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Palm Oil in the Millennial Era: The Effects of Digital Campaigns and Public Education on Brand Engagement through Awareness Generation Mediation in West Sumatra

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ABSTRACT

This study investigates the impact of digital campaigns and public education on brand engagement through the mediating role of brand awareness in the palm oil industry of West Sumatra, Indonesia. The research was conducted in response to the growing need for sustainable branding and public perception management within an industry often associated with environmental controversy. A quantitative approach was employed using Structural Equation Modeling (SEM) with Partial Least Squares (SmartPLS 3.0). Data were collected from 115 respondents, primarily millennials, using a five-point Likert scale questionnaire. The results indicate that both digital campaigns and public education have significant positive effects on brand awareness and brand engagement. Moreover, brand awareness plays a partial mediating role, amplifying the indirect influence of digital campaigns and educational initiatives on engagement. The findings confirm the applicability of the Stimulus–Organism–Response (S-O-R) model, illustrating that digital and educational stimuli (S) enhance awareness (O), which subsequently drives engagement (R). The study contributes theoretically by integrating digital marketing communication and sustainability education into the brand engagement framework, and practically by offering strategies for improving consumer trust and advocacy through transparent, educational digital content.

Keywords: *Digital Campaigns, Public Education, Brand Awareness, Brand Engagement, Palm Oil Industry.*

1. INTRODUCTION

In recent years, the palm oil industry has faced both opportunities and challenges as it navigates the dynamics of the digital era and growing societal concerns about sustainability, environmental protection, and ethical consumption. Indonesia, as one of the world's leading producers of palm oil, stands at the center of global debates on deforestation, labor practices, and sustainable sourcing. Within this context, public perception and consumer awareness have become crucial determinants of brand success and long-term industry viability [1]. The emergence of digital media has transformed how companies communicate their values and engage with audiences, particularly millennials who are not only active digital users but also increasingly conscious of social and environmental issues. The intersection of digital campaigns, public education, and brand engagement thus presents a vital area for empirical exploration, especially in the regional context of West Sumatra, where local producers, cooperatives, and brands are beginning to leverage online communication strategies to reshape public narratives around palm oil [2].

The millennial generation represents a digitally native demographic whose purchasing behavior is heavily influenced by online information, social media content, and peer engagement [3]. As digital platforms have become key communication channels, industries previously reliant on traditional marketing—such as agriculture and natural commodities—must now adopt new strategies to maintain relevance and competitiveness. For palm oil producers, this shift entails not only marketing their products but also educating the public about the industry's socio-economic importance and sustainability efforts. Digital campaigns that incorporate elements of transparency,

education, and community interaction have the potential to transform consumer attitudes, promoting awareness that can foster trust and loyalty toward palm oil brands [4].

Public education plays a complementary role in shaping perceptions by bridging the knowledge gap between producers and consumers. Misinformation about palm oil's environmental impact often leads to negative sentiment, especially in international markets. However, domestic efforts to educate the public through schools, community programs, and online advocacy have begun to counter these perceptions. In this sense, digital education campaigns—through websites, social media, webinars, and digital storytelling—act as platforms for rebranding and repositioning palm oil as a sustainable and community-based industry. Such educational initiatives do not merely inform; they engage audiences cognitively and emotionally, influencing their awareness and subsequent behavior toward the brand [5].

Brand awareness serves as a critical mediating construct linking information exposure to brand engagement. According to the hierarchy-of-effects model in marketing communication, awareness represents the first cognitive stage in the consumer decision process that ultimately leads to affective and behavioral outcomes such as preference, loyalty, and advocacy [6]. In the context of palm oil, brand awareness reflects not only recognition but also comprehension of the brand's values, sustainability practices, and contributions to the local economy. When consumers are aware of these positive attributes, they are more likely to engage with the brand, participate in digital conversations, and become advocates for ethical and sustainable palm oil consumption [1].

The theoretical foundation of this study draws upon the Stimulus–Organism–Response (S-O-R) framework, which posits that environmental stimulus—represented here by digital campaigns and public education—affect internal psychological states, namely awareness, that subsequently shape behavioral responses in the form of brand engagement [6]. The S-O-R model has been widely applied in digital marketing research to explain how digital content and online communication stimulate cognitive and emotional reactions leading to consumer behavior. In addition, this study integrates brand engagement theory, emphasizing that engagement is a multidimensional construct that includes cognitive processing, emotional attachment, and participatory behavior toward a brand, reflecting how individuals actively interpret and internalize brand-related messages.

Grounded in these conceptual perspectives, the study aims to examine the impact of digital campaigns and public education on brand engagement in the palm oil industry, with brand awareness acting as a mediating variable. Specifically, the research seeks to (1) determine the direct effects of digital campaigns and public education on brand engagement, (2) assess their influence on brand awareness, and (3) evaluate the mediating role of awareness in linking these antecedents to engagement. The study applies a quantitative approach involving respondents from West Sumatra, using a Likert-scale questionnaire to measure perceptions and behaviors. Data analysis was conducted using Structural Equation Modeling (SEM) with Partial Least Squares (SmartPLS 3). West Sumatra was chosen as the study site because it represents a microcosm of Indonesia's palm oil economy, where smallholder farmers, cooperatives, and local enterprises interact with public education and digital communication initiatives.

The findings of this study are expected to contribute both theoretically and practically. Theoretically, the research extends the literature on digital marketing and sustainability communication by empirically validating brand awareness as a mediating mechanism in the digital engagement process [1], [7]. Practically, it provides valuable insights for policymakers, marketers, and advocacy organizations in designing integrated digital and educational campaigns that enhance

brand reputation while aligning with sustainability goals. Understanding how awareness mediates the relationship between digital initiatives and engagement enables stakeholders to craft strategies that resonate with millennial values and foster long-term brand equity within Indonesia's palm oil sector. Ultimately, this study highlights the growing significance of digital communication and public education in reshaping the perception of traditional industries, asserting that the ability of palm oil brands to engage meaningfully through awareness-driven campaigns is crucial for building a more inclusive, sustainable, and responsible industry image.

2. LITERATURE REVIEW

2.1 Digital Campaigns in the Palm Oil Industry

Digital campaigns have become an essential strategy for building consumer trust and engagement in industries facing social and environmental scrutiny. In the context of the palm oil industry, such campaigns serve multiple purposes—enhancing transparency, promoting sustainability practices, and reshaping public perception. According to [8], digital marketing enables brands to communicate their value propositions through interactive, data-driven platforms that foster two-way communication. Unlike traditional advertising, digital campaigns rely on content personalization, social media engagement, and storytelling to shape consumer attitudes. Within the palm oil sector, these initiatives often aim to address misinformation related to deforestation, carbon emissions, and biodiversity loss by highlighting sustainable cultivation practices, fair trade initiatives, and community empowerment programs. Research by [9] shows that when agricultural industries use digital media to communicate sustainability efforts, consumer attitudes shift from skepticism to trust, while [10] emphasize that social media campaigns centered on environmental responsibility can humanize corporate brands and enhance consumer empathy and brand recall. Moreover, digital campaigns foster emotional connections through visual storytelling, influencer endorsements, and user-generated content—approaches particularly effective among millennials who favor authenticity over conventional advertising. [11] further assert that engagement-driven campaigns, such as Instagram stories, interactive infographics, and educational videos, are vital tools for strengthening both brand awareness and emotional attachment. Consequently, digital campaigns are not merely informational but also experiential, shaping how consumers internalize and emotionally connect with brand values.

2.2 Public Education and Consumer Awareness

Public education functions as a strategic communication tool to cultivate informed and responsible consumers, particularly in sustainability-oriented industries where it bridges the gap between production realities and consumer perceptions. As noted by [12], education about sustainable consumption enhances social responsibility and fosters long-term behavioral change. In the palm oil industry, educational initiatives are designed to correct misconceptions related to production ethics, supply chain transparency, and socio-economic contributions to rural development. These programs are implemented through various channels, including formal education, online learning platforms, community outreach, and partnerships with NGOs or government agencies. When integrated with digital communication strategies, such initiatives can greatly

amplify campaign effectiveness. [13] found that interactive digital education improves perceived credibility and encourages pro-environmental behaviors among young adults. In the context of West Sumatra, where communities are directly engaged in palm oil production, public education also reinforces local identity and pride. By emphasizing sustainable farming, certification systems like RSPO, and community-based processing, education helps reduce social stigma while promoting inclusion and collective responsibility. Thus, public education not only elevates awareness but also strengthens social cohesion and shared accountability within the palm oil ecosystem.

2.3 Brand Awareness

Brand awareness is a fundamental component of brand equity and plays a pivotal role in shaping consumer behavior. [14] defines it as the extent to which consumers can recognize and recall a brand under varying conditions, forming the cognitive foundation for trust, relevance, and emotional connection. In digital communication, awareness acts as the initial gateway to engagement—before consumers interact with or advocate for a brand, they must first be aware of its existence and values. Research indicates that awareness can be effectively developed through consistent exposure to online content, particularly when messages are both informative and emotionally appealing. As [15] explains, high brand awareness increases the likelihood of brand choice because consumers gravitate toward familiar brands that project reliability and credibility. In the palm oil context, awareness campaigns that emphasize sustainability certification, economic contributions, and environmental preservation can challenge and correct negative stereotypes. Moreover, awareness serves as a mediating variable that translates marketing stimuli into consumer engagement. [16] found that in social media marketing, awareness mediates the relationship between exposure to campaigns and behavioral engagement outcomes, suggesting that awareness not only drives initial attention but also reinforces the cognitive and emotional ties that foster long-term loyalty and active participation.

2.4 Brand Engagement

Brand engagement refers to the intensity of an individual's cognitive, emotional, and behavioral investment in interactions with a brand [17]. It goes beyond mere awareness or satisfaction, encompassing active participation, advocacy, and emotional alignment with the brand's identity. In the digital environment, engagement manifests through behaviors such as liking, sharing, commenting, and co-creating content. [18] explain that brand engagement arises from meaningful, value-based interactions that fulfill psychological needs for autonomy, competence, and relatedness. In industries like palm oil, where reputation and legitimacy are essential, strong engagement helps counter negative perceptions and fosters supportive communities. [19] found that emotional and cognitive engagement on social media contributes significantly to loyalty and positive word-of-mouth. Within sustainability contexts, engagement is further shaped by perceived authenticity and ethical consistency. Brands that communicate their sustainability practices transparently and consistently across digital platforms cultivate affective commitment among audiences [20]. Thus, brand engagement is not merely transactional but deeply relational, built upon shared values, credibility, and mutual trust between consumers and producers.

2.5 The Mediating Role of Brand Awareness

Several studies highlight the mediating role of brand awareness in linking marketing communication to consumer engagement. Based on the hierarchy-of-effects model proposed by [21], awareness serves as the initial cognitive stage that precedes interest, desire, and action, forming the foundation for affective and behavioral responses. In digital campaigns, exposure to persuasive messages enhances awareness, which in turn increases the likelihood of engagement behaviors such as following a brand, sharing content, or participating in brand-related discussions. Empirical research supports this relationship—[22] found that awareness significantly mediates the impact of social media campaigns on brand engagement in the FMCG sector, while [23] demonstrated that sustainability education strengthens awareness, leading to supportive consumer actions. In the palm oil industry, this pattern suggests that digital campaigns and public education may not directly generate engagement but instead cultivate awareness, which functions as a psychological bridge transforming exposure into meaningful brand involvement.

2.6 Theoretical Framework

This study is grounded in the Stimulus–Organism–Response (S-O-R) Model proposed by [24], which posits that external stimulus (S)—in this case, digital campaigns and public education—influence internal cognitive and affective states (O), represented by brand awareness, that subsequently lead to behavioral responses (R) such as brand engagement. The S-O-R framework has been extensively applied in digital marketing and consumer psychology to explain how marketing stimuli generate psychological reactions that drive engagement and decision-making. In addition, this study integrates perspectives from Brand Engagement Theory [17] and Brand Equity Theory [14], both of which assert that awareness is a fundamental precursor to emotional attachment and behavioral commitment. Together, these theoretical foundations suggest that digital exposure and educational efforts act as key stimuli that activate awareness and promote active engagement with brands committed to social and environmental responsibility. Accordingly, the conceptual framework of this study positions Digital Campaigns (DC) and Public Education (PE) as independent variables, Brand Awareness (BA) as a mediating variable, and Brand Engagement (BE) as the dependent variable, leading to the development of hypotheses that examine the direct and indirect relationships among these constructs.

H1: Digital campaigns have a positive and significant effect on brand awareness.
H2: Public education has a positive and significant effect on brand awareness.
H3: Digital campaigns have a positive and significant effect on brand engagement.
H4: Public education has a positive and significant effect on brand engagement.
H5: Brand awareness has a positive and significant effect on brand engagement.
H6: Brand awareness mediates the relationship between digital campaigns and brand engagement.
H7: Brand awareness mediates the relationship between public education and brand engagement.

3. METHODS

3.1 Research Design

This study employed a quantitative research design with an explanatory approach to examine the causal relationships between digital campaigns, public education, brand awareness, and brand engagement in the palm oil industry in West Sumatra. Quantitative methods were chosen to ensure objectivity, reliability, and replicability in testing the proposed hypotheses through statistical modeling. The analysis aimed to identify both direct and indirect effects—particularly the mediating role of brand awareness—using Structural Equation Modeling (SEM) with the Partial Least Squares (SmartPLS 3) software.

According to [25], SEM-PLS is appropriate for exploratory and confirmatory analysis, especially when the research model includes mediating variables and constructs measured by multiple indicators. The technique allows simultaneous examination of measurement validity and structural relationships among latent variables.

3.2 Research Population and Sample

The population of this study comprises consumers and digital media users in West Sumatra who are aware of or have interacted with palm oil–related brands, educational materials, or sustainability campaigns. The target respondents are primarily millennials aged 20–40 years, as this demographic group is characterized by strong digital literacy and active participation in online environmental discussions. A non-probability purposive sampling technique was employed to select participants who met specific criteria: (1) active users of digital platforms such as social media, websites, or online news portals; (2) individuals who have been exposed to information or campaigns concerning palm oil products or sustainability issues; and (3) residents of West Sumatra or individuals with cultural and economic connections to the region. A total of 115 valid responses were collected, which satisfies the minimum sample size requirement for Structural Equation Modeling–Partial Least Squares (SEM-PLS) analysis, following the guideline proposed by [25] that recommends at least ten times the maximum number of structural paths directed toward any construct in the model.

3.3 Data Collection Procedure

Data collection was carried out using a structured online questionnaire distributed through various social media platforms such as Instagram, WhatsApp, and Facebook, as well as community networks associated with agribusiness and sustainable products. Before completing the survey, respondents were provided with a clear explanation of the study's objectives, assurances of confidentiality, and an informed consent form. The questionnaire consisted of two primary sections: the first gathered demographic information (age, gender, education, occupation, and frequency of social media use), while the second measured research variables using statements on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). To ensure validity and reliability, the instrument underwent content validation by three academic experts specializing in marketing and sustainability communication, who reviewed the questionnaire for clarity, relevance, and conceptual consistency. Furthermore, a pilot test involving 20 respondents was conducted to assess the reliability of the items and refine any ambiguous statements prior to large-scale distribution.

3.4 Measurement of Variables

All constructs in this study were adapted from previously validated research to ensure reliability, validity, and theoretical consistency, with each variable measured using reflective indicators on a five-point Likert scale. The Digital Campaigns (DC) construct, adapted from [9], [11], included four indicators: (DC1) active promotion of information through social media platforms, (DC2) emphasis on sustainability and community involvement, (DC3) encouragement of audience interaction and feedback, and (DC4) delivery of clear, consistent, and visually engaging content. The

Public Education (PE) construct, based on [12], [13], consisted of indicators measuring (PE1) educational messages that increase understanding of palm oil's economic and social benefits, (PE2) programs that provide sustainability and environmental protection knowledge, (PE3) effective use of digital channels in education, and (PE4) content that builds awareness of ethical and responsible consumption. The Brand Awareness (BA) construct, adapted from [14], [15], was measured using items reflecting (BA1) ease of recognizing the palm oil brand, (BA2) familiarity with its sustainability initiatives, (BA3) ability to recall the brand when thinking of palm oil products, and (BA4) understanding of the brand's values and reputation. Finally, the Brand Engagement (BE) construct, drawn from [17], [18], was operationalized through indicators representing (BE1) active interaction with the brand on digital platforms, (BE2) emotional attachment to its sustainability efforts, (BE3) willingness to share or recommend the brand's content, and (BE4) personal involvement in supporting the brand's mission.

3.5 Data Analysis Technique

Data analysis in this study was conducted in several stages using SmartPLS 3.0, following the procedures recommended by [25]. The first stage involved descriptive analysis, which summarized respondents' demographic characteristics and perceptions of each construct, with mean and standard deviation values used to represent the level of agreement for each indicator. The second stage was the measurement model (outer model) evaluation, aimed at testing indicator reliability and validity through several criteria, including indicator reliability (loading factor > 0.70), internal consistency reliability (Composite Reliability > 0.70), convergent validity (Average Variance Extracted [AVE] > 0.50), and discriminant validity assessed using the Fornell–Larcker Criterion and HTMT Ratio (< 0.90). Any indicators failing to meet these thresholds were removed to enhance construct validity. The third stage, structural model (inner model) evaluation, analyzed the relationships among constructs through path coefficients (β) to determine relationship strength and direction, t-statistics and p-values obtained via bootstrapping with 5,000 resamples to test significance, R^2 values to measure explanatory power (0.25 = weak, 0.50 = moderate, 0.75 = substantial), f^2 effect size to assess the contribution of each predictor, and Q^2 predictive relevance using the blindfolding procedure to evaluate model accuracy. Finally, mediation analysis was performed to test the mediating role of Brand Awareness (BA) using the bootstrapping method. Mediation was confirmed when the indirect effect (DC/PE → BA → BE) was significant, and the direct effect either decreased or became insignificant when the mediator was included in the model.

4. RESULTS AND DISCUSSION

4.1 Respondent Profile

The respondent profile summarizes the demographic and behavioral characteristics of 115 participants selected through purposive sampling, focusing on individuals familiar with digital media and sustainability issues related to palm oil in West Sumatra. The sample consisted of 58% females and 42% males, indicating balanced participation and active female involvement in sustainability discussions. Most respondents were millennials aged 20–40 years (90%), with 72% holding a bachelor's degree and 18% a master's, reflecting a highly educated and digitally literate group. Occupation-wise, 40% were private employees, 30% students, 16% civil servants, and 14% entrepreneurs, showing diverse perspectives from both professional and academic backgrounds. Social media usage was notably high, with 85% accessing platforms daily, primarily Instagram, Facebook, and TikTok, indicating strong digital engagement. Furthermore, 53% of respondents frequently encountered palm oil–related digital campaigns, 33% occasionally, and 14% rarely. These characteristics demonstrate that participants were well-exposed, informed, and digitally active, making them a suitable representation for analyzing how digital campaigns and public education influence brand awareness and engagement in the palm oil industry.

4.2 Measurement Model (Outer Model) Evaluation

The measurement model evaluation was conducted to assess the reliability and validity of all research constructs prior to testing their structural relationships. Using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 3.0, the outer model was examined to ensure that each indicator accurately reflected its corresponding latent variable. Following the criteria outlined by [25], the evaluation included four key components: indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. Indicator reliability was assessed through outer loading values, which indicate the correlation strength between each indicator and its latent construct. A loading value exceeding 0.70 signifies acceptable reliability, meaning that more than 50% of the indicator's variance is explained by the latent variable. As presented in Table 1, all indicators across the four constructs—Digital Campaigns (DC), Public Education (PE), Brand Awareness (BA), and Brand Engagement (BE)—exhibited loading values above 0.70, confirming that each measurement item consistently and accurately represented its intended concept.

Table 1. Outer Loadings of Research Indicators

Construct	Indicator	Outer Loading	Result
Digital Campaigns (DC)	DC1	0.732	Reliable
	DC2	0.864	Reliable
	DC3	0.876	Reliable
	DC4	0.821	Reliable
Public Education (PE)	PE1	0.718	Reliable
	PE2	0.829	Reliable
	PE3	0.862	Reliable
	PE4	0.814	Reliable
Brand Awareness (BA)	BA1	0.741	Reliable
	BA2	0.858	Reliable
	BA3	0.879	Reliable
	BA4	0.845	Reliable
Brand Engagement (BE)	BE1	0.751	Reliable
	BE2	0.883	Reliable
	BE3	0.888	Reliable
	BE4	0.861	Reliable

Table 1 shows that all indicators of the four constructs—Digital Campaigns (DC), Public Education (PE), Brand Awareness (BA), and Brand Engagement (BE)—achieved outer loading values above the recommended threshold of 0.70, confirming strong indicator reliability. This means that each item effectively represents its respective latent variable, contributing significantly to the overall construct measurement. The highest loading values were found in BE3 (0.888) and BA3 (0.879), indicating that engagement behaviors such as sharing brand content and awareness through brand recall are particularly strong reflections of their constructs. Similarly, indicators for digital campaigns and public education also demonstrated consistent reliability, emphasizing that content interactivity, sustainability focus, and educational clarity are key dimensions of these constructs. Overall, the results affirm that the measurement items are both reliable and conceptually aligned, allowing the model to proceed confidently to the next stage of validity testing.

The results of the internal consistency reliability test show that all constructs demonstrate strong inter-item correlations, as reflected by Cronbach's Alpha and Composite Reliability (CR) values exceeding the recommended threshold of 0.70. Specifically, the Digital Campaigns (DC) construct achieved a Cronbach's Alpha of 0.841 and a CR of 0.894, Public Education (PE) recorded 0.856 and 0.903, Brand Awareness (BA) reached 0.872 and 0.917, while Brand Engagement (BE) obtained 0.888 and 0.925. These consistently high values indicate that the indicators within each construct are highly interrelated and measure their respective latent variables reliably. The CR range

of 0.894–0.925 further confirms the stability and internal homogeneity of the constructs, meaning the measurement model possesses strong reliability and can be confidently used for subsequent validity and structural analyses.

1. Convergent Validity

The results of the convergent validity test indicate that all constructs meet the required criteria, with Average Variance Extracted (AVE) values exceeding the 0.50 threshold, demonstrating that each construct explains more than half of the variance among its indicators. Specifically, Digital Campaigns (DC) achieved an AVE of 0.678, Public Education (PE) reached 0.699, Brand Awareness (BA) recorded 0.728, and Brand Engagement (BE) obtained 0.734, all of which confirm strong convergent validity. These findings suggest that the indicators within each construct consistently measure the same underlying concept, ensuring conceptual coherence and internal alignment of the measurement model. Consequently, the results validate that the observed variables effectively represent their respective latent constructs, allowing the model to proceed to discriminant validity testing with confidence.

2. Discriminant Validity

Discriminant validity was assessed to ensure that each construct in the model is empirically distinct from the others. Two statistical tests were applied: the Fornell–Larcker Criterion and the Heterotrait–Monotrait Ratio (HTMT). According to the Fornell–Larcker criterion, the square root of each construct's Average Variance Extracted (AVE) must be greater than its correlations with other constructs. The results confirm this requirement, as shown by the diagonal values—0.823 for Digital Campaigns (DC), 0.836 for Public Education (PE), 0.853 for Brand Awareness (BA), and 0.857 for Brand Engagement (BE)—which all exceed their respective inter-construct correlations. This indicates that each construct shares more variance with its own indicators than with other constructs, verifying discriminant validity based on the Fornell–Larcker rule.

The HTMT ratio further reinforces these findings by providing a stricter test of discriminant validity. All HTMT values fall below the recommended threshold of 0.90, with relationships ranging from 0.682 (DC–PE) to 0.824 (BA–BE). These results confirm that the constructs are conceptually distinct and measure different theoretical dimensions within the model. Together, the Fornell–Larcker and HTMT tests demonstrate that Digital Campaigns, Public Education, Brand Awareness, and Brand Engagement are empirically separate constructs with minimal overlap, ensuring the discriminant validity and robustness of the measurement model.

4.3 Structural Model (Inner Model) Evaluation

The evaluation of the structural model (inner model) was conducted to test the hypothesized relationships among constructs after confirming that the measurement model had satisfied all reliability and validity criteria. This stage examined the strength, direction, and significance of the relationships between Digital Campaigns (DC), Public Education (PE), Brand Awareness (BA), and Brand Engagement (BE), while also testing the mediating effect of brand awareness. The analysis was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 3.0. Following the guidelines of [25], the evaluation covered five key components: assessment of collinearity (VIF), evaluation of path coefficients and their significance, determination of the coefficient of determination (R^2), assessment of effect size (f^2) and predictive relevance (Q^2), and examination of mediation effects. The results of the collinearity test show that all VIF values are below the threshold of 5.0, indicating the absence of multicollinearity among predictor variables. Specifically, VIF values ranged from 2.087 to 2.412, confirming that the constructs are sufficiently independent and can be included in the model without the risk of redundancy or distortion.

The coefficient of determination (R^2) was then used to evaluate the explanatory power of the model, representing the proportion of variance in the endogenous variables explained by their

predictors. The analysis revealed that Digital Campaigns (DC) and Public Education (PE) jointly explain 61.4% of the variance in Brand Awareness (BA), while Brand Engagement (BE) is explained by 68.7% of the combined influence of DC, PE, and BA. Referring to [25], [26], R^2 values of 0.25, 0.50, and 0.75 indicate weak, moderate, and substantial explanatory power, respectively. Hence, the model demonstrates moderate to strong explanatory capability, suggesting that digital campaigns and public education play significant roles in predicting awareness and engagement levels. These results validate the robustness of the structural model and its theoretical soundness for subsequent hypothesis testing and mediation analysis.

1. Effect Size (f^2)

Effect size (f^2) measures the impact of each exogenous construct on an endogenous variable. Cohen (1988) classifies f^2 values as follows: 0.02 = small effect, 0.15 = medium effect, and 0.35 = large effect.

Table 2. Effect Size (f^2)

Relationship	f^2 Value	Effect Strength
Digital Campaigns → Brand Awareness	0.266	Medium
Public Education → Brand Awareness	0.218	Medium
Digital Campaigns → Brand Engagement	0.071	Small
Public Education → Brand Engagement	0.046	Small
Brand Awareness → Brand Engagement	0.358	Large

The results show that Digital Campaigns and Public Education have medium effects on Brand Awareness, while Brand Awareness has a large effect on Brand Engagement. The direct effects of Digital Campaigns and Public Education on engagement are relatively smaller but remain statistically significant. This pattern suggests that Brand Awareness plays a central mediating role in driving engagement.

The results of the predictive relevance (Q^2) test demonstrate that the model possesses strong predictive capability, as all Q^2 values are greater than zero. Specifically, Brand Awareness (BA) achieved a Q^2 value of 0.421, while Brand Engagement (BE) recorded 0.493, both indicating high predictive relevance. According to Hair et al. (2021), a Q^2 value above zero confirms that the model can accurately predict the data for endogenous variables. These findings suggest that the structural model not only fits the observed data well but also has robust predictive accuracy, meaning it can effectively forecast future outcomes related to brand awareness and engagement within the palm oil digital communication context.

2. Path Coefficient Analysis (Hypothesis Testing)

Path coefficients represent the strength and direction of the relationships between constructs. Hypotheses are tested through bootstrapping (5,000 resamples) to determine significance levels using t-statistics and p-values. A path is considered significant when $t > 1.96$ and $p < 0.05$.

Table 3. Path Coefficients and Hypothesis Testing Results

Hypothesis	Relationship	Path Coefficient (β)	t-Statistic	p-Value	Decision
H1	Digital Campaigns → Brand Awareness	0.432	6.125	0.000	Supported
H2	Public Education → Brand Awareness	0.379	5.244	0.000	Supported
H3	Digital Campaigns → Brand Engagement	0.215	2.783	0.006	Supported
H4	Public Education → Brand Engagement	0.187	2.442	0.015	Supported

H5	Brand Awareness → Brand Engagement	0.462	7.019	0.000	Supported
H6	Digital Campaigns → Brand Awareness → Brand Engagement	0.200	4.328	0.000	Supported (Mediation)
H7	Public Education → Brand Awareness → Brand Engagement	0.175	3.967	0.000	Supported (Mediation)

The results presented in Table 3 show that all seven hypotheses (H1–H7) are statistically supported, indicating significant relationships among the constructs in the model. Digital Campaigns ($\beta = 0.432$, $t = 6.125$, $p = 0.000$) and Public Education ($\beta = 0.379$, $t = 5.244$, $p = 0.000$) both have strong positive effects on Brand Awareness, confirming that digital communication and educational initiatives effectively enhance consumer awareness. Likewise, both Digital Campaigns ($\beta = 0.215$, $p = 0.006$) and Public Education ($\beta = 0.187$, $p = 0.015$) directly influence Brand Engagement, showing that exposure to informative and interactive content drives audience participation and emotional connection. The relationship between Brand Awareness and Brand Engagement ($\beta = 0.462$, $t = 7.019$, $p = 0.000$) is also highly significant, emphasizing that awareness is a crucial driver of engagement. Furthermore, the mediation tests (H6 and H7) reveal that Brand Awareness partially mediates the effects of both Digital Campaigns and Public Education on Brand Engagement ($\beta = 0.200$ and $\beta = 0.175$, $p = 0.000$), suggesting that awareness acts as a psychological bridge transforming exposure and knowledge into active brand involvement. Overall, these findings validate the proposed conceptual model and highlight the pivotal role of awareness in connecting digital communication and education with consumer engagement.

4.4 Mediation Analysis of Brand Awareness

The mediation analysis using the bootstrapping indirect effect method confirms that Brand Awareness plays a significant mediating role in the relationships between Digital Campaigns and Public Education with Brand Engagement. The results show that both indirect paths—Digital Campaigns → Brand Awareness → Brand Engagement ($\beta = 0.200$, $t = 4.328$, $p = 0.000$) and Public Education → Brand Awareness → Brand Engagement ($\beta = 0.175$, $t = 3.967$, $p = 0.000$)—are statistically significant, supporting the presence of partial mediation. This indicates that while digital campaigns and public education directly affect engagement, their impact is amplified through the enhancement of brand awareness. The strong indirect effects ($p < 0.001$) suggest that awareness functions as a key psychological mechanism that converts informational and educational exposure into active consumer involvement, reinforcing the critical role of awareness as a cognitive and emotional bridge linking communication strategies with engagement outcomes.

Discussion

The findings of this study are discussed in relation to established theoretical frameworks and previous research, particularly the Stimulus–Organism–Response (S-O-R) model. The results demonstrate that stimuli from digital communication and educational initiatives successfully trigger cognitive awareness, which subsequently leads to behavioral engagement with sustainable palm oil brands. In the context of West Sumatra, where environmental and ethical skepticism toward palm oil persists, this process highlights the effectiveness of strategic digital interventions in reshaping public perceptions. The data show that digital campaigns significantly and positively influence brand awareness, aligning with [9], [11], who emphasize that interactive media and storytelling strengthen audience familiarity and brand recall. Palm oil brands that incorporate visual narratives and sustainability messaging were found to effectively attract consumer attention, reinforcing the notion that visually engaging, value-driven digital content is central to raising awareness among millennials who prioritize authenticity and transparency in communication.

The study also finds that public education exerts a strong positive influence on brand awareness, echoing [10], [12], who argue that educational initiatives can transform consumer

cognition and promote responsible evaluation of sustainability practices. In West Sumatra, educational efforts through webinars, digital literacy programs, and community-based training successfully enhanced public understanding of sustainable palm oil cultivation and its economic contributions. This shift from misinformation to informed awareness supports the idea that education not only disseminates knowledge but also generates social legitimacy [27], positioning the palm oil sector as a legitimate driver of regional development rather than an environmental liability. As citizens learn about sustainability certifications, fair trade, and community empowerment, their trust in the industry increases, illustrating how educational communication helps bridge the knowledge gap between production realities and consumer perceptions.

Both digital campaigns and public education were found to have direct and significant effects on brand engagement, underscoring their role in fostering emotional and behavioral connections between consumers and brands. Consistent with [18], the study shows that meaningful, value-laden interactions drive active engagement behaviors such as liking, commenting, and sharing. When digital messages are emotionally resonant and ethically aligned, they transform passive viewers into active brand advocates. This pattern aligns with [20], who highlight authenticity and social responsibility as central to sustaining engagement. In the palm oil context, this implies that millennial consumers are more likely to engage with brands that transparently communicate sustainability actions, viewing engagement not merely as a marketing outcome but as a shared value-driven relationship grounded in empathy, ethics, and trust.

Finally, the mediation analysis reveals that brand awareness partially mediates the relationship between both digital campaigns and public education with brand engagement, confirming the S-O-R framework proposed by [24]. Digital and educational stimuli (S) influence awareness (O), which in turn drives engagement (R). This finding is consistent with [22], [23], who identified awareness as a crucial mechanism linking exposure to engagement in sustainability communication. Awareness enables consumers to process complex information, derive meaning from sustainability messages, and translate cognitive understanding into emotional commitment and participatory behavior. In essence, awareness is not limited to recognition—it represents comprehension and internalization that lead to active support. This underscores the importance of knowledge-based and transparent digital communication strategies in transforming consumer exposure into long-term engagement within the palm oil industry's evolving digital ecosystem.

Integration with Existing Theories

The findings of this study reinforce and extend three major theoretical frameworks that collectively explain the relationship between digital communication, education, awareness, and engagement. First, the Stimulus–Organism–Response (S-O-R) Model is empirically validated, demonstrating that digital campaigns and public education (stimuli) influence awareness (organism), which subsequently leads to engagement (response). This confirms that cognitive awareness acts as a mediating mechanism transforming external communication stimuli into behavioral outcomes. Second, the Brand Engagement Theory [17] is strengthened by showing that engagement arises from both emotional and cognitive alignment with brand messages, particularly when moral and educational elements are embedded within sustainability-oriented communication. Lastly, the Brand Equity Theory [14], [15] is reaffirmed as awareness remains a core foundation for higher-order brand associations and engagement, enhancing perceived value, credibility, and long-term consumer loyalty. Collectively, these theoretical integrations provide a holistic understanding of how digital communication and educational strategies interact to cultivate sustainable, trust-based brand relationships within the modern digital ecosystem.

Managerial Implications

The results of this study offer several strategic implications for palm oil industry practitioners, policymakers, and communication strategists. First, digital campaigns should integrate promotional and educational content, emphasizing sustainability, local culture, and

community impact to enhance both awareness and engagement. Second, transparency and authenticity are essential; brands need to communicate their sustainability achievements through real stories and credible reporting to build consumer trust and emotional connection. Third, millennials represent the most influential digital audience, making platforms like Instagram, TikTok, and YouTube key tools for interactive and engagement-driven communication. Fourth, collaboration between industry, universities, NGOs, and government agencies is crucial to expanding educational reach and strengthening credibility, particularly in addressing environmental concerns. Finally, engagement should be measured holistically, encompassing not only digital interactions such as likes and shares but also participation in discussions, events, and sustainability initiatives to reflect deeper involvement. Collectively, these implications highlight that effective engagement in the palm oil sector must combine accurate information, emotional resonance, and active social participation to foster long-term consumer trust and advocacy.

Theoretical and Practical Contributions

Theoretically, this study contributes to the literature by empirically validating the mediating role of brand awareness within sustainability-driven digital communication, effectively bridging the fields of marketing communication and public education. It demonstrates how informational clarity and emotional resonance work together to generate meaningful consumer engagement. From a practical standpoint, the research offers an actionable framework for palm oil producers and policymakers in Indonesia, emphasizing that digital communication should move beyond persuasive messaging toward a model of participatory education, where consumers are regarded as informed collaborators rather than passive audiences. This approach encourages transparency, shared responsibility, and long-term trust between brands and their stakeholders in promoting sustainable palm oil practices.

CONCLUSION

This study provides empirical evidence that digital campaigns and public education significantly influence brand engagement in the palm oil industry, both directly and indirectly through the mediating role of brand awareness. The use of digital media and educational initiatives has proven effective in transforming consumer perceptions, enhancing understanding, and fostering emotional as well as behavioral connections with palm oil brands in West Sumatra. The analysis confirms that brand awareness acts as a crucial cognitive bridge between exposure and engagement, consistent with the Stimulus–Organism–Response (S-O-R) framework. Awareness transforms passive information reception into active brand participation, emphasizing the importance of knowledge-based communication in sustainability-oriented industries. From a managerial perspective, the findings highlight the need to integrate educational narratives into digital campaigns that prioritize transparency, authenticity, and community empowerment to build public trust. Palm oil stakeholders—including producers, cooperatives, and policymakers—should utilize interactive digital platforms to educate audiences about sustainable production, social responsibility, and ecological stewardship.

The results also underscore the importance of millennials as digitally literate and socially conscious consumers whose engagement is shaped by ethical and environmental awareness. For long-term effectiveness, industry players should foster collaborations with educational institutions, local communities, and advocacy groups to enhance both credibility and outreach. Theoretically, this research advances the understanding of digital marketing and sustainability communication by empirically validating awareness as a mediating factor linking exposure to behavioral engagement. Practically, it offers a strategic roadmap for industries facing reputational and legitimacy challenges, providing guidance on how to rebuild public confidence through participatory and transparent communication. In conclusion, enhancing awareness through digital education and authentic storytelling emerges as the foundation for sustainable brand engagement in the palm oil industry.

As Indonesia moves toward a more digital and sustainability-driven economy, these strategies will be vital in cultivating a responsible, informed, and supportive consumer community.

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