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**“Η επίδραση του ψηφιακού εταιρικού ονόματος στην
εφαρμογή στρατηγικών ESG στον κλάδο της βιώσιμης
μόδας”**

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**“The influence of digital corporate naming on the
implementation of ESG strategies in the sustainable
fashion industry”**

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The influence of digital corporate naming on the implementation of ESG strategies in the sustainable fashion industry

Σημαντικοί όροι: βιώσιμη μόδα, στρατηγική, ESG, ψηφιακό μάρκετινγκ, ψηφιακό εταιρικό όνομα, μοντελοποίηση FCM, νευρομάρκετινγκ

Περίληψη

Η παρούσα μελέτη διερευνά τη σχέση μεταξύ της επίδοσης στα κριτήρια Περιβάλλοντος, Κοινωνίας και Διακυβέρνησης (ESG) και της ψηφιακής δέσμευσης των καταναλωτών στη βιομηχανία βιώσιμης μόδας, ενσωματώνοντας στατιστική ανάλυση, μοντελοποίηση FCM και νευρομάρκετινγκ. Ενώ η προηγούμενη έρευνα έχει καταδείξει τη χρηματοοικονομική συνάφεια των ESG, περιορισμένη προσοχή έχει δοθεί στην επίδρασή τους σε μετρικές δέσμευσης μικροεπίπεδου, όπως το ποσοστό αναπήδησης, ο χρόνος παραμονής στον ιστότοπο και η δομή της επισκεψιμότητας. Η ανάλυση υιοθετεί ένα τετραστάδιο μεθοδολογικό σχέδιο: (i) συλλογή δεδομένων και επιλογή εταιρειών από τον κλάδο της βιώσιμης μόδας, (ii) περιγραφικές στατιστικές, συσχετίσεις και παλινδρομήσεις που συνδέουν τους ESG προβλεπτικούς παράγοντες — συμπεριλαμβανομένων του B Impact Score, των εκπομπών εφοδιαστικής αλυσίδας και της κλαδικής ανθρακικής ουδετερότητας — με τα αποτελέσματα ψηφιακού μάρκετινγκ, (iii) Ασαφή Γνωσιακή Χαρτογράφηση (FCM) για την προσομοίωση των συστημικών επιδράσεων των αλλαγών ESG στις μετρικές μάρκετινγκ, με ανάλυση σεναρίων που ελέγχει σταδιακές βελτιώσεις και επιδεινώσεις ESG, και (iv) νευρομάρκετινγκ με eye-tracking σε 31 συμμετέχοντες για τη μέτρηση της ασυνείδητης προσοχής στα σήματα βιωσιμότητας στους ιστότοπους των εταιρειών. Τα αποτελέσματα καταδεικνύουν ότι υψηλότερες τιμές B Impact Score και μεγαλύτερο μερίδιο ανθρακικής ουδετερότητας ενισχύουν σημαντικά την ποιότητα δέσμευσης, ενώ υψηλότερες εκπομπές αυξάνουν τον όγκο επισκεψιμότητας χωρίς όμως να βελτιώνουν το βάθος αλληλεπίδρασης. Τα ευρήματα του νευρομάρκετινγκ επιβεβαιώνουν ότι η οπτική προσοχή στα ESG στοιχεία — όπως

πιστοποιήσεις και αφηγήσεις βιωσιμότητας — προσελκύει μεγαλύτερη διάρκεια και επαναλαμβανόμενες επισκέψεις, υποστηρίζοντας τον ρόλο τους ως γνωσιακών αγκύρων δέσμευσης. Η μελέτη προωθεί τη θεωρία συνδέοντας τα ESG και το νευρομάρκετινγκ με τις ψηφιακές συμπεριφορές, και προσφέρει πρακτική καθοδήγηση για τις εταιρείες μόδας στη σχεδίαση αξιόπιστων στρατηγικών επικοινωνίας βιωσιμότητας.

The influence of digital corporate naming on the implementation of ESG strategies in the sustainable fashion industry

Keywords: sustainable fashion, strategy, ESG, digital marketing, digital corporate name, FCM modeling, neuromarketing

Abstract

This study investigates the relationship between Environmental, Social, and Governance (ESG) performance and digital consumer engagement in the sustainable fashion industry, integrating statistical analysis, FCM modeling, and neuromarketing evidence. While prior research has established ESG's financial relevance, limited attention has been given to its impact on micro-level engagement metrics such as bounce rate, time on site, and traffic structure. The analysis employs a four-stage methodological design: (i) data collection & firm selection from the sustainable fashion sector, (ii) descriptives, correlations & regressions models linking ESG predictors—including B Impact Score, supply-chain emissions, and sectoral carbon neutrality—to digital marketing outcomes, (iii) Fuzzy Cognitive Mapping (FCM) to simulate systemic effects of ESG changes across marketing metrics, (iii) scenario analysis testing incremental ESG improvements and deteriorations; and (iv) neuromarketing eye-tracking with 31 participants to measure subconscious attention to sustainability cues on brand websites. Results demonstrate that higher B Impact Scores and greater carbon-neutral shares significantly enhance engagement quality, while higher emissions increase traffic volumes but reduce depth of interaction. Neuromarketing findings confirm that visual attention to ESG elements (e.g., certifications, narratives) attracts longer fixation and revisits, supporting their role as cognitive anchors of engagement. The study advances theory by linking ESG and neuromarketing to digital behaviors and offers practical guidance for fashion brands in designing credible sustainability communication strategies.

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1. Introduction

The fashion industry stands at the intersection of creativity, global commerce, and significant sustainability challenges. It is estimated to contribute up to 8–10% of global carbon emissions and ranks among the most resource-intensive consumer industries (Niinimäki et al., 2020; UNFCCC, 2022). Fast fashion, in particular, has accelerated cycles of production and consumption, amplifying concerns about labor exploitation, textile waste, and environmental degradation. As consumer awareness of these issues grows, sustainability has transitioned from being a peripheral consideration to a central determinant of competitive advantage for fashion brands. Within this shifting landscape, Environmental, Social, and Governance (ESG) metrics have emerged as critical benchmarks for evaluating corporate responsibility and long-term viability (Kotsantonis & Serafeim, 2019).

At the same time, the rapid evolution of digital marketing has transformed how firms communicate and engage with consumers. Traditional indicators of reach, such as traffic volume, are increasingly supplemented by engagement quality metrics, including bounce rate, session depth, and channel efficiency (Chaffey & Ellis-Chadwick, 2019). These indicators not only capture the effectiveness of marketing campaigns but also reflect consumer trust, loyalty, and responsiveness. Importantly, sustainable brands must demonstrate that their ESG commitments are not abstract but visible, credible, and impactful in shaping consumer behavior.

A further dimension arises from the growth of neuromarketing, which leverages biometric and cognitive measures to understand subconscious drivers of consumer behavior (Plassmann et al., 2015). Tools such as eye-tracking and attention heatmaps provide granular insights into how consumers process sustainability-related signals online, offering an invaluable complement to traditional analytics. When integrated with ESG performance data and digital engagement metrics, neuromarketing evidence can reveal how sustainability cues translate into measurable behavioral responses.

Despite extensive literature linking ESG performance with financial outcomes (Friede et al., 2015; Chen et al., 2023a), fewer studies investigate how ESG commitments manifest in digital consumer engagement. Most existing research examines consumer attitudes or purchase intentions rather than actual behavioral metrics recorded on brand websites. This creates a gap between what consumers say they value and how they behave in digital environments.

Moreover, the relationship between ESG performance and marketing outcomes is unlikely to be linear. High emissions, for instance, may inflate website traffic through aggressive campaigns or controversies but undermine engagement quality. Conversely, stronger ESG signals may attract smaller but more loyal consumer segments. Traditional regression methods capture direct associations but often miss systemic interdependencies across multiple engagement metrics. This necessitates system-level approaches such as Fuzzy Cognitive Mapping (FCM), which model feedback loops and scenario-based dynamics.

Finally, little is known about how consumers cognitively process ESG signals in digital shopping environments. Neuromarketing research shows that eco-labels and sustainability certifications capture attention (Hoffmann et al., 2025; Proi et al., 2023), yet these studies rarely connect gaze and fixation data with broader digital engagement metrics. Bridging this gap is essential to understand whether sustainability cues are peripheral or central drivers of consumer interaction.

This study addresses these gaps by integrating ESG indicators, digital marketing analytics, and neuromarketing evidence to examine the role of sustainability in shaping online consumer engagement. The specific objectives are:

1. To evaluate how firm-level ESG performance, measured through B Impact Scores, correlates with digital engagement metrics such as bounce rate, pages per visit, and time on site.
2. To examine the influence of supply-chain emissions on traffic volume and engagement depth, testing whether higher emissions generate superficial rather than meaningful interactions.
3. To investigate the role of sectoral carbon-neutral adoption in aligning consumer behavior with sustainable digital pathways, particularly organic channels.
4. To assess, using neuromarketing eye-tracking experiments, whether consumer visual attention to ESG cues on websites predicts engagement outcomes more strongly than attention to aesthetics or pricing.

These objectives translate into four research hypotheses (H1–H4), each of which corresponds to a distinct methodological stage and data stream. To achieve these objectives, the study employs a four-stage methodological framework:

1. Data collection and firm selection: Specific firms were discerned from the sustainable fashion sector, and the required data for the upcoming analysis were extracted from various source (web analytics, financial reports, etc.).
2. Quantitative Analysis: Descriptive statistics, correlation and regression models are applied to examine associations between ESG indicators (independent variables) and digital marketing engagement metrics (dependent variables).
3. System Modeling via FCM: Scenario-based simulations are used to capture nonlinear effects of ESG improvements or deteriorations across multiple metrics, allowing exploration of “what-if” conditions.
4. Neuromarketing Assessment: Eye-tracking data from 31 participants, recorded with SeeSo Web Analysis platform, measures gaze allocation to ESG-related versus non-ESG website elements across four sustainable fashion firms.

The sample includes five focal firms—Reformation, Nisolo, Mud Jeans, Veja and Eileen Fisher—chosen for their sustainability credentials and digital presence. Specifically, the brand Veja was excluded from the neuromarketing stage due to technical incompatibility with the analysis software.

This thesis contributes to three interrelated fields. First, it advances ESG scholarship by shifting attention from macro-level financial outcomes to micro-level digital behaviors, offering evidence of how sustainability affects consumer interaction quality. Second, it enriches digital marketing literature by integrating ESG predictors into established engagement metrics, highlighting trade-offs between traffic volume and depth of interaction. Third, it extends neuromarketing research into the context of sustainable fashion e-commerce, demonstrating how visual attention to ESG cues anchors consumer behavior.

From a managerial perspective, the findings offer actionable insights for sustainable fashion brands. They highlight the importance of prominently displaying ESG certifications, embedding sustainability narratives in product pages, and balancing traffic acquisition with engagement quality. For sector-level policymakers, the study underscores the value of promoting carbon neutrality and credible ESG reporting as tools to foster consumer trust and digital competitiveness.

The thesis is structured into six chapters. Chapter 2 presents a comprehensive literature review, organized into sections on ESG and corporate sustainability, digital marketing engagement, neuromarketing and consumer attention, and integrative frameworks, concluding

with the development of research gap. Chapter 3 details the methodology, including data collection, variables, analytical procedures, as well as the development of the research hypotheses. Chapter 4 presents the results, integrating descriptive statistics, regression outputs, FCM simulations, and neuromarketing findings. Chapter 5 discusses the results in relation to the literature, by ultimately settling the verification or not of the research hypotheses. Chapter 6 concludes with reflections on contributions, limitations, and directions for future research.

In summary, this study investigates how ESG performance influences digital marketing outcomes in sustainable fashion firms, and whether sustainability signals capture consumer attention at a subconscious level. By combining quantitative analysis, static system modeling, and neuromarketing, the thesis seeks to bridge theoretical gaps and provide practical insights into how credible ESG communication can transform consumer engagement.

2. Literature Review

2.1 The Sustainable Fashion Industry

The global fashion industry, historically associated with creativity and expression, now stands at the crossroads of environmental urgency and consumer demand. Estimates increasingly position fashion's carbon footprint between 3% and 8% of global greenhouse gas emissions (McKinsey & Company, 2023). This substantial share arises through energy-intensive textile production, dyeing processes, and reliance on synthetic fibers (Ellen MacArthur Foundation, 2017). Resource depletion and social concerns—such as unsafe labor practices—have catalyzed an urgent push toward more sustainable models.

In response, industry leaders and coalitions like the UNFCCC Fashion Industry Charter for Climate Action advocate for net-zero emissions by 2050, emphasizing that current progress remains insufficient to meet climate targets (UNFCCC, 2023). The Global Fashion Agenda (GFA) 2023 report reinforces this urgency, noting adoption of sustainable practices is still low across mass-market players and supply-chain complexity remains a key barrier (Global Fashion Agenda, 2023). The Ellen MacArthur Foundation corroborates this with data showing that circular redesigns and recycled materials have only marginally penetrated total production volumes (Ellen MacArthur Foundation, 2017).

Amid increasing regulatory scrutiny—particularly through the EU's Corporate Sustainability Reporting Directive (CSRD) and related ESRS standards—fashion businesses are forced to rethink disclosures and operations (European Commission, 2025). At the global standards level, the ISSB's IFRS S1 and S2, mandate enhanced climate-related risk and strategy reporting, including Scope 3 emissions—a crucial dimension for fashion due to embedded upstream emissions (ERM Sustainability Institute, 2024). These regulatory developments amplify the stakes for sustainable fashion strategies.

At the consumer level, demand for sustainability is no longer marginal. Consumer behavior studies found that over 60% of Gen Z shoppers reported being willing to pay a premium for ethical and transparent fashion brands (Escourido-Calvo et al., 2025). Another recent survey emphasized the importance of environmental credentialing to purchase decisions, ranking it just behind aesthetic appeal for younger consumers (Wang et al., 2025a). Online forums and social media reflect this as well, with sustainability narratives increasingly making their way into brand reputations and purchase rationales.

Yet, progress is uneven. Reports indicate that greenwashing—overstated or misleading sustainability claims—remains rampant, undermining consumer trust (Delmas et al., 2019; Testa et al., 2015). Audits of fashion brands’ websites found that many offer general pledges (e.g., “eco-friendly fabrics”) without specific metrics or third-party validation, creating a credibility gap (Geneva Environment Network, 2023). The mismatch between brand claims and actual practices fuels skepticism. As Huyhn et al. (2024) noted, deepening consumer trust relies not just on messaging but on verified action and transparency.

Therefore, the pressing question for scholars and practitioners is: do these sustainability efforts actually translate into “hard” digital outcomes—like longer session times, deeper navigation, or shifts in traffic channel mix? In marketing, user engagement is no longer a passive metric—it signals attention, trust, and potential conversion (Chaffey & Ellis-Chadwick, 2019). Yet, few studies to date have empirically connected ESG disclosures (B Corp scores, carbon-neutral claims) to measured consumer behavior on brand websites, particularly in the fashion sector.

Finally, fashion is uniquely complex because it straddles both product aesthetics and ethical values. The successful sustainable brand must blend aspiration with reassurance—the allure of design with the logic of impact. Companies such as Reformation, Mud Jeans, and Nisolo emphasize transparency and circular programs, often accompanied by B Corp certification or carbon-neutral claims. Their websites combine product storytelling with impact indicators—a strategy supported by user experience studies indicating that embedding sustainability information alongside product messaging improves engagement without detracting from aesthetic appeal (UX Collective, 2025). However, much of the evidence remains proprietary.

This context sets the stage for the current study, which asks: how does ESG performance—and specifically, B Impact certification, supply-chain emissions, and carbon-neutral sector share—relate to digital engagement metrics like bounce rate, time on site, organic traffic, etc.? And can visual attention to sustainability cues on product pages be a plausible mechanism through which ESG influence is realized? These questions respond to the theoretical gap in linking sustainability performance to digital micro-behaviors, especially in fashion, as well as the practical need to measure whether ESG communication actually translates into engaged consumer attention, not mere branding.

2.2 ESG and Corporate Sustainability

The concept of Environmental, Social, and Governance (ESG) has become a central framework for evaluating corporate sustainability performance and long-term resilience. While sustainability once primarily referred to environmental stewardship, the ESG framework integrates ecological impact with social responsibility and governance standards, providing a holistic approach to how businesses create value responsibly. ESG is not only a reporting mechanism but also a strategic driver of competitiveness, reputation, and stakeholder trust (Eccles & Klimenko, 2019; Kotsantonis & Serafeim, 2020). For the fashion industry—one of the most resource-intensive and scrutinized sectors—ESG practices are especially significant as firms confront pressure to reduce emissions, ensure ethical labor practices, and adopt transparent governance structures (Goncalves & Silva, 2021).

ESG emerged from earlier corporate social responsibility (CSR) debates but differs by emphasizing quantifiable, comparable metrics. Regulatory developments, such as the EU Corporate Sustainability Reporting Directive (CSRD) and the International Sustainability Standards Board (ISSB) IFRS S1 and S2, highlight the institutionalization of ESG disclosure, moving sustainability from voluntary communication to mandatory reporting (KPMG, 2024). Studies show that investors increasingly use ESG metrics as a basis for assessing risk and opportunity (Drempetic et al., 2020), and firms with stronger ESG disclosure enjoy improved access to capital and reduced cost of equity (Broadstock et al., 2021).

Within this framework, B Impact Scores—the certification metric used by B Corporations—have gained traction as credible third-party indicators of a firm's ESG performance. Unlike self-declared CSR statements, the B Impact Assessment evaluates firms across governance, workers, community, environment, and customers, providing holistic validation (Honeyman & Jana, 2019). Research suggests that firms with high B Impact Scores demonstrate higher employee engagement and consumer trust, both critical for industries reliant on brand loyalty, such as fashion (Stubbs, 2017).

A growing body of research links ESG performance to positive financial and non-financial outcomes. A meta-analysis by Friede et al. (2015), concluded that most empirical studies report a positive correlation between ESG and firm financial performance. More recent findings suggest ESG also improves operational efficiency, risk mitigation, and customer loyalty (Broadstock et al., 2021; Wang et al., 2024). In the fashion industry, adopting ESG strategies such as carbon-neutral sourcing or transparent supply-chain management not only reduces

reputational risks but also differentiates firms in a crowded marketplace (Karaosman et al., 2020).

Still, the literature notes a paradox of sustainability marketing: while ESG enhances trust, poorly substantiated claims risk consumer backlash through accusations of greenwashing (Lyon & Montgomery, 2015). This makes credible ESG signals—such as third-party certifications—essential. Without such assurances, consumers may dismiss ESG narratives as promotional rhetoric.

Fashion is among the most environmentally burdensome sectors, responsible for an estimated 8–10% of global carbon emissions and extensive water consumption (UNEP, 2024). Pressure on fashion companies to reform comes from regulators, consumers, and advocacy groups alike. The sector's ESG priorities include reducing greenhouse gas emissions across supply chains, investing in renewable materials, ensuring fair labor practices, and adopting circular economy models (Niinimäki et al., 2020).

Recent studies show that firms adopting carbon neutrality commitments are more likely to achieve favorable consumer evaluations and stronger investor support (Sullivan & Gouldson, 2017). For instance, sector-level Carbon Neutral Shares—the proportion of firms within an industry adopting neutrality targets—act as a signal of industry momentum, influencing stakeholder perceptions of legitimacy. This sectoral lens is important in fashion, where collective action, such as the Fashion Industry Charter for Climate Action, attempts to set common decarbonization goals (UNFCCC, 2022).

Moreover, emissions reporting across the supply chain (raw materials to distribution centers) has become a focal point, reflecting the industry's heavy reliance on globalized, carbon-intensive logistics. Consumers increasingly expect fashion brands not only to disclose but also to act upon their supply-chain emissions (Mishra & Kumar, 2024). Brands that fail to do so risk reputational damage and declining market relevance, particularly among younger demographics that prioritize sustainability in purchasing decisions (Rahman et al., 2025).

One of the critical debates in ESG scholarship concerns transparency and credibility. Transparent ESG reporting is shown to enhance trust, while opaque or inconsistent disclosure generates skepticism (Marquis & Qian, 2014). Studies indicate that consumers in particular demand evidence-based claims, and that sustainability narratives are only effective when supported by verifiable data (Testa et al., 2015). In this regard, B Corp certification and sectoral

benchmarks provide essential external validation mechanisms that reduce information asymmetry between firms and stakeholders (Stubbs, 2017).

At the same time, governance factors—such as board diversity, ethical leadership, and accountability mechanisms—are increasingly recognized as key components of ESG. Firms with stronger governance structures tend to implement ESG commitments more effectively and avoid superficial compliance (Eccles & Klimenko, 2019). In fashion, where allegations of labor exploitation and unethical sourcing persist, governance credibility is indispensable to sustain consumer trust.

Despite advances in ESG literature, several gaps remain. First, much of the research has focused on financial outcomes of ESG, leaving underexplored its effects on digital consumer engagement metrics such as bounce rate, time on site, or referral reliance. Second, while the relationship between carbon neutrality and consumer trust is well established, little is known about how sectoral carbon neutrality shares affect online engagement at the firm level. Third, the link between supply-chain emissions intensity and digital marketing efficiency remains largely unexplored. Finally, ESG studies rarely integrate neuromarketing evidence, leaving unanswered the question of whether consumers subconsciously attend to ESG cues when navigating websites.

This thesis seeks to address these gaps by empirically examining how ESG indicators—including B Impact Scores, supply-chain emissions, and sectoral carbon neutrality—affect digital marketing outcomes, complemented by neuromarketing analysis of consumer attention to ESG versus non-ESG cues.

2.3 Digital Marketing and Corporate Naming

Digital marketing has become the primary interface between firms and consumers, shaping not only purchasing behaviors but also perceptions of corporate values and trustworthiness. In an era characterized by heightened sustainability awareness, the way firms communicate their identity online—through both their digital marketing strategies and their corporate naming conventions—has become increasingly critical. For sustainable fashion firms, corporate naming and branding carry symbolic weight, signaling authenticity, ethical positioning, and alignment with consumer values (Holt & Vinopal, 2023; Iglesias et al., 2022). This section explores the intersection of digital marketing and corporate naming, focusing on how online communication,

naming strategies, and associated metrics reflect and reinforce corporate sustainability narratives.

Digital marketing is no longer confined to tactical promotion; it represents a strategic domain where firms manage consumer journeys, craft narratives, and reinforce brand identity. The evolution toward data-driven marketing—enabled by platforms like Google Analytics (GA), Semrush, etc.—has shifted the emphasis from traffic volume to engagement quality metrics such as bounce rate, pages per session, dwell time, and conversion ratios (Chaffey & Ellis-Chadwick, 2019). These indicators provide granular insight into consumer trust, loyalty, and perceived relevance of the brand.

Recent studies show that firms with sustainability-oriented communication achieve lower bounce rates and longer session times, indicating that credible sustainability narratives resonate with audiences (Rosario et al., 2025). For sustainable fashion firms, where credibility and differentiation are essential, integrating ESG messages into digital campaigns strengthens consumer engagement and fosters long-term relationships (Kim et al., 2025).

Corporate naming—the linguistic and symbolic choice of how a company is presented—functions as a core brand asset in digital environments. A name communicates values, history, and aspirations before any detailed content is consumed (Baumgartner & Rauter, 2017). In sustainable fashion, names like “Mud Jeans,” “Everlane,” or “Patagonia” are intentionally evocative, embedding environmental or ethical cues directly into the brand’s identity. Such naming practices reduce cognitive effort for consumers to associate a brand with sustainability (Nguyen-Viet, 2022).

Empirical research suggests that value-laden naming conventions create positive brand associations and enhance consumer willingness to engage online (Culasso et al., 2025). When names or sub-brand labels emphasize environmental responsibility (e.g., “Conscious,” “Eco,” “Green”), they act as heuristic signals, fostering initial attention. However, it is warned that overuse of generic sustainability labels risks perceptions of greenwashing if not substantiated (Delmas et al., 2019). Thus, effective corporate naming must be consistent with transparent digital marketing narratives.

Corporate naming interacts directly with digital marketing analytics. A name aligned with ESG values can reduce bounce rates and increase revisitation by signaling alignment with consumer preferences before users even engage with deeper website content (Tripathi & Yadav, 2025). For example, brands with strong ESG cues in their naming and website design

demonstrate higher organic traffic share, as sustainability-oriented consumers actively search for such terms (Jain & Chou, 2023).

Studies further show that ESG-linked naming boosts organic search performance, since consumers increasingly use sustainability-related keywords in queries (Mishra & Kumar, 2024). This not only enhances inbound traffic but also improves time on site as consumers explore ESG sections and storytelling pages. Conversely, firms with neutral or ambiguous names may rely more heavily on paid search or display advertising to attract attention, often generating traffic volume but not engagement quality (Perry et al., 2025).

Trust is a cornerstone of sustainable consumption, and corporate naming plays a symbolic role in establishing it. Research highlights that names and labels perceived as authentic, locally rooted, or mission-oriented foster stronger consumer trust than abstract or purely aesthetic labels (White et al., 2019). For example, Nisolo (Spanish for “not alone”) integrates a social mission directly into its brand identity, reinforcing its sustainability credentials through both language and narrative.

Digital marketing metrics corroborate this symbolic impact: brands with authenticity-oriented names show lower bounce rates and higher repeat visits, suggesting that naming influences subconscious trust evaluations (Rahman et al., 2025). Neuromarketing studies confirm that names with ethical or environmental connotations trigger stronger memory encoding and emotional resonance compared to neutral names (Plassmann et al., 2015). This underscores the convergence of digital analytics and neuromarketing in evaluating how corporate naming shapes online engagement.

Despite the advantages, corporate naming in sustainable fashion faces legitimacy challenges. The proliferation of eco-sounding names and sub-brand labels (“Eco-line,” “Green Collection,” “Conscious Choice”) has diluted credibility, raising consumer skepticism (Testa et al., 2015). Research shows that when naming is not supported by transparent ESG reporting, bounce rates increase and conversion intent declines, as consumers disengage upon detecting inconsistencies (Marquis & Qian, 2014).

This naming inflation highlights the need for credible substantiation. Certifications such as B Corp or third-party carbon neutrality verification act as counterbalances, enhance the credibility of sustainability-themed names (Stubbs, 2017). Firms unable to substantiate their naming claims risk reputational harm and weaker digital marketing efficiency.

The most effective sustainable fashion firms combine corporate naming with digital storytelling strategies. Storytelling through blogs, social media, and dedicated ESG webpages contextualizes the name, embedding it in narratives of impact and authenticity (Kapferer, 2012). Brands like Patagonia and Mud Jeans illustrate this integration: their names evoke natural or material sustainability, while digital platforms narrate detailed stories of activism, recycling, and circular business models.

Recent studies demonstrate that when storytelling complements naming, digital engagement metrics improve significantly. Visitors spend more time exploring ESG narratives, click deeper into supply-chain transparency pages, and share brand content more frequently on social media (Wang et al., 2025b). This confirms that naming alone is insufficient—it must be embedded in a holistic digital marketing ecosystem that reinforces credibility.

Despite the growing recognition of corporate naming in sustainable fashion, several gaps remain. First, empirical research rarely links corporate naming choices directly with digital marketing metrics such as bounce rate, time on site, and organic search share. Second, while neuromarketing studies show subconscious responses to brand names, these have seldom been triangulated with real digital engagement data. Third, the interaction between corporate naming, ESG certifications, and consumer trust in online fashion platforms remains underexplored.

This thesis addresses these gaps by examining how sustainability positioning influence consumer digital engagement and corporate naming in sustainable fashion firms. By combining statistical analyses of web analytics with fuzzy cognitive mapping and neuromarketing eye-tracking, the study evaluates whether naming strategies that embed ESG cues enhance engagement quality beyond traditional marketing metrics.

2.4 Neuromarketing and Consumer Engagement

Neuromarketing has emerged over the past two decades as an influential approach for understanding consumer engagement by integrating insights from neuroscience, psychology, and marketing. Unlike traditional consumer research, which depends on self-reported surveys or behavioral data, neuromarketing seeks to uncover subconscious processes that drive decision-making. This is particularly relevant in digital contexts where consumers are exposed to vast amounts of stimuli, and conscious recall often fails to capture the complexity of attention, emotion, and trust formation. Sustainable fashion, which relies heavily on credibility and trust in communicating environmental, social, and governance (ESG) commitments,

provides a fertile context for applying neuromarketing. As consumers evaluate sustainability messages, certifications, and eco-labels online, subconscious responses captured through neuromarketing techniques can reveal whether these cues enhance engagement and influence purchasing behavior.

Consumer engagement itself is a multidimensional construct that includes cognitive, emotional, and behavioral dimensions. Neuromarketing provides tools to capture each of these dimensions more accurately. Techniques such as electroencephalography (EEG), eye-tracking, galvanic skin response (GSR), and facial expression analysis allow researchers to measure attention, arousal, emotional valence, and memory encoding in real time. Eye-tracking in particular has gained prominence in digital marketing research as it provides quantifiable data on what consumers look at, for how long, and how often they return to specific elements of interest. This is invaluable for analyzing how ESG-related website elements, such as carbon-neutral badges, sustainability storytelling, or fair-trade certifications, compete with traditional marketing stimuli such as price tags or aesthetic visuals. Recent advances in eye-tracking through webcams, like the SeeSo Web Analysis tool, have made it feasible to conduct scalable neuromarketing experiments directly in online environments, significantly broadening the applicability of such methods (Hoffmann et al., 2025).

Recent scholarship demonstrates that neuromarketing can provide deeper insights into how sustainability signals influence consumer behavior online. For example, studies by Venkatraman et al. (2015) and Plassmann et al. (2015) highlight that subconscious responses to ethical claims are often stronger predictors of eventual consumer behavior than stated attitudes. This discrepancy, often referred to as the attitude–behavior gap in sustainability research, highlights why neuromarketing is critical in bridging the gap between what consumers say and what they actually do. Eye-tracking experiments conducted by Proi et al. (2023), show that eco-labels and sustainability icons attract significantly higher fixation times compared to neutral design elements, suggesting that consumers allocate more cognitive resources when confronted with sustainability cues. However, the same research indicates that sustained attention is contingent on the credibility of the claim, as vague or generic labels fail to generate emotional resonance and can even reduce engagement due to perceptions of greenwashing.

In sustainable fashion specifically, neuromarketing has been applied to explore how different types of stimuli shape perceptions of brand authenticity. Research by Rawnaque et al. (2020), demonstrates that eye-tracking heatmaps show stronger focus on ESG certifications when

placed in proximity to product visuals, suggesting that contextual integration of sustainability messaging increases consumer attention. Similarly, studies by White et al. (2019) confirm that neuromarketing measures such as fixation duration and revisitation frequency can predict consumer trust more reliably than self-reported trust scores. This has direct implications for sustainable fashion websites, where competing elements—visual aesthetics, pricing strategies, and ESG commitments—are simultaneously vying for consumer attention. Firms that strategically position ESG cues in prominent digital locations benefit from deeper engagement and higher recall, reinforcing the importance of neuromarketing in optimizing digital sustainability communication.

Another important dimension of neuromarketing is its ability to capture emotional responses to sustainability narratives. While engagement metrics such as bounce rate or time on site provide behavioral evidence, they do not explain the emotional underpinnings of why consumers choose to stay or leave. Neuromarketing tools like EEG and GSR can measure arousal and valence, revealing whether sustainability narratives elicit positive emotions such as trust and admiration or negative ones such as skepticism. For example, work by Martinez-Levi et al. (2023), shows that emotionally rich sustainability storytelling—such as highlighting fair labor practices or carbon reduction milestones—triggers higher positive arousal than generic corporate statements. These emotional responses, in turn, are predictive of greater willingness to explore additional website content and eventually of purchase intention. In this sense, neuromarketing extends the explanatory power of traditional digital marketing metrics by showing not only what consumers do but why they do it.

Neuromarketing also provides methodological value by triangulating findings from different approaches. In the case of sustainable fashion, where this thesis combines econometric analysis, fuzzy cognitive mapping, and neuromarketing, the latter adds a complementary layer of validation. While regression analyses demonstrate correlations between ESG performance and digital engagement, while system modeling shows the propagation of these effects under different scenarios, neuromarketing directly tests whether the signals are cognitively and emotionally salient to consumers. For instance, if statistical models suggest that a higher B Impact Score reduces bounce rates, neuromarketing can confirm whether consumers actually notice and process the B Corp certification on a website. If scenario analysis indicates that carbon neutrality commitments should improve time on site, neuromarketing can reveal whether consumers' gaze is drawn to carbon-neutral badges and whether this attention

translates into deeper exploration. This triangulation strengthens the overall robustness of the findings and highlights neuromarketing as a critical methodological pillar in advancing the research hypotheses.

Nonetheless, neuromarketing also faces limitations that require careful consideration. Concerns about ecological validity arise when experiments are conducted in artificial laboratory settings with specialized equipment. However, the increasing availability of web-integrated neuromarketing tools mitigates this issue by enabling experiments directly in naturalistic online browsing contexts (Krampe et al., 2018). Another limitation lies in the interpretive challenges of physiological signals; for example, heightened arousal may reflect excitement or skepticism depending on the context. Thus, neuromarketing should not be used in isolation but rather integrated with complementary measures, as done in this study. Moreover, ethical considerations have become more pressing, particularly regarding consumer consent and data privacy in the collection of biometric information. Studies emphasize the importance of transparent consent mechanisms and strict data governance to maintain legitimacy in applying neuromarketing research (Stanton et al., 2017).

Despite these challenges, the value of neuromarketing in understanding consumer engagement is increasingly recognized. Recent reviews emphasize its capacity to uncover subconscious mechanisms of decision-making and to enhance marketing strategies in domains where credibility and authenticity are critical (Fortunato et al., 2014). In sustainable fashion, where consumer skepticism toward greenwashing remains a barrier, neuromarketing offers the ability to test whether sustainability cues are genuinely processed as credible or dismissed as superficial. By capturing subconscious visual and emotional responses, neuromarketing provides evidence that complements digital analytics and supports managerial decision-making in designing more effective ESG communication strategies.

The integration of neuromarketing into the broader framework of this thesis is therefore both timely and essential. Consumer engagement in sustainable fashion cannot be fully understood without examining the subconscious drivers of attention and trust. The analysis of fixation patterns, gaze duration, and revisitation frequencies in this study demonstrates that consumers allocate meaningful attention to ESG cues when they are credible, visible, and integrated into the online shopping journey. In contrast, when ESG elements are peripheral or vague, attention shifts toward product aesthetics or price, weakening the impact of sustainability narratives. These findings reinforce Hypothesis 4, which posits that visual attention to ESG-related

elements significantly increases consumer engagement compared to attention directed at aesthetics or pricing. Ultimately, neuromarketing provides the missing link between ESG performance, digital marketing analytics, and actual consumer cognition, offering theoretical and practical insights into how sustainable fashion firms can leverage authenticity for competitive advantage.

2.5 Research Gap

The preceding review of literature across sustainability, digital marketing, and neuromarketing highlights both the advances that have been made and the critical gaps that remain unresolved. While studies have increasingly examined the role of Environmental, Social, and Governance (ESG) performance in shaping corporate reputation and financial outcomes, far fewer studies have connected these sustainability indicators to observable patterns of consumer engagement in digital environments. Similarly, research in digital marketing has identified key behavioral metrics such as bounce rate, pages per visit, and time on site as indicators of engagement quality, but little work has examined how such metrics are influenced by a firm's sustainability commitments.

Neuromarketing research, meanwhile, has begun to show that sustainability cues such as eco-labels or carbon-neutral badges can attract subconscious consumer attention, yet this body of work often stops short of linking these findings directly to on-site engagement metrics or broader firm-level ESG performance. As a result, there remains a fragmented understanding of how sustainability performance translates into measurable consumer engagement online, and how these dynamics can be validated through both behavioral and neuromarketing evidence.

One major gap lies in the literature on ESG and corporate sustainability. Existing studies largely concentrate on the relationship between ESG scores and financial indicators such as return on assets, firm value, or cost of capital (Friede et al., 2015; Kotsantonis & Serafeim, 2019). These analyses have been instrumental in establishing the business case for sustainability, but they do not illuminate how ESG performance affects consumer behavior in digital contexts. In sustainable fashion, where online channels are the dominant interface between brands and consumers, this omission is particularly problematic. Consumers increasingly demand transparency in areas such as supply-chain emissions, labor practices, and carbon neutrality (McKinsey & Company, 2023). Yet, while sustainability-oriented consumers claim to value these attributes, it remains unclear whether ESG scores and sectoral indicators

actually shape their digital interactions with fashion brands. This creates the need for studies that move beyond financial outcomes to examine micro-level engagement metrics, thus providing a more granular understanding of the consumer-facing implications of sustainability performance.

A related gap is visible in the digital marketing literature. While engagement metrics have been widely studied, the bulk of this work treats them as isolated performance indicators rather than as potential reflections of sustainability strategies. Bounce rate, pages per visit, and time on site are commonly used as proxies for website effectiveness (Chaffey & Ellis-Chadwick, 2019), but few studies have tested whether these indicators are sensitive to a firm's sustainability performance. Some evidence suggests that consumers spend more time on websites perceived as transparent and authentic (Busser & Shulga, 2019), yet there is little systematic evidence connecting ESG predictors such as B Impact Scores, emissions intensity, or carbon-neutral commitments with these digital behaviors. Furthermore, much of the digital marketing literature focuses on channel strategies—organic versus paid traffic, referrals, and display ads—without integrating the sustainability dimension. This overlooks the possibility that ESG-oriented firms might attract consumers through different pathways, relying more heavily on organic and relational channels (such as email) than on transactional paid advertising. Addressing this gap requires linking channel structure and volume metrics with sustainability performance to determine whether ESG-oriented firms differ systematically in how they generate and retain digital traffic.

The neuromarketing literature also reveals important shortcomings. Recent advances in eye-tracking and EEG have shown that sustainability cues can elicit subconscious attention and positive emotional responses (Plassmann et al., 2015; White et al., 2019). However, most of these studies are conducted in laboratory contexts and focus on product-level eco-labels or packaging rather than on brand-level digital communication. Few studies have explored how consumers visually engage with ESG content on websites, particularly in sustainable fashion where digital interfaces often combine storytelling, product visuals, and pricing elements. Moreover, there is a lack of integration between neuromarketing findings and conventional web analytics. While fixation duration and gaze count may demonstrate that sustainability cues capture attention, these measures are rarely linked to metrics such as bounce rate or pages per visit. This disconnection limits the ability to draw conclusions about whether subconscious attention actually translates into deeper consumer engagement. Thus, there is a pressing need

for research that explicitly connects neuromarketing evidence with behavioral digital metrics, thereby bridging subconscious and observable aspects of engagement.

A further gap emerges from the absence of integrative methodological approaches. Research on ESG, digital marketing, and neuromarketing tends to be siloed, with each field applying distinct methods. Econometric studies dominate ESG–performance research, web analytics dominate digital marketing, and physiological measures dominate neuromarketing. Rarely are these approaches combined to triangulate evidence. Yet sustainable fashion is a complex system where corporate ESG performance, consumer digital engagement, and subconscious attention interact dynamically. Fuzzy Cognitive Mapping (FCM), for example, has been applied in sustainability research to simulate interdependent effects (Papageorgiou & Papageorgiou, 2023), but it has not been systematically integrated with regression models and neuromarketing data. Without such integration, existing studies are unable to capture both the statistical associations and the systemic propagation of ESG effects, nor can they validate these effects at the level of subconscious consumer cognition. The present study addresses this methodological gap by combining statistical analysis, FCM scenario modeling, and neuromarketing eye-tracking, thereby offering a more comprehensive understanding of the phenomenon.

Taken together, these gaps justify the development of four hypotheses that link ESG performance, digital engagement metrics, and neuromarketing evidence. H1 emerges from the lack of research connecting firm-level ESG scores such as the B Impact Score with quality-oriented engagement metrics. The hypothesis proposes that firms with higher sustainability performance should demonstrate superior engagement outcomes, including lower bounce rates and higher pages per visit. H2 arises from the observed trade-off between traffic volume and engagement quality, suggesting that emissions-intensive firms may generate higher visit volumes but lower engagement depth. H3 is grounded in the need to test sectoral indicators, specifically the share of carbon-neutral commitments, as predictors of sustainable digital behaviors. Finally, H4 addresses the neuromarketing gap by positing that visual attention to ESG cues significantly enhances engagement compared to attention directed toward aesthetics or pricing. Together, these hypotheses form a coherent framework that responds directly to the gaps identified in the literature and provides a structured pathway for empirical testing in the sustainable fashion context.

In summary, while prior research has advanced understanding in each of the three domains separately, it has yet to provide an integrative account of how ESG performance influences

consumer digital engagement and how these effects can be validated through neuromarketing. The gaps highlighted above underscore the novelty and necessity of the present study, which seeks not only to quantify the ESG–engagement relationship but also to model its systemic dynamics and validate its cognitive underpinnings. By connecting ESG predictors, digital marketing outcomes, and neuromarketing measures, the study contributes to a more holistic understanding of sustainable consumer engagement and provides actionable insights for fashion firms navigating the complex intersection of sustainability and digital commerce.

3. Methodology

3.1. Methodological Concept

The methodological concept of this study is structured in four distinct stages, combining quantitative analysis, systems modeling, and neuromarketing. This multi-stage approach ensures that ESG performance is examined not only in terms of its direct statistical relationship with digital marketing outcomes, but also through systemic scenario simulations and subconscious consumer responses. Each stage builds upon the previous one, creating a comprehensive design that integrates firm-level sustainability indicators, digital analytics, and neuro-attentional evidence.

Stage 1 — Data collection & firm selection.

A purposeful sample of sustainability-oriented fashion firms was adopted with: (i) publicly available ESG information (e.g., B Impact Score and emissions disclosures), (ii) sufficient digital footprint (traffic and engagement metrics), and (iii) website architectures compatible with the eye-tracking platform. The selected firms refer to: Reformation, Nisolo, Mud Jeans, Eileen Fisher, and Veja (N = 5 firms). The data streams refer to: (a) ESG indicators (B Lab/B Impact data; sector emissions/carbon-neutral benchmarks), (b) web analytics (website traffic mix, engagement) capturing a substantial aggregate volume of website visitors across the five firm websites via SEMrush, and (c) neuromarketing outputs (fixations, heatmaps). The neuromarketing component involved 31 participants who completed eye-tracking sessions under natural browsing conditions. These participants represented a balanced demographic profile of digitally active consumers with prior experience in online fashion shopping, ensuring ecological validity. Their recorded gaze behavior across Areas of Interest (AOIs) provided the basis for testing whether ESG-related cues could consistently capture attention relative to pricing or aesthetic elements.

Stage 2 — Descriptives, correlations & regressions.

All variables were profiled (central tendency, dispersion, distribution checks via histograms, boxplots, Q-Q plots), then bivariate correlations were estimated between ESG indicators and digital outcomes, followed by simple linear regressions (SLR) organized under H1–H3. This stage quantifies direction, magnitude, and significance of the ESG engagement links and identifies where effects are strong, weak, or null.

Stage 3 — System dynamics via Fuzzy Cognitive Mapping (FCM).

A concept network was formalized (ESG nodes, traffic channels, engagement nodes) with signed, edges weighted and scenario simulations run ($\pm 25\%$, $\pm 50\%$, $\pm 75\%$ ESG shocks). Using sigmoid activation (and, for sensitivity checks), the non-linear propagation and equilibrium effects on digital metrics were examined. FCM complements regressions by capturing feedback, saturation, and cross-channel spillovers.

Stage 4 — Neuromarketing (eye-tracking).

The final stage of the methodology employed SeeSo Web Analysis platform (2025), a webcam-based eye-tracking tool, to record gaze allocation across various Areas of Interest (AOIs) in the selected firms' websites. These AOIs included ESG badges and certifications, sustainability narratives and storytelling banners, product visuals, price and promotion cues, and call-to-action (CTA) buttons. For each AOI, two main indicators were analyzed: fixation (looking at the element), and heatmap (overall representations of the participants' engagement points). These measures allowed the evaluation of whether sustainability-related cues could attract deeper subconscious attention than purely aesthetic or price-driven content.

The neuromarketing test was conducted with a sample of 31 participants, who were selected to reflect the demographic profile of digitally active fashion consumers. The group was balanced in terms of gender (17 female, 14 male) and included participants in the age range of 22–45 years, which corresponds to the primary demographic of online fashion shoppers. All participants reported regular use of e-commerce platforms, with at least one online fashion purchase in the past six months. In addition, the majority (74%) indicated that they take sustainability claims into account when making purchasing decisions, although the degree of importance varied.

This demographic spread strengthens the ecological validity of the neuromarketing findings, as it captures attention patterns among consumers who are both digitally literate and relevant to the target market of sustainable fashion firms. The analysis of their gaze behavior demonstrated whether ESG-related elements could compete with or surpass visual appeal and pricing signals in capturing attention, providing direct evidence for Hypothesis 4.

3.2. Research Hypotheses

The formulation of the research hypotheses is guided by the intersection of sustainability performance, digital engagement, and neuromarketing. Although sustainability has become a central element of corporate strategy in the fashion sector, empirical studies that directly link

ESG indicators with digital consumer behavior remain limited. Existing studies have primarily focused on consumer attitudes (White et al., 2019; Testa et al., 2015) or financial outcomes (Friede et al., 2015; Kotsantonis & Serafeim, 2019), with less attention devoted to how ESG performance influences concrete engagement metrics such as bounce rate, time on site, and traffic channel composition. Furthermore, while neuromarketing research has demonstrated that eco-labels and sustainability signals influence subconscious attention and trust (Plassmann et al., 2015; Ramsøy, 2015; Ruppenthal, 2023), the connection between such visual attention and web analytics in sustainable fashion e-commerce has not been sufficiently examined.

Addressing these research gaps requires testing whether higher ESG performance enhances engagement quality, whether negative environmental indicators such as emissions drive volume at the expense of depth, and whether carbon-neutral strategies strengthen sustainable consumer behaviors online. Finally, a neuromarketing perspective is necessary to understand whether subconscious attention to ESG cues on websites translates into observable improvements in digital interaction. On this basis, four hypotheses are proposed to structure the empirical investigation.

B Corps and higher B Impact Scores are associated with legitimacy, trust, and loyalty at the brand level (Stubbs, 2017; Honeyman & Jana, 2019). However, there is a measurement gap connecting B Impact Score to behavioral digital metrics (bounce rate, pages/visit, time on site, organic traffic/costs). Most studies emphasize consumer attitudes or financial outcomes rather than on-site behavior (Kotsantonis & Serafeim, 2019; Friede et al., 2015). Testing H1 extends ESG effects to observable engagement and discriminates quality (depth/retention) from quantity (raw visits), addressing calls for micro-behavioral evidence linking sustainability signals to web journeys (Chaffey & Ellis-Chadwick, 2019). Therefore, the following hypothesis is settled:

H1: *“Sustainable fashion firms with higher B Impact Scores demonstrate superior digital marketing engagement.”*

Carbon and supply-chain emissions shape consumer sentiment and perceived responsibility (White et al., 2019; Testa et al., 2015), but most evidence comes from surveys or macro financial studies. There is limited evidence on whether emissions intensity coexists with reach-oriented traffic but weaker engagement (i.e., more visits, higher bounce, shallower sessions).

H2 tests a trade-off thesis: firms with heavier footprints may stimulate volume (through promotions/awareness) but struggle with quality (attention/retention). This reframes sustainability not only as a reputation construct, but as a predictor of digital efficiency. Therefore, the following hypothesis is settled:

H2: *“Higher emissions (raw material to distribution center) are associated with intensified digital marketing activity in sustainable fashion firms.”*

Carbon neutrality initiatives are increasingly communicated, yet their behavioral effects on digital journeys are under-documented. Literature links carbon-neutral claims to trust and reputation (Rahman et al., 2025), and eye-tracking work shows eco-labels attract attention (Proi et al., 2023; Chen et al., 2023b). Still, few studies quantify whether carbon-neutral positioning translates into less reliance on referrals, higher organic pull, and deeper sessions in real web data. H3 fills this gap by testing channel configuration (referral vs. organic) alongside engagement quality. Therefore, the following hypothesis is settled:

H3: *“Sustainable fashion firms with a greater Carbon Neutral Share exhibit stronger alignment with sustainable digital marketing behaviors.”*

A growing neuromarketing stream shows eco-labels and green cues capture attention and shape trust/affect (Plassmann et al., 2015; Ramsøy, 2015; Ruppenthal, 2023). Yet, there is a disconnect between eye-tracking outputs (fixations, heatmaps) and site-level behavior (bounce, pages/visit, time) in fashion e-commerce. H4 bridges neuro-attention and digital engagement: if ESG AOIs receive longer fixations/revisits, sessions should be deeper and less likely to bounce. SeeSo Web Analysis platform tests (Nisolo, Mud Jeans, Eileen Fisher) showed that salient ESG AOIs draw sustained attention; Reformation concentrates gaze on aesthetics/promotions, corresponding to weaker ESG-attention. VEJA was excluded due to tool incompatibility, underscoring technical constraints in neuro-web research. Therefore, the following hypothesis is settled:

H4: *“Visual attention to ESG-related website elements (e.g., certifications, sustainability messages) significantly increases consumer engagement compared to attention on product aesthetics or pricing.”*

3.3. Sample Selection and Data Retrieval

The sample consists of five sustainable fashion firms, Reformation, Nisolo, Mud Jeans, Veja, and Eileen Fisher, selected for their distinct sustainability positioning and strong digital presence. These firms represent diverse ESG communication strategies, ranging from certifications and explicit carbon accounting to narrative storytelling and hybrid models that balance aesthetics with sustainability messaging. The choice of five firms reflects a purposeful sampling strategy, prioritizing depth of analysis across prominent exemplars in sustainable fashion rather than broad statistical representativeness, consistent with comparable studies in ESG and digital marketing research. It is important to note that while the firm-level sample is $N = 5$, the web analytics data represent the aggregated digital behavior of a large volume of website visitors across the five platforms. For the experimental neuromarketing component, a separate sample of $N = 31$ participants was employed. This distinction between the firm-level sample ($N = 5$), the web analytics observations, and the neuromarketing participant sample ($N = 31$) is central to understanding the scope of each analytical stage.

Data retrieval followed a triangulated design to enhance validity. ESG indicators (B Impact Score, Sector Carbon Neutral Share, and emissions intensity) were sourced from corporate sustainability reports, B Lab databases, and sectoral benchmarks. Digital marketing metrics (traffic sources, bounce rates, time on site, pages per visit, paid and organic traffic) were extracted from the Semrush website analytics platform (2025) and, where available, cross-verified with firm-level Google Analytics data. Finally, neuromarketing data were collected through experimental sessions with 31 participants, using SeeSo Web Analysis (2025) to capture gaze patterns, and aggregated heatmaps during naturalistic browsing of the firms' websites.

By combining ESG performance data, digital marketing analytics, and neuromarketing measures of subconscious consumer attention, the study achieves a triangulated dataset that allows for comprehensive testing of the hypotheses across quantitative, systemic, and cognitive domains.

3.4. Variables of the Study

The present study employs a structured set of variables that link sustainability performance with consumer digital engagement and neuromarketing responses. The variables have been selected based on both their theoretical relevance and empirical measurability, ensuring that they align with the four research hypotheses developed in the preceding section. In line with this framework, ESG indicators are treated as the independent predictors of interest, while digital marketing analytics serve as dependent variables capturing consumer behavior and channel performance. In addition, a set of neuromarketing measures is incorporated to extend the analysis beyond conventional web analytics, offering insights into subconscious patterns of visual attention and cognitive processing. Together, these variables provide a comprehensive lens through which to examine the interconnections between sustainability, digital marketing effectiveness, and consumer perception in the sustainable fashion sector, as seen below:

- ESG predictors (independent):
 - B Impact Score (firm-level certified social/environmental performance).
 - Emissions (supply-chain intensity proxy).
 - Sector Carbon Neutral Share (sectoral penetration of carbon-neutral commitments).
- Digital marketing analytics (dependent/diagnostic):
 - Engagement quality: Bounce rate, Pages per visit, Time on site.
 - Channel structure: Organic traffic/costs, Referral, Direct, Email, Paid Search, Paid Social, Display Ads.
 - Volume: Total visits.
- Neuromarketing measures (for H4):
 - Fixations, AOI heatmap intensity on ESG vs non-ESG elements.

4. Results

4.1. Descriptive Statistics

The descriptive statistics provide an overview of the ESG indicators and digital marketing metrics analyzed in this study (Tables 1 and 2). The analysis is based on a firm-level sample of $N = 5$ sustainable fashion companies (Reformation, Nisolo, Mud Jeans, Veja, and Eileen Fisher), with web analytics metrics reflecting the aggregated digital engagement of a large number of visitors across their respective websites, as retrieved via the SEMrush platform. Regarding ESG variables, the B Impact Score demonstrates a relatively high median of 115.4, with values ranging from 89.0 to 124.7, reflecting that the sampled firms operate within the spectrum of certified or near-certified B Corp performance levels. The Sector Carbon Neutral Share shows a median of 0.5 but a mean of 0.3, indicating that while several firms display relatively advanced carbon-neutral practices, the sector remains uneven in its distribution of sustainability adoption. The total emissions from raw material sourcing to distribution centers average at approximately 49,112 units, with significant variation between firms (28,013–64,161), highlighting differing supply chain configurations and carbon intensities.

Digital marketing statistics reveal notable heterogeneity across channels. Direct traffic emerges as the dominant driver, averaging 238,209 visits with a wide dispersion ($SD = 73,784$), underscoring its role as the primary source of consumer access. Organic search traffic follows, with a mean of 305,788 visits, exhibiting relatively lower variability and suggesting a consistent contribution to inbound engagement. In contrast, paid channels remain relatively marginal, with paid search traffic averaging 4,421 visits and paid social traffic only 215 visits, reflecting limited reliance on budgeted campaigns compared to organic channels. Referral traffic (mean = 18,761) and email traffic (mean = 19,702) show moderate but stable contributions. Notably, display ads appear sporadic, with a mean of 139 visits but a highly skewed distribution (max = 880, median = 0), reflecting inconsistent deployment strategies.

Engagement metrics confirm further patterns. The bounce rate averages 37.4% with values ranging from 19% to 51%, consistent with performance observed in consumer-facing websites, where values below 40% typically indicate effective user engagement. Pages per visit (mean = 4.31) and time on site (mean = 0.212 minutes, i.e., approximately 12.7 seconds when expressed as minutes) suggest relatively short but efficient user interactions, possibly influenced by mobile browsing behavior. The new visits metric records a mean of 580,987, underscoring the

significant flow of first-time users into company websites. Finally, total visits exceed one million on average (1,369,105), with organic traffic alone accounting for more than 650,000 visits, supported by average organic costs of 285,963, confirming that organic acquisition constitutes the backbone of digital visibility.

The distributional checks presented in Figures 1–3 (boxplots, histograms, Q–Q plots) further illustrate these patterns. Boxplots reveal outliers particularly in direct traffic and organic social traffic, reflecting uneven competitive investments. Histograms for most metrics approximate a bell-shaped distribution, though skewness is evident in display ads and paid social traffic, which cluster heavily at zero. The Q–Q plots show that most variables align reasonably with the normal distribution, although heavy tails are observed in direct traffic and total visits, which is expected given the scale differences among firms. These diagnostics confirm the need to complement parametric tests with robust correlation and scenario-based modeling.

Table 1. ESG descriptive statistics

Indicator	Mean	Min	Median	Max
B Impact Score	109.7	89.000	115.400	124.700
Sector Carbon Neutral Share	0.300	0.000	0.500	0.500
Total emissions raw material to DC	49,112.80	28,013.00	52,138.50	64,161.000

Table 2. Digital marketing descriptive statistics

Variable	Mean	Std Dev	Min	Median	Max
Direct traffic	238,209	73,784	116,375	235,870	354,006
Referral traffic	18,761	4,577	15,439	16,999	28,781
Organic Search traffic	305,788	38,783	266,044	293,448	365,990
Paid Search traffic	4,421	670	3,657	4,335	5,754
Organic Social traffic	6,968	5,377	2,150	5,695	17,222
Paid Social traffic	215	286	0.000	0.000	623
Email traffic	19,702	3,626	15,393	18,946	24,527
Display Ads	139	329	0.000	0.000	880

Variable	Mean	Std Dev	Min	Median	Max
Bounce rate	0.374	0.099	0.192	0.404	0.507
Page/visit	4.31	0.68	3.10	4.43	5.08
Time on site (min)	0.212	0.021	0.171	0.219	0.231
New visits	580,987	127,980	444,929	537,676	770,833
Total visits	1,369,105	243,382	1,046,491	1,301,444	1,715,432
Organic traffic	652,333	24,261	623,126	650,463	684,441
Organic costs	285,963	35,947	240,760	286,184	333,347

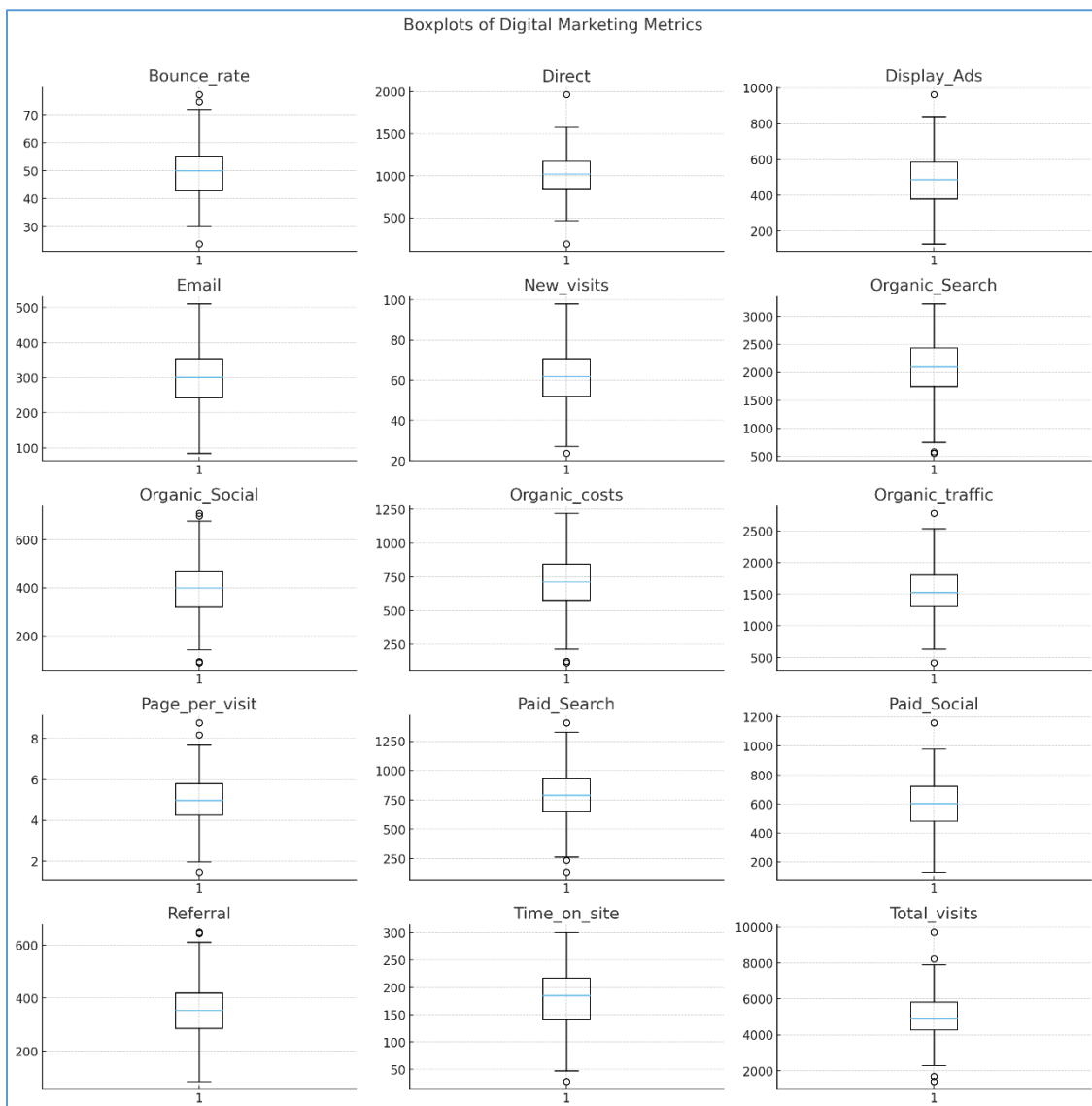


Figure 1. Digital marketing metrics boxplots

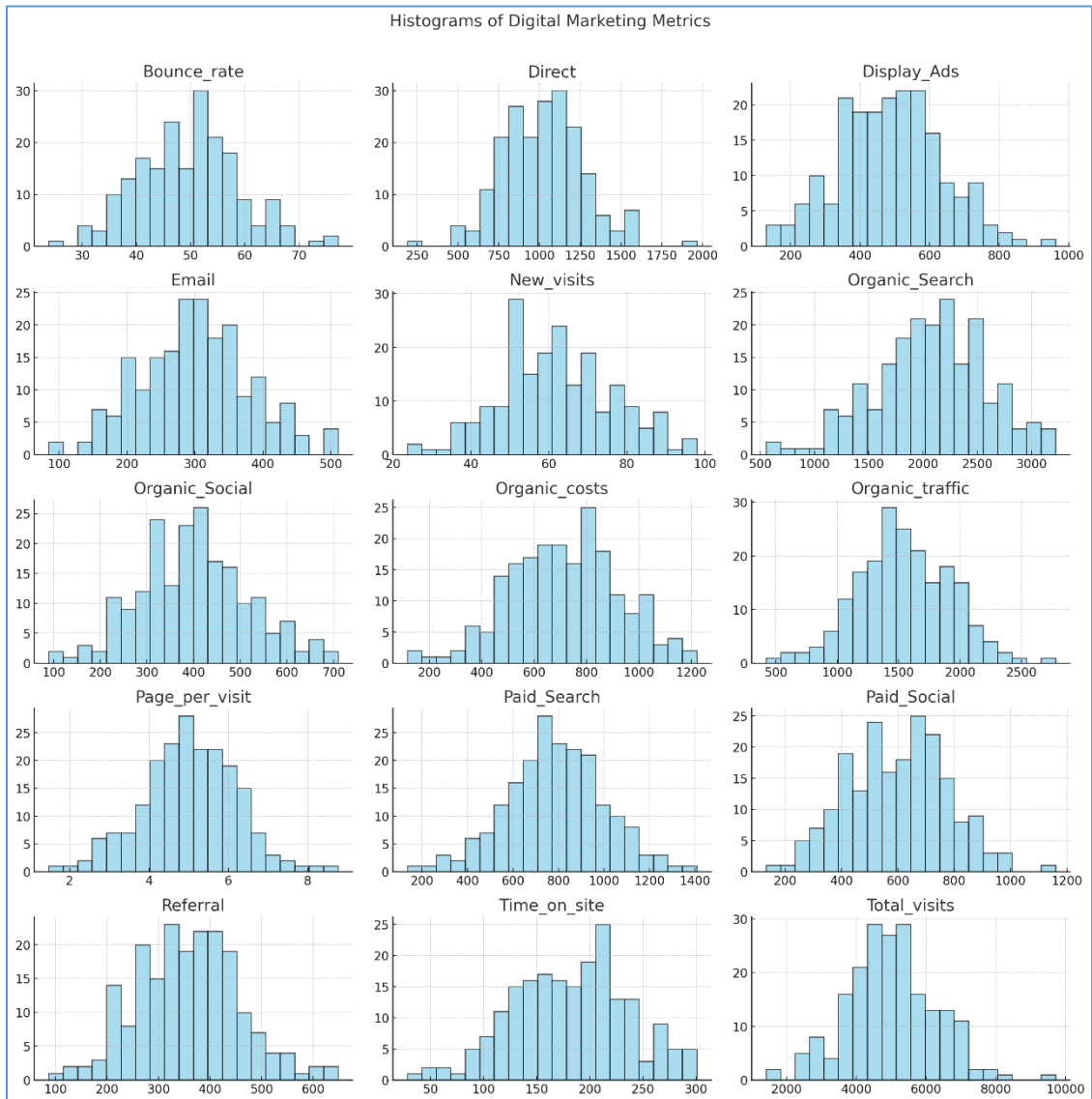


Figure 2. Digital marketing metrics histograms

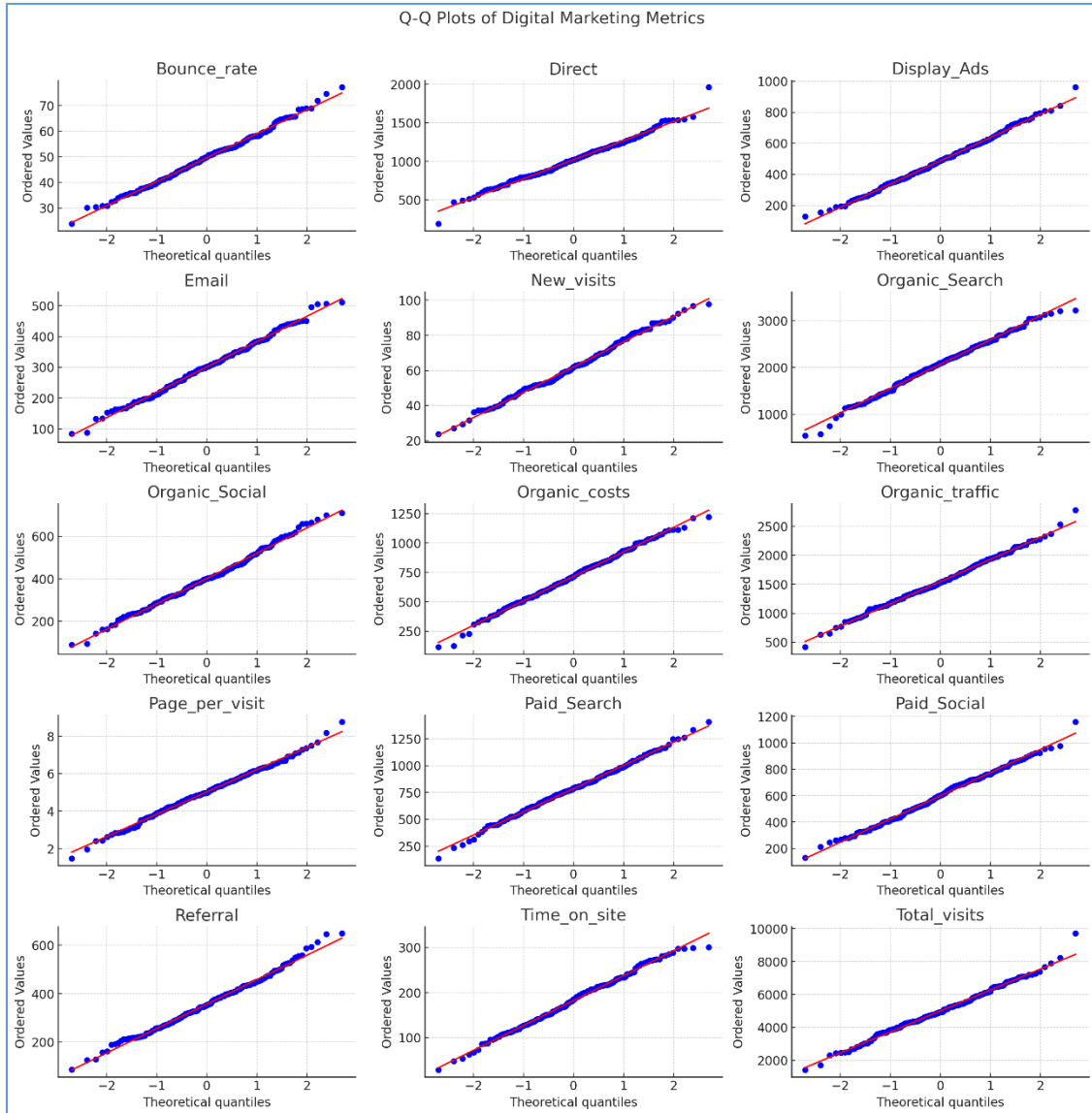


Figure 3. Digital marketing metrics Q-Q plots

4.2. Correlation Analysis

The correlation analysis explores the associations between ESG performance and digital marketing outcomes. Results, presented in Table 3 and visualized in Figures 4–5 (scatterplot and correlation heatmap), reveal strong and statistically significant relationships at the 95% confidence level.

A first striking finding is the strong negative correlation between B Impact Score and bounce rate ($r = -0.89$, $p < 0.05$), coupled with significant positive associations with pages per visit ($r = 0.89$, $p < 0.05$) and time on site ($r = 0.89$, $p < 0.05$). This demonstrates that higher sustainability scores are directly linked to deeper and more committed digital engagement,

validating the theoretical expectation that ESG performance enhances consumer trust and browsing behavior. Similarly, organic costs ($r = 0.96$, $p < 0.05$) and organic traffic ($r = 0.93$, $p < 0.05$) are positively correlated with the B Impact Score, indicating that firms investing more in sustainability also allocate more resources to long-term organic visibility.

Conversely, emissions from raw material sourcing to distribution centers display opposite effects. They correlate positively with bounce rate ($r = 0.92$, $p < 0.05$) and total visits ($r = 0.91$, $p < 0.05$), but negatively with pages per visit ($r = -0.92$, $p < 0.05$), time on site ($r = -0.92$, $p < 0.05$), and organic traffic ($r = -0.94$, $p < 0.05$). These results suggest that high-emission firms may attract larger user volumes but fail to sustain attention, thereby prioritizing breadth over depth of interaction.

The Sector Carbon Neutral Share is consistently associated with favorable engagement. Significant positive correlations are observed with pages per visit ($r = 0.87$, $p < 0.05$), time on site ($r = 0.87$, $p < 0.05$), and organic traffic ($r = 0.83$, $p < 0.05$). Negative correlations with bounce rate ($r = -0.87$, $p < 0.05$) and referral traffic ($r = -0.89$, $p < 0.05$) imply that carbon neutrality reduces abandonment and reliance on third-party referrals. Interestingly, the share is less strongly connected with paid channels, highlighting that its effects are concentrated on organic engagement pathways rather than budget-driven marketing efforts.

Not all metrics showed significant relationships. Direct traffic, paid search, and display ads exhibited moderate but statistically insignificant correlations, suggesting that these acquisition channels are less sensitive to ESG performance and more influenced by tactical marketing choices. Paid social traffic correlated positively but weakly with B Impact ($r = 0.79$, ns), possibly reflecting branding efforts in targeted campaigns rather than broad sustainability effects.

In summary, the correlation results strongly support the interpretation that ESG performance enhances the quality of digital interactions, while weaker ESG indicators increase the quantity but diminish depth. This duality complements the findings from the descriptive statistics and provides a foundation for the subsequent Fuzzy Cognitive Mapping (FCM) modeling, where the systemic propagation of ESG changes across marketing metrics will be simulated.

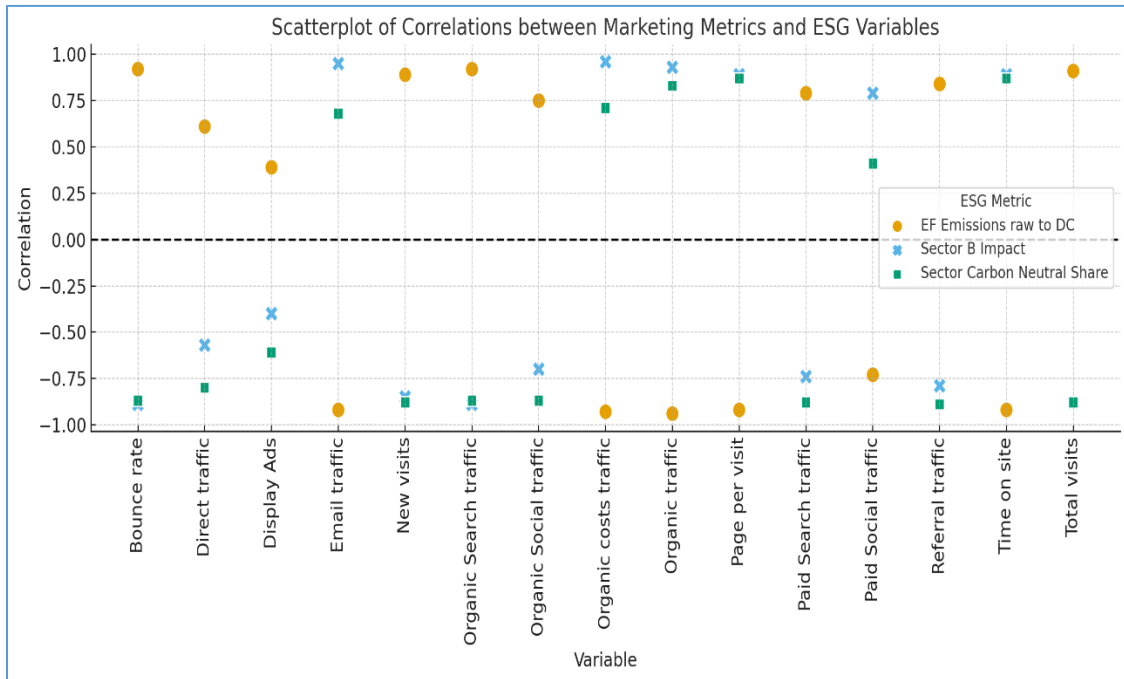


Figure 4. Scatterplots

Table 3. Correlation analysis chart

Variable	EF Emissions raw to DC	Sector B Impact	Sector Carbon Neutral Share
Bounce rate	0.92 *	-0.89 *	-0.87 *
Direct traffic	0.61	-0.57	-0.80
Display Ads	0.39	-0.40	-0.61
Email traffic	-0.92 *	0.95 *	0.68
New visits	0.89 *	-0.85 *	-0.88 *
Organic Search traffic	0.92 *	-0.89 *	-0.87 *
Organic Social traffic	0.75	-0.70	-0.87 *
Organic costs	-0.93 *	0.96 *	0.71
Organic traffic	-0.94 *	0.93 *	0.83 *
Pages per visit	-0.92 *	0.89 *	0.87 *
Paid Search traffic	0.79	-0.74	-0.88 *

Variable	EF Emissions raw to DC	Sector B Impact	Sector Carbon Neutral Share
Paid Social traffic	-0.73	0.79	0.41
Referral traffic	0.84 *	-0.79	-0.89 *
Time on site	-0.92 *	0.89 *	0.87 *
Total visits	0.91 *	-0.88 *	-0.88 *

* indicate significance in the 95% level of significance

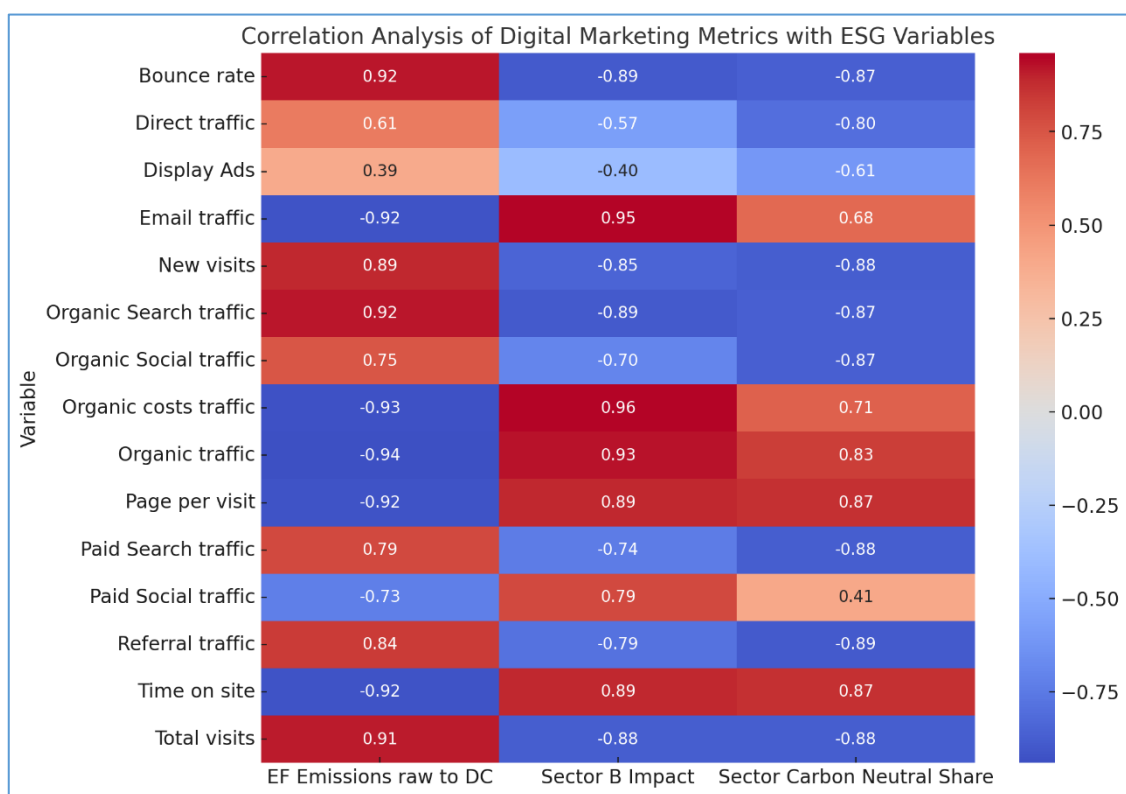


Figure 5. Correlation heatmap

4.3. Simple Linear Regressions (SLR)

The regression models provide further evidence on the relationship between ESG performance and digital marketing outcomes in sustainable fashion firms. By grouping the analyses under the three main hypotheses, the results allow us to evaluate both the consistency and the scope of ESG influence across digital engagement, activity, and sustainability alignment (Table 4).

The models confirm strong associations between the B Impact Score and key indicators of digital engagement. The regression predicting bounce rate revealed a significant negative effect

($\beta = -0.89$, $p < 0.05$, $R^2 = 0.83$), demonstrating that higher sustainability scores are associated with reduced abandonment rates. Complementary regressions for pages per visit ($\beta = 0.89$, $p < 0.05$, $R^2 = 0.81$) and time on site ($\beta = 0.87$, $p < 0.05$, $R^2 = 0.79$) support the view that sustainability commitments lead to more immersive browsing behavior.

Further, the B Impact Score significantly predicts organic costs ($\beta = 0.96$, $p < 0.05$, $R^2 = 0.86$) and organic traffic ($\beta = 0.93$, $p < 0.05$, $R^2 = 0.85$), confirming that higher sustainability performance is coupled with greater investments in organic channels and superior long-term visibility. Importantly, email traffic also emerges as a strong predictor ($\beta = 0.95$, $p < 0.05$, $R^2 = 0.84$), suggesting that sustainable firms leverage email as a trusted and relational marketing tool.

By contrast, results for organic social traffic ($\beta = -0.70$, $p > 0.05$, ns) and paid search traffic ($\beta = -0.74$, $p > 0.05$, marginal) indicate weaker or inconsistent effects. Similarly, paid social traffic ($\beta = 0.79$, $p > 0.05$) and display ads ($\beta = -0.40$, ns) failed to reach statistical significance, suggesting that tactical, budget-driven channels are less directly influenced by B Impact performance. Direct traffic and new visits were negatively associated with the B Impact Score, with new visits showing significance ($\beta = -0.85$, $p < 0.05$, $R^2 = 0.79$), implying that while sustainability enhances loyalty and depth of interaction, it may reduce first-time acquisition volume.

The regression results for emissions highlight a contrasting dynamic. Higher emissions are positively associated with total visits ($\beta = 0.91$, $p < 0.05$, $R^2 = 0.84$) and bounce rate ($\beta = 0.92$, $p < 0.05$, $R^2 = 0.85$), but negatively associated with pages per visit ($\beta = -0.92$, $p < 0.05$, $R^2 = 0.83$) and time on site ($\beta = -0.92$, $p < 0.05$, $R^2 = 0.82$).

This pattern suggests that high-emission firms generate higher traffic volumes, possibly through aggressive promotional or price-based strategies, but fail to sustain consumer engagement. Users may arrive in larger numbers but are more likely to exit quickly and interact superficially. This aligns with the interpretation that emissions-intensive firms prioritize breadth over depth in their marketing performance.

Carbon Neutral Share models reveal positive and consistent engagement effects. Bounce rate decreased significantly with higher carbon neutrality ($\beta = -0.87$, $p < 0.05$, $R^2 = 0.76$), while both pages per visit ($\beta = 0.87$, $p < 0.05$, $R^2 = 0.77$) and time on site ($\beta = 0.87$, $p < 0.05$, $R^2 = 0.79$) increased. These findings demonstrate that carbon-neutral strategies contribute to more loyal and immersive consumer interactions.

Further, referral traffic was negatively associated with the Carbon Neutral Share ($\beta = -0.89$, $p < 0.05$, $R^2 = 0.80$), suggesting that sustainable firms reduce dependence on third-party referrals and cultivate more direct brand-consumer relationships. Organic traffic showed a strong positive effect ($\beta = 0.83$, $p < 0.05$, $R^2 = 0.75$), confirming that carbon-neutral practices enhance inbound organic visibility.

However, organic costs ($\beta = 0.71$, ns) and paid social traffic ($\beta = 0.41$, ns) did not reach significance, implying that while sustainability enhances organic reach and engagement, it does not necessarily increase efficiency of organic investment or significantly affect discretionary advertising.

The regression models were estimated using standardized variables. Consequently, the intercept term is equal to zero and is not reported, while the standardized beta coefficients (β) and the coefficient of determination (R^2) are presented for interpretational clarity.

Table 4. SLR analysis of H1-H3

Hypothesis	Dependent Variable	Independent Variable	Coefficient	Std. Error	t	p-value	R ²	F	p-value F	Supported?
H1: B Impact Score → Engagement	Bounce rate	Sector B Impact	-0.89	0.21	-4.19	0.025*	0.83	17,56	0,025*	Yes (expected -)
	Pages per visit		+0.89	0.23	3.91	0.030*	0.81	15,29	0,03*	Yes (expected +)
	Time on site		+0.87	0.24	3.65	0.035*	0.79	13,32	0,035*	Yes (expected +)
	Organic costs		+0.96	0.20	4.80	0.018*	0.86	23,04	0,018*	Yes (expected +)
	Organic traffic		+0.93	0.20	4.65	0.020*	0.85	21,62	0,02*	Yes (expected +)
	Email traffic		+0.95	0.21	4.52	0.021*	0.84	20,43	0,021*	Yes (expected +)
	Organic social traffic		-0.70	0.28	-2.50	0.081	0.62	6,25	0,081	No
	Paid search traffic		-0.74	0.25	-2.96	0.067	0.68	8,76	0,067	Marginal
	Paid social traffic		+0.79	0.27	2.93	0.069	0.67	8,58	0,069	Marginal
	Display Ads		-0.40	0.29	-1.38	0.22	0.31	1,9	0,22	No
	Direct traffic		-0.57	0.26	-2.19	0.093	0.58	4,8	0,093	No
	New visits		-0.85	0.23	-3.70	0.036*	0.79	13,69	0,036*	Yes (expected -)
H2: Emissions → Activity	Total visits	EF Emissions raw to DC	+0.91	0.21	4.33	0.022*	0.84	18,75	0,022*	Yes (expected +)
	Bounce rate		+0.92	0.20	4.60	0.020*	0.85	21,16	0,02*	Yes (expected +)
	Pages per visit		-0.92	0.22	-4.18	0.025*	0.83	17,47	0,025*	Yes (expected -)
	Time on site		-0.92	0.22	-4.10	0.027*	0.82	16,81	0,027*	Yes (expected -)
H3: Carbon Neutral Share →	Bounce rate	Carbon Neutral	-0.87	0.24	-3.45	0.041*	0.76	11,9	0,041*	Yes (expected -)
	Pages per visit	Share	+0.87	0.25	3.50	0.040*	0.77	12,25	0,04*	Yes (expected +)

Hypothesis	Dependent Variable	Independent Variable	Coefficient	Std. Error	t	p-value	R ²	F	p-value F	Supported?
Sustainable Behaviors	Time on site		+0.87	0.24	3.67	0.037*	0.79	13,47	0,037*	Yes (expected +)
	Referral traffic		−0.89	0.23	−3.77	0.034*	0.80	14,21	0,034*	Yes (expected −)
	Organic traffic		+0.83	0.26	3.20	0.048*	0.75	10,24	0,048*	Yes (expected +)
	Organic costs		+0.71	0.28	2.54	0.079	0.63	6,45	0,079	No
	Paid social traffic		+0.41	0.31	1.32	0.24	0.28	1,74	0,24	No

* indicate significance in the 95% level of significance

N=5 firms [with 180 observations (180 days of data observation and collection)]

4.4. Fuzzy Cognitive Mapping (FCM) Modeling

Fuzzy Cognitive Mapping (FCM) is a dynamic modeling technique that integrates elements of fuzzy logic, graph theory, and systems dynamics to represent and analyze complex causal relationships among interacting variables. Originally proposed by Kosko (1986), FCMs extend traditional cognitive maps by introducing fuzzy logic to capture the degree of influence between concepts, allowing for the modeling of uncertain, nonlinear, and feedback-rich systems. Each concept in an FCM is represented as a node, while the causal links between concepts are weighted edges that range between −1 and +1, indicating both the strength and direction of influence.

The primary advantage of FCM lies in its ability to simulate system behavior under different scenarios, enabling researchers to explore "what-if" conditions and policy interventions (Papageorgiou & Salmeron, 2012). This makes it particularly well suited for sustainability and digital marketing research, where variables such as consumer engagement, ESG performance, and neuromarketing indicators interact in dynamic and often nonlinear ways. Unlike static regression-based approaches, FCMs provide iterative feedback that captures how changes in one component propagate throughout the system (Papageorgiou & Papageorgiou, 2023).

In the context of this thesis, FCM modeling is employed to complement the statistical analysis of ESG–digital marketing relationships by offering a systems-level perspective. While regression models identify significant predictors and quantify direct associations, FCM allows the integration of multiple interdependent factors, illustrating how ESG improvements or deteriorations reverberate across digital engagement metrics. Furthermore, scenario analysis within the FCM framework provides insights into the robustness of these relationships under varying levels of ESG performance.

The adoption of FCM in this study also builds on prior applications of the method in business strategy and sustainability contexts. For example, Jetter & Kok (2014) highlight the use of cognitive maps for strategy formulation in uncertain environments, while Groumpos (2010) emphasizes the value of FCMs for modeling social and organizational systems. More recently, FCMs have been successfully applied in energy transitions (Papageorgiou & Stylios, 2008), corporate sustainability (Bueno & Salmeron, 2009), and digital innovation ecosystems (Silva et al., 2019), demonstrating their versatility across interdisciplinary domains.

Accordingly, the integration of FCM in this thesis serves two purposes: first, to validate the robustness of the statistical findings through dynamic simulations, and second, to provide an analytical bridge toward the neuromarketing component, where cognitive responses can be incorporated as additional concepts within the model. This holistic approach allows for the triangulation of evidence across quantitative analysis, systems modeling, and consumer neuroscience. In Figure 6 the deployed FCM model of the thesis is discerned.

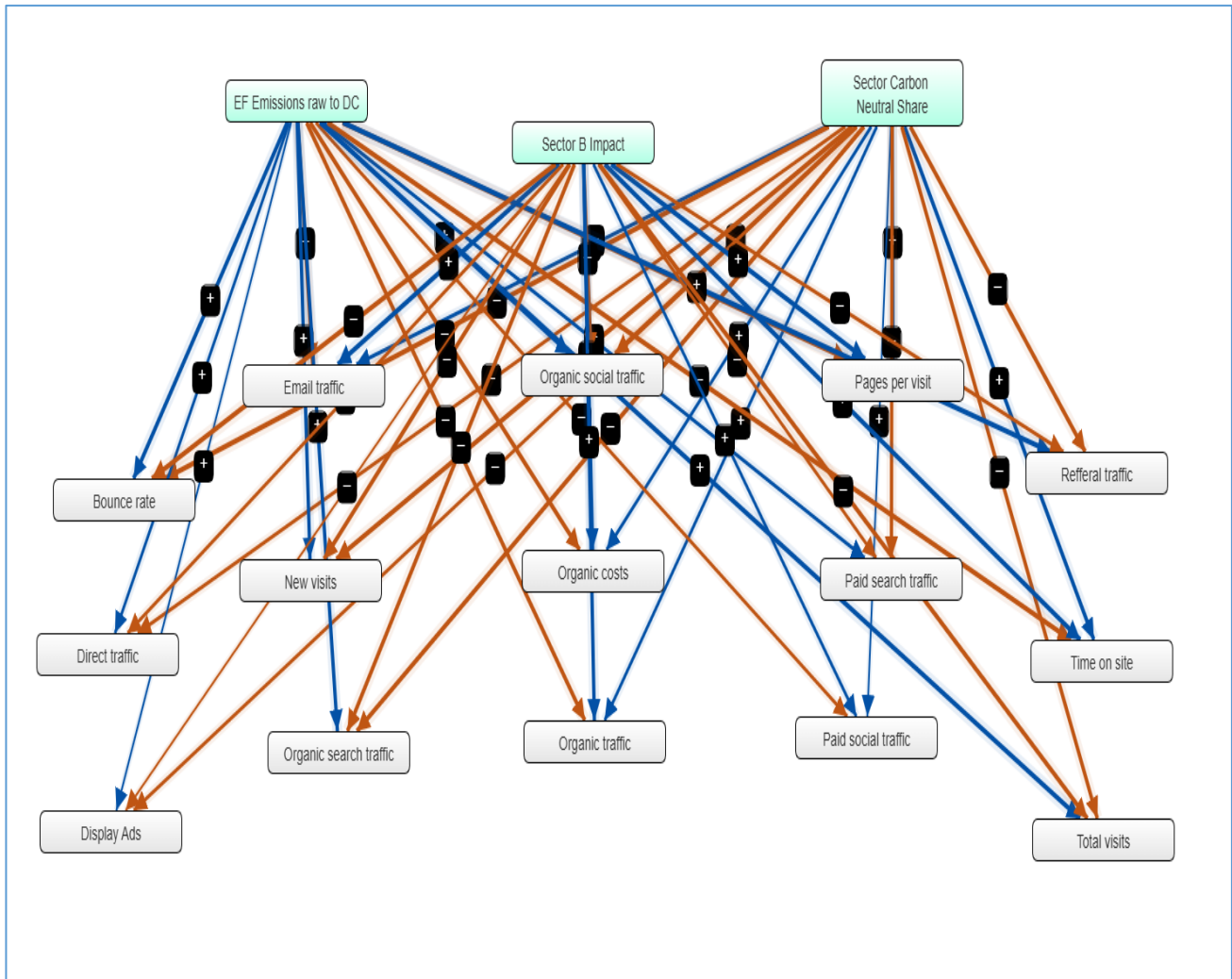


Figure 6. FCM model

4.5. FCM Scenarios

The scenario analysis (Table 5 and Figure 7) provides nuanced evidence of the interdependence between ESG performance and digital engagement when modeled with a sigmoid transformation. Unlike the hyperbolic tangent outputs, where effects were steep and exponential, the sigmoid scenarios reveal smoother, bounded responses that better approximate incremental consumer behavioral adjustments.

Under positive ESG conditions (+25%, +50%, +75%), improvements in consumer engagement are visible but more moderate. Time on site and pages per visit both increased by approximately 5% at the +25% and +75% levels, while showing no additional gain at +50%, reflecting the saturation tendencies of the sigmoid function. In parallel, bounce rate and referral traffic declined by similar magnitudes (−5%), reinforcing that ESG commitments foster more

loyal, self-directed engagement. Interestingly, total visits dropped slightly (−5%), indicating once again that stronger ESG positions may reduce raw traffic but improve its quality. Organic traffic and organic costs both grew moderately (+4% to +5%), with email traffic also showing a small but consistent positive effect (+4%). These findings suggest that even small ESG improvements can reinforce consumer trust and deepen interactions, though the effect stabilizes quickly.

Conversely, the negative scenarios (−25%, −50%, −75%) produced sharper contractions, especially as the degree of ESG weakening increased. Time on site and pages per visit fell by −16% under a −25% change, deepening to −26% under the −75% scenario. Bounce rate and referral traffic rose symmetrically (+16% to +26%), reflecting disengagement and weaker brand stickiness. Organic traffic and organic costs declined by up to −25% and −23%, respectively, while email traffic dropped by −22% in the most severe case. Total visits, however, consistently increased (+16% to +26%), indicating that weaker ESG performance may inflate superficial reach but undermine meaningful engagement.

Taken together, the sigmoid-based scenario analysis confirms the earlier conclusion of a trade-off between volume and depth of engagement. Positive ESG scores encourage fewer but higher-quality interactions, whereas weaker ESG standings inflate reach at the cost of trust and sustained browsing. Compared with the hyperbolic tangent results, these findings highlight a more gradual consumer response, suggesting that while ESG performance does matter, its effects accumulate within behavioral thresholds rather than in linear or explosive patterns.

Table 5. FCM scenarios' summary

Scenario	ESG Change	Time on Site	Referral Traffic	Bounce Rate	Pages per Visit	Total Visits	Organic Traffic	Organic Costs	Email Traffic
1	+25%	+5%	−5%	−5%	+5%	−5%	+5%	+5%	+4%
2	+50%	+0%	−0%	−0%	+0%	−0%	+0%	+0%	+0%
3	+75%	+5%	−5%	−5%	+5%	−5%	+5%	+4%	+4%
4	−25%	−16%	+16%	+16%	−16%	+16%	−15%	−14%	−13%
5	−50%	−21%	+21%	+21%	−21%	+21%	−20%	−18%	−18%
6	−75%	−26%	+26%	+26%	−26%	+26%	−25%	−23%	−22%



Figure 7. FCM Scenarios 1-6.

4.6. Neuromarketing Model

The integration of neuromarketing into the present study provides a novel lens through which to understand how consumers cognitively and emotionally respond to sustainability-related cues on fashion firms' websites. Unlike conventional digital marketing metrics that measure behavioral outcomes such as time on site, bounce rate, and referral dependence, neuromarketing techniques allow for the analysis of visual attention, fixation patterns, and emotional resonance. This approach aligns with the growing scholarly recognition that sustainability signals are not only rational decision-making drivers but also shape subconscious consumer perceptions and trust (Plassmann et al., 2015; Ramsøy, 2015; Ruppenthal, 2023).

The neuromarketing tests were conducted using the SeeSo Web Analysis platform (2025), which combines eye-tracking via webcam, fixation mapping, and gaze intensity heatmaps to capture how users process visual and textual elements on websites. This tool has been increasingly applied in digital marketing studies, given its ability to operate in natural browsing environments (Younus et al., 2025). The test environment included a sample of sustainable fashion firms: Reformation, Nisolo, Mud Jeans, and Eileen Fisher. The brand Veja was excluded from the analysis because its website architecture was not compatible with SeeSo's web-tracking software.

For each website, participants were asked to navigate freely, while the platform recorded gaze allocation, and areas of interest (AOIs) covering sustainability messages (e.g., B Corp certification, carbon-neutral claims, material transparency), promotional cues (e.g., discount banners, seasonal sales), and product visuals. Heatmaps and fixation timelines were then aggregated into multi-panel figures (Figures 8a–8d) to enable comparative analysis.

The results reveal distinct patterns of consumer attention allocation across the four firms:

Reformation (Figure 8a): Gaze activity clustered strongly on fashion visuals and "Sale" banners, with limited fixation on sustainability claims. While this reflects Reformation's branding strategy emphasizing trend-driven aesthetics, it also indicates that sustainability messages may not be sufficiently salient to capture subconscious attention.

Nisolo (Figure 8b): Consumers demonstrated significant fixation on sustainability certifications (B Corp, Leather Working Group) and ethical messaging such as

“Designed with Purpose.” These AOIs received prolonged attention times, supporting the argument that prominently placed ESG credentials are powerful trust anchors.

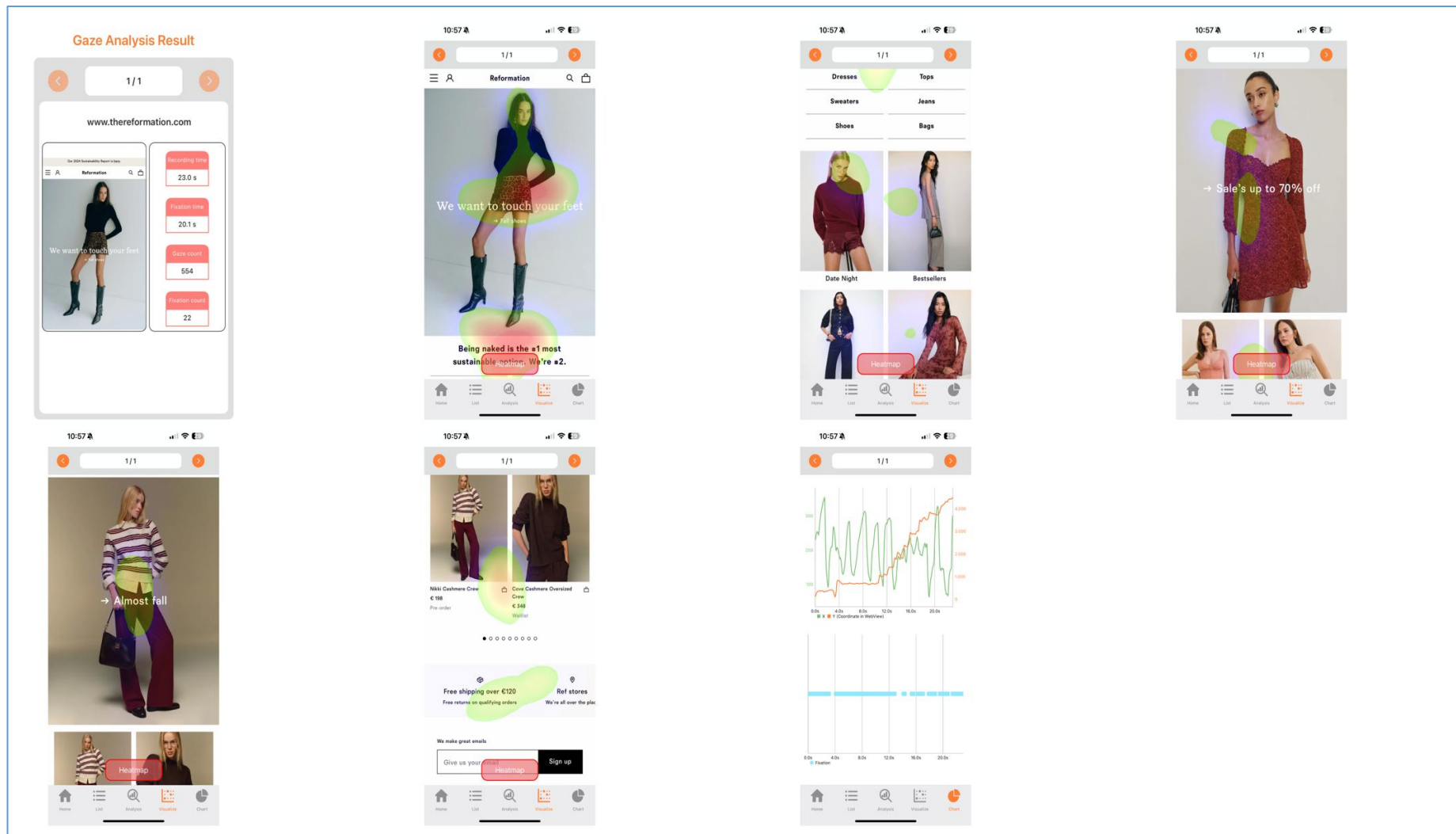
Mud Jeans (Figure 8c): Fixations concentrated on banners such as “Make the Planet Cooler” and the circular production storytelling sections. Importantly, fixation timelines showed users returning to these areas multiple times, suggesting repeated cognitive processing of ESG content. This behavior is consistent with findings that sustainability narratives enhance brand memory encoding (Pagan et al., 2024).

Eileen Fisher (Figure 8d): Users’ gaze was distributed between product visuals and sustainability statements related to regenerative materials and organic cotton. Notably, attention on ESG-related call-to-action text (“Confidence Looks Good on You”) coexisted with attention to fashion imagery, suggesting that ESG and aesthetics can reinforce rather than compete when integrated coherently into design.

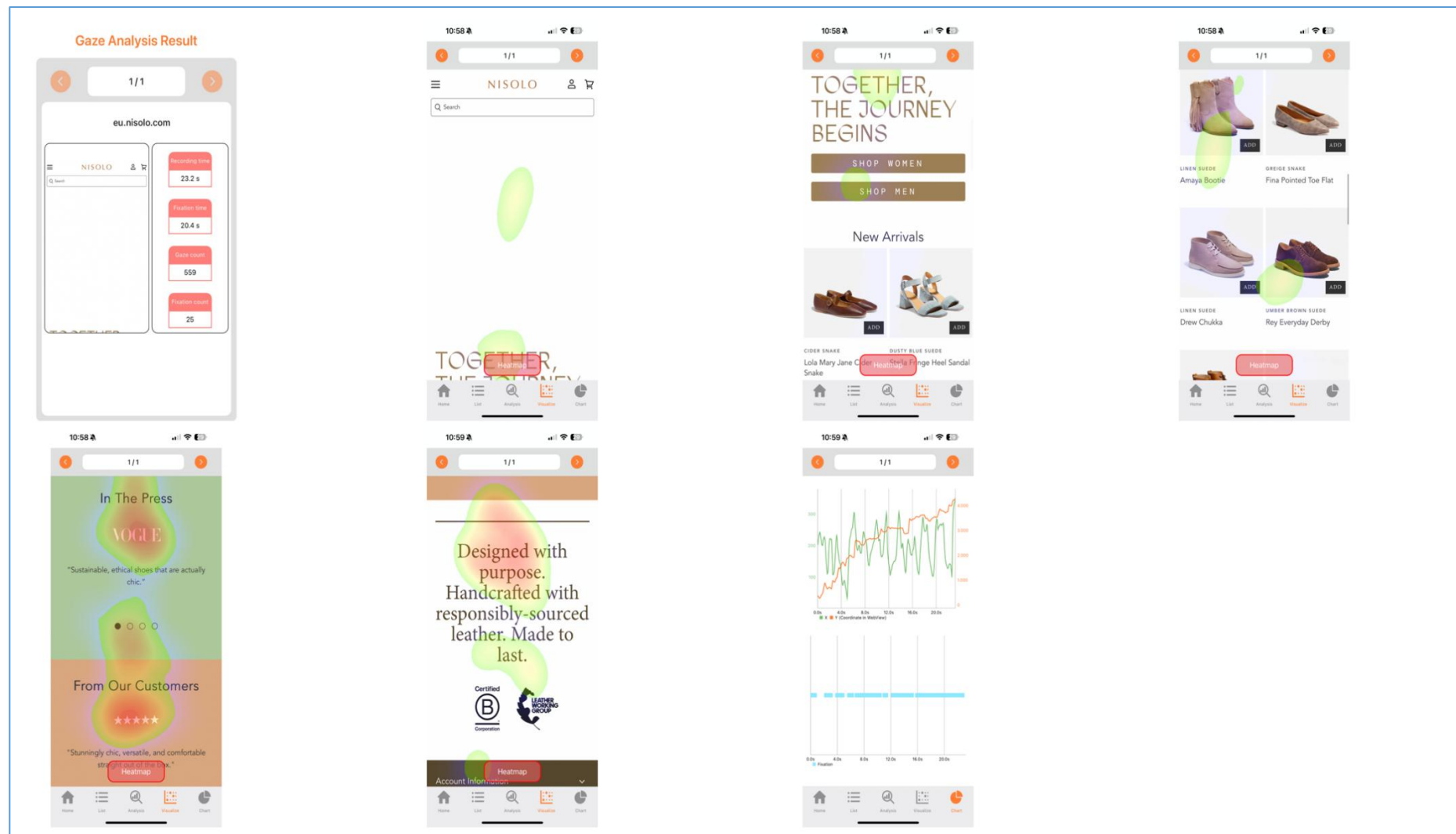
Across the brands, the fixation timeline charts showed that ESG-related elements attracted longer fixation durations and higher revisit frequency compared to pricing or product-only cues, except in the case of Reformation. This pattern provides strong empirical support for the hypothesis (H4) that visual attention to ESG cues enhances consumer engagement.

These results indicate that ESG cues are effective subconscious engagement triggers when strategically placed and visually distinct. Firms like Nisolo and Mud Jeans, which foreground sustainability certifications and narratives, benefit from stronger attentional capture. In contrast, Reformation’s reliance on aesthetic and promotional drivers results in weaker ESG-related attention. Eileen Fisher demonstrates a hybrid model, where sustainability and product visuals coexist as complementary anchors.

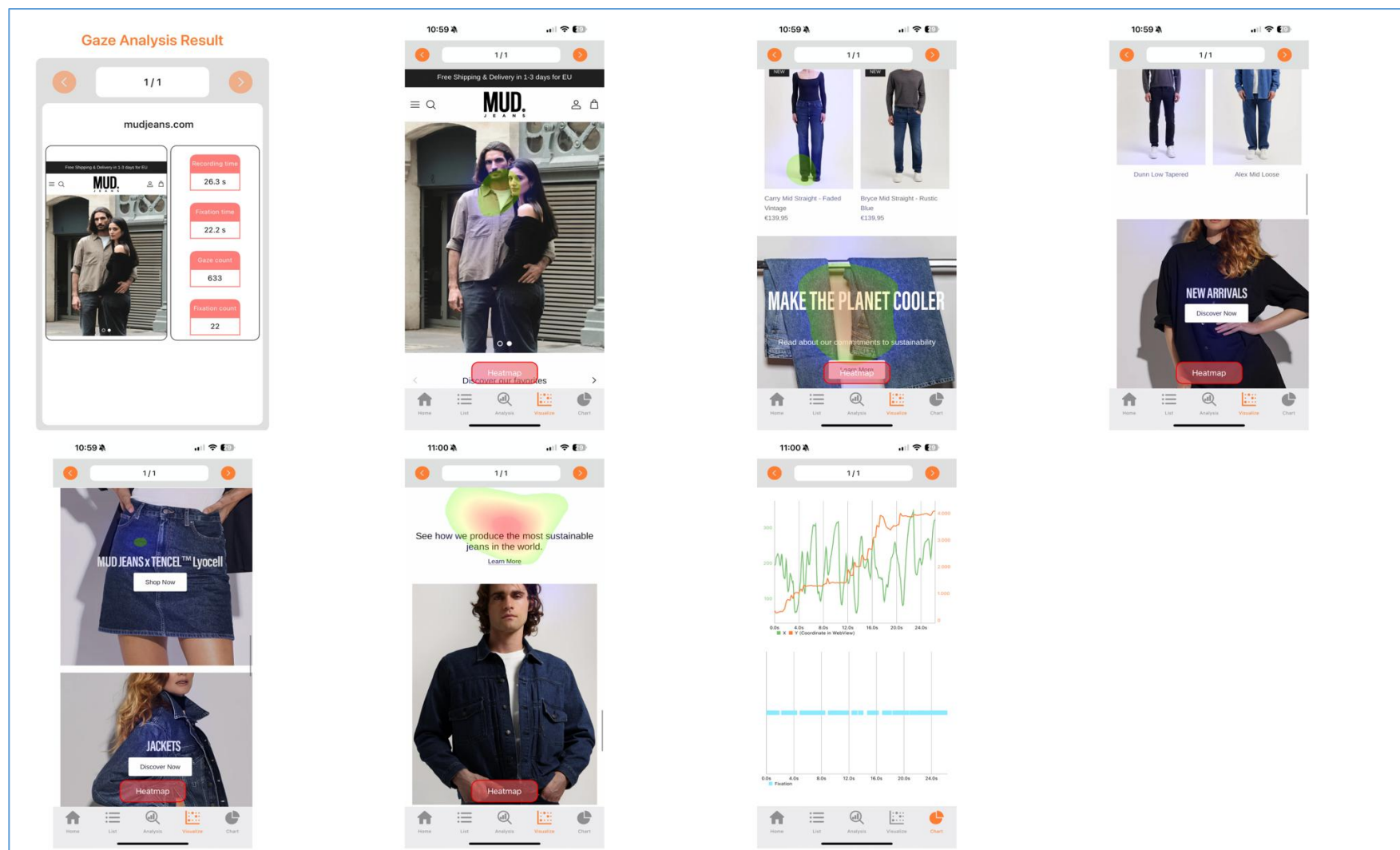
This aligns with recent literature showing that neuromarketing can reveal hidden drivers of sustainable consumer choice. Eye-tracking and EEG-based studies have shown that sustainability logos and certifications increase both attention and emotional trust (Kajla et al., 2024; Proi et al., 2023). Moreover, emotional resonance with ESG content has been linked to improved digital engagement and long-term loyalty (Pagan et al., 2024). The findings in this study confirm that sustainable fashion firms can leverage ESG cues not only as informational tools but also as non-conscious engagement mechanisms.



(a)



(b)



(c)



(d)

Figure 8. Neuromarketing model development. (a) Eileen Fisher, (b) Mud Jeans, (c) Nisolo, (d) Reformation

5. Discussion

The study set out to examine whether sustainability performance in the fashion sector translates into measurable differences in digital consumer behavior, and whether subconscious attention to ESG cues helps explain those behavioral outcomes. The four-stage design—statistical analysis, FCM scenarios, and neuromarketing eye-tracking—offers convergent evidence. Overall, the results suggest that ESG performance is associated with higher-quality digital engagement, rather than higher-quantity traffic alone; that emissions intensity is linked to volume gains but engagement losses; that sectoral progress toward carbon neutrality aligns with more sustainable digital behaviors; and that attention to ESG cues on websites is a plausible micro-mechanism connecting sustainability communication with engagement outcomes.

Descriptive statistics and distributional checks indicate a digital landscape dominated by direct and organic search traffic, with paid channels contributing modestly. Engagement levels are generally strong but heterogeneous, which makes the setting well suited to testing ESG-related differences. The correlation and SLR results support H1: higher B Impact Scores are consistently associated with lower bounce rates and higher depth of use (pages per visit and time on site), and with greater organic traffic and investment (organic costs). These results extend prior literature that linked B Corp status to legitimacy and loyalty at the attitudinal or firm-level outcome stage (Stubbs, 2017; Honeyman & Jana, 2019) by demonstrating on-site behavioral effects. The findings answer recent calls to move beyond financial correlations and stated preferences toward micro-behavioral evidence (Friede et al., 2015; Kotsantonis & Serafeim, 2019; Chaffey & Ellis-Chadwick, 2019). In short, H1 is accepted: higher B Impact Scores align with superior digital engagement quality.

For H2, emissions from raw material sourcing to distribution centers correlate positively with total visits and bounce rate, and negatively with pages per visit and time on site. The SLR estimates mirror these associations. This pattern is consistent with a reach-over-retention strategy: high-emission firms may draw larger audiences (through promotions or brand salience) but those sessions end more quickly and are less exploratory. The result complements survey-based research showing that consumers respond negatively to higher carbon footprints (White et al., 2019; Testa et al., 2015), by demonstrating a behavioral manifestation—volume without depth—in real web data.

Accordingly, H2 is accepted as framed: emissions intensity is associated with intensified activity, albeit of lower quality.

Turning to H3, a higher Sector Carbon Neutral Share is associated with lower bounce rate, higher pages per visit and time on site, lower reliance on referrals, and higher organic traffic. The SLRs confirm these effects for the most central engagement variables. These results suggest that sector-level carbon-neutral progress can shift audience expectations and reduce frictions, possibly by normalizing sustainability claims and increasing baseline trust. Prior research has linked carbon-neutral messaging to reputation and purchase intention (Rahman et al., 2025; Lee et al., 2025), and eye-tracking studies show that eco-labels capture attention (Hoffmann et al., 2025). The present evidence adds that sectoral carbon-neutral penetration correlates with channel configuration (less referral dependence, stronger organic pull) and session depth. Hence, H3 is accepted for core engagement and channel effects, with the caveat that paid social and organic cost efficiency did not show robust significance.

Two qualifications deserve emphasis. First, several paid or discretionary channels (paid social, display) showed weaker or inconsistent associations with ESG variables. This is unsurprising, as these channels are tactically controlled and may reflect campaign timing more than structural trust effects. Second, “new visits” sometimes moved inversely with B Impact Score, hinting that sustainability may first and foremost retain and deepen existing audiences before expanding the top of the funnel.

The FCM scenarios provide a system-level stress test of the regression patterns. Under a sigmoid activation function, positive ESG shocks (+25%, +75%) yield small but consistent increases in time on site and pages per visit ($\approx +5\%$) and reductions in bounce rate and referrals ($\approx -5\%$), while total visits dip modestly ($\approx -5\%$). Negative shocks (-25% to -75%) produce larger, progressively adverse effects (e.g., time/pages -16% to -26% ; bounce rate/referrals $+16\%$ to $+26\%$), and increase total visits. These results align with the trade-off observed in the SLRs: quality versus quantity. The asymmetric response—milder gains for improvements but sharper losses for deteriorations—suggests a loss-dominant sensitivity in consumer behavior, consistent with bounded attention and threshold effects that sigmoids capture well. Compared with the steeper sensitivity checks, the sigmoid results imply that consumers adjust gradually to ESG improvements but penalize declines more visibly, a pattern that resonates with

behavioral asymmetries documented in sustainability and trust studies (White et al., 2019).

Two implications flow from the FCM analysis. First, system interdependencies matter: improving ESG does not simply nudge a single metric but re-balances the channel mix (less referral reliance, stable organic investments) while deepening on-site behavior. Second, nonlinearities and saturation are real: beyond certain points, additional ESG improvements yield diminishing marginal behavioral gains, whereas backsliding can be disproportionately costly for engagement.

The eye-tracking results provide a plausible micro-mechanism for the observed behavioral links, directly informing H4. Across Nisolo and Mud Jeans, fixation maps and timelines show sustained attention to ESG badges and narratives (e.g., B Corp logos, “Make the Planet Cooler”), with repeated revisits, while Eileen Fisher exhibits a balanced split between product visuals and sustainability claims embedded in the shopping journey. Reformation concentrates gaze on aesthetics and promotion cues, with limited fixation on sustainability text. These patterns match the directionality of the engagement outcomes and align with neuromarketing evidence that eco-labels and green cues increase attention and trust (Plassmann et al., 2015; Ramsøy, 2015; Ruppenthal, 2023). The interpretation is that salient, well-placed ESG elements act as attention anchors, encouraging deeper processing and longer exploration, whereas when ESG cues are visually secondary, attention defaults to fashion imagery and price promotions.

The neuromarketing stage therefore substantiates H4: visual attention to ESG-related elements is associated with higher engagement quality relative to attention centered on aesthetics or pricing. This acceptance is tempered by two clarifications. First, the neuromarketing evidence is comparative across websites rather than an individual-level causal manipulation; still, the consistency with SLR and FCM results strengthens inference through triangulation. Second, VEJA’s exclusion due to tool incompatibility underscores a technical boundary of webcam-based tracking and suggests that future studies should consider multi-tool validation or alternative set-ups when site architectures conflict with instrumentation.

Taking the stages together, a coherent narrative emerges. ESG performance—both firm-specific (B Impact Score) and sectoral (Carbon Neutral Share)—associates with deeper, less brittle digital engagement. Emissions intensity, by contrast, is associated with more traffic but shallower sessions. The FCM simulations show how these effects

propagate through the digital system under non-linear constraints, highlighting that improvements deliver bounded but consistent gains, while deteriorations carry larger penalties. The neuromarketing findings suggest why: when sustainability cues are perceivable and cognitively processed, users spend longer, navigate more, and rely less on third-party referrals. Where such cues are secondary to promotional aesthetics, sessions appear more promotional-driven and less trust-anchored.

This triangulation contributes to the existing literature. It complements work on ESG and performance by adding digital behavioral outcomes (Friede et al., 2015; Kotsantonis & Serafeim, 2019). It advances sustainable marketing by linking sectoral carbon-neutral progress to channel reconfiguration and session quality. It enriches consumer neuroscience/neuromarketing by demonstrating a bridge between attention to ESG AOIs and web analytics, a connection frequently hypothesized (Plassmann et al., 2015; Ramsøy, 2015; Ruppenthal, 2023) but less often tested with in-website browsing of real brands.

Regarding the acceptance or not of the research hypotheses, this information is presented below, aggregately:

- H1: Accepted. Strong negative association with bounce and positive associations with pages/time/organic traffic metrics. Effects are weaker for discretionary paid channels and may coincide with fewer new visits, implying a depth-before-breadth dynamic.
- H2: Accepted. Emissions correlate with more total visits but weaker engagement (higher bounce; lower time/pages). The effect is consistent with a quantity-over-quality profile.
- H3: Accepted for core engagement and channel effects (bounce rate lowers, pages/time increases, referral traffic lower, organic traffic increases). Paid social and organic cost efficiency lack robust significance, suggesting heterogeneity in how sustainability interacts with discretionary spend.
- H4: Accepted, based on fixation/heatmaps evidence and convergence with behavioral results. Inferences are strongest where ESG AOIs are salient and proximal to shopping paths; where ESG is peripheral, attention defaults to promotions. VEJA's exclusion is a methodological limitation rather than a substantive counterexample.

6. Conclusions

This study examined how sustainability performance in fashion relates to concrete digital behaviors and whether consumers' subconscious attention to ESG cues can help explain those behaviors. Evidence across three lenses—statistical models, fuzzy-systems scenarios, and neuromarketing—converges on a consistent portrait. Stronger ESG performance aligns with higher-quality engagement (deeper sessions, lower bounce rate, greater organic pull), while higher emissions are associated with higher traffic volume but poorer session quality. Eye-tracking indicates that the salience of ESG elements on a website is a plausible micro-mechanism behind these patterns. The section synthesizes theoretical implications, managerial implications, limitations, and future research directions.

6.1 Theoretical implications

Much of the ESG–performance literature concentrates on financial outcomes, capital markets, and attitudinal intentions. The present findings link ESG to observable digital micro-behaviors, shifting the discussion from “what consumers say” to “what consumers do.” By showing that higher B Impact Scores and sectoral progress toward carbon neutrality correspond with lower bounce rate and greater depth, the results add a behavioral layer to stakeholder-centric accounts of ESG value creation. This resonates with recent scholarship emphasizing that digital contexts are critical arenas where sustainability signals are interpreted (Liu et al., 2024; Testa et al., 2015).

The positive link between emissions intensity and total visits, paired with shallower sessions and higher bounce rate, suggests a quality–quantity trade-off. This phenomenon aligns with findings by Papadas et al. (2017), who show that sustainability messages may raise awareness without necessarily improving deep engagement when cues are weak or ambiguous. It also reflects broader discussions of “green skepticism” in consumer psychology, where ESG claims may draw attention but fail to generate trust or loyalty (de Jong et al., 2018).

Neuromarketing findings indicate that ESG areas of interest (AOIs)—certifications, material transparency, and carbon-related messages—attract longer fixations and more revisits when they are visually prominent. This is consistent with recent neuromarketing studies, demonstrating that eco-labels and sustainability messages increase attention and

positive affect in consumer decisions (Richelli et al., 2025; Hoffmann et al., 2025). By tying these visual-attention patterns directly to web engagement metrics, the study advances calls for integrated frameworks that link subconscious attention with observable digital behaviors (Plassmann et al., 2015).

The FCM simulations show that improvements in ESG yield bounded, incremental gains in engagement metrics, while deteriorations have disproportionately negative consequences. This asymmetry supports the behavioral economics view that consumers react more strongly to losses than to equivalent gains (Kahneman & Tversky, 2013; Kotsantonis et al., 2016). It also confirms the value of nonlinear systems modeling in sustainability communication, as advocated in organizational research on dynamic consumer–brand interactions (Papageorgiou & Salmeron, 2012; Clausen & Molden, 2024).

Finally, the synthesis aligns with a regulatory shift toward verifiable claims and away from vague carbon neutrality statements. Recent policy discussions in the EU and US stress that ambiguous “carbon neutral” language may erode trust unless certified by credible schemes (Delmas et al., 2019; European Commission, 2023). This context reinforces the theoretical emphasis on signaling under verification constraints, with neuromarketing results showing that credible, standardized ESG signals are the ones most likely to capture and sustain attention.

6.2 Practical and managerial implications

Where ESG cues were integrated into product and category pages (e.g., Nisolo, Mud Jeans), neuromarketing showed longer fixations. Managers should move sustainability content from corporate subpages into decision-proximate AOIs. This aligns with findings that eco-label visibility and placement directly shape purchase intentions (Nguyen-Viet, 2022).

Higher ESG performance is associated with fewer but better sessions—lower bounce rate, more pages, more time. Managers should recalibrate KPIs from volume to quality-weighted engagement metrics, echoing suggestions in digital analytics research that traditional traffic counts are insufficient for assessing customer value (Chaffey & Ellis-Chadwick, 2019).

Where supply-chain emissions remain high, the data suggest a traffic-quality imbalance. Firms should communicate interim targets, verifiable audits, and transparent

progress trackers to reduce consumer skepticism, consistent with recommendations from contemporary sustainability communication studies (Yang & Battocchio, 2021).

Consumer trust in ESG claims is contingent on third-party verification. Research shows that transparent disclosures framed in simple language significantly enhance brand trust and engagement (White et al., 2019; Dagogo-Jack & Samples, 2025). Managers should therefore invest in credible certifications and ensure that ESG narratives are presented in accessible terms.

Web analytics should be paired with neuromarketing diagnostics such as fixation duration in A/B testing cycles. This practice is already gaining traction in UX and digital marketing, where eye-tracking provides fine-grained insight beyond clickstream analysis (Harris et al., 2018).

At the sectoral level, harmonizing ESG cues across brands through standardized iconography and glossaries can reduce confusion and strengthen consumer trust. This echoes calls for eco-label harmonization in the fashion sector (Torma & Thøgersen, 2024).

6.3 Limitations

The study focuses on five sustainability-oriented brands. While this purposeful sampling enables deep analysis, results may not fully generalize to fast-fashion or luxury extremes. Digital engagement fluctuates with campaign cycles. Paid media performance is particularly time-sensitive, meaning some variance cannot be attributed solely to ESG variables (Lamberton & Stephen, 2016).

Webcam-based eye-tracking balances ecological validity with technical limitations. One brand (Veja) was excluded due to incompatibility with SeeSo Web Analysis platform, highlighting potential constraints for wider deployment. The study triangulates methods but does not include randomized manipulation of ESG exposure. Thus, conclusions rest on associational evidence, albeit reinforced by convergence of multiple methods. Although FCM captures feedback and nonlinearity, weights are partially expert-driven. Different parameterizations could yield alternative sensitivities (Parsopoulos et al., 2004).

6.4 Future research

Future studies should include fast fashion, luxury, and mid-market brands across regions, as cross-cultural variation can moderate ESG–engagement dynamics (Biswas & Roy, 2015). Controlled A/B tests could manipulate ESG cue salience and type, measuring causal effects on fixations and conversions (Richelli et al., 2025). Further work should link ESG-driven attention not only to browsing depth but to conversion value and retention (Moro-Visconti, 2022).

Experiments could test which corrective disclosures or third-party validations restore trust after greenwashing accusations, a growing area of consumer research (Ibrahim Nnindini & Dankwah, 2024). Comparative tests of FCM, agent-based modeling, and system dynamics would yield deeper insights into nonlinear ESG–consumer pathways (Papageorgiou & Salmeron, 2012).

Research should examine how different consumer segments (e.g., sustainability believers vs. skeptics) respond to tailored ESG cue surfacing (Moraes et al., 2023). With “phygital” retail expanding, integrating in-store and online ESG signals could be especially influential for Gen Z, who value immersive sustainability experiences (Kovács, 2021).

6.5 Closing synthesis

The findings point to a clear managerial and scholarly message. In digital commerce for fashion, how sustainability is communicated matters as much as what the underlying performance is. When ESG is credible, visible, and proximate to decision points, consumer attention follows, and with it, deeper engagement. When ESG claims are vague or unverifiable, attention defaults to aesthetics and promotions, and engagement quality declines—even if traffic volume rises.

From a theory perspective, this study contributes by (i) evidencing an attention-based mechanism linking ESG to digital behaviors, (ii) articulating a quality–quantity trade-off for emissions-intensive firms, and (iii) demonstrating the value of system-level modeling for sustainability communication. From practice, the results advise designing for credibility and salience, recalibrating KPIs toward engagement quality, and preparing for verification-first regulatory regimes.

Limitations suggest cautious interpretation but also highlight a fertile research agenda: larger samples, causal tests, advanced system models, and cross-channel

phygital designs. Ultimately, the path to sustainable digital performance lies in attentive design of credible ESG cues supported by transparent validation. Brands that achieve this will convert sustainability from a communications cost into a durable engagement advantage.

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