J. Empir. Soc. Sci. Stud. 5(1)

Exploring the Convergence of Eco-Friendliness and Fashion: A social-media Perceptual Analysis

Darly Beltran Ventura

Fashion designer, Universidad autonoma del caribe

Barranquilla, Colombia

Abstract

This study investigates the potential correlation between a fashion brand's eco-friendliness and its fashion perceptual attributes, utilizing Facebook data mining techniques. An algorithm estimated brand perception scores regarding eco-friendliness and fashion attributes based on user interactions. Regression analysis revealed a positive relationship between environmental practices and fashion/style attributes across luxury, high-end, and fast fashion brands. However, ethical business practices did not correlate with fashion attributes like glamour and style, suggesting consumer perceptions do not align ethical practices with glamorous, stylish brand images. The methodology demonstrates the value of social media data analysis for understanding brand perceptions without biases affecting survey approaches. Findings indicate environmental sustainability is becoming integral to fashion brand positioning, especially for luxury brands where consumers anticipate serious eco-commitments, positively impacting brand image. Consequently, fashion companies should focus communication efforts on ethical business investments which currently do not significantly influence consumer brand perceptions. Overall, this pioneering study makes significant contributions to research on the relationship between eco-friendly attitudes and consumer behavior. The highly adaptable methodology can be utilized to conduct in-depth investigations of consumer perceptions across domains. Findings provide guidance for fashion companies regarding communicating sustainability efforts. While environmental aspects positively correlate with fashion

attributes, additional investments should target promoting ethical practices through certifications. Further research could explore competitive brand positioning and segmentation using social network analysis.

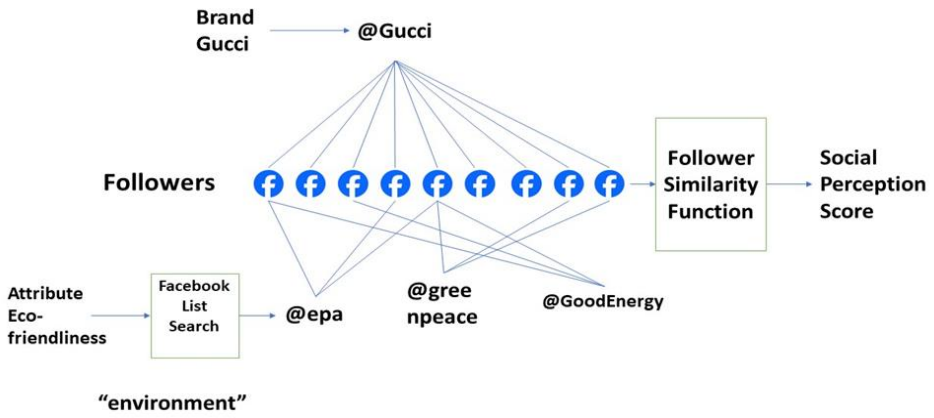
Keywords: brand perception, eco-friendliness, ethical fashion, sustainability, social media mining, Facebook data analysis

Introduction

The recent years have witnessed a growing engagement of fashion companies in the development and promotion of eco-fashion, encompassing sustainable and ethical fashion practices, with the aim of advocating sustainable consumption. This shift is not limited to luxury brands but has extended to high and fast fashion labels that seek to emulate luxury fashion trends. This transformation challenges conventional perceptions of fashion [1]. Luxury brands such as Luis Vuitton, Prada, Armani, and Versace have taken the lead in incorporating materials aligning with consumers' sustainability expectations and adopting more sustainable production methods, including the adoption of circular practices to create a regenerative system where garments circulate, retaining maximum value before re-entering the system through reuse or recycling [2].

The clothing, textiles, and footwear industry has been ranked as the fourth most environmentally impactful industry by the European Environmental Agency. This high environmental impact is primarily due to significant water usage during textile production, pollution from chemical treatments used in dyeing and preparation, and substantial waste generated during disposal. In response to increasing environmental and social concerns, the fashion industry has reoriented its focus towards addressing these issues [3]. Companies are now investing in energy and water consumption reduction, transitioning to renewable energy sources, enhancing lighting and air-conditioning systems, and implementing energy and water consumption monitoring across their operations. For example, ASOS, a prominent British online fashion and cosmetics retailer, achieved a 76% reduction in electricity consumption and a reduction of over 2.3 thousand tons of annual carbon emissions by upgrading the lighting in one of its UK warehouses to low-carbon LED alternatives. Hugo Boss has systematically analyzed its CO2 emissions in logistics and transportation processes, optimizing routes and means of transport to achieve a 95% reduction in emissions compared to conventional sea-air shipping [4].

Figure 1.



Sustainability in the fashion industry necessitates a collective endeavor involving the commitment of all stakeholders, including regulators, consumers, non-governmental organizations, and other relevant entities. Consumers play a pivotal role in steering the industry toward sustainable growth. Ethical fashion and consumer purchase behavior have been explored, emphasizing consumers' willingness to pay a premium for ethical fashion. However, it is essential to note that the relatively small sample size and data limited to Hong Kong restrict the generalizability of these findings. Further research has categorized fashion consumers into three groups based on survey data analysis: "Self" consumers prioritizing hedonistic needs, "Social" consumers emphasizing social image, and "Sacrifice" consumers seeking to reduce their impact on the environment [5]. Despite a growing trend towards conscious consumption, many consumers remain hesitant to embrace sustainable products, particularly in the fast fashion sector. Fast fashion products continue to attract consumers valuing constant changes in their fashion consumption patterns and embracing a culture of impulse buying. An analysis of consumer perceptions is crucial in driving change in fashion production. As consumers increasingly associate eco-friendliness with fashion brands, sustainable clothing is likely to gain more support. "Eco-friendliness" is defined as the brands' capacity to communicate their ethical and environmental consciousness, contrasting with the perception of fashion involving conveying fashion, style, and glamour characteristics. Consumers can significantly influence fashion companies' transition towards sustainability through their purchasing decisions. The research aims to explore this association, especially for consumers oriented towards luxury, high, and fast fashion brands, by providing an original, in-depth analysis of

consumers' perceptions of fashion brands using extensive data mining techniques on the Facebook platform [6].

We aim to explore the potential link between the fashion perceptual attribute of luxury, high fashion, and fast fashion brands and the eco-friendliness perceptual attribute. Specifically, our research seeks to address the following inquiries: Is eco-friendliness becoming an inherent characteristic of fashion brands? Is there a convergence between eco-friendliness and fashion within the fashion industry? Should firms operating in the fashion sector equally prioritize their environmental and social investments along with their design investments? Does this trend extend to luxury, high fashion, and fast fashion brands? The convergence of eco-friendliness and fashion concepts suggests that in the fashion industry, being eco-friendly is increasingly becoming a fundamental element of fashion brands' value proposition rather than a mere addition to their product offerings. Prior research has primarily focused on studying consumer motivations for purchasing green products and the impact of green marketing on shaping a company's image [7]. However, to the best of our knowledge, empirical studies examining the relationship between eco-friendliness and fashion perceptual attributes of fashion brands are scarce. The recent widespread use of social media by both marketers and consumers offers a valuable data source for understanding consumer perceptions. In this research, we implemented a novel social network mining methodology to estimate brand perceptions using a chosen perceptual attribute, now sourced from publicly available secondary social media data, particularly Facebook [8]. From a selection of fashion clothing brands, we focused on those with the largest Facebook followings. Subsequently, we designed an algorithm that takes a specific brand and a brand attribute as inputs, generating an associated score. A higher score indicates a stronger perceived connection between the brand and the attribute [9].

The primary empirical findings can be summarized as follows: Eco-friendliness is evolving into a fundamental element of the value propositions of fashion brands, particularly luxury brands. There exists a substantial correlation between the fashion and eco-friendliness perceptual attributes of luxury brands. Consumers exhibit a greater sensitivity to the environmental practices of fashion brands than their ethical business conduct [10]. Environmental practices encompass strategies adopted by organizations to minimize their environmental footprint, while ethical business practices encompass potentially contentious areas. This article is structured as follows: Section two briefly introduces the theoretical framework of the study, summarizing existing literature on eco-friendliness and fashion perceptual attributes, and outlines the research hypotheses. Section three details the methods employed, specifically the algorithm designed to address the research questions. The

results obtained from the regression model estimation are presented in section four, while the final section provides the concluding remarks [11].

Theoretical Background and Development of Hypotheses

The Fashion Industry's Sustainable Development: Luxury, High, and Fast Fashion Brands:

The fashion industry has a significant environmental impact, with global textile consumption exceeding 30 million tons annually. Its supply chain is complex and often less transparent than those in other sectors. Evaluating the workings of all component suppliers, including social and environmental factors, presents a challenge. This includes aspects such as labor conditions during garment production, transportation, aftercare, and disposal of garments. Many fashion companies have initiated sustainability efforts to optimize resource usage, reduce pollution, and improve labor conditions. The OECD Guidelines for Multinational Enterprises lay the groundwork for sustainable supply chains, guiding companies to establish benchmarks for human rights, labor practices, and environmental concerns throughout their value chain.

Luxury brands in the fashion industry have been the subject of extensive research due to the apparent tension between "luxury" and "sustainability." Many luxury brands have expanded into low-cost manufacturing, while others have shifted their focus to reduce costs and maximize profits. This shift has raised sustainability concerns, including the preservation of rare species, sourcing raw materials, and labor conditions in factories. Recent reports and scandals have pushed luxury companies toward greater transparency, linking "responsibility" and "sustainability" with the evolving concept of luxury.

High and fast fashion brands have also embraced sustainable production, driven by increased consumer environmental awareness. Previous studies indicate that consumers are interested in purchasing sustainable fashion products and are willing to pay a premium for high-quality eco-friendly products. For example, a fast fashion company introduced a sustainability program on Facebook, which generated employment opportunities, used recyclable resources in production, and educated consumers about ethical consumption practices [12]. However, there remains a need to empirically identify and measure how the sustainability investments of fashion companies influence consumers' brand perceptions on Facebook.

Consumer perception: contrasting fashion and eco-friendliness:

Understanding consumer perception is instrumental in shaping effective marketing strategies. The conscientiousness of environmental and ethical concerns has motivated fashion brands to make substantial investments in reducing their environmental footprint and enhancing their social responsibility [13]. However, it is essential to investigate whether consumers can discern a company's commitment to

sustainable practices and their perception of eco-friendly brands on Facebook. Existing literature explores the impact of sustainable clothing industries on purchase behavior and consumer views of a luxury brand's social responsibility initiatives, offering fragmented and primarily anecdotal evidence on the relationship between brand eco-friendliness, consumer perception, and purchase behavior. To gain a better understanding, we will provide a brief overview of brand perception in the following sections [14].

Brown et al. define the concept of a "brand" by emphasizing the mental associations consumers form with it. For these associations to develop, consumers need exposure to the brand. The perceptions and experiences that consumers encounter while engaging with a brand shape their understanding of it and, consequently, their brand perception. In other words, consumers are the architects of brands, not the companies themselves. Companies can disseminate messages through advertising and direct conversations among consumers on social media platforms. Additionally, marketing experiences play a pivotal role; they should be novel, surprising, conducive to learning, and engaging for customers. Nevertheless, consumers' experiences are pivotal in forging emotional connections with brands. The success of a company's efforts to enhance brand value hinges on consumers' perceptions. Brand equity is customer-centric; it exists when customers are familiar with the brand and hold positive, robust, and distinctive brand associations. What consumers know about a brand influences their responses to future interactions with the brand, whether through advertising, products, or staff [15].

Brand awareness is closely linked to brand perception, and customers' responses are grounded in their assessment of information, derived from comparative evaluations, preferences, and social behaviors. Effectively managing brand awareness is a critical task for brand managers. The use of cognitive maps as a technique to display the perceptions of existing or potential customers is widespread in marketing, applied to both products and brands. Other studies investigate this phenomenon through surveys, focus groups, and semi-structured interviews. For instance, some studies analyze the perceived luxuriousness of a brand using a scale to explain the decision-making process of luxury consumers. The scale comprises items measuring different dimensions. Respondents evaluate luxury brands through a structured questionnaire that includes open-ended questions. This study offers a conceptual framework and a scale for assessing the perception of brand luxury [16]. Other research explores the potential interrelation between consumers' "snob" and "bandwagon" inclinations in the luxury fashion sector through an online survey and semi-structured interviews. The results suggest that both snob and bandwagon attitudes can be expressed by the same individuals, with differences in their peer groups and motivations. Bandwagoners seek affiliation with higher social classes, while snobs strive for

social recognition as superior and unique. Nonetheless, survey-based methods tend to overstate the influence of ethical concerns on purchase intentions. This bias arises from societal expectations regarding individuals' care for ethical and environmental issues, leading respondents to provide socially desirable answers. By utilizing social media data, this research bridges the intention-behavior gap, basing all findings on consumer actions rather than statements. Following a specific Facebook account, for instance, demonstrates consumer loyalty to a brand and contributes to shaping a brand's public image, offering more reliable opinions than those obtained through traditional surveys [17].

Hypotheses

In recent years, fashion luxury firms have increasingly embraced ethical and environmental considerations, particularly eco-friendliness, as integral aspects of their business strategy. With a greater emphasis on sustainability, luxury brands have transitioned towards more environmentally responsible production methods more readily than high and fast fashion brands, which are compelled to balance quality and affordability through cost-effective strategies. Although the latter category of brands is gradually adopting sustainable practices, it still lags behind luxury brands in terms of their association with exceptional quality and sustainability.

In the realm of luxury fashion, the dimension that predominantly contributes to consumer value is semiotics. The value of a luxury product is intricately tied to the perception others hold regarding the product, as well as the social status and prestige it confers upon its owner. Consumers attribute to such products a symbolic status value that transcends functional utility, thereby justifying the willingness to pay a premium price. For a firm to sustain the brand's identity, it must acknowledge the distinguishing features of the brand and accentuate the inherent elements of the product or service offered [18]. This perspective highlights the increasing significance attached to the concepts of responsibility and sustainability, a significance that appears closely intertwined with the evolving notion of luxury and its inherent values. In contemporary society, sustainability can be perceived as a source of luxury.

Building upon the theoretical framework, we propose two testable hypotheses:

H1. There is a convergence between the eco-friendliness and the fashion perceptual attributes of a fashion brand.

H2. The convergence between eco-friendliness and fashion perceptual attributes is more pronounced for luxury brands as compared to high and fast fashion brands.

3. Method

Data Collection and Data Mining

The research hypotheses were examined utilizing data collected from Facebook. Facebook employs an algorithm designed to present content on users' timelines. This

algorithm assesses tweet relevance based on criteria such as recency, media content, past interactions with the author, and engagement history. Facebook has been widely adopted for brand image and brand personality development, offering a cost-effective means of reaching the brand community with frequent, conversation-like messaging, setting it apart from other social media platforms. Additionally, Facebook allows public access to all social connections, with only a small proportion of private accounts, providing dynamic access to connections through the Facebook API. This is of significance since "following a brand" serves as a social signal that links social network data with users, enabling the definition of brand image. Users frequently categorize Facebook accounts using thematic lists, providing a dynamic means to identify the most relevant Facebook accounts for a particular topic.

Given a brand, such as Gucci, and a perceptual attribute, like eco-friendliness, the research objective is to develop an automated method for assigning a score to the brand. A higher score signifies a strong perceived connection between the brand and the attribute. This approach is built upon the concept of an attribute exemplar, which refers to an individual or organization strongly associated with a specific attribute. When a user in a social network follows a Facebook account, "likes" a Facebook page, or connects with another entity in the network, they publicly associate themselves with that entity. This association can be interpreted as an expression of affinity (or homophily) between the user and the entity. Thus, the perception of a brand by users can be measured by examining how many users following a specific brand also follow Facebook accounts that exemplify a particular concept. Users who follow accounts recognized as exemplifying a particular attribute are likely to consider that concept important. For instance, when considering eco-friendliness, if a user follows the Greenpeace Facebook account, it indicates sensitivity to environmental issues. In this context, if a brand on Facebook (e.g., Gucci) has a significant number of followers who also follow the Greenpeace Facebook account, it is perceived by its followers as closely related to eco-friendliness.

To collect data, Facebook profiles of fashion clothing brands were obtained from the Social bakers website in April 2018. This platform offers a comprehensive list of the most followed fashion clothing brands. We selected Facebook accounts with a substantial following to ensure sufficient data for analysis, excluding accounts with fewer than 100,000 followers. The list was further refined to exclude duplicates and non-English-speaking accounts, retaining only international brand accounts, thereby eliminating accounts linked to specific locations. For each account, we automatically collected their followers' usernames. Given the impracticality of collecting usernames from accounts with over 10 million followers, a sample of one million followers' usernames was obtained using a random sampling procedure.

For each brand, a score was calculated to indicate the degree of eco-friendliness and fashion perception among consumers. If the fashion score is found to be dependent on the eco-friendliness score, it suggests a correlation between the brand's eco-friendly perception and the fashion perceptual attribute.

Figure 1 illustrates the overall data mining process, with each stage detailed in subsequent sections. Can the results obtained from this analysis be generalized to the broader population's perception of online brands? Existing literature suggests an affirmative answer.

Choice of Exemplars

In the context of gathering data and monitoring discussions pertinent to a specific concept within a brand's follower network, the selection of relevant social media accounts, here referred to as "exemplars," is of paramount importance. To acquire a list of Facebook accounts that best exemplify the target concept, we propose an automated approach, aligning with the methodology recommended by Culotta and Cutler in 2016. Several reasons underscore the preference for this automated approach:

- In certain instances, identifying suitable exemplars can be a formidable task, given the vastness of Facebook.
- Automation facilitates scalability, rendering the process adaptable to various attributes.
- Obscure or less well-known accounts often yield more valuable insights for computing the final perceptual score. Such accounts tend to attract followers who display a heightened interest in the subject matter under investigation, unlike widely recognized accounts with diverse follower bases. On Facebook, users typically organize accounts into topic-based lists, akin to a crowd-sourced categorization system or a folksonomy. The term "folksonomy" represents a form of online content classification reliant on tags for personal retrieval. The accumulation and aggregation of tags give rise to a classification system based on keywords, serving as a rudimentary form of metadata. Google's search engine serves as a valuable resource for identifying the most influential lists associated with specific attributes. The attributes we focus on in our study are fashion and eco-friendliness.

To capture conversations related to fashion, we selected keywords based on a study concerning the personalities of luxury fashion brands. From this pool of keywords, we eliminated those not directly relevant to the fashion industry, as well as keywords that did not yield a minimum of 20 exemplar accounts. Consequently, the keywords retained for assessing the fashion attribute are "fashion," "glamour," and "style." In the context of eco-friendliness, we incorporated two keywords: "environment" and "ethical business." For each keyword, we compiled a word cloud of the most frequently cited terms within the first 500 Facebook posts of each exemplary

account. This step allowed us to gain a better understanding of the contextual usage of each keyword and enhance the interpretation of our results [19].

In the case of fashion-related keywords, they are closely linked to notions of "new" and "now." The term "fashion" is also associated with words like "collection" and "season," while "glamour" correlates with "online experience" and references to a bridal clothing brand. The keyword "style" is connected to generally positive adjectives related to experiences rather than products. For the eco-friendliness attribute, the keyword "environment" is associated with topics like climate change, clean energy, and institutions influencing relevant regulations. It also conveys a positive, forward-looking connotation. In contrast, "ethical business" encompasses a broader spectrum of connotations, including concerns about discrimination, child labor exploitation, and the adoption of ethical business practices. The most frequently used phrase is "ethical hour," which represents a community of ethical and sustainable businesses, consumers, and bloggers. "Ethical business" is more business-oriented than "environment," as it relates to terms like "business" and "brand/brands," and maintains a direct connection with the realm of fashion. To illustrate the perceptual attributes, we conducted a Google query for each selected keyword, exclusively retrieving webpages corresponding to Facebook lists. After eliminating duplicate lists, we collected the Facebook accounts found in the first 50 results of each Google query. An exemplar Facebook account was considered as such if it featured in at least two of the lists obtained earlier and boasted more than 1,000 followers. Subsequently, we implemented a procedure similar to the one employed for brands, gathering the usernames of up to 100,000 followers for each exemplar, using random sampling techniques [20].

Social Perception Score (SPS) Index and Testing the Validity and Reliability of the Perceptual Attributes

To assess the degree to which a brand's followers also follow exemplar accounts, we applied the approach proposed by Culotta and Cutler in 2016, employing the Jaccard similarity index. The Jaccard Index calculates the similarity between the followers of Brand B and exemplar account E, considering the common followers between them. To prevent duplicate counting, the followers they share are subtracted from the denominator. These indexes were then averaged to compute a single score defining the brand's perception regarding a given attribute. A weighted average was employed, with the weight of each score inversely proportional to the number of followers of the exemplar account.

To compute the Social Perception Score (SPS), we developed an algorithm. The algorithm's inputs include: 1) the Facebook account name of a brand, and 2) a query describing the attribute for which we intend to measure the brand's perception. To ensure the correct alignment of each keyword with the corresponding attribute and

to gain diverse perspectives on the same attribute, we executed the algorithm using multiple queries.

In order to validate and assess the reliability of perceptual attributes related to fashion and eco-friendliness, we conducted robustness tests. First, we verified the attribute related to fashion. Figure two illustrates the existence of a correlation between the SPS (Social Perception Score) values. A stronger correlation is indicated by the points on the scatter plot aligning along a straight line, signifying a higher correlation between the two keywords. This correlation implies that these keywords convey similar concepts and can be employed in our analysis. Notably, the "fashion" and "glamour" as well as "glamour" and "style" plots exhibit the most significant correlations, while the "fashion" and "style" plots display comparatively weaker correlations [21]. It is noteworthy that "glamour" occupies an intermediate position between the other two terms. Based on this qualitative analysis, we anticipate that luxury fashion brands will exhibit higher fashion and glamour scores in contrast to style attributes, while non-luxury fashion brands are expected to demonstrate the opposite.

Secondly, we assessed the eco-friendliness attribute. Figure three presents the correlation diagram of the SPS scores computed for the keywords "ethical business" and "environment." The line in the diagram indicates the linear regression estimate of the two sets of scores. The size of each data point represents the number of followers for respective Facebook accounts, and the color corresponds to the brand type. The brand type categorization is based on the price point of the flagship product, which signifies a company's prominent product and its market positioning:

- Luxury brands are characterized by the highest price point (e.g., Gucci or Stella McCartney).
- High fashion brands have a relatively lower price point than luxury brands but are not categorized as casual brands (e.g., Lacoste or Ralph Lauren).
- Fast fashion brands offer products at the lowest price point (e.g., H&M or Zara).

Our analysis reveals a pronounced correlation between "ethical business" scores and "environment" scores, with a few exceptions like Diesel, Mulberry, and Vivienne Westwood. One potential concern when assessing SPS scores is that individuals who prioritize a particular attribute may follow a Facebook account because they perceive the associated brand as negatively related to that attribute, effectively acting as watchdogs monitoring the brand's activities. To investigate this, we conducted a sentiment analysis on select brands included in our study. Specifically, we analyzed brands with the lowest scores for environmental concepts, such as Gucci, Chanel, and Versace, as well as brands with the highest scores, including Vivienne Westwood, Diesel, and Stella McCartney.

This sentiment analysis employs three emotional dimensions for words: 1) pleasure (indicating the level of happiness); 2) activation (measuring excitement); 3) dominance (evaluating the extent to which a term influences the overall sentiment of the text snippet it is part of). This tool offers a more nuanced assessment compared to many other sentiment analysis tools, which often categorize sentiment as positive, negative, or neutral on a three-value scale. Healey's scales operate on a nine-point range, offering a more detailed representation of sentiment. For all brands, we observe that the majority of Facebook posts fall on the right side of the graph. Posts on the left side, indicating a negative connotation, are more prevalent for brands with lower scores on the environmental scale than for those with higher scores. These findings suggest that individuals who follow a brand on Facebook primarily do so because they appreciate the brand's products and message, with watchdog users representing a minority of the total followers [22].

4. Estimation Model and Results

To ascertain the influence of a fashion brand's eco-friendliness perception on its overall reputation within the Facebook platform, we conducted an OLS regression analysis, with a particular focus on eco-friendliness and the Social Perception Score (SPS) for fashion. The linear model employed in this estimation can be expressed as follows:

$$SPS_{\text{Fashion}} = \beta_0 + \beta_1 SPS_{\text{Environment}} + \beta_2 SPS_{\text{Ethical Business}} + \epsilon$$

Here, (SPS_{Fashion}) represents the Social Perception Score of a brand concerning its fashion perceptual attribute. To ensure a comprehensive analysis, we executed three separate OLS regressions, examining the relationships between eco-friendliness, glamour, and style, not only within the entire dataset but also categorically for various brand types, including luxury, high-end, and fast fashion brands. $(SPS_{\text{Environment}}) and (SPS_{\text{Ethical Business}})$ denote the Social Perception Scores of a brand regarding its environmental practices and ethical business conduct, respectively. (β_0) signifies the intercept, while $(\beta_1) and (\beta_2)$ are the coefficients estimated by the linear model, elucidating the connections between these two scores and the fashion perceptual attribute.

Table 1:

All		Fashion Luxury	High and Fast	All	Glamour Luxury	High and Fast	All	Style Luxury	High and Fast
Environment	4.519***	5.477***	2.714	11.871***	16.218***	7.047	3.770***	4.909***	2.570**
(1.085)	(0.922)	(2.373)	(2.271)	(1.855)	(4.637)	(0.626)	(0.696)	(1.201)	
Ethical business	3.897	-1.182	4.205	-11.898**	-35.424***	-1.760	-2.985*	-9.415***	-0.119
(3.682)	(5.792)	(4.403)	(5.488)	(8.657)	(4.594)	(1.667)	(3.364)	(1.047)	
Followers	0.000392***	5.958e-05	0.000522***	0.000527**	-0.0004923	0.0008037**	-3.78e-05	-0.0003204**	4.41e-05
(0.000108)	(0.000228)	(0.000174)	(0.000203)	(0.000339)	(0.000343)	(5.53e-05)	(0.000122)	(9.36e-05)	
Constant	-0.00372**	0.001584	-0.004896***	-0.004131	0.01242**	-0.007884**	0.0007047	0.0052833**	-0.0004401
(0.001584)	(0.003924)	(0.0017466)	(0.002943)	(0.005679)	(0.0030857)	(0.0008307)	(0.002043)	(0.0007578)	
Observations	58	30	28	58	30	28	58	30	28
R-squared	0.5103	0.5589	0.4293	0.576	0.7101	0.5184	0.5184	0.6156	0.4725

Robust standard errors in parentheses
** p¡0.01, ** p¡0.05, * p¡0.1

The results suggest that luxury brands exhibit a more robust positive correlation between fashion, glamour, and the environment, reflecting the trend of luxury fashion firms increasingly incorporating environmental concerns into their core business strategies. This shift towards environmental responsibility is more prominent for luxury brands as opposed to non-luxury ones. Similarly, a strong positive relationship between style and the environment component is observed, not only for luxury brands but also for high and fast fashion brands, despite a 10% reduction in correlation values. These results align with the agility of fast fashion brands in identifying and adapting to evolving styles, trends, and market demands. In contrast, the connection between ethical business and all fashion components is not statistically significant, with a 10% decrease in correlation values. This implies that the perception of ethical business is negatively associated with the notions of glamour and style, indicating that issues such as discrimination, child labor exploitation, and ethical responsibilities in employer-employee relationships are at odds with the glamorous and stylish brand image. It should be noted that this analysis focused exclusively on English-speaking Facebook accounts with more than ten million followers, and for calculation constraints, a million followers' data were sampled randomly [23].

Ethical business encompasses diverse cultural and moral considerations, which may vary across geographical regions. For instance, what is considered unethical in one country may be deemed ethical in another, reflecting significant cultural disparities. This discrepancy could adversely affect brand perceptions. Another interpretation is that consumers may not be as aware of a firm's ethical business practices as they are of their environmental efforts [24].

Conclusions

This study, utilizing Facebook data, explored the potential correlation between a brand's eco-friendliness and its fashion perceptual attribute. To achieve this, we deployed an algorithm that leveraged publicly accessible data from the Facebook API to estimate a brand's perception in relation to a specific topic. The analysis was centered on globally recognized brands with an active Facebook presence and a substantial following, encompassing at least 100,000 followers.

This investigation contributes significantly to the body of literature regarding consumer perception. While previous research has primarily concentrated on luxury brands and relied heavily on survey-based methodologies, our study embraced a broader perspective by encompassing not only luxury brands but also high and fast fashion brands. We introduced a pioneering approach for evaluating consumer perception through Facebook data mining [25]. Unlike traditional survey-based approaches, which may introduce biases due to social desirability, the utilization of Facebook data offers a more unbiased perspective, as it doesn't explicitly solicit individuals for their opinions. This novel methodology gauges consumer perception based on their interaction with a brand's Facebook page, thereby mitigating overestimations related to the disparity between pro-environmental attitudes and actual behavior (social desirability bias). This approach offers valuable insights for research on the relationship between eco-friendly attitudes and consumer behavior.

From a managerial standpoint, this study has implications for clothing companies striving to enhance the effectiveness of their environmental and social sustainability initiatives. Even as these companies adopt new production models, such as circular ones, or invest in reducing their environmental impact, they often grapple with uncertainty regarding how consumers perceive these investments. Our research suggests that a brand's eco-friendliness positively correlates with the fashion perceptual attribute, especially in the case of luxury brands. Consumers familiar with luxury brands and following them on Facebook anticipate a heightened commitment to environmental responsibility. This anticipation stems from an augmented perception of fashion, glamour, and style as brand attributes. Consequently, luxury, high-end, and fast fashion companies should reconsider how they communicate their ethical business investments. Currently, consumers appear less engaged in ethical business practices. This may be attributed to varying global perceptions of ethics, skepticism about brands' authenticity in their eco-friendly claims, and the complexity of discerning the societal impact of such practices. Therefore, investments in this area have yet to significantly influence consumer perceptions of a brand as fashionable, glamorous, or stylish. In summary, environmental aspects play a pivotal role in the luxury, high-end, and fast fashion markets, while additional

investments should focus on communicating ethical aspects, possibly through ethical certifications like the B-corp [26].

The methodology applied in this study is highly adaptable and can be utilized by researchers and practitioners seeking to conduct in-depth investigations of consumer perceptions across various domains. Marketing experts can develop routines for ongoing brand positioning analysis relative to competitors and measure the impact on consumer perceptions and sentiment regarding specific actions [25]. Perceptual mapping, a fundamental tool in marketing research, can now incorporate big data as a vital component of marketing business intelligence [27].

While the algorithm employed in this work yielded plausible results, there exist areas for improvement that could yield more precise brand perception estimates or extend the applicability to brands with smaller followings. First, this analysis can be conducted at multiple time points to generate a panel dataset, enabling the use of regression algorithms designed for panel data analysis, such as the "within estimator", which removes time and brand-invariant effects from the estimates. Another area of enhancement involves refining the process of generating a list of exemplary accounts for each topic [28]. By supplementing the automated Facebook account classification method used in this study with accounts identified through a customized survey, we can enhance the accuracy of brand perception estimates. Future research could also explore the use of this social network mining model to compute similarity measures between brands and to create competitive market structures and brand association networks. Additionally, clustering consumers based on specific attributes may enable market segmentation grounded in social network similarities [29,30].

References

1. Li, Y., Zhao, X., Shi, D. & Li, X. Governance of sustainable supply chains in the fast fashion industry. *Eur. Manag. J.* **32**, 823–836 (2014).
2. Krishnan, H. S. Characteristics of memory associations: A consumer-based brand equity perspective. *Int. J. Res. Mark.* **13**, 389–405 (1996).
3. Ko, E., Hwang, Y. K. & Kim, E. Y. Green marketing' functions in building corporate image in the retail setting. *J. Bus. Res.* **66**, 1709–1715 (2013).
4. Kim, H.-B. Perceptual mapping of attributes and preferences: an empirical examination of hotel F&B products in Korea. *Int. J. Hosp. Manag.* **15**, 373–391 (1996).
5. Hartmann, P. & Apaolaza-Ibáñez, V. Consumer attitude and purchase intention toward green energy brands: The roles of psychological benefits and environmental concern. *J. Bus. Res.* **65**, 1254–1263 (2012).
6. Hartman, K. B. & Spiro, R. L. Recapturing store image in customer-based store equity: a construct conceptualization. *J. Bus. Res.* **58**, 1112–1120 (2005).

7. Cimatti, B., Campana, G. & Carluccio, L. Eco design and sustainable manufacturing in fashion: A case study in the luxury personal accessories industry. *Procedia Manuf.* **8**, 393–400 (2017).
8. Hamers, L. *et al.* Similarity measures in scientometric research: The Jaccard index versus Salton's cosine formula. *Inf. Process. Manag.* **25**, 315–318 (1989).
9. De Angelis, M., Adıgüzel, F. & Amatulli, C. The role of design similarity in consumers' evaluation of new green products: An investigation of luxury fashion brands. *J. Clean. Prod.* **141**, 1515–1527 (2017).
10. Armstrong, C. M., Niinimäki, K., Kujala, S., Karell, E. & Lang, C. Sustainable product-service systems for clothing: exploring consumer perceptions of consumption alternatives in Finland. *J. Clean. Prod.* **97**, 30–39 (2015).
11. Amatulli, C., De Angelis, M., Korschun, D. & Romani, S. Consumers' perceptions of luxury brands' CSR initiatives: An investigation of the role of status and conspicuous consumption. *J. Clean. Prod.* **194**, 277–287 (2018).
12. Rathore, B. The Fashion Paradox: Deciphering the Relationship between Consumer Behaviour and Evolving Marketing Trends. *EIPRMJ* **7**, 61–71 (2018).
13. Eunha, E., Han, J. & Ko, E. Applying PLM approach for sustainable new product development in fashion industry. *Fash. Text. Res. J.* **20**, 34–49 (2018).
14. Pather, A. Entrepreneurship and regional development: case of fashion industry growth in South Africa. *J. Entrep.. Sustain. Issu.* **3**, 56–65 (2015).
15. Jang, J., Ko, E., Chun, E. & Lee, E. A study of a social content model for sustainable development in the fast fashion industry. *J. Glob. Fashion Mark.* **3**, 61–70 (2012).
16. Ciasullo, M. V., Cardinali, S. & Cosimato, S. A strenuous path for sustainable supply chains in the footwear industry: A business strategy issue. *J. Glob. Fashion Mark.* **8**, 143–162 (2017).
17. Bouzon, M. & Govindan, K. Reverse logistics as a sustainable supply chain practice for the fashion industry: An analysis of drivers and the Brazilian case. in *Springer Series in Supply Chain Management* 85–104 (Springer International Publishing, 2015).
18. Ceballos, L. M. & Villegas, J. Use of archetypes in the Colombian fashion industry. in *The Sustainable Global Marketplace* 195–195 (Springer International Publishing, 2015).
19. Niinimäki, K., Pedersen, E., Hvass, K. & Svengren-Holm, L. Fashion industry and sustainability. in *Handbook of Sustainable Apparel Production* 516–545 (CRC Press, 2015).

20. Rahman, S. & Yadlapalli, A. Sustainable practices in luxury apparel industry. in *Handbook of Sustainable Luxury Textiles and Fashion* 187–211 (Springer Singapore, 2015).
21. Radhakrishnan, S. Fashion industry and sustainability. in *Handbook of Sustainable Apparel Production* 501–530 (CRC Press, 2015).
22. Molderez, I. & van Elst, B. Barriers towards a systemic change in the clothing industry: How do sustainable fashion enterprises influence their sector? *J. Corp. Citizensh.* **2015**, 99–114 (2015).
23. Sutter, M. B., Galleli, B., MacLennan, M. L. F., Polo, E. F. & Correa, H. L. Brazil's fashion and clothing industry: sustainability, competitiveness and differentiation. *Lat. Am. J Manag. Sustain. Dev.* **2**, 280 (2015).
24. Lakshmanan, A., Jose, S. & Chakraborty, S. Luxury hair fibers for fashion industry. in *Sustainable Fibres for Fashion Industry* 1–38 (Springer Singapore, 2016).
25. Moorhouse, D. & Moorhouse, D. Designing a sustainable brand strategy for the fashion industry. *Cloth. Cult.* **5**, 7–18 (2018).
26. Lou, X. & Cao, H. A comparison between consumer and industry perspectives on sustainable practices throughout the apparel product lifecycle. *Int. J. Fash. Des. Technol. Educ.* **12**, 1–9 (2018).
27. Serhiyevich., T. Fashion industry development and sustainable development: Different directed vectors. *Экономическая наука сегодня* 74–79 (2018).
28. Kang, M. Y., Korea Advanced Institute of Science and Technology, Republic of Korea, Choi, Y. & Choi, J. The effect of celebrity endorsement on sustainable firm value: Evidence from the Korean telecommunication industry. *Glob. Fashion Manag. Conf.* **2018**, 275–276 (2018).
29. Moretto, A. *et al.* Designing a roadmap towards a sustainable supply chain: A focus on the fashion industry. *J. Clean. Prod.* **193**, 169–184 (2018).
30. Pal, R. & Gander, J. Modelling environmental value: An examination of sustainable business models within the fashion industry. *J. Clean. Prod.* **184**, 251–263 (2018).