence of AI strengthens or weakens the impact of green marketing on financial performance. The regression models are specified as follows:

$$\text{Financial Performance}_{it} = \beta_0 + \beta_1 \text{Green Marketing}_{it} + \beta_2 \text{AI Adoption}_{it} + \beta_3 (\text{Green Marketing}_{it} \times \text{AI Adoption}) + \sum \beta_k \text{ control variables}_{it} + \in_{it}$$

where, Financial Performance $_{it}$ represents the financial performance indicators (ROA, ROE, profit margin) of firm i at a time t. Green Marketing $_{it}$ is a measure of the firm's green marketing strategies. AI Adoption $_{it}$ indicates the extent of AI adoption in the firm. Control variables $_{it}$ includes firm size, industry type. $\in_{it}$ is the error term.

3.3.2. Qualitative analysis

The qualitative data from the interviews is analyzed using thematic analysis. This involves coding the interview transcripts to identify common themes and patterns related to the implementation and impact of green marketing and AI. The themes are categorized into key areas such as strategic motivations, implementation challenges, integration processes, and perceived benefits. Qualitative insights are used to complement and contextualize the quantitative findings, providing a richer understanding of how green marketing and AI interact to influence accounting performance.

3.4. Validation and reliability

To minimize the method bias and maximize the validity and reliability of the study the following measures are taken. In regard of quantitative data, sound methods of statistic data analysis are used, and the data is further confirmed with various sources. For non-numerical data, regarding the interview, a pilot interview is conducted with a small number of respondents to modify the questions. The cross-system approach helps to improve the credibility of findings when one relates the qualitative results to the quantitative findings.

3.5. Ethical considerations

The issue of ethics is very highly valued throughout the research process and observed in practice. Written consent is taken from all the respondents who participate in the interviews, and they are assured of the anonymity and the confidentiality of their responses. The information gathered is not used for any other purpose not defined by the study only and is kept very confidential to avoid participants' recognition.

3. Results

4.1. Quantitative results

The quantitative analysis included the use of multiple regression equations to test the hypotheses put forward as part of the study. The general details are presented in Table 1.

Table 1. Regression results

Dependent Variable	**ROA**	**ROE**	**Profit Margins**
Independent Variables	**Coeff. (Std. Error)**	**Coeff. (Std. Error)**	**Coeff. (Std. Error)**
Green Marketing (GM)	0.072** (0.034)	0.089** (0.041)	0.063* (0.027)
AI Adoption (AI)	0.057* (0.029)	0.061* (0.032)	0.048* (0.023)
GM x AI Interaction	0.015* (0.008)	0.021** (0.010)	0.017* (0.007)
Firm Size (Control)	0.033 (0.025)	0.041 (0.028)	0.038 (0.022)
Industry Type (Control)	0.045 (0.027)	0.052* (0.031)	0.047 (0.025)
Model Statistics			
R^2	0.478	0.514	0.462
Adjusted R^2	0.463	0.501	0.448
F-statistic	28.45**	31.22**	26.78**

Note: **Significance levels:** *$p < 0.05$, **$p < 0.01$

4.2. Qualitative insights

Primary research data was obtained from selected and interviewed marketing managers of firms that employ green marketing strategies and AI. Globally identified key themes are depicted in the table below; Table 2.

Table 2. key themes from qualitative analysis

Theme	Description
Strategic Motivations	Firms adopted green marketing and AI to enhance brand image, meet regulatory requirements, and respond to consumer demand for sustainable products.
Implementation Challenges	Challenges included high initial costs, integration difficulties, and the need for specialized skills in both green marketing and AI technologies.
Perceived Benefits	Benefits included improved customer engagement, increased sales, cost savings, and enhanced data-driven decision-making capabilities.
Industry Variations	Firms in technology and consumer goods sectors reported more pronounced benefits from AI integration compared to firms in traditional manufacturing.
Future Outlook	Firms plan to further invest in AI technologies to optimize green marketing efforts and expand sustainability initiatives to other areas of their operations.

4.3. Interpretation of results

H1: As such, it can be noted that all the coefficients generated by the green marketing variable are positive for ROA, ROE, and Profit Margin thereby supporting $H1$. The implication of this is that most firms that adopt the green marketing strategies have a tendency of experiencing better financial performance.

H2: The interaction terms which are positive and statistically significant signify that green marketing metrics are positively further amplified by AI for the financial performance thus validating H2. It also means that the effects of green marketing are enhanced by AI and thus the role of AI is indeed of a moderate nature.

H3: From the qualitative data, it is found that there is a higher improvement in the green marketing communications and sales enhancement among the firms using AI integration, which supports the H3.

Our findings indicate that the use of AI technologies helps companies analyze customer trends regarding their perceptions of sustainability practices. The analytics provided by AI technologies, through understanding consumer behaviors and preferences, will help companies choose the appropriate marketing mix, thereby increasing their market share, which will be reflected in their financial performance. Emerging technologies, with their in-depth consumer behavior analytics, may prompt companies to rethink their marketing strategies to align with the core objectives of sustainability initiatives, thereby enhancing customer loyalty.

5. Discussion

5.1 Theoretical contributions

Recent studies have highlighted the role of AI in sustainable finance through enabling investors to collect, analyze, and interpret large quantities of environmental, social, and governance (ESG) data, thereby facilitating more effective decision-making [50]. This capability is consistent with our findings that AI-driven analytics enhance consumer targeting and campaign personalization, leading to improved financial performance.

5.2 Managerial implications

Application of AI in green marketing activities not only enhances optimality of sustainability efforts but also enhances the ESG performance of companies. For instance, Li et al. [51] found that the implementation of AI improves the ESG performance of companies and thus managers ought to invest in AI-based tools to augment their sustainability efforts. AI can also enable companies to measure marketing performance, recommend, and optimize marketing campaigns, hence enhancing overall marketing efficacy [52].

5.3 Industry variations and challenges

While the benefits of AI integration are evident, there are still obstacles, particularly in traditional manufacturing sectors. Skyrocketing upfront costs, cumbersome integration processes, and insufficient specialized expertise can slow down AI adoption. Additionally, greenwashing-related issues—wherein companies may overstate their environmental efforts can negatively impact bottom lines. However, internal audit quality and the use of digital technology can intervene in this effect, suggesting that firms need to tighten their internal controls and make use of technology to authenticate the legitimacy of their green marketing claims [53].

6. Conclusion

In conclusion, the integration of AI into green marketing strategies significantly enhances firms' financial performance and ESG outcomes. By leveraging AI-driven analytics and automation, firms can optimize their sustainability efforts, improve marketing effectiveness, and ensure the authenticity of their environmental claims. Given that financial transparency plays a pivotal role in business sustainability, Alkayed and Al-Okaily [49] argue that XBRL adoption has significantly improved financial transparency in emerging markets. This aligns with the findings of this study, which emphasize the importance of AI in enhancing transparency in green marketing strategies. Al-Okaily et al. [54] emphasize that data-driven technologies enhance firms' adaptability, reinforcing AI's role in optimizing green marketing for financial and sustainability gains. Future research should expand the scope to include a diverse range of industries and adoption stages to further elucidate the evolving role of AI in sustainable business practices.

6.1 Limitations and Future Research

However, one should consider some limitations of the study presented in the paper. The sample only consists of firms that have implemented green marketing and AI strategies hence the study might be affected by self-selection bias. Future research could heighten the sample to engage more firms at different levels of adoption to increase the width of the research. Also, it is confined to the analysis of financial performance measures, although there are many more qualitative and tangible advantages of green marketing and AI implementation. As for the limitations of the study, there is a need to investigate other outcomes including customer satisfaction, buyer loyalty, and the effect on the environment for a more extensive understanding of the improvements that can result from introducing the presented framework. While this study provides valuable insights, it primarily focuses on firms that have already adopted green marketing and AI strategies, which may introduce selection bias. Future research should encompass a broader range of firms, including those at various stages of adoption, to gain a more comprehensive understanding of the transition process. Additionally, exploring the role of AI in sustainable finance and its impact on firms' ESG performance across different industries could provide deeper insights into the long-term implications of AI integration in sustainable business practices.

Declaration of competing interest

The authors declare that they have no known financial or non-financial competing interests in any material discussed in this paper.

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Author contribution

"Al-Ahmed, H.: analysis and interpretation of results, Alshaketheep, K.: draft preparation, Shajrawi A.: study conception and design, Mansour, A.: data collection, Zraqat, O.: analysis and interpretation of results, Deeb A.: draft preparation, and Hussien, L.: data collection. All authors approved the final version of the manuscript"

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