Chapter 1

Digital Transformation and Environmental Sustainability: Environmentally Friendly Digital Marketing Solutions

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Abstract

This study examines the impact of digital transformation on environmental sustainability from a digital marketing perspective and explores green digital marketing solutions. Digital transformation plays a strategic role in achieving environmental sustainability goals while reshaping the business models and marketing processes of businesses. Although the relationship between digital transformation and sustainability is discussed in various dimensions in the literature, there is no holistic framework on how digital marketing can support environmental sustainability. Therefore, this study aims to fill this gap by categorizing the digital transformation process in the field of marketing from an environmental sustainability perspective. In this context, document analysis, one of the qualitative analysis techniques, was used in the study and 45 documents selected from databases such as Web of Science, Scopus, Ebsco and Google Scholar by purposive sampling method were analyzed to examine the digital transformation process in marketing from an environmental sustainability perspective and to present a holistic approach for businesses and researchers who want to develop sustainable marketing strategies.

1. Introduction

Digital transformation is the process of redesigning and developing business models, processes, and organizational structures of businesses using digital technologies. This transformation, which covers many areas from procurement to production, from customer relations to management processes, enables businesses to become more efficient, flexible and competitive (Plekhanov et al.,

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2023). Digital transformation also acts as an important catalyst in achieving the environmental sustainability goals of businesses.

One of the most important components of digital transformation is the digitization of marketing processes (Desai and Vidyapeeth, 2019: 196), which is referred to as digital marketing. Digital marketing provides businesses with a competitive advantage by focusing on analyzing consumer behavior, delivering personalized content, and increasing customer engagement. In today's world, where information and communication technologies have been transformed into disruptive innovations, businesses are trying to communicate with customers in the most efficient way (Panda & Mishra, 2022) by using websites, social media applications, and mobile platforms (Al-Azzam & Al-Mizeed, 2021) and aim to positively influence customers' purchasing decisions (Ziółkowska, 2021). Digital marketing activities also support sustainable marketing activities by minimizing the negative impact on the environment in marketing processes through the use of digital marketing tools such as digital advertising, email marketing, marketing through social media tools, search engine optimization (SEO) and search engine marketing (SEM) applications, and content marketing.

The contribution of digital transformation to sustainable marketing processes is largely driven by data-driven strategies and the effective use of digital tools. Digital marketing tools such as SEO

and SEM help businesses promote their sustainable products and services to a wider audience and increase the visibility of environmentally friendly brands. Trujillo and Perez (2022) emphasize that digital marketing plays a critical role in the transition to sustainable business models, and that businesses can more effectively fulfill their environmental responsibilities by improving their digital capabilities. In particular, social media marketing and content strategies stand out as important tools to raise consumer awareness and promote sustainable consumption habits. However, it is also noted that the impact of the competitive factor on sustainable marketing strategies has not been clearly demonstrated (Hilali et al., 2020).

It is noted that the COVID-19 pandemic has accelerated digitization processes and made sustainable marketing strategies more critical (Esses et al., 2021). During the pandemic, businesses have seized new opportunities to deliver their sustainable products and services directly to consumers through more effective use of online marketing channels. Data analytics, personalized advertising, and artificial intelligence-based marketing solutions used to increase the visibility of sustainable products, especially on e-commerce platforms, can change consumer habits and promote sustainable consumption.

Digital transformation is supporting sustainable marketing not only in manufacturing and services, but also in agriculture and retail. Smart agricultural technologies and digital supply chain management promote sustainable food production, while digital solutions such as data analytics and blockchain enable consumers to better understand the environmental impact of products (Hrustek, 2020). In addition, digital marketing practices in developing countries contribute to sustainable development and enable small businesses to offer sustainable products to global markets (Costa et al., 2022).

One of the most important contributions of digital technologies to sustainable marketing is the process of educating and guiding consumers. Social media campaigns, content marketing strategies, and effective digital advertising models that allow green products and sustainable business practices to reach a wider audience increase consumers' tendency to prefer sustainable products (Truong, 2022). In particular, the implementation of green marketing strategies through digital channels contributes to the fulfillment of businesses' environmental responsibilities and supports the growth of the sustainability-oriented market by increasing consumer awareness.

In the education sector, digital transformation can contribute to environmental sustainability through integration with sustainable marketing strategies. In particular, online education platforms are seen as a critical tool in the transition to sustainable business models (Mohamed Hashim et al., 2022). Digital education solutions and smart campus applications help to reduce environmental impacts by increasing the sustainability awareness of both businesses and individuals (Trevisan et al., 2024).

Various dimensions of the relationship between digital transformation and environmental sustainability are discussed in the literature. However, the sectoral fragmentation and the lack of a holistic approach to the theoretical framework are considered significant shortcomings of research in this area (Guandalini, 2022). The impact of digital transformation on sustainable marketing is increasingly being explored. In particular, through digital marketing strategies, it becomes possible to promote sustainable consumption behaviours and disseminate sustainable marketing practices that reduce environmental impacts (Feroz et al., 2021). In this context, this study seeks to answer the following research question in order to develop a sustainable marketing strategy by evaluating the contribution of digital transformation to sustainable marketing processes within a holistic framework and revealing the implementation components of this strategy.

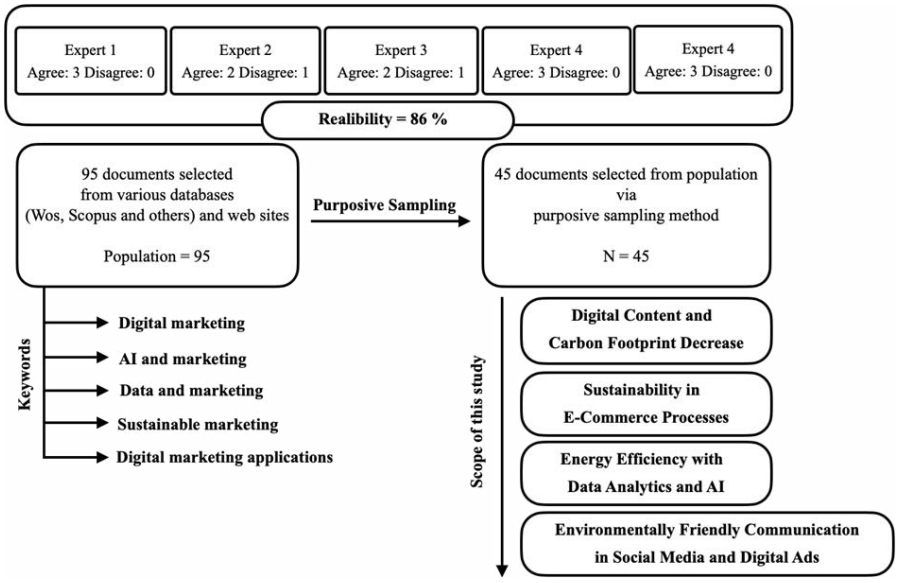
RQ1. What are the digital marketing practices that relate to digital transformation to maintain environmental sustainability? How are these practices integrated into marketing processes?

2. Methodology

Document analysis, a qualitative analysis method, was employed to address the research question of the study. This method can be utilized either as an independent analysis technique or as a complementary approach to support other methods. In this study, it was applied as an independent analysis method (Nas et al., 2021). To define the population of the study, searches were conducted on Web of Science (WoS), Scopus, and other databases (Ebsco and Google Scholar) using the keywords "digital marketing," "AI and marketing," "data and marketing," "sustainable marketing," and "digital marketing applications" from websites featuring the most current topics. A total of 95 documents relevant to the subject were identified, forming the population of the study. From this population, 45 documents, which are cited in the Results section, were selected through the purposive sampling method. These documents constituted the sample of the study. To ensure the reliability of the study, the research process and the selected samples were evaluated by five researchers who are experts in their respective fields. Three questions were posed concerning the research process, the relevance of the selected documents to the keywords, and the contribution of these documents to the study's subject matter. The evaluation yielded 13 positive and 2 negative responses. The negative feedback pertained to the need to expand the range of selected keywords. In this context, the reliability rate was calculated using the model proposed by Miles and Huberman (1994, p. 64) as follows: Reliability = Agreement / Agreement + Disagreement = 13 / (13 + 2) = 86%.

The research process of the study is illustrated in Figure 1.

Figure 1. Research Process (Authors Elaboration)



2.1. Findings

RQ1. What are the digital marketing practices that relate to digital transformation to maintain environmental sustainability? How are these practices integrated into marketing processes?

The relationship between environmental sustainability and digital marketing aims to reduce environmental impact and promote more conscious consumption habits. In this context, digital marketing practices associated with digital transformation for environmental sustainability are categorized into four distinct groups within the scope of this study.

2.2. Digital Content and Carbon Footprint Decrease

2.2.1. Usage of Green Hosting

Hosting refers to the infrastructure used for data storage. Businesses can establish their own data storage infrastructure or utilize hosting services provided by external vendors. The integration of green solutions within the hosting services used by businesses contributes to achieving sustainability goals while appealing to environmentally conscious consumers and enhancing brand loyalty. Additionally, green digital marketing strategies offer significant opportunities for gaining a competitive advantage. Green hosting solutions, known as green web hosting, are characterized as a sustainable web hosting model aimed at reducing energy consumption for IT and Internet services

by utilizing renewable resources such as solar or wind energy. This approach is part of Green IT and involves environmentally friendly operations and the use of renewable resources, with the primary objective of reducing carbon emissions. Green hosting providers minimize their energy consumption by leveraging renewable energy sources, including solar and wind power. They also engage in recycling initiatives and offset their carbon footprint through mechanisms such as carbon credits (Karyotakis & Antonopoulos, 2021; Trouwloon et al., 2023; Tokatlı et al., 2025).

2.2.2. Optimization in E-mail Marketing

Email marketing is an effective digital marketing method aimed at promoting products or services by sending commercial messages to targeted customer groups (Gedik, 2020). As a component of sustainable digital marketing, green enhancements in email marketing play a significant role (Samantaray & Pradhan, 2020). Developing a green email strategy requires minimizing unnecessary sends, targeting the appropriate audience, and utilizing personalized content. Additionally, simplifying email designs reduces both visual and data load, thereby decreasing server load and energy consumption (Pavlov et al., 2008; Wang et al., 2023). Implementing less frequent and more targeted email campaigns contributes to a reduced carbon footprint. This approach not only enhances the user experience but also supports brands in achieving their sustainability goals. Consequently, email marketing serves as an environmentally friendly and effective communication tool (Wang et al., 2023).

2.2.3. Sustainable Consumption

Sustainable consumption is an approach that emphasizes the efficient use of resources and the preference for environmentally friendly products and services. It is grounded in the principles of maintaining ecological balance and preventing waste to meet the needs of both present and future generations. Key components of sustainable consumption include practices such as energy conservation, recycling, and reuse. This approach encourages individuals and institutions to make conscious choices that minimize their ecological impact, ultimately aiming to establish an environmentally, economically, and socially balanced lifestyle over the long term (Dimitrova et al., 2022; Helvacioğlu et al., 2025).

Another aspect of sustainable consumption involves limiting the use and storage of unnecessary data. For instance, in digital marketing processes, smaller images and videos can be utilized through data compression techniques and code optimization rather than relying on high-quality visuals. This approach

is also believed to enhance visibility in search engine optimization (SEO) techniques. Additionally, such practices contribute significantly to reducing the carbon footprint, as less data translates to reduced storage space, lower computing power requirements, and decreased energy consumption (Li & Huang, 2023; Lucivero, 2020).

2.3. Environmentally Friendly Communication in Social Media and Digital Ads

2.3.1. Content Promoting Environmental Awareness

A trademark is defined by the American Marketing Association as a name, symbol, design, or combination of these elements used to identify a product and distinguish it from similar products. The World Intellectual Property Organization similarly defines a trademark as a sign used to differentiate the products of a commercial or industrial organization from those of others. Based on these definitions, a brand encompasses the totality of identity elements that enable a product to stand out in a competitive market (Kaptanoğlu et al., 2019: 249). Brands can raise social awareness about sustainability by sharing environmentally friendly content on social media platforms.

Such content can be presented in various formats, such as posts that highlight environmental issues, recycling, and tips for sustainable living. In doing so, brands not only strengthen their green image but also contribute to the spread of environmental awareness in society. Content that raises environmental awareness not only deepens the relationship between brands and consumers but also enables them to take an important step toward environmental sustainability (Jerzyk, 2016; Seelig et al., 2021).

2.3.2. Minimalist Advertising Campaigns

Digital advertising is a crucial marketing tool that enables businesses to reach consumers via the Internet. With the advancement of digital media platforms, it has largely replaced traditional advertising, providing businesses with various channels to connect with target audiences. Digital advertising includes the distribution of content and messages through various formats, such as banner ads, pre-roll and mid-roll videos, search engine advertising, online ads, and social media ads. The digital nature of these advertisements allows businesses to reach a global audience (Karakum and Ventura, 2022: 80). Minimalist advertising campaigns aim to reduce energy consumption by minimizing unnecessary clutter in digital advertisements. These campaigns focus on delivering concise content to effectively reach the target audience. The minimalist approach not only helps prevent ad fatigue among consumers

but also minimizes the negative environmental impact of digital marketing. By processing less data, minimalist ads reduce server energy consumption, thereby supporting brands' sustainability objectives (Cabañas et al., 2023).

2.3.3. Green Campaigns

Green marketing is a strategy designed to meet the needs of consumers who prioritize environmentally friendly products and services. This approach ensures that products, which are quality-driven, performance-oriented, and cost-effective, do not negatively impact the environment. Green marketing involves activities such as product modifications, alterations in production processes, development of eco-friendly advertisements, and changes in packaging (Mishra and Sharma, 2014: 79).

By showcasing the successes of environmentally friendly projects, green campaigns inspire consumers and encourage other brands to adopt a sustainable approach. Digital marketing tools enable brands to communicate their sustainability efforts to a broad audience by emphasizing environmental values. Green campaigns shared through digital platforms such as social media, blogs, and video content help raise environmental awareness and stimulate consumer demand for green products. This strategy fosters brand loyalty and trust while promoting an environmentally conscious society. In turn, it can positively influence the purchasing decisions of environmentally aware consumers (Jayasinghe, 2022; Josephine & Are, 2022).

2.3.4. Focusing on Green Consumer Trends

Green consumers are individuals who engage in consumption behaviors that promote environmental and social outcomes while enhancing consumer welfare. Green consumption is defined as a sustainable approach that benefits both current and future generations. These consumers adopt environmentally friendly habits, such as using organic products and preferring clean and renewable energy sources, to address environmental challenges. Green consumer behavior has become a critical research area for businesses in a world where demand for environmentally friendly and sustainable products and services is growing (Haba et al., 2023: 2).

The number of environmentally conscious consumers is rapidly increasing, requiring brands to adapt to these trends. Digital platforms provide powerful tools for engaging with individuals who embrace green consumer trends. Social media, in particular, has proven to be an effective platform for promoting green products. By highlighting their green products and sustainable production processes through digital content, brands can appeal to environmentally

conscious consumers. This strategy not only promotes products but also fosters a strong connection with users who embrace eco-friendly lifestyles. Platforms such as Instagram, TikTok, and YouTube can be leveraged to share educational content about the benefits and ease of use of eco-friendly products. Such content raises environmental awareness and demonstrates brands' commitment to sustainability objectives (Alagarsamy et al., 2021; Borah et al., 2024; Haba et al., 2023; Josephine & Are, 2022).

2.3.5. Influencer Partnerships

Influencer marketing is a digital marketing strategy that enables brands to communicate their messages through sponsored content by collaborating with individuals who possess significant online influence and a large following. This approach aims to promote products and services by utilizing content producers who produce valuable content on social media platforms. While influencers often share similarities with celebrities, they present a more relatable identity by engaging intimately and directly with their followers. Such interactions foster the perception of a personal relationship, making followers more responsive to the content (Vrontis et al., 2020: 617-618).

Collaborations with influencers represent a potent digital marketing strategy for promoting green products and raising environmental awareness. Partnering with influencers who have strong environmental awareness can enhance the perception of brands as environmentally friendly. These influencers can promote green products to their eco-conscious followers, encouraging their adoption. Well-executed social media campaigns can effectively reach a broad audience embracing a greener lifestyle. By leveraging influencers' reach and credibility, brands can communicate their green messages effectively. Simultaneously, collaborating with influencers helps brands meet their sustainability goals and establish trust with their target audiences (Ramdan et al., 2023; Zatwarnicka-Madura et al., 2022; Zhao et al., 2024).

2.4. Energy Efficiency with Data Analytics and AI

2.4.1. Targeted Digital Advertisements

Targeted advertising in digital marketing is an effective strategy that enables brands to reach the appropriate audience. However, the environmental impact of digital advertising should also be taken into account. By utilizing artificial intelligence-powered tools, advertisements can be personalized and tailored to align with the target audience's level of environmental awareness. Artificial intelligence (AI), which is modeled after human intelligence, allows for the development of systems capable of generating new solutions, learning, and

making decisions based on information gained from past experiences (Yoşumaz, 2024 & Yoşumaz, 2025). This approach helps avoid unnecessary ad displays and reduces excessive energy consumption. For instance, customizing ads for users interested in green products or sustainable lifestyles not only enhances advertising efficiency but also contributes to brands' sustainability goals by conveying a green message. Optimizing digital ads in this manner reduces energy consumption and bolsters the image of environmentally conscious brands (Ahmed et al., 2019; Mokoena et al., 2023; Saura et al., 2020).

2.4.2. Energy Efficiency Analytics

Data analytics is the systematic process of analyzing and drawing meaningful conclusions from an organization's data. This process involves collecting the necessary data, posing the right questions, and processing the data effectively in accordance with its speed and variability to extract the right information. Data analytics supports organizations' decision-making processes by providing valuable insights from large and variable data sets. In this way, businesses can develop strategies to maximize the value derived from data through reporting and analysis based on accurate information (Girgin, 2019: 9).

Data analytics plays a crucial role in digital marketing activities aimed at optimizing energy consumption (Saura et al., 2020). Activities such as digital advertising, content development, and website operations can be energy-intensive. In this context, energy efficiency analytics can be employed to identify marketing activities that consume excessive energy and propose more sustainable solutions (Giakomidou et al., 2022). For example, by monitoring the energy consumption of digital advertising campaigns, decisions can be made to prioritize the most efficient and environmentally friendly methods. By optimizing digital marketing strategies in this manner, brands can make more efficient use of their budgets while reducing their environmental impact. This approach is pivotal in achieving sustainability goals and helps brands build an environmentally conscious image (Groening et al., 2014).

2.5. Sustainability in E-Commerce Process

2.5.1. Sustainable Packaging

Sustainable packaging refers to packaging solutions designed and produced to minimize negative environmental impacts. These solutions promote the use of materials that are recyclable, biodegradable, and derived from renewable resources. Additionally, recycling and reusing waste materials are crucial to prevent the depletion of natural resources and raw materials. Plastic, one of the most widely used packaging materials, is made from petroleum-based polymers

that are non-biodegradable and have low recycling rates. Therefore, the use of biodegradable polymers, such as materials derived from plant sources like cellulose, starch, and chitosan, should be prioritized, and manufacturers should shift toward using 100% recyclable materials. Sustainable packaging practices include efficient raw material usage, waste reduction, and environmentally friendly production processes (Ibrahim et al., 2022: 12).

The e-commerce sector is rapidly growing, and consumer demand for environmentally friendly shopping options is also increasing. Brands can project an environmentally conscious image by using sustainable packaging solutions. Recyclable and biodegradable materials play an important role in reducing the environmental impact of e-commerce. In addition, brands can appeal to environmentally conscious consumers by emphasizing this strategy in their digital marketing campaigns. Digital platforms can educate consumers about sustainable packaging through educational content, videos, and infographics. This approach not only helps the environment but also provides long-term business benefits by building brand loyalty (Boz et al., 2020).

2.5.2. Carbon Neutral Transport Options

Carbon neutral transportation is an approach that aims to compensate for the carbon emissions generated during the transportation of products. This means achieving zero carbon emissions from the transportation process. Carbon neutral transportation can be accomplished by using environmentally friendly transportation methods or implementing carbon offset projects. For example, low-carbon transportation methods such as electric vehicles and projects like planting trees or purchasing carbon credits can help offset emissions. This strategy is not limited to e-commerce but also applies to sectors like apparel, cosmetics, and food. Carbon neutral transportation is crucial in combating climate change, reducing waste, and protecting biodiversity (Ehlig-Economides & de Guzman, 2020; Guo et al., 2022; Reddy et al., 2023).

Consumers are increasingly concerned about their environmental impact when making purchases (Alagarsamy et al., 2021). In this context, offering carbon neutral transportation options is an important way for brands to demonstrate their environmental consciousness. On e-commerce platforms, carbon neutral transportation options can be digitally promoted, allowing users to easily select them when placing orders. To achieve carbon neutrality, companies can invest in tree planting projects to offset emissions (Kronenberg & Mieszkowicz, 2011) or raise awareness about the importance of carbon credits (Yang & Xu, 2024). Highlighting this service in digital marketing

strategies can capture the attention of environmentally conscious consumers and enhance the brand's sustainability communication.

2.5.3. Digital Invoices and Documents

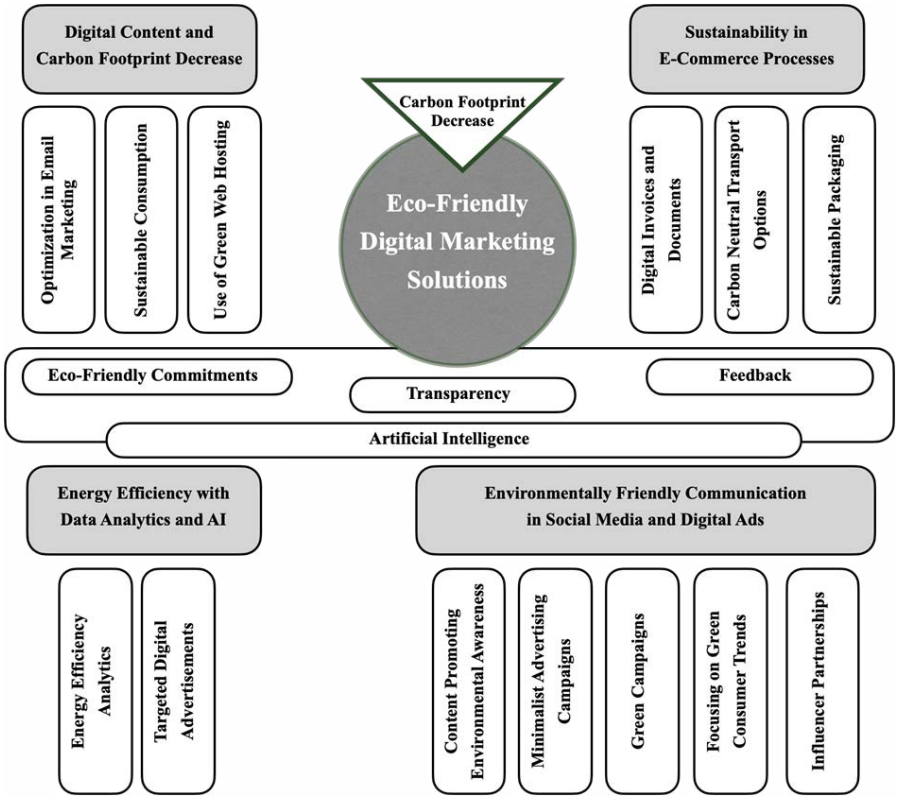
Digital invoicing and digital documents refer to the process of generating, transmitting, and storing traditional paper-based documents in a digital format. With digital transformation, invoices and documents are electronically generated and delivered to recipients via email, digital mailboxes, or other digital platforms. This process offers significant advantages in terms of speed and cost. Costs related to paper, printing, and postage are eliminated, while digital documents can be easily archived, accessed, and stored securely. Moreover, digital invoices and documents improve process efficiency through automated data processing, verification, and tracking. The use of electronic signatures and verification methods ensures secure transactions (Eke, 2023: 115-116). Digital invoices and documents are a crucial step for businesses transitioning from physical to digital data storage (Erceg & Zoranović, 2022). In doing so, they contribute to enhanced sustainability, particularly within e-commerce processes. By reducing paper consumption, the environmental footprint is minimized, while digital documents simultaneously improve the customer experience (Feroz et al., 2021).

Discussion And Conclusion

Digital transformation in marketing has a distinct dynamic compared to other business functions. The primary reason for this difference is that the audience impacted in the marketing process consists of the business's current or potential customers. In this context, digital transformation in marketing can be viewed in two main dimensions. The first dimension includes transformations implemented within the business's internal practices. Particularly, the adoption of innovative technologies such as AI enables more efficient data analysis management, which reduces the amount of data that needs to be stored, thereby lowering energy consumption. These transformations not only enhance internal business efficiencies but also contribute to environmental sustainability. Additionally, communicating these transformations to customers through advertising campaigns highlights the business's environmental commitment and has the potential to strengthen customer loyalty. The second dimension pertains to the outward-facing aspect of marketing, which involves direct interaction with customers, typically through promotional campaigns. In this dimension, digital marketing serves as a powerful tool for brands to provide transparency and effectively communicate their environmental consciousness. Today, consumers are increasingly scrutinizing the environmental impact of brands

and expect transparency regarding sustainability practices. This expectation necessitates that businesses engage with their customers in a more open and trustworthy manner. Digital platforms enable brands to communicate regularly and transparently about their sustainability practices and environmental impacts. Social media, blogs, email newsletters, and websites serve as effective channels for reporting environmental performance and announcing sustainability initiatives. Consumer feedback on brand transparency through these platforms enhances brand-consumer interaction and fosters customer loyalty. Digital marketing also presents significant opportunities for brands to effectively convey their environmental commitments. Through digital platforms, brands can share their long-term sustainability goals and build trust by presenting these goals in a transparent manner. For instance, commitments to using recyclable materials, reducing carbon footprints, or utilizing renewable energy can be communicated through social media posts, videos, and infographics. Such transparency practices not only increase consumer trust in the brand but also strengthen the brand-consumer connection. Figure 2 provides an overview of these processes.

Figure 2. Environmentally Sustainable Marketing through Digital Transformation (Authors Elaboration)



This study aims to provide green solutions by examining how digital marketing strategies can integrate sustainability into the digital transformation process. The effective use of digital marketing aligned with sustainability goals not only enhances environmental responsibility but also enables brands to gain a competitive advantage in the digital transformation journey. The practices analyzed in this study demonstrate how digital marketing can play a strategic role in minimizing environmental impact.

Practices such as digital content management, green web hosting, and data consumption optimization significantly contribute to reducing carbon footprints by enhancing energy efficiency. In particular, targeted email marketing and social media content that raises environmental awareness highlight the effectiveness of digital marketing in supporting environmental sustainability. Sustainable packaging, carbon-neutral transportation options, and digital invoices in e-commerce processes foster eco-friendly shopping experiences, raise consumer awareness, and encourage green consumption behaviors.

Moreover, digital marketing provides an effective platform for brands to communicate their sustainability commitments clearly and transparently. Collaborations with influencers and minimalist advertising campaigns play a strategic role in engaging eco-conscious consumers, while regular communication of sustainability practices through digital platforms helps build brand trust and consumer loyalty.

Theoretical Contributions

This study makes a theoretical contribution to digital marketing by addressing the relationship between digital transformation and sustainability from the perspective of digital transformation in marketing. The study theoretically explains how digital content management, email marketing, social media strategies, and e-commerce processes can be optimized in the context of sustainability. It also aims to fill the gap in the field by categorizing the digital marketing process.

This study synthesizes the literature on digital marketing and environmental sustainability to show how green digital marketing strategies can be developed.

Practical Contributions

The study's findings offer practical recommendations for businesses on how to effectively utilize digital marketing strategies to achieve sustainability objectives. Businesses can reduce their environmental impact by enhancing energy efficiency through digital content management and optimizing data consumption. Additionally, they can provide a greener shopping experience

by incorporating sustainable packaging and carbon-neutral transportation options within e-commerce processes. By leveraging influencer collaborations and social media campaigns to share content that raises environmental awareness, brands can engage environmentally conscious consumers and build trust through transparent communication of their sustainability efforts. The interactive nature of digital platforms serves as an effective tool for increasing customer loyalty, allowing consumers to quickly provide feedback on sustainability initiatives. In this context, the study offers valuable guidance to marketers and businesses seeking to align their digital marketing strategies with environmental sustainability goals. Furthermore, it provides insights for policymakers in developing public policies that promote the achievement of environmental sustainability targets.

Limitations of the Study and Future Research

This study theoretically addresses the integration of digital marketing strategies with environmental sustainability due to time and effort constraints. Future research could focus on the challenges and practical applications of this integration. In addition, sectoral uses of carbon credits and the challenges of carbon neutral practices are among the topics that can be explored.

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