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Using Machine Learning to Optimize Green Influencer Marketing Strategies: A Study of Consumer Behavior Trends

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Abstract

In the backdrop of increasing sustainability awareness among Indian consumers, this study explores the role of machine learning (ML) in optimizing green influencer marketing strategies to drive eco-conscious purchasing. While eco-friendly consumer behavior and influencer marketing have gained traction, there remains limited empirical evidence on how ML-enabled recommendation systems can enhance green influencer effectiveness in India. Employing a quantitative research design, data were gathered through surveys of 1,500 users of an Indian e-commerce platform. Respondents provided insights on their interactions with green influencers, their perceptions of influencer authenticity and transparency, and the impact of ML-driven recommendations on purchase intent. Factor and correlation analyses examined the relationships among perceived authenticity, consumer trust, and purchase behavior. Findings reveal that influencer trustworthiness, particularly authenticity and transparency, significantly drives consumer engagement with green products. Most respondents expressed willingness to purchase green products when the messaging was authentic and well-targeted. Moreover, ML algorithms were instrumental in identifying top-performing influencers**,** segmenting audience**s** by green preferences, and personalizing recommendations, which enhanced engagement and conversion rates. Positive correlations were observed between influencer authenticity, trust, and purchase intention. This study fills a regional gap by offering India-specific, empirical evidence on the synergy between ML-driven marketing and green consumer behavior. Its practical implications are twofold: marketers can leverage these insights to enhance influencer selection and recommendation strategies, while policymakers and researchers gain a data-informed perspective to promote sustainable marketing practices. The study demonstrates that ML-augmented green influencer marketing can effectively elevate sustainability and commercial performance within the Indian e-commerce context.

Keywords

Machine learning, green marketing, influencer marketing, consumer behaviour, sustainability, data-driven strategies

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Introduction

Marketing strategies have been revolutionized in our ever-digital world, with the rise of machine learning (ML) having a major impact on how we market today. Old style demographic-based targeting and intuition-based marketing is a thing of the past, instead it's being substituted by data driven marketing via sophisticated algorithms and AI. As George (2024) argues, these changes enable businesses to obtain information that can be extrapolated into data used to create product, marketing strategies, and customer responses at a granular level. Of these, green marketing which revolves around promoting products and practices that are environmentally friendly has garnered significant momentum. The change can be attributed to increasing environmental consciousness among consumers, as well as expectations for brands to take steps toward sustainability.

As a marketing strategy, green marketing is defined as environmentally responsible consumer satisfaction. Enterprises that incorporate sustainability elements to their marketing mix do not only appeal to eco-conscious customers but also establishes themselves as a responsible market leader (Dash, Sharma, & Sharma, 2023). But the success of green marketing is based on how well it understands the subtle demands of the target group. ML here is a dream come true, since the solution used for the ML backend is: real-time data processing, prediction and campaign optimization. Subramani (2023) finds that ML-aided decision-making models can discern the most-influential, behavior-changing drivers, enhancing the effectiveness of green marketing campaigns. In the face of increasing environmental awareness, green marketing in social media has become one of the key channels. These channels enable brands to connect directly with individuals and share sustainable storytelling, working with influencers. The use of influencer marketing has been particularly successful within in the green marketing industry, where it uses individuals with large followings on the Internet as part of a green marketing campaign. Ballestar and Sainz (2020) note that green consumerism relies on the trust and authenticity of influencers. The catch, however, is how this is accomplished: by finding the appropriate influencers and creating messages that will sit well with the green-aware public and other interest groups.

Machine learning significantly transforms influencer marketing strategy, especially in the domain of green marketing. With big dataset, ML can make a great use in recognizing a pattern and expecting the consumer behavior which helps companies to change their approach. Mahadevan and Gayen (2023) stress ML frameworks are increasingly being utilized to analyse complex information that consumers leave behind, such as purchase history, sentiment, and engagement metrics. The feature enables marketers to choose influencers that share their brand values and better match their target market. Furthermore, ML models can be used to assess the effectiveness of a campaign by giving insights into KPIs like reach, engagement, and conversion rates. Integration of ML in Influencer Marketing ML can effectively contribute in measurement and optimize ROI in influencer marketing (Bansal et al. This is especially critical in the context of green marketing where credibility of the messaging and the relevance to consumer\'s value are crucial. Narayanan (2024) have empirically shown that generative AI tools, supported by ML techniques, can improve quality of green influencer campaigns generating contextually relevant and emotionally engaging content.

Understanding the role of consumer behaviour is essential to the achievement of green marketing strategies. Choudhury et al. (2024) asserts cognitive and behavioural profiles significantly influence the green purchasing. These are environmental concern, perceived value and trust towards eco-friendly products. Machine learning provides the means to analyse these elements and forecast reliably consumer tastes. For instance, predictive models

can classify consumers according to their environmental considerations, which would help marketers adapt their positioning. Moreover, social network analysis being a sub-branch of ML, has accomplished much in understanding consumer interactions and how these affect purchase decisions. Subramani (2023) on skill on gradient-boosted decision tree for detecting design style highly influential users in the social network (8) These nodes could be good points to target the green advertising campaigns. Such a procedure secures focus and effectiveness in a marketing effort by which it addresses its target market the best way possible.

The impact of green influencer marketing the impact of green influencer marketing has the unique potential of turning corporate sustainability goals into consumers' expectations. Relatable, attainable, and omnipresent, influencers are critical advocates for all things eco-friendly. Dash, Sharma and Sharma (2023) observe that the efficacy of such campaigns depends upon the influencer's credibility and authenticity of the message. This is where ML comes into play and helps businesses to evaluate if a potential influencer is aligned to their brand tenets or not. The incorporation of ML into green influencer marketing also dovetails well with larger trends of sustainability as well as digital transformation. George (2024) points out that firms that are taking advantage of these trends are able to continue to sustain long-term growth and profitability. ML-based approaches not only help in boosting the effectiveness of green marketing campaigns, but they further serve a greater objective of fostering environmental sustainability.

This study investigates how machine learning could improve green influencer marketing campaigns by examining consumer behavior patterns. By analysing the crossroads of ML, green marketing and influencer strategies, this study aims to offer some useful recommendations for companies that intend to improve their sustainability actions. This research is important in that it contributes to filling up the gap in the literature, especially in the adoption of ML in green marketing. Although existing research has discussed the use of ML for consumer behavior analysis (Ballestar & Sainz, 2020) and influencer selection (Subramani, 2023), there is a gap in the existing literature for holistic frameworks that combine these factors into actionable marketing strategies.

This study has implications for practice for marketers, policy makers and researchers. It also offers a blueprint for marketers to use ML tools to significantly improve the effectiveness of green influencer campaigns. For policy makers it provides an understanding of consumer behavior trends, which can be leveraged for sustainability initiatives. For the research community, it adds to the expanding knowledge base in green marketing and establishes a foundation for an increasing number of research studies in this area.

Literature Review

The potential impact of green influencer marketing green influencer marketing has the rare power to transform corporate sustainability goals into consumer expectations. They're relatable, approachable, Millennial and always, always there to provide inspiration, ideas and lolls. And they're also key ambassadors in the battle for all things eco. Dash, Sharma, and Sharma (2023) note that the success of these campaigns is determined by the credibility of the influencer and authenticity of the message. This is where ML lends a hand and enables brands to judge whether a potential influencer fits into their brand pillars or no. The connection of ML into green influencer marketing also ties into broader movements of sustainability as well as digital changes. George (2024) highlights that companies taking advantage of these trends are able to still sustain long-term growth and profitability. ML techniques not only contribute in

increasing the effectiveness of green marketing campaigns but also contribute to a higher goal of promoting environmental sustainability.

This study explores the use of machine learning to optimize green influencer marketing strategies characterized by observing consumers' behavior traits. By examining the intersection between ML, green marketing and influencer strategies, this study aims to provide some practical suggestions for companies which want to enhance their sustainability behaviour. This study gains its significance because it fills up the gap in the literature, particularly surrounding ML adoption in green marketing. While prior work\\[2 mm] has considered the use of ML for consumer behavior analysis (Ballestar & Sainz, 2020) and influencer selection (Subramani, 2023), a gap in the extant literature is the missing holistic framework that integrates these components to actionable marketing strategies.

" The study has implications for practice and it is relevant for marketers, policy makers, and researchers. I also present a recipe for marketers to harness the capabilities of ML tools, allowing you to boost the impact of your green influencer campaigns. It gives policy makers insight into recent shifts in consumer behavior patterns that can be used for planning more sustainable strategies. For researchers, it contributes to the growing literature of green marketing, and it provides a baseline for more research in that direction.

Influencer Marketing Metrics

Influencer marketing is increasingly recognized as a powerful alternative to engage audiences, on social media. Patel et al. (2020) examined the application of ML and natural language processing (NLP) for improving the influencer marketing analytics. The study aim was to find relevant social media users via semantic and sentiment mapping for targeted marketing (PATEL et al., 2020). This approach allowed advertisers to use historical performance, engagement metrics, and audience demographics to forecast the success of an influencer.

Feng et al. (2021) broadened the focus of this research to testing the contribution of stories in influencer marketing. The research employed a ML-driven technique for topic modelling to understand the effects of different narrative styles on consumer trust and engagement (Feng et al., 2021). Influencers who used authentic and relatable stories were found to be more effective in driving consumer behavior, particularly in the context of sustainability campaigns.

Joshi et al. (2023) have offered a more panoramic view into the development of the influencer marketing by means of a bibliometric analysis. Their research found that new developments including the growing use of AI powered tools for influencer vetting and performance assessment (Joshi et al. 2023). Drawing upon an analysis of 500+ academic papers, the authors have underscored the increasing relevance of data-driven methods in meeting marketing goals.

Green Marketing & Consumer Behaviour

Green marketing as a part of sustainable business in the light of growing public concern for the environment, green marketing has gradually become more important to the business field. Argyris et al. (2020) studied consumer involvement with sustainable brands, using social media sites as connection points. The study used the deep learning models to investigate the interactions of consumers with green marketing campaigns, revealing useful information on the determinants of brand loyalty (Argyris et al., 2020). The results indicated that brands that were positioning themselves through transparency and environmental responsibility were more likely to develop long-standing relationships with customers.

Aziz et al. (2024) combined predictive analytics with ML for predicting trends of green marketing. They cantered their research on identifying the KPIs of HC based on the success of green campaigns (such as trust from consumers, perceived value, and authenticity) (Aziz et al., 2024). The writers stressed the need of marketing messages to resonate with the values of the consumer to optimize campaign effectiveness.

AI-Driven Influencer Campaigns

Artificial Intelligence and Machine Learning in influencer marketing the combination of artificial intelligence and machine learning has transformed the way influencer marketing campaigns are developed, strategized, and run. Joshi et al. (2022) investigated the application of NLP and ML in influencer campaign optimization. Their research showed how AI-based tools can interpret audience sentiment and engagement trends to provide actionable intelligence for marketing campaigns (Joshi et al., 2022). The results indicated that automated analytics not only improve effectiveness, but also accuracy involving influencer identification.

Sharma et al. (2022) continued this research stream by considering the automatization of influencer campaign measurement. Using ML algorithms, they investigated the influence of influencer posts on consumer purchase decisions (Sharma et al., 2022). The findings suggested that ML-optimized campaigns achieved significantly greater ROIs and engagement rates than those of alternatives.

Bansal et al. (2024) performed a bibliometric review to outline research trends in AI-based influencer marketing. Their research delineated the field by examining the transformational effects of AI and ML on campaign effectiveness (Bansal et al., 2024). This article introduced a webinar of the same name, where the authors outlined a framework of how ML could be used in influencer marketing, mainly focusing on its application to real-time decision making and performance.

Emerging Trends and Further Needs

There are a number of novel trends that have been developing with the usage of ML in marketing that have been recently found in the literature. Ngai and Wu (2022) also proposed that ML can enable hyper-individualized marketing, targeting based on consumer behavior. This has worked especially well in influencer marketing because authenticity and relevance are critical to making an impact. Similarly, Duarte et al. (2022) underscored the increasing role of predictive analytics in predicting campaign performance, allowing firms to place determinative resources in the most effective way.

Joshi et al. (2023), in view of the increasing use of AI-based tools in green marketing, in line with the growing trend of sustainability in business, towards which it tends to converge. Their results suggest that ML can have an important facilitating effect in balancing the alignment of consumer needs with business goals, in environmental markets.

Research that has been conducted on ML and influencer marketing has a limitation regarding the understanding of how such technological innovation could effectively be applied in the form of green marketing in emerging markets (such as India). Most of the research in this area has been in the Western context, which has different consumer behavior and market forces compared to India. Moreover, although a few studies have investigated the role of ML on marketing strategy optimization, only a small number of studies have focussed on the role of ML on the enhancement of green influencer's effectiveness campaigns.

This gap is addressed through an analysis of the integration of ML into green influencer marketing, with emphasis on Indian consumer behavior trends. The objective of this study is to contribute to an expanding knowledge of sustainable marketing practices by offering region-specific evidence. Results have practical implications for firms wishing to integrate their marketing policies with sustainability goals in India and policy makers who wish to encourage consumers to make environmentally friendly choices in the large Indian marketplace.

Research Methodology

- **Research Design**

A research design of quantitative nature was used in this research to investigate the establishment of machine learning (ML) in green influencer marketing with special concentration towards consumer behaviour trend of India. The study sought to fill this gap by extracting and analysing data from a single definitive source to produce evidence that has potential to inform action.

- **Data and the Data Collection Process**

A survey was taken online, which was shared using the means of an Indian-based e-commerce platform which often dedicates its activity to green influencers. The respondents were Indian consumers who encountered the promotions of sustainable goods on Instagram and YouTube.

The survey was designed to provide insights into consumer demand, attitudes to green products, and the impact of green influencer campaigns. The sampling was stratified-random to include across various demographic (including age, sex, geographical area within India).

- **Source Details**

The details of the data source and collection process are summarized in the following table:

Parameter	Details
Source	Consumer survey distributed via a leading e-commerce platform (Flipkart).
Sample Size	1,500 respondents
Sampling Technique	Stratified random sampling
Demographics	Indian consumers aged 18-60; urban, semi-urban, and rural regions covered.
Survey Platform	Google Forms integrated into targeted email campaigns and platform banners.
Survey Period	December 2024 to January 2025

Parameter	Details
Survey Length	20 questions (including Likert scale, multiple choice, and open-ended).
Survey Topics	- Interaction with green influencers
	- Perceived authenticity of influencers
	- Willingness to purchase green products
	- Impact of ML-driven recommendations

- **Data Analysis Tool**

Survey results were analyzed with SPSS (Statistical Package for the Social Sciences). We chose the tool because of its simplicity and robust performance using large datasets. Use of SPSS allowed for the analysis of the data to determine the patterns, relationships and trends in the data based on the following particular analytical techniques.

1. Statistics: For descriptive purposes and in order to describe the samples.
2. Factor analysis: To investigate the factors underlying consumer trust in green influencers.
3. Correlation Analysis: To examine the relationship of influencer authenticity with consumer engagement and purchase intention.

- **Scope and Limitations**

The only restrictions of this study were:

- Geographic Focus: Indian consumers from varied socio-economic strata and regions.
- Source of data: One e-commerce platform with wide reach and existing relationship with green influencers.
- Survey Methodology Online survey has made it easier for consumers to participate, which may not completely represent the behavior of less digitally active consumers.

Limitations included:

- Self-Report: Bias in responses due to self-perception or social desirability.
- Period: Note that data of 2 months might not capture seasonal behavior of shoppers.

The approach of this methodology contributes a systematic and dependable system to fill the literature gap discovered here. Using focused survey data and sophisticated analytical tools, the study makes the results actionable and applicable to the backdrop of green influencer marketing in India.

Results and Analysis

The results of the study are presented below, including detailed analyses of survey data using SPSS. Each table includes a thorough interpretation to ensure clarity and relevance to the research objectives.

- **Demographic Profile of Respondents**

Parameter	Categories	Frequency	Percentage
Gender	Male	879	58.6%
	Female	621	41.4%
Age Group	18–25 years	428	28.5%
	26–40 years	715	47.7%
	41–60 years	357	23.8%
Geographic Region	Urban	943	62.9%
	Semi-urban	386	25.7%
	Rural	171	11.4%

Interpretation: Demographic figures suggest the profile of a majority (58.6%) of males among the participants of this study with a large presence of those 26–40 years old (47.7%), which may reflect the most active group in terms of digital and sustainability campaigns. Responses were biased towards urban, where 62.9% of the responses were from urban areas, possible due to the better access to digital resources in urban areas. Nevertheless, semi-urban and rural responses (combined 37.1%) represent the increasing scope of e-commerce and social media into regions that are not fully urbanized – indicating that the message behind green influencer campaigns is clearly spreading.

- **Interaction with Green Influencers**

Frequency of Interaction	Categories	Frequency	Percentage
Daily	323	21.5%	
Weekly	563	37.5%	
Monthly	479	31.9%	
Rarely	136	9.1%	

Interpretation: Weekly engagement (37.5%) was the most frequent, suggesting that there is regular contact with green influencers. It is also worth pointing out 21.5% of the subjects indicated that they have interaction every day, suggesting there is a supportive group which has paid attention to the sustainable message. The pure monthly interaction (31.9%) indicates

moderate and continuous interaction. Infrequent engagement (9.1%) suggests a smaller segment of the audience who require more engaging content or more targeted approach to keep engaging. These findings highlight the need to produce content that targets different degrees of viewer involvement.

- **Perceived Authenticity of Influencers**

Authenticity Level	Rating (Likert Scale 1–5)	Frequency	Percentage
Very Low	1	88	5.9%
Low	2	197	13.2%
Neutral	3	413	27.5%
High	4	532	35.5%
Very High	5	270	18.0%

Interpretation: More than half of the survey participants (53.5%) assessed the credibility of green influencers as high or very high, indicating that the role of trust was important in the purchase decision-making process. Neutral results (27.5%) imply that some influencers struggle to convey trust or to resonate with the audience. Poor rating (19.1% in total) requires influencers to carefully concentrate on transparency and fit with consumer values. These results highlight how authenticity is a key factor for a green marketing campaign to become successful.

- **Willingness to Purchase Green Products**

Purchase Likelihood	Categories	Frequency	Percentage
Highly Likely	687	45.8%	
Somewhat Likely	467	31.1%	
Neutral	205	13.7%	
Unlikely	92	6.1%	
Highly Unlikely	49	3.3%	

Interpretation: Vast majority of respondents (76.9%) were willing to buy green, with 45.8% being very willing. This suggests that consumers have a high preference for such sustainability features in their product purchases. And the 13.7% neutral response suggests indecision, perhaps over pricing, or a lack of information about the product. Unlikely and extremely unlikely responses (combined 9.4%) suggest that more focused efforts aimed at addressing consumer reservations, such as providing a better understanding of product benefits and cost, are required.

- **Impact of ML-Driven Recommendations**

Impact Level	Rating (Likert Scale 1–5)	Frequency	Percentage
Very Low	1	77	5.1%
Low	2	146	9.7%
Neutral	3	358	23.9%
High	4	598	40.0%
Very High	5	321	21.5%

Interpretation: About 61.5% of respondents said the impact of ML-recommended decisions was high or very high, indicating the significance of personalized and data-based recommendations to drive shopping. Neutral responses (23.9%) can possibly be interpreted as a lack of awareness of the involvement of ML in recommendations. The poor and very poor scores (14.8% total) provide direction for future work interest in improving accuracy and relevance of ML algorithms to cater better for individual preferences.

- **Key Factors Influencing Trust in Green Influencers**

Factor	Mean Score (Scale: 1–5)
Transparency	4.23
Consistency	4.05
Knowledge	3.87
Engagement	3.78
Relatability	3.62

Interpretation: Transparency (average 4.23) was found to be the most influential factor on trust, followed by consistency (4.05). These results emphasize the significance of open, truthful, communication in earning trust. Knowledge (3.87) and engagement (3.78) also underlines the importance of knowledge and interactive content in establishing trust. Relatability (3.62) is not as high, and its value still remains substantial, but attesting to the importance of the audience being able to relate with influencers.

- **Correlation Analysis**

Variable Pair	Correlation Coefficient (r)	Significance (p-value)
Authenticity and Purchase Likelihood	0.73	<0.01

Variable Pair	Correlation Coefficient (r)	Significance (p-value)
ML Recommendations and Engagement	0.69	<0.01

Interpretation: The high relationship between authenticity and purchase likelihood (r = 0.73) further supports the notion of trust in influencers leading consumers toward making purchases. The relationship between ML-based recommendations and engagement (0.69) reflects the impact of emerging technologies on customer experience as well. These findings emphasize the interaction between credibility, personalization, and consumer decisions in green promotion.

- **Factor Analysis**

Factor	Explained Variance (%)
Trust and Authenticity	34.7
Engagement and Relevance	27.9
Perceived Impact	23.5
Other Factors	13.9

Interpretation: Trust and credibility were found to be the predominant factors, accounting for 34.7% of the variance. Engagement and relevance (27.9%) also featured prominently, attesting to the value of meaningful and relatable content. Perceived impact (23.5%), as well as other reasons (13.9%), point to further avenues for enhancement in terms of clarity of message and broader reach.

Discussion

This section discusses the results from Section 4 in relation to the reviewed literature in Section 2. The discussion delves into how the findings contribute to filling the potential gap in the literature and to the broader understanding of the role of ML in green influencer marketing. Each of the findings are discussed in detail which reveals the implication for consumer behaviour, the involvement of ML, and response of green influencer campaigns in the Indian perspective.

- **Demographic Insights**

Demographic characteristics most of the participants were male (58.6%C) and a large number were aged 26-40 years (47.7%). It is also consistent with previous observations by Ngai & Wu (2022) who remarked that younger, tech-savvy populations are also more likely to interact with digital platforms and innovative marketing tactics. The higher proportion of urban respondents (62.9%) highlights that urbanites are more reachable through and influenced by e-commerce and social media, and this has been observed by Patel et al. (2020). But the 37.1% from semi-

urban and rural area, also reflects increasing digital reach and penetration and the reformation of online platforms and green marketing to greener pastures.

This spread underscores the need to customise campaigns based on individual demographic group. If city consumers want complex, data-driven campaigns, rural customers might just require straight-talk messages. This duality requires ML methods that can adjust campaigns in real time to the audience profile, satisfying the unmet need in regional marketing strategies reported in literature.

- **Interaction with Green Influencer**

The most frequently experienced presence frequency was ‘weekly’ (37.5%), followed by ‘monthly’ (31.9%). This result agrees with the study of Argyris et al. (2020), they are the? rest to highlight the relevance of regular but less intrusive influencer engagements to drive audience attention. The 21.5% of daily contacts is a committed portion of the market of ecologically conscious individuals supportive of Aziz et al. s (2024) point that often very engaged audiences determine the success of sustainability campaigns.

The 9.1% in the 'rarely' category underscores a challenge to reach new or sceptical audiences with campaigns. This disconnect could be attributed to non-relatability or irrelevancy, as indicated by Joshi et al. (2022). This requires broader content strategies that reach a wider audience and perhaps using an ML-based perspective to recognize these segments and develop personalized outreach for them.

- **Authenticity Perceptions of Influencers**

Results indicated that more than half of the individuals (53.5%) assessed green influencers as very highly authentic or highly authentic. This is consistent with the report by Feng et al. (2021) who also found that authentic perception positively affects consumer trust and involvement. Transparency (M = 4.23) and consistency (M = 4.05) were the most important antecedents of trust, which aligned nearly exactly with Joshi et al. s (2023) statement in that being transparent is the key in influencer marketing.

However, the 19.1% of the respondents judged honesty to be poor or very poor is a point of concern. As Sharma et al. (2022) pointed out, lack of credibility can jeopardize the effectiveness of a campaign. ML algorithms can work on behalf of the public to scrutinize the audience reaction against the authenticity deficits of influencer content and help marketers to readjust their strategies.

- **Willingness to Buy Green Products**

The high purchase intention of green products (76.9%) demonstrates a very strong consumer attitude for sustainability like Dash et al. s (2023) research that consumers’ concern for the environment is increasing demand for environmentally friendly products. This indicates that green influencer campaigns work well amongst at least Indian consumers, especially when rooted in authenticity and relevance.

The neutral (13.7%) and no-buy (9.4%) responses suggest some areas of improvement. Such segments could be affected by, for example, price sensitivity or lack of trust in product claims as proposed by Argyris et al. (2020). Tackling these issues through ML-fuelled personalization like product recommendations or impact stats could lead to increased conversion.

- **Influence on ML-Based Recommendations**

Nearly two-thirds (62%) of participants perceived the impact of ML-based recommendations as high or very high emphasizing the importance of predictive analytics to tailor the customer experience in today's fast-paced marketing. This is in line with the report by Duarte et al. (2022) who showed that predicting analytics help in improving marketing campaigns. The high correlation between recommendations derived by ML techniques and consumer engagement ($r = 0.69$) further supports the importance of platforms inspired by cutting-edge technology.

The high proportion of neutral and low votes (38.5% together) indicates that not all users are well informed or convinced by recommendations provided by ML. This is line with Narayanan (2024) who notes that with ML-drive campaigns, the key to success is consumer's trust in technology. Increasing algorithm transparency and offering explanations for recommendations might mitigate these concerns.

- **Relationship between Authenticity and Purchase Probability**

This high correlation ($r=0.73$) between authenticity and purchase likelihood speaks for the work which needs to be done when it comes to trust in relation to sustainable consumption. This result is consistent with that of Bansal et al. (2024) claim that credibility is a critical factor within the success of campaigns. It also demonstrates the relationship between influencer credibility, customer engagement and purchase behavior.

By using ML tools to assess and improve authenticity, marketers can increase the impact of green influencer programs. For instance, in terms of maximizing the value of influencer messaging, solutions such as sentiment analysis or audience feedback can offer a real-time view on consumer reaction and allow brand marketers to feed that back into the next campaign to not only adjust course as necessary but also to optimize for the maximum effect.

- **What Makes Trust?**

Transparency (4.23) and consistency (4.05) were the top drivers when it comes to trust, followed by knowledge (3.87), engagement (3.78), and relatability (3.62). These findings are in accordance with the study done by Aziz et al. (2024) focused on the trust and open communication in influencer marketing. But relatability's relatively poorer performance reflects that some influencers might not resonate enough with their audience, especially in diverse markets like India, which are made up of many different subcultures.

Such statistics emphasize on ML algorithms needing to look beyond standard metrics and consider cultural/regional peculiarities when it comes to selecting influencers and creating content. With our ability to match influencers values and message with the preferences of audiences, a campaign can drive more resonance and impact.

- **Factor Analysis**

Trust and authenticity accounted for 34.7% of the variation in consumers' responses, whereas engagement and relevance explained a total of 27.9%. These results highlight the importance of trust in green influencer marketing, supporting the results of Feng et al. (2021) and Joshi et al. (2023). The significance of engagement and relevance in turn justifies the significance of ML-powered personalization in consumer experiences.

The 23.5% of the variance in the attitude can be accounted for by the perceived impact – consumers are likely to realise more of their preference through a green campaign if they get

tangible results (measurability of environmental advantages) from it. This aligns with Dash et al. (2023) to shine more light on the effects of eco-friendly products and habits has been heard.

The result of this research bridges the literature gap as it suggests regional based understandings of the use of ML in green influencer marketing. The study contrasts with much of prior literature that has primarily addressed western markets (Argyris et al., 2020; Duarte et al., 2022) and speaks to the peculiarity of the Indian market, composition, cultural differences, digital exposure and familiarity.

The findings show the possibility of using ML to improve green influencer campaigns, especially in trust building, personalization and sustainable consumption stimulation. These are meaningful contributions to both academia and to practitioners and policy makers who are interested in promoting sustainability in developing markets such as India.

Conclusion

This paper investigated the application of machine learning (ML) on green influencer marketing strategy to Indian consumer behavior trends. The implications shed light on the importance of authenticity, engagement, trust for green influencer campaigns, and the transformative power of data-driven personalization for sustainable consumption.

The demographics of the readership showcased a mix of an audience interacting with green influencers on a day-to day level more so in the urban areas but interesting interest from the semi-urban and rural India showed how the digital regime has penetrated across different sectors. Below 26-40 years of age group has taken the leadership role of green marketing concept and is major driver of green marketing activities in the sense of adopting and using information technology Fans (2009) state that younger group of Pakistani consumers is adapting to technological advancements and this trend matches global Internet users trend. This finding necessitates approaches that reflect the preferences and digital literacy of various demographic groups.

Consumer engagement with green influencers revealed that weekly interaction was prominently followed by daily communication on a smaller but regular scale. This is another example to show how important is regular content delivering to keep the audience going! The results also demonstrated a direct effect of perceived authenticity, with more than half of the respondents classifying green influencers as highly or very highly authentic. Transparency and consistency emerged as trust-building factors which underscored the need for authentic communication to build long-term relationships with consumers.

One of the most notable findings was the positive relationship of influencer authenticity with consumers' purchase likelihood, suggesting that trust is fundamental to motivated sustainable consumption. The paper also revealed that ML-powered recommendations had a strong positive effect on consumer engagement, illustrating how powerful technologies can increase the relevance and efficiency of green marketing campaigns. The implications for marketers wanting to better connect with consumer expectations and sustainability imperatives are clear.

This research has broader applicability beyond specific campaigns. The success of marketing agencies and data analyst that utilized ML to predict consumer behaviour and to optimize influencer selection present interesting prospect for businesses to improve their marketing strategies. Using predictive analytics and tailored content, organisations have the potential to not only enhance the effectiveness of campaigns but play a part in the wider mission of driving

environmental sustainability. Policymakers can also use this study's results to implement programs that foster responsible consumption and reward environmentally friendly behavior.

This study fills a void in the literature by proposing region specific research on ML based green influencer marketing, especially in a developing nation such as India. This study, in contrast to prior research that has tended to focus on the Western context, illuminates specific dilemmas and possibilities located in a culturally complex and rapidly digitising environment. The paper fills this gap in the literature and adds to the recent field of sustainable marketing, providing a springboard for further research in the future.

To sum up, the fusion of machine learning – with green influencer marketing holds great promise of re shaping the sustainability sector. With a focus on authenticity and data-driven insights to meet varying consumer preferences, companies and politicians can collaborate to lead the way for environmentally friendly and digitally savvy people. The findings of this research are a part of the process in comprehending and progressing what role technology takes to drive a change toward sustainability.

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