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Extended Abstract |The 2nd Research Innovations in Sustainable Marketing: A Global Symposium

The Dark Side of Digital Marketing: Environmental Harm

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The incorporation of AI in digital marketing is growing exponentially as digital marketing offers fertile soil for AI. Specifically, data intensive applications such as search engine marketing, predictive analytics, personalized recommendations, segmentation and targeting, programmatic advertising, price optimization, social media marketing, chatbots, and online advertising are among the original utilizers of AI and primary beneficiaries (Chintalapati & Pandey, 2022Ziakis & Vlachopoulou, 2023). While there is plenty of research on digital marketing and AI, the dark side of their environmental impact is rarely mentioned in the literature. There are several sources of negative environmental impact. First, training AI models requires considerable computational power, which is energy-intensive resulting in a high carbon footprint due to the electricity required for data centers and cloud services (Dhiman et al., 2024). A conservative estimate from 2015 stipulates that online advertising comprises 3.2–5.4% of the total global electricity consumption (Pärssinen et al., 2018). Advances in AI amplify power demand as machine learning (ML) models grow more complex and resource-intensive. In addition, data centers are primarily powered by fossil fuels and need huge quantities of water for cooling. There is also the question of electronic waste generation such as electronic devices that are not recycled properly and whose rate of obsolescence is exacerbated by marketing.

The objective of this study is to take an inventory of the literature on digital marketing and environmental impact, to account for what we know and do not know, and to propose an agenda for future research putting digital marketing on a more sustainable path. Marken et al. (2024) break down the processes through which energy consumption occurs in digital marketing – from data transmission via various networks to data storage, cooling of data centers, ML training models, data analytics, SEO, real-time bidding and delivery of multimedia advertising content. Another way of assessing energy consumption is to look at the networks associated with digital marketing and the actual rendition on the users' devices (Gonzalez-Cabanas et al., 2023). While marketing professionals are aware to a certain extent of the huge energy consumption of these processes, the total scale of the problem is neither clear nor widely understood. The complexity of the processes and the lack of measurement exacerbate the problem. The biggest players in the space – Google, Meta, Amazon, Apple



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–have no interest in disclosing data on energy consumption. For example, a study shows that even a simple action such as blocking ads in a browser can reduce energy consumption (Marken et al., 2024). On the supply side, once advertisers become aware of their carbon footprint, they could take measures to reduce it by working with fewer partners adding fewer layers on their ad deliveries, for example Thangam and Chavadi (2023). Another study identifies ten solutions that digital advertisers can use to reduce their carbon emissions such as choosing green partners, calibration diffusion settings, and optimizing ad production and targeting (El Hana et al., 2024). Thus, efficiency measures should include not only cost efficiency but also carbon footprint. We need to devise frameworks linking marketing effectiveness with energy- efficient AI systems to balance innovation and sustainability goals. Considering the above, the following research agenda emerges. At the consumer level, we need to understand consumers' motivation for energy-efficient options when it comes to digital marketing – the awareness level, the choice of browsers, platforms, and devices; the opportunity to opt out of advertising or certain types of ads, the possibility to opt out of AI processes, etc. At the firm level, we need to understand companies' and stakeholders' awareness of the severity of the problem, the availability of measurements to assess the carbon footprint, the institutional pressures to act on reducing energy usage, the areas within digital marketing, social media, and e-commerce that result in the greatest energy usage and how these can be minimized. What kind of metrics should be devised to optimize digital marketing solutions incorporating energy efficiency? What are the best mitigation strategies? At the government and regulatory level, we need to understand where carbon emission reductions are not likely to occur via market mechanisms and to look for solutions to maximize societal welfare. For example, how does society benefit from companies using consumer information to train ML models when the process results in a worsening of the user experience and increased energy consumption? What is the role of the government at the intersection of AI, increased carbon emissions, and human rights? At all levels, researchers need to turn their attention to mitigation solutions – e.g. optimizing AI algorithms for energy efficiency, data centers powered by renewable/nuclear energy, and developing more efficient hardware. In sum, the energy consumption of digital marketing and AI-intensive applications is significant, yet there is little awareness of the scale of the problem. The marketing field requires more research to establish robust frameworks for understanding and mitigating these environmental impacts.

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Conflict of Interest

The authors declare no conflict of interest.

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