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CLOSING THE GREEN GAP: A HYBRID PLS-SEM-ANN APPROACH TO DIGITAL TRUST AND THE INTENTION-BEHAVIOUR DIVIDE IN SOUTH ASIAN RETAIL CONSUMERS

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Abstract

This study examines how green digital marketing (GDM) influences green purchase intention (GPI) and green purchase behaviour (GPB) among South Asian retail consumers by integrating green trust (GT) as a mediating mechanism and digital literacy (DL), willingness to pay a premium (WTP), and perceived consumer effectiveness (PCE) as moderating factors. Drawing on the stimulus-organism-response framework, the study addresses the persistent intention-behaviour gap in sustainable consumption within digitally expanding retail markets. A quantitative cross-sectional survey was conducted among adult consumers from South Asian countries who had exposure to online sustainability-related product information. Data from 480 valid responses were analysed using partial least squares structural equation modelling (PLS-SEM), complemented by artificial neural network (ANN) analysis to assess nonlinear predictive importance. The PLS-SEM results reveal that GDM significantly enhances GT and GPI, while GPI positively influences actual GPB. GT significantly mediates the relationship between GDM and GPI, confirming that credible digital green communication shapes purchase intention through consumer trust. DL strengthens the effect of GDM on GT, indicating that digitally literate consumers are better able to evaluate environmental claims. Furthermore, WTP and PCE significantly moderate the GPI-GPB relationship by improving the conversion of intention into actual green purchasing. ANN findings further confirm that GPI is the most important predictor of GPB, while PCE and WTP provide additional predictive value. Overall, the findings highlight the importance of credible green communication, consumer trust, digital literacy, and reduced economic and behavioural barriers in promoting sustainable retail consumption across South Asian markets.

Keywords: Green Digital Marketing; Green Trust; Green Purchase Intention; Green Purchase Behaviour; Digital Literacy

1. Introduction

Green consumption (GC) is considered as a crucial pathway to environmental sustainability amid growing challenges of global warming, pollution, depletion of resource, and non-sustainable production (Riva et al., 2022). In emerging economies, the shift towards green consumption is becoming increasingly significant, driven by the rapid urbanization, market growth and digitization that are changing consumers' habits and lifestyles (Shehawy & Khan, 2024). South Asia is a particularly significant region not only characterized by fast-growing retail sectors, but also by rising awareness of environmental issues and significant growth in digital markets (Uikey et al., 2025). Muhammad and Stukalina (2025) reveals that digital interaction with customers in South Asian digital retail markets has significantly improved customer loyalty and customers' purchasing decisions, especially in Pakistan, India, Bangladesh, and Sri Lanka. Thus,

understanding consumer assessment, trust, and reaction to digitally communicated environmental claims is vital to encourage sustainable consumption in South Asia. In a study Bhukya et al. (2025) explain that Digital transformation has changed the way green products are communicated, with social media, e-commerce, influencers, online reviews, and personalized advertising providing a fast and interactive way of communicating sustainability. Green digital marketing (GDM) enables companies to convey sustainability messages and shape consumer views throughout the buying process. But effective communication can only happen if the consumer believes the green claims are credible and trustworthy. Prior research have shown that green marketing impacts on purchase intention via brand trust and its underlying psychological processes, which suggests that trust is a crucial bridge between environmental communication and consumers' reactions (Tan et al., 2022). Green trust (GT) shows consumers' perceived assurance in the legitimacy and trustworthiness of organization's green affirmations and practices and is a crucial factor of GPI (Ahmad & Zhang, 2020). But there is variation among consumers in their ability to assess digital environmental information. In a study, Van Hoang et al. (2025) revealed that green promotional techniques significantly enhance GPI and GT is a strong mediating factor in an emerging FMCG market. Hence, digital literacy (DL) can become an influencing boundary condition in the association between GDM and GT (Dong & Zhang, 2026). In a recent study, Salam, Smith and Mehboob (2022) gave an empirical evidence that GT enhances consumers' green purchase intentions (GPI) in Pakistan, demonstrating its importance in converting environmental information into positive behavioural intentions. Digital marketing and green marketing were found to significantly influence brand development among retail companies in India (Sivasubramanian, 2024).

Although there has been an increase in sustainability awareness and a rise in the use of digital platforms for green promotional practices, there is still a discrepancy between consumers' GPI and their real behaviour. This intention-behaviour discrepancy has been well documented in the literature but has not yet been sufficiently explored in the South Asian context (ElHaffar, Durif, & Dubé, 2020; Tawde, Kamath, & ShabbirHusain, 2023). Existing studies offer limited insight into the association between GDM and the creation of GT, as well as the impact of DL, the willingness to pay premium (WTP) and PCE on the link from intent to action, especially in the retail market in South Asia (Mabaso, Osakwe, & Jibril, 2025). Existing literatures are mostly limited to the developed and selected emerging economies, while there has been limited research conducted across countries in South Asia (Sharma, Aswal, & Paul, 2023). Previous studies have been conducted using linear analysis methods, and the possibility of the existence of complex and non-linear relationships between variables in GC behaviour has not been considered (Uikey et al., 2025).

Thus, the intends of this research is to address four important objectives. First, it proposes an integrated model of GDM, GT, GPI and GPB with GT as a intervening constructs and DL as a interacting construct. Second, it also investigates WTP and PCE enhances the process of turning green consumption intention into actual consumption. Third, the study also extends beyond individual country investigations and compares these relationships across South Asian countries, with multi-group structural equation modelling. Lastly, the study uses an ANN analysis along with the PLS-SEM to support and order the relative predictive importance of the proposed determinants, addressing the rising trend of using hybrid analytical methods in sustainability studies (Foroughi et al., 2025).

2. Literature Review

2.1. Theoretical Framework

This research is based on the SOR framework, that explains Influence of extrinsic factors on individual psychological condition and subsequent behaviours (Lin et al., 2023). In GC, GDM serves as the stimulus, GT as the organism's state, and GPI and behaviour are the behavioural responses (Ahmad & Zhang, 2020). In addition, trust theory proposes that consumers' trust in transactions will rely on their perception of firms' environmental claims credibility, reliability, and integrity. These perspectives create a strong base to understand sustainable consumer behaviour in digital context (Chen & Chang, 2013). The framework also includes digital literacy, WTP and PCE as a moderating variable. Digital literacy strengthens the GDM-green trust relationship, while WTP and PCE facilitate the behaviour and intention conversion in GC (Fraccascia,

Ceccarelli, & Dangelico, 2023; Hu & Meng, 2023). Thus, SOR provides a concise foundation for explaining the digital green stimulus-trust-intention-behaviour pathway and the green intention-behaviour disparity.

2.2. GDM and GT

According to Naim et al. (2024), GDM is using digital media to market environmentally friendly products, to convey information about environmental initiatives and to disseminate information about companies' environmental actions (Ikhsan et al., 2024). Digital platforms can transfer green information quickly and interactively, but consumer trust relies more on the credibility, transparency and consistency in the sustainability messages than on the quantity of exposure (La Ragione & Risitano, 2026).

GT is the customer's trust in the reliability of a organization's green information and the benefits that are offered to the environment. Ahmad and Zhang (2020) demonstrate that green trust facilitates online green purchase responses while greenwashing undermines it. Similarly, Van Hoang et al. (2025) illustrate that green promotional practices strengthen GT and subsequently GPI (Zhang et al.), while Wu and Long (2024) illustrate the significance of credible green communication in building trust. However, previous studies focus mainly on traditional green marketing or on single-country environments, and the association between GDM and green trust is not well investigated in various retail markets in South Asia (Uikey et al., 2025). To address this issue, this research will analyze how GDM can be used as a digital stimulus to influence consumers' green trust. Accordingly;

H1: GDM significantly enhance GT.

2.3. GT and GPI

GT shows how confident customers are in the validity of companies' green promises and their capability to deliver genuine green benefits (Chauhan & Goyal, 2024). According to (Chen, Lin, & Weng, 2015), as green attributes are often difficult to verify before purchase, trust mitigate uncertainty and encourages consumers to rely on sustainability claims

Empirical researches confirms the positive impact of green trust on GPI (Ahmad & Zhang, 2020; Jaiswal et al., 2022). Furthermore greenwashing and consumer skepticism can undermine the process of trust formation (de Sio et al., 2022). The study on Pakistan suggest that green promotional practices can lead to increased GPI and that GT is an important factor in this relationship (Ahmad & Zhang, 2020). However, prior research has mainly Centered on trust as a direct predictor, and less on the link between green information communicated digitally and GT (Tan et al., 2022). Earlier research centered on individual markets, with little exploration of the trust-intention relationship in various South Asian retail environments (Uikey et al., 2025). Therefore, this study analyzes GT as a key factor linking customer's evaluation of environmental claims with their GPI. Therefore, the study suggest the hypothesis is

H2: GT has positive effects on the GPI.

2.4. GPI and GPB

While GPI is generally seen as a proximal antecedent of behaviour, evidence consistently demonstrates that positive GPI do not automatically lead to real green purchases (Grimmer & Miles, 2017). According to Mabaso, Osakwe and Jibril (2025), some consumers might fall back on traditional products due to factors: price, availability, accessibility, habit, and performance issues, leading to the traditional green action and intention discrepancy. Dhir et al. (2021) emphasize that digital platforms can enhance the availability of green goods, but the context can hinder the enactment of the behaviour and the existing behaviour patterns. Evidence from existing research further suggests that intention is necessary but insufficient for explaining green purchasing (Kaur, Yadav, & Mishra, 2024). Importantly, much of the existing literature is about intention to buy, and not actual purchase behaviour, thus limiting the knowledge about the conversion of sustainability intentions into marketplace actions in South Asia context (ElHaffar, Durif, & Dubé, 2020). This study therefore analyzes the translation of GPI to green actual behaviour among South Asian retail consumers. Accordingly;

H3: GPI is a positive determinant for GPB.

2.5. Mediating Role of GT

In line with the SOR framework, the GT is viewed as a mechanism at the organismic level that mediates the effect of GDM on GPI. While digital platforms offer a wide range of sustainability information, its behavioural effects depend on the authenticity and trustworthiness of the details perceived by consumers (Luo, Zheng, & Guo, 2023). Previous literature shows that GT has a considerable impact on purchase-related outcomes (Amin & Tarun, 2021; Tan et al., 2022) and credible sustainability related commitments can reinforce customer's belief and intention to purchase (Wu & Long, 2024). The research shows that green promotional practices significantly enhance GPI and GT is a strong mediating factor in FMCG organization (Van Hoang et al., 2025). Prior researches mainly studied GT as a predictor, and the partial mediating impact of GT between GDM and GPI is rarely explored (Ahmad & Zhang, 2020). This is especially pertinent in online retail where consumers cannot see the actual green attributes or the actual environmental practices of firms. Thus, the present study investigated the psychological mechanism which mediates GDM-Purchase intention, namely GT.

H4: GT mediates the correlation between GDM and GPI.

2.6. Moderating Role of DL

DL is a consumer's capacity to access, comprehend, assess and utilize information effectively using digital tools (Sharma, Aswal, & Paul, 2023). According to Dong and Zhang (2026), consumers who are digitally literate can be more likely to compare environmental claims, to note the supporting information, to recognize misleading information and to assess the credibility of the sustainability message. Yang et al. (2026), illustrate that DL plays a psychological role in GC, which can be mediated by self-efficacy and outcome expectations. Likewise, the study on rural households in China revealed that DL has a positive impact on GC (Yu & Yi, 2026).

Previous research, however, primarily investigates the direct impact of DL on green consumption, with few researches focusing on the role of DL in the process of developing trust (Hu & Meng, 2023). Therefore, this study investigates if DL improves GDM-green trust relationship by increasing consumer's evaluation capacity of digital sustainability claims. Therefore, the study suggests the hypothesis is

H5: DL significantly moderates the correlation between GDM and GT.

2.7. Moderating Role of WTP

WTP shows how much people are ready to spend on green products. and can help understand the green intention-behaviour gap (Joshi & Rahman, 2015). While environmental information can raise consumers' willingness to pay, there is considerable variation in actual willingness to pay, especially if green products are more expensive (Kumar et al., 2023; Xu et al., 2022). Chaudhary and Bisai (2018) discovered a stronger intention-behaviour link among Indian consumers who were prepared to pay a higher price.

According to Mabaso, Osakwe and Jibril (2025), WTP, however, is widely different across consumers and can make the difference between translation of green intentions into purchase actions. Past studies, however, largely investigate willingness to pay a premium as either an outcome or predictor and limited studies focus on this role in regard of strengthening the link between action and intention (Nazmi & Kurniawati, 2024). Therefore, this study focuses to understand whether the increase in the WTP level helps to translate the intention to buy green into actual behaviour by minimizing price-related barriers. Accordingly;

H6: WTP positively moderates the association between GPI and GPB.

2.8. Moderating Role of PCE

PCE reflects customer's perception that their individual consumption choices can help in addressing green problems (Kim & Lee, 2023). Although meta-analytic evidence confirms PCE as an important predictor of GPB, its effects may vary depending on the cultural setting. (Vieira, Araújo, & Groening, 2025). Solaiman and Rana (2023) studied on environmentally friendly electronic products and show that attitude towards personal environmental impact can shape green purchasing decisions. Likewise, Joshi et al. (2021) also highlighted that perceived environmental effectiveness can help to convert positive attitude into green purchase.

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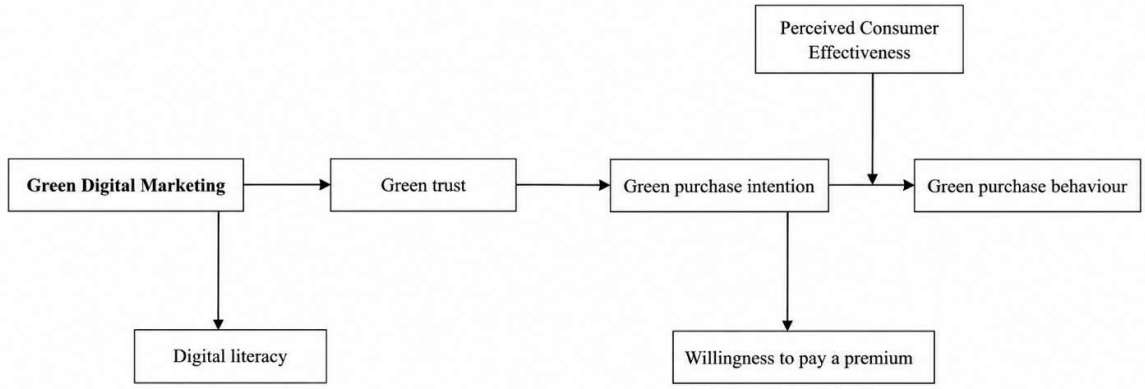
However, existing research primarily examines PCE as a direct predictor, with limited focus on its role in explaining the action and intention discrepancy (Joshi & Rahman, 2015). Hence, this study suggests that the role of PCE is moderating, and reveals that consumers who feel as if their purchases are helping the ecosystem are more inclined to buy green goods and actually act on their intentions. Accordingly;

H7: PCE significantly shape the correlation between GPI and GPB.

The suggested assumptions are represented schematically in Figure 1 as a conceptual model.

Figure 1

Conceptual Model



3. Methods

A cross-sectional, interview-based, and quantitative research framework was employed to analyse the association between GDM, GT, GPB, GL, WTP, and PCE among South Asian retail consumers. The study design was followed by (Mabaso, Osakwe, & Jibril, 2025) A quantitative research design was suitable because it allowed for the examination of direct, mediating and moderating relationships simultaneously (Thomas & Zubkov, 2023; Watson, 2015). PLS-SEM was used due to the presence of multiple latent constructs, moderation, mediation, and several groups analysis in the proposed model, which was prediction oriented (Mabaso, Osakwe, & Jibril, 2025). ANN analysis was also employed to detect the existence of nonlinearity and the rank of the importance of the explanatory factors in predicting the dependent element (Chowdhury & Samuel, 2014).

3.1. Data Collection and Sampling

The selected group was the adult retail consumer from the specified south Asian countries that involve Bangladesh, Sri Lanka, Pakistan, India and Nepal. The member's age was expected to be at least eighteen years, use digital tools like social media, websites, mobile apps, or e-commerce platforms, and have seen sustainability information about products online. A convenience and purposive sampling method was used to ensure the members had relevant experience in digital retail (Van Hoang et al., 2025). A structured web-based interviews were used to collect the data through social media, online consumer communities, and personal and professional networks. A total of 526 interviews were collected. After screening, data with incomplete and duplicate responses were excluded, as well as straight-line responses, yielding 480 valid responses for final analysis.

3.2. Research Tools

There were two sections of the questionnaire. The first data collected consisted of gender, age education, country, salaries and online shopping frequency. The second involved scales for measurement of the study constructs that had previously been validated with some adaptation to the context.

DL was measured on five items scale adapted from (Mume & Sun, 2026). GT (3 items) and GDM (5 items) were adapted from (Van Hoang et al., 2025). WTP (3 items), GPB (2 items), GPI (3 items), and PCE

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(3 items) were adapted from (Mabaso, Osakwe, & Jibril, 2025). Minor wording adjustments were done to clarify and to make sure that the measure items are related to the South Asian setting of retail, while maintaining the original meaning and conceptual structure of the scales. A 5-point Likert scale was used to rate the results, with 1 denoting strongly disagree and 5 denoting strongly agree. To evaluate the interviews readability, clarity and contextual significance, a pre-test was conducted.

3.3. Data Analysis

SmartPLS was used to assess the gathered information. Indicator loadings, Cronbach's alpha, composite reliability, AVE, the Fornell-Larcker criterion, HTMT, and VIF were utilized to evaluate the model's measurement. The model was then evaluated to test the direct, mediation, and moderation hypotheses (Wong, 2013). Direct and indirect effects were evaluated using bootstrapping and 5,000 resamples. PLS-MGA was conducted to compare relationships across South Asian countries. Finally, ANN analysis was performed to find the nonlinear patterns and rank the relative predictive importance of the study variables (Abiodun et al., 2018).

All information was gathered voluntarily, and consent was acquired before the interview was completed. Participants were assured of secrecy and anonymity, and no individually identifiable information was gathered. The members had the authority to drop out at any point without losing points. To ensure confidentiality and integrity of research, all data were anonymized and reported in aggregate form.

4. Results

4.1. Respondent Profile

Total 480 valid responses were obtained from South Asian retail consumers. The respondents were selected from Bangladesh, India, Pakistan, and Sri Lanka. Pakistan had the most respondents (30.0%) while India (29.0%) and Bangladesh (22.3%) had the next largest populations respectively and Sri Lanka had the least (18.8%). The distribution of genders was equal with 50.4% being female and 49.0% being male. The biggest group of age was 18-24 (40.8%), followed by 25-30 years (26.5%), 31-40 years (20.2%), and above 40 years (12.5%). In relation to education, 56.0% of the population had a university/college level qualification, 21.9% had a postgraduate degree and 22.1% a high school degree. In terms of monthly income, 41.7% reported middle income, 27.7% low income, 20.8% upper-middle income, and 9.8% high income.

Table 1

Demographics

Question	Criterion	Response	Percentage %
South Asian Country	Bangladesh	107	22.3
	India	139	29.0
	Pakistan	144	30.0
	Sri Lanka	90	18.8
Gender	Female	242	50.4
	Male	235	49.0
Age group	18-24	196	40.8
	25-30	127	26.5
	31-40	97	20.2
	Above 40	60	12.5
Education level	High school	106	22.1
	Postgraduate	105	21.9
	University/College	269	56.0
Monthly Income	High	47	9.8
	Low	133	27.7
	Middle	200	41.7
	Upper-middle	100	20.8

Note. Percentages are based on the reported valid responses.

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4.2. Measurement Model

The measuring model's validity and internal consistency reliability were evaluated initially. Table 2 shows the CR and CA values for the instruments, which range from 0.781 to 0.880 with a composite reliability value of 0.858 to 0.912. All values were above threshold value of 0.70 and showed satisfactory internal consistency (Adamson & Prion, 2013). For every construct, CV with the AVE was satisfactory and its range was from 0.548 to 0.820 which was above the critical value of 0.50.

Table 2

Assessment of the Measurement Model

Construct	Cronbach's alpha	Composite reliability	AVE
DL	0.880	0.912	0.675
GDM	0.793	0.858	0.548
GPB	0.781	0.901	0.820
GPI	0.827	0.897	0.743
GT	0.819	0.892	0.734
PCE	0.783	0.872	0.696
WTP	0.854	0.910	0.772

4.3. Discriminant Validity

The HTMT ratio and FLC were utilized to analyse the DV. Table 3 shows that square root of AVE of each factor was more than the threshold, indicating sufficient discriminant validity. The results show that the Strongest correlation was between GPI and GT (0.638) and the highest diagonal was 0.862 and 0.857, respectively. The discriminant validity was also supported by an HTMT analysis. All HTMT values were found under 0.85, with the highest ratio 0.772 within GPI and GT.

Table 3

Fornell and Larcker's Criterion

	DL	GDM	GPB	GPI	GT	PCE	WTP
DL	0.822						
GDM	0.162	0.740					
GPB	0.208	0.243	0.906				
GPI	0.255	0.376	0.509	0.862			
GT	0.304	0.429	0.426	0.638	0.857		
PCE	0.091	0.048	0.266	0.214	0.175	0.834	
WTP	0.052	0.093	0.265	0.296	0.136	0.057	0.879

4.4. Structural Model and Hypothesis Testing

The model supported each of the seven hypotheses. In support of H1, green digital marketing positively and significantly influenced GT ($\beta = 0.411$, $t = 12.263$, $P < 0.001$) bb. GT strongly predicted GPI ($\beta = 0.638$, $t = 25.403$, $p < 0.001$), supporting H2. Furthermore, GPI also significantly influenced the GPB ($\beta = 0.472$; $t = 12.883$; $p < 0.001$), thus supporting H3. The GDM indirect effect on GPI via GI was high ($\beta = 0.262$, $t = 10.023$, $p < 0.001$), which supported H4. The results from the moderation were also significant. The results further confirmed that GDM positively moderated the association between GDM and GT ($\beta = 0.164$, $t = 4.319$, $p < 0.001$), which favors H5. The link between GPI and GPB became stronger when the WTP was added (H6, $\beta = 0.158$, $t = 3.978$, $p < 0.001$). This relationship was also supported by the perceived consumer effectiveness ($\beta = 0.169$, $t = 5.106$, $p < 0.001$) and H7 was accepted.

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Table 5
Structural path coefficients for direct, mediation and moderation results analysis

H	Path	β-values	SD	T statistic	P values	Support
H1	GDM -> GT	0.411	0.033	12.263	0.000	S
H2	GT -> GPI	0.638	0.025	25.403	0.000	S
H3	GPI -> GPB	0.472	0.037	12.883	0.000	S
H4	GDM -> GT -> GPI	0.262	0.026	10.023	0.000	S
H5	DL x GDM -> GT	0.164	0.038	4.319	0.000	S
H6	WTP x GPI -> GPB	0.158	0.040	3.978	0.000	S
H7	PCE x GPI -> GPB	0.169	0.033	5.106	0.000	S

4.5. Mediation and Moderation Results

H4 was supported by the mediation analysis. The findings explain that the GPI had a significant indirect impact on GDM with the mediation of GT ($\beta = 0.262$, $t = 10.023$, $p < 0.001$), showing that a significant part of the influence of GDM on the GPI was conveyed through GT. The results of moderation also confirmed all suggested moderating hypotheses. This study results supports the H5 proposing that DL significantly moderates the association between GDM and GT ($\beta = 0.164$, $t = 4.319$, $p < 0.001$). Moreover, the link between GPI and GPB was supported by WTP ($\beta = 0.158$, $t = 3.978$, $p < 0.001$) which also supported H6. The intention-behaviour relationship also significantly increased with perceived consumer effectiveness ($\beta = 0.169$, $t = 5.106$, $p < 0.001$), thus supporting H7. All of the seven hypotheses were thus supported.

4.6. Explanatory Power and Predictive Relevance

The model accounted for 36.6% of the GPB variance, 26.8% in GT, and 40.7% in GPI. The corresponding adjusted R2 values were 0.263, 0.405, and 0.360.

The predictive assessment also yielded a satisfactory relevance. All endogenous constructs had positive Q^2 predict values: green trust (0.253), GPI (0.175), and GPB (0.194). The RMSE values were 0.868, 0.913, and 0.903, respectively.

Figure 2
Complete Structural Model with Path Coefficients

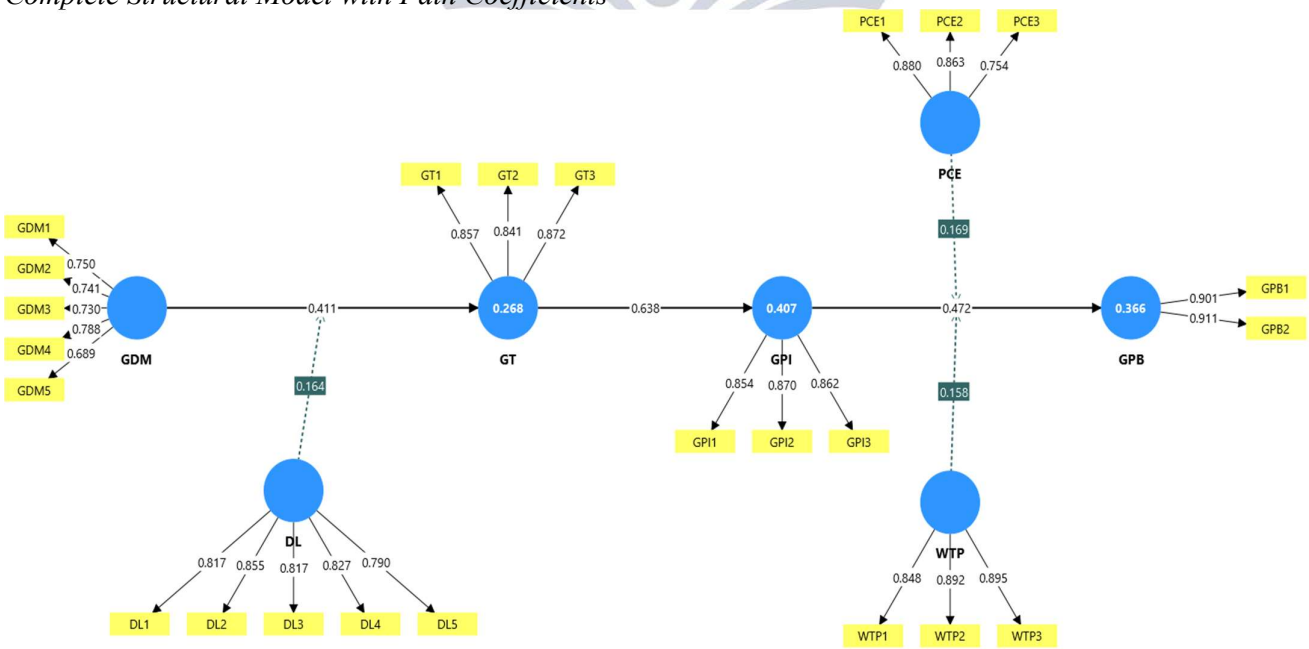

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Table 6
PLS-RMSE and LM-RMSE

Predictive	PLS_RMSE	LM_RMSE
GPB1	0.742	0.756
GPB2	0.759	0.780
GPI1	0.845	0.820
GPI2	0.815	0.800

4.7. Artificial Neural Network Analysis

To complement the findings of the explanatory PLS-SEM technique, the predictive performance of the analysis and the comparative importance of the predictors were assessed by utilizing ANN analysis. ANN Model A was used to predict green trust through the use of green digital marketing and digital literacy. Across 10 neural networks, the mean RMSE training was 0.192 (SD = 0.003), while the mean RMSE testing was also 0.192 (SD = 0.023). Stable predictive performance with small training and testing errors, suggesting that there was no significant overfitting. Sensitivity analysis revealed that green digital marketing was the most dominant predictor, followed by DL with normalized importance values of 100.00% and 43.86% respectively.

Figure 3
ANN model A

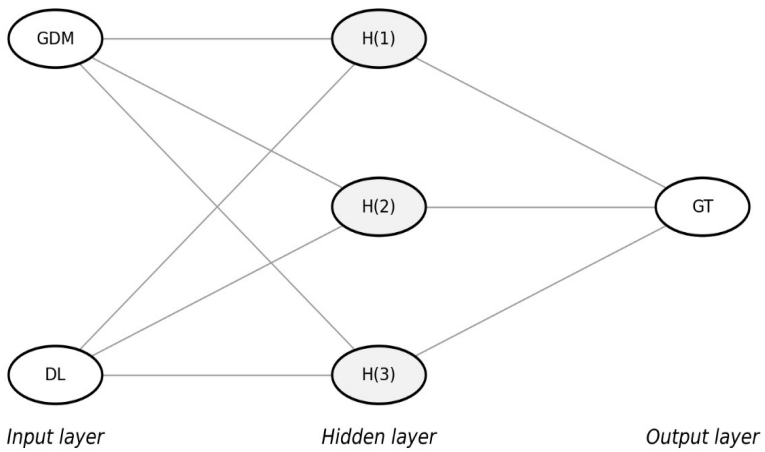

Table 7
Values of RMSE

Neural Network	N	SSE	RMSE	N	SSE	RMSE	Total Samples
1	432	16.389	0.195	48	1.266	0.162	480
2	432	15.879	0.192	48	2.141	0.211	480
3	432	16.147	0.193	48	1.510	0.177	480
4	432	15.310	0.188	48	2.303	0.219	480
5	432	15.974	0.192	48	1.723	0.189	480
6	432	16.335	0.194	48	1.269	0.163	480
7	432	16.353	0.195	48	1.703	0.188	480
8	432	15.208	0.188	48	2.399	0.224	480
9	432	15.819	0.191	48	2.226	0.215	480
10	432	16.194	0.194	48	1.468	0.175	480
Mean		15.961	0.192		1.801	0.192	
SD		0.420	0.003		0.433	0.023	

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Table 8
Sensitivity analysis

Neural Network	GDM	DL
1	0.726	0.274
2	0.683	0.317
3	0.701	0.299
4	0.684	0.316
5	0.712	0.288
6	0.700	0.300
7	0.681	0.319
8	0.697	0.303
9	0.680	0.320
10	0.689	0.311
Average importance	0.6951	0.3049
	100.00%	43.86%

Note. Importance values within each neural network sum to 1.

ANN Model B was used to predict the GPB based on PCE, WTP and GPI. The model again had a close training and testing performance with a RMSE training of 0.147 (SD = 0.002) and RMSE testing of 0.148 (SD = 0.021). Sensitivity analysis revealed that green purchase intention had the highest relative importance (100.00%). PCE was second at 23.09% and WTP at 15.07%. Therefore, the results from ANN further support the results obtained from PLS-SEM as GPI is the most important factor influencing actual GPB, whereas PCE and WTP offer supplementary contribution to the explanation of the actual green purchase behaviour.

Figure 4
ANN model B

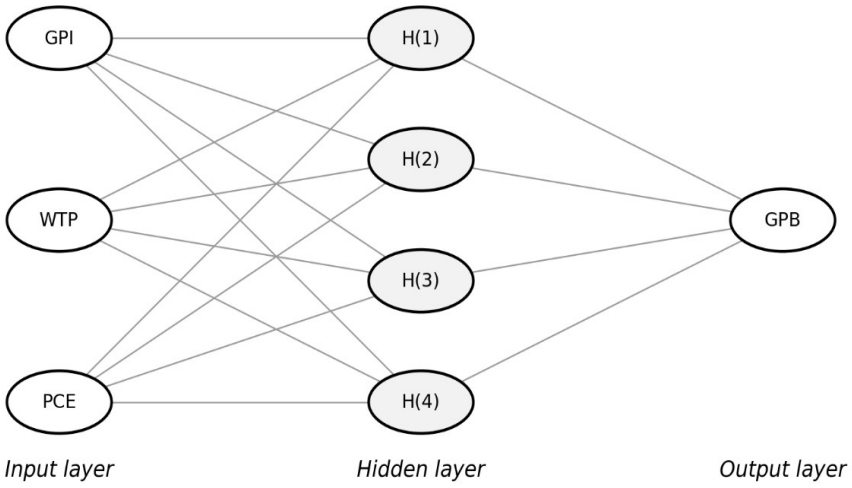

Table 9
RMSE values

Neural Network	N	SSE	RMSE	N	SSE	RMSE	Total Samples
1	432	9.301	0.147	48	1.066	0.149	480
2	432	9.354	0.147	48	0.979	0.143	480
3	432	9.258	0.146	48	1.050	0.148	480
4	432	9.641	0.149	48	0.744	0.125	480
5	432	9.433	0.148	48	0.889	0.136	480
6	432	8.678	0.142	48	1.702	0.188	480

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7	432	9.522	0.148	48	0.870	0.135	480
8	432	8.957	0.144	48	1.415	0.172	480
9	432	9.068	0.145	48	1.263	0.162	480
10	432	9.591	0.149	48	0.731	0.123	480
Mean		9.280	0.147		1.071	0.148	
SD		0.303	0.002		0.309	0.021	

Table 10
Sensitivity analysis

Neural Network	GPI	WTP	PCE
1	0.762	0.116	0.123
2	0.691	0.122	0.187
3	0.738	0.098	0.164
4	0.706	0.123	0.171
5	0.716	0.114	0.169
6	0.699	0.103	0.197
7	0.741	0.104	0.155
8	0.735	0.100	0.165
9	0.733	0.106	0.162
10	0.717	0.103	0.180
Average importance	0.7238	0.1091	0.1672
Normalized importance (%)	100.00%	15.07%	23.09%

Note. Importance values within each neural network sum to 1.

5. Discussion

The goal of this study was to examine the connection between GDM, GT, GPI and GPB of South Asian retail consumers. Additionally, the study aimed to account for the gap between behaviour and intention by exploring the effects of digital literacy as a boundary condition, WTP, and PCE. To achieve this objective, the study combined a hybrid PLS SEM and ANN methodology to yield both explanatory and predictive insights.

The results indicate that if a consumer is given clear, credible, and environmentally relevant information through digital platforms, they will have greater confidence in the firm's environmental claims. The results line with the study of Van Hoang et al. (2025), which discussed green marketing strategies as a contributor of GT and then motivates GPI. Similarly, Wu and Long (2024) concluded that advertising on social media is a key predictor of fostering GT, which, in turn, strongly associates with the consumer's intention to purchase environmental goods. This finding therefore reinforces the SOR approach by demonstrating the influence of green digital marketing as an external stimulus on the internal trust of consumers. Secondly, it was found that GT had a significant association with GPI, supporting H2. This reveals that customers will be more likely to consider sustainable and eco-friendly products when they feel confident in the reliability of firms' green claims. The finding is supported by Altaf Hussain (2025), who found that GT significantly contributes to GPI among Pakistani consumers. Similar evidence was reported by Luo, Zheng and Guo (2023), who shows that GT was the mechanism by which consumers' information capabilities can be transformed into green consumption intention. Third, the results are consistent with H3, which posited that GPI would pose a positive link with GPB. While there are challenges of affordability, convenience, and availability, the current results reveal that higher intentions will lead to green buying behaviour. This aligns with recent studies showing that intention is still a crucial factor in addressing the green intention-behaviour discrepancy (Cui, Li, & Wang, 2024; Kim & Lee, 2023; Rasheed et al., 2024). However, it should not be considered the only determinant of green behaviour, as there are contextual factors that can hinder consumers from acting on their intentions.

Fourth, the results showed that GT was confirmed as a mediator in the association between GDM and GPI, which supported H4. In this regard, it can be considered that digital marketing does not just shape purchase intention by directly persuading consumers to purchase a product; rather, the impact of digital marketing is mediated by consumers' belief in the companies' environmental claims. This finding strengthens the SOR explanation and agrees with Luo, Zheng and Guo (2023), discussed that GT act as an important factor in the association between consumer information capability and GC intention, and Wu and Long (2024), who also concluded that GT is an intermediary mechanism between social media marketing and GPI.

Fifth, Digital Literacy fostered the association between GDM and GT, supporting H5. In this regard, it can be considered that the digitally literate consumers might be more capable of evaluating environmental information, comparing claims, and recognizing credible sustainability communication. In line with the findings of Yang et al. (2026), who revealed that DL fosters GC behaviour through ecological information and green self-efficacy, and that this relationship is strengthened by prosocial behaviour. Sixth, the WTP added support to the association between GPI and GPB, which was consistent with H6. It shows that buyers like to buy green products even if they have to pay a premium price for it, leading to their actual purchase. However, the literature from Pakistan is inconclusive, as recent sustainable apparel research conducted in Pakistan revealed that WTP insignificantly relates to the intention behaviour of buyers (Farooqi & Frooghi, 2024; Rasheed et al., 2024).

Seventh, PCE was also an integral element strengthening the link between behaviour and intention, supporting H7. When buyers perceive that their individual behaviours are important to protect the environment, they are more inclined to take action with regard to their green intentions. This discovery aligns with Hussain and Huang (2022), who found that PCE is a vital component of green purchasing. Moreover, the PLS-SEM results are confirmed by the ANN results. Finally, the most concerning predictor of green trust was green digital marketing, and the strongest predictor was green purchase intention. PCE and WTP provided additional predictive contribution. Thus, the results indicate that trust improves the association between digital marketing. Moreover, personal and economic factors are beneficial for converting intention to actual green behaviour.

6. Research Implications

6.1. Theoretical Implications

This study significantly adds value to the GC behaviour literature. The research enhances the SOR framework by placing GDM as the stimulus, green trust as the internal psychological response, and GPI and behaviour as the final responses. The results indicate that digital green communication can affect consumers' responses not only directly, but through building trust. Consistent with the previous research in the field, this study concludes that the use of sustainable marketing tools enhanced the belief of customer in the green brand and then directly affected the choice to buy the good or service. (Akram et al., 2024; Alhomaid, 2025; Tan et al., 2022).

Second, the study confirms the importance of the green trust that exists between digital marketing and purchase willingness. This is especially applicable to online settings where consumers are unable to independently confirm the statements. Recent literature also studied the significance of green trust as an important facilitator between social media marketing and sustainable buying intentions (Luo, Zheng, & Guo, 2023; Wu & Long, 2024). Second, the study enriches the existing research by combining the concept of DL, WTP, and PCE into the intention-behaviour relationship model. This provides a more complete explanation of why consumers with positive green intentions may or may not engage in actual green purchasing. Finally, the use of PLS-SEM and ANN provides both explanation and prediction. This methodological approach improves the existing evidence by demonstrating the existence of relationships and the relative importance of the associated variables in predicting green purchase behaviour.

6.2. Practical Implications

The findings also offer a number of useful insights for green marketers, online retailers, and lawmakers in South Asian countries. Therefore, companies should focus on creating clear, transparent, and credible digital green marketing messages. Firms should nurture consumer trust by providing evidence of ecofriendly

materials, processes of production, certifications, and benefits of environment rather than making claims about environmental sustainability. This can decrease consumer doubt and boost consumer buying intent. In recent research, it is also pointed out that trustworthy environmental information is vital to social media marketing (Wu & Long, 2024).

Second, companies should invest in digital learning and readily available sustainability information. Consumers that are literate digitally are better positioned to understand and evaluate environmental knowledge, while recent evidence shows that digital literacy can promote green consumption (He et al., 2025; Yang et al., 2026). Therefore, companies can employ basic product labelling, short videos, infographics, and simple sustainability information. Third, marketers need to overcome the intention-behaviour gap by making green products accessible, available, and convenient. Moreover, attention to consumers and the promotion of credible green certification can help promote green consumption. These measures can boost consumer confidence, making it easier to purchase sustainably in digital markets of South Asia.

7. Research Limitations and Future Indications

Various shortcomings are evident in this research that are important to be recognized when analysing its findings. The research was grounded in a survey that is cross-sectional, which involves gathering data all at once. Thus, the findings provide insights into the associations that exist among the variables and do not necessarily establish the causes of the relationships. Secondly, the study employed self-reported information, which may not always be an accurate indication of consumer purchasing practices. Third, the results are analysed using purposive and convenience samples, its generalizability can be restricted to all South Asian consumers. Research in Pakistan also has revealed the importance of studying green consumption among larger Islamic mass consumers and within diverse contexts (Rana et al., 2024).

Therefore, future studies based on a longitudinal study design are needed to evaluate how GDM and GT lead to purchasing action in the long-term. In addition, researchers could use responses from surveys to incorporate records of actual online purchases or observed purchasing data to further account for the intention-behaviour gap. Future studies should further compare urban and rural consumers and investigate whether the proposed associations vary across individual South Asian countries. Future research can be conducted on specific platforms like Instagram, TikTok, YouTube, and Facebook as consumers might hold different perspectives towards green content when shown on each platform. Moreover, future research might incorporate the concept of green skepticism, greenwashing perceptions, and environmental concern to explain why some consumers reject green marketing despite positive environmental intentions.

Author Contributions

All authors participated in ideation, development, and writing the manuscript. All authors read and approved the final manuscript.

Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this article.

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Informed Consent

Informed consent was obtained from all participants prior to data collection. Participants were informed about the purpose of the study, the voluntary nature of their participation, and their right to withdraw at any time without any consequences. The confidentiality and anonymity of respondents were guaranteed throughout the research process.

Data Availability

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request. The authors are committed to transparency and will provide detailed methodological information and analysis protocols upon request.

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