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RESEARCH ARTICLE

Farmers' awareness and involvement in government agricultural schemes: A study in Coimbatore district

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Abstract: The availability of agricultural credit has significantly improved farming practices in India by enabling farmers to invest in quality inputs and adopt modern techniques. This study, conducted in Coimbatore district, examines farmers' awareness and involvement in government agricultural schemes based on insights from loan providers. Using statistical tools like frequency, percentage, and mean scores, the research reveals that while awareness of key schemes such as the Pradhan Mantri Fasal Bima Yojana (PMFBY) is high—89% knew it is mandatory for loanee farmers—knowledge of others like the Pradhan Mantri Krishi Sinchai Yojana (PMKSY), e-NAM, and Small Farmers Agri-business Consortium (SFAC) remains low. Farmers displayed greater involvement during the initial stages of scheme implementation, with mean scores highest in surveying (1.65) and planning (1.61), and lower participation in later stages like implementation, maintenance, and evaluation. Overall, 63.33% of respondents showed medium involvement in government schemes, and only 12.5% had high involvement. The findings underscore the need for enhanced awareness campaigns, farmer training programs, and stronger bank-farmer engagement to improve participation and the effective use of agricultural schemes, thereby promoting inclusive growth and reducing rural poverty.

Keywords: *Agricultural scheme, Loan providers, Involvement, Farmers, Awareness*

Introduction

The agriculture sector in India, which employs more than 50% of the labour force and accounts for roughly 17–18% of the GDP, depends heavily on agricultural lending and financing. It is imperative that farmers have access to reasonably priced credit to invest in contemporary farming methods, buy high-quality inputs and boost output (Kumar & Phougat, 2021).

Numerous institutions, including commercial banks, cooperative banks, regional rural banks and microfinance institutions, offer agricultural financing in India. In India, crop loans, the Kisan Credit Card (KCC) scheme, agricultural term loans and agricultural insurance are just a few of the additional credit support options available for agricultural financing in addition to traditional lending (Agrawal & Sharma, 2024). These programmes are designed to give farmers financial support for crop production, input purchases and capital investments in agriculture (Kambali & Niyaz, 2021).

Farmers can use crop loans, which are short-term loans, to cultivate crops (Jahan et al., 2024). The repayment period for these loans, which are approved for a specific crop season, usually lasts between six

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and twelve months. The loans are given to farmers to cover input costs, including buying seeds, fertiliser, pesticides and other farming supplies (Dhull & Asha, 2024).

The Reserve Bank of India (RBI) reports that the total outstanding crop loan amount disbursed by Indian banks grew by 21.4% YoY, from INR 8,55,328 crore in March 2020 to INR 10,38,954 crore in March 2021. Farmers were able to overcome the financial strain brought on by the COVID-19 pandemic thanks to this increase in crop loans (Burhanudin et al., 2020).

Agriculture insurance: Farmers are shielded by agricultural insurance from crop losses brought on by pest infestations, droughts, and floods. The Indian government introduced the Pradhan Mantri Fasal Bima Yojana (PMFBY), a crop insurance programme, in 2016 (Kumari & Singh, 2025). Farmers are covered by the programme against crop losses brought on by pests, diseases, or natural disasters. The PMFBY insured more than 5.61 crore farmers as of 2020, with a total insured amount of INR 2,37,000 crore. The programme has been crucial in protecting farmers' finances and lessening the suffering caused by crop losses in agriculture.

Effects of lending and financing for agriculture in India: Increasing agricultural productivity has been made possible in large part by the availability of inexpensive credit and income levels of farmers. Farmers have been able to expand their farming operations, buy high-quality inputs, and adopt modern technologies thanks to the increased credit flow. Crop yields have significantly increased as a result, raising farm incomes and lowering rural poverty (Dhull & Asha, 2024; Ramasamy & Malaiarasan, 2023).

While several government schemes exist to support Indian farmers, there exists persistent gaps in scheme awareness and utilization, particularly at the grassroots (Baruah & Mohan, 2022). Among the farmers who remained aware of the agricultural schemes, a substantial portion did not avail the benefits, mainly due to heavy paperwork and disinterest in availing benefits (Bhogale & Roy, 2022). Higher awareness levels positively impact the adoption of sustainable agricultural practices among Indian smallholder farmers (Ashrit & Thakur, 2021). The present study, therefore, aims to assess the extent of farmers' awareness level of agricultural schemes as communicated by bank loan providers and determine their involvement patterns across various stages of implementation in Tamil Nadu.

Literature Review

Sethi and Biswal (2023) found that the growth and development of the Indian economy are measured by the advancement of agriculture. Many programmes for the welfare and means of subsistence of farmers have been put in place by the state and federal governments to promote agriculture. However, some farmers are not aware of those government programmes, so they cannot take advantage of them. Consequently, adequate awareness among farmers is essential for them to benefit from various government programmes. The purpose of the study was to determine the sources of farmers' awareness as well as their level of awareness regarding the agricultural programmes run by the federal and state governments. Primary data are gathered via a structured questionnaire and in-person visits to the farmers using the random sampling technique. Of the total respondents, 55.6% of the farmers are aware of the government programmes that are offered in the research area. For the most part, farmers obtain their knowledge from television, with newspapers and radio following closely behind. Farmers need to be educated and trained so that they could benefit from welfare programmes and make progress.

In a study by Baruah and Madanmohan (2022), it was found that four fifths of India's female workforce works in agriculture, and 48% of self-employed farmers are women. The literature currently in publication depicts a significant information vacuum that keeps women farmers from knowing the fundamentals of boosting the output, efficiency and revenue of their farming operations. This essay aims to investigate the knowledge of female farmers in India's North-Eastern Region (NER) regarding the nation's ongoing agricultural initiatives. The results show that one gap in women farmers' agricultural advancement in the NER is their ignorance of official agricultural programs.

Extension services play a vital role in increasing both awareness and adoption of government schemes. This can be achieved by bridging the information gap between policy formulation and actual implementation. Tanti et al. (2022) emphasised that institutional mechanisms, such as government extension services, participation in farmer field schools, and timely access to input subsidies significantly influence the adoption of climate-smart agricultural technologies, particularly among small holders. These findings emphasise the catalytic role of localised knowledge dissemination and interactive learning models in increasing farmers' exposure to innovative schemes.

Further supporting this perspective, Biradar et al. (2025) demonstrated that education, targeted training initiatives and the use of information and communication technology significantly enhance farmers' capabilities to understand, access and adopt technical advisory services and government-sponsored schemes. It was found that marginalised farmers, especially those with limited land holdings, lower income levels or belonging to socially disadvantaged groups, benefit disproportionately from well-structured extension initiatives when digital platforms and vernacular content are utilised effectively. This suggests that extension services not only act as information multipliers but also serve as instruments of social equity by enabling more inclusive participation in government interventions.

Moreover, contemporary evidence suggests that convergence between public extension services and community-based organizations such as Farmer Producer Organisations or Self-Help Groups can further amplify awareness through peer learning and localised mobilisation. Integrating extension delivery with digital advisory tools, such as mobile apps, SMS alerts and e-governance portals, has also emerged as a cost-effective strategy to improve reach, especially in remote or under-served regions (Singh et al., 2023). Therefore, the effectiveness of extension systems remains a critical determinant in translating government schemes into meaningful outcomes at the grassroots level.

Nikita and Sharma (2024) identified several barriers in Rajasthan, including low landholding, lack of awareness, communication gaps with extension workers, delayed claims, insufficient financial support, and administrative hurdles such as untimely availability of supervisors. These findings are resonated by Mallappa and Pathak (2023), who found that high input costs, limited knowledge and youth migration further impede the adoption of climate-smart technologies and governmental initiatives.

Recent studies indicate that while a significant proportion of Indian farmers are aware of major schemes like the Kisan Credit Card and Soil Health Card, a substantial gap is identified in awareness, particularly among marginalised groups, such as women farmers. Singh and Rathore (2023) found that although many farmers benefit from these schemes, a majority of them still require greater awareness to fully utilise the available resources. Baruah and Mohan (2022) specifically highlighted the pronounced information gap among women farmers in the North Eastern Region, which limits their ability to improve productivity and income. Additionally, Tripathi et al. (2023) reviewed the evolution and objectives of key schemes, emphasising the need for continued outreach to ensure broader awareness and participation.

Adoption rates of government schemes and new technologies are often hindered by limited awareness, insufficient training and communication challenges. Rai and Singh (2025) used sentiment analysis of social media and found that enhanced communication, training and awareness initiatives are crucial to boost adoption among farmers. Similarly, Singh and Rathore (2023) reported that beneficiaries of schemes experience higher incomes, but adoption is not universal due to persistent knowledge and access gaps.

Methodology

The present study was cross-sectional in nature and employed a survey-based quantitative approach. A purposive sampling technique was followed to select 120 loan officers from both cooperative and nationalised banks in Coimbatore district, Tamil Nadu. Primary data were collected during 2018–2019 from loan providers, specifically those with high performance ratings. A pre-tested structured questionnaire was served as the primary research instrument, comprising closed-ended questions focused on two key dimensions: awareness and involvement in government agricultural schemes. The research tool was

designed to capture loan officers' perceptions of how awareness is disseminated to farmers – most commonly through community meetings and announcements by local agricultural teams.

The involvement of farmers in agricultural schemes across five different stages was quantified using a scoring system based on responses to structured questions. Each response was assigned a score from 0 to 2, depending on the level of involvement. The data was scored based on respondents' levels of involvement: Complete Involvement (2 points), Partial Involvement (1 point) and No Involvement (0 points). These scores were averaged to calculate mean involvement levels across various scheme stages.

Data analysis was done using SPSS software. Descriptive statistical tools, including frequencies, percentages, mean scores and rank order analysis, were used to identify patterns in the loan officers' responses. Aggregate scores were computed to derive meaningful inferences aligned with the study's objectives.

Results

This section presents the findings on farmers' awareness and involvement in various government agricultural schemes in Coimbatore district as communicated by loan providers. In addition, the study also analysed the involvement pattern of farmers in these schemes across different stages of scheme implementation, ranging from initial surveying to planning, implementation, maintenance and monitoring.

Awareness of agricultural development scheme to the farmers from the loan providers

According to the loan providers, the awareness of farmers regarding various agricultural development schemes showed significant variations, with some schemes being well-known, while others reflect low levels of understanding (Table 1). A high percentage of farmers (89%) were found to be aware of the mandatory nature of the Pradhan Mantri Fasal Bema Yojana (PMFBY) for loanee farmers. About 86% of farmers were aware of the crops included under PMFBY, but awareness level of crop premiums among the farmers was slightly lower (72%).

Farmers also showed a higher level of awareness regarding the Agricultural Technology Management Agency (ATMA) scheme, with 72% aware of the scheme and 68% of its implementing agency. Only 56% of farmers were aware of the Pradhan Mantri Krishi Sinchai Yojana (PMKSY) and awareness of subsidy patterns for micro-irrigation is low (35%). Knowledge about additional benefits for small and marginal farmers under PMKSY is limited, with only 36% awareness. Similarly, only 32% of farmers had knowledge about sealing of area under the scheme for availing benefits. Awareness of the National Food Security Mission (NFSM) is moderate, with 58% aware of the scheme but only 52% aware of the implementing agency. Awareness of the Mission on Integrated Development of Horticulture (MIDH) is limited, with only 53% of farmers aware of the scheme. Awareness levels of farmers about implementing agency (48%), about its components (40%) and about subsidy pattern under the scheme were also limited.

Farmers have a moderate level of awareness (68%) on the Soil Health Card (SHC) scheme, but awareness of its benefits is lower (56%). Seventy percent of farmers were aware of the Promotion of Agricultural Mechanization for In-Situ Crop Residue Management, whereas most of them had knowledge about Custom Hire Centre (62%) and programmed/trainings organized under the scheme (65%). However, the knowledge of farmers on specific aspects such as farm machinery assistance was comparatively lower (58%). Awareness about the e-NAM facility is very low, with only 28% of farmers aware. Awareness of Parampragat Krishi Vikas Yojana (PKVY) was very low, with only 36% of farmers knowing about the scheme and 32% knowing about its implementation agency. Only 28% farmers were aware of purposes of scheme while a mere 16% of them were aware of assistance for the promotion of organic farming under the scheme. In a similar way, awareness of the Small Farmers Agri-business Consortium (SFAC) scheme was very low. Only 32% were aware of the scheme, 26% knew about implementing agency and just 14% were aware of its purposes.

Overall, the findings suggested that certain schemes, particularly those related to crop insurance and mechanization, are well-known. However, there are significant gaps in farmers' knowledge on other important programs, especially those related to concerning organic farming and micro-irrigation.

Table 1: Farmers' degree of awareness on various agricultural development schemes

Sl. No	Statements	Degree of Awareness			
		Aware		Not Aware	
		f	%	f	%
1	Pradhan Mantri Fasal Bema Yojana				
(a)	Awareness about crops included under the scheme	86	86.00	14	14.00
(b)	Awareness about the premium of crops	72	72.00	28	28.00
(c)	Knowledge that PMFBY is mandatory for Loanee farmers	89	89.00	11	11.00
2	Pradhan Mantri Krishi Sinchai Yojana (Per Drop More Crops)				
(a)	Awareness about PMKSY	56	56.00	44	44.00
(b)	Awareness about subsidy patterns for micro-irrigation	35	35.00	65	65.00
(c)	Knowledge about sealing of area under the scheme for availing benefits	32	32.00	68	68.00
(d)	Knowledge about additional benefits for Small & marginal farmers under the scheme	36	36.00	64	64.00
3	Awareness about the e-NAM facility				
(a)	e-NAM facility	28	28.00	72	72.00
4	Agricultural Technology Management Agency (ATMA)				
(a)	Awareness about ATMA scheme	72	72.00	28	28.00
(b)	Awareness about implementing agency	68	68.00	32	32.00
5	National Food Security Mission (NFSM)				
(a)	Awareness about NFSM scheme	58	58.00	42	42.00
(b)	Awareness about implementing agency	52	52.00	48	48.00
6	Mission on Integrated Development of Horticulture (MIDH Sub component-NHM)				
(a)	Awareness about MIDH	53	53.00	47	47.00
(b)	Awareness about implementing agency	48	48.00	52	52.00
(c)	Awareness about the components of the scheme	40	40.00	60	60.00
(d)	Awareness about subsidy pattern under the scheme	36	36.00	64	64.00
7	Soil Health Card Scheme				
(a)	Awareness about SHC	68	68.00	32	32.00
(b)	Awareness about benefit of SHC	56	56.00	44	44.00
8	Promotion of Agricultural Mechanization for *In-Situ* Crop Residue Management				
(a)	Awareness about the scheme	70	70.00	30	30.00
(b)	Knowledge about Custom Hire Centre	62	62.00	38	38.00
(c)	Knowledge that assistance is being provided on farm Machinery under the scheme	58	58.00	42	42.00
(d)	Awareness about programmed/trainings organized under the scheme	65	65.00	35	35.00
9	Parampragat Krishi Vikas Yojana (PKVY)				
(a)	Awareness about the scheme	36	36.00	64	64.00
(b)	Awareness about implementing agency	32	32.00	68	68.00
(c)	Awareness about purpose of scheme	28	28.00	72	72.00
(d)	Knowledge about assistance given for promotion of organic farming under the scheme	16	16.00	84	84.00
10	Small Farmers Agri-business Consortium (SFAC)				
(a)	Awareness about the scheme	32	32.00	68	68.00
(b)	Awareness about implementing agency	26	26.00	74	74.00
(c)	Awareness about purpose of scheme	14	14.00	86	86.00

Involvement pattern of farmers in government scheme for development of agriculture

The involvement of farmers was analysed across five stages of agricultural development schemes: surveying, planning, implementation, maintenance and monitoring. These scores were aggregated to calculate mean involvement scores for each activity. In the surveying stage, the highest mean involvement score (1.83) was found in the collection of information from proposed areas. This was followed by initial general village meetings (1.68), discussions regarding resource availability (1.66), prioritization of felt needs (1.58), and problem identification and analysis (1.54), respectively ranked from I to V.

During the planning stage, the greatest involvement was in identifying needs and problems of agricultural development (1.75), followed by selecting development members (1.69), mitigating problems without a work plan (1.54), and selecting scheme beneficiaries (1.49).

In the implementation phase, farmers were most involved in adopting recommended practices (1.66), followed by participation without contributing land, labor, or funds (1.63), and involvement in group discussions (1.61). The lowest score in this phase was observed for participation in selecting and executing programs (1.49). Under maintenance, the top activity was involvement in implementing new development activities (1.58). This was followed by assigning responsibilities to development committees (1.46) and maintaining or restoring agricultural assets (1.45).

In the monitoring and evaluation stage, farmers showed the most involvement in providing feedback (1.65), followed by identifying deficiencies (1.59), assessing scheme outcomes (1.55), and evaluating the effectiveness of scheme components (1.42). Overall, the total mean involvement scores indicate that farmers were most engaged during the surveying stage (1.65), followed by planning (1.61), implementation (1.59), monitoring (1.55), and finally maintenance (1.49). This suggests that initial stages of scheme execution attract more farmer participation, while continued involvement in maintenance and evaluation tends to decline.

Overall, the highest mean involvement was in the surveying phase (1.65), followed by planning (1.61), implementation (1.59), monitoring (1.55), and maintenance (1.49), highlighting a need for improved engagement beyond the initial phases.

Table 2: Overall involvement pattern of farmers in government scheme for agricultural development

Sl. No.	Involvement pattern	Score of respondents					
		Compt. Involve	Partial Involve	No Involve	Total score	Mean involve Score	Rank
1.	In Surveying						
a.	Involvement in collection of information proposed area.	120	40	60	220	1.83	I
b.	Involvement in initial general village meeting	84	52	66	202	1.68	II
c.	Involvement in identification and analysis of problems.	45	70	70	185	1.54	V
d.	Involvement in discussion regarding the availabilities of main resources	75	60	65	200	1.66	III
e.	Involvement in prioritizing the felt needs.	60	60	70	190	1.58	IV
	Total Mean Score					1.65	
2.	In planning						
a.	Involvement in identification of needs and problems of agriculture development.	90	60	60	210	1.75	I
b.	Involvement in mitigating the problems and constraints without plan of work.	60	50	75	185	1.54	III
c.	Involvement in selecting members for agriculture development.	81	58	64	203	1.69	II
d.	Involvement in selecting beneficiaries for benefits under the schemes.	45	58	76	179	1.49	IV
	Total Mean score					1.61	
3.	In Implementation						
a.	Involvement by adopting the recommended agricultural practices.	75	60	65	200	1.66	I
b.	Involvement in selecting and execution of agricultural development programme for agriculture development committees.	45	58	76	179	1.49	IV
c.	Involvement without contributing land, labour and money in agricultural government schemes	69	60	67	196	1.63	II

Sl. No.	Involvement pattern	Score of respondents					
		Compt. Involve	Partial Involve	No Involve	Total score	Mean involve Score	Rank
d.	Involvement in group discussion about government schemes and argil practices.	69	56	69	194	1.61	III
	Total mean score					1.59	
4.	In maintenance						
a.	Involvement in implementing new agricultural development activities.	60	60	70	190	1.58	I
b.	Involvement in fixing the responsibilities to the agriculture development committees.	45	52	79	176	1.46	II
c.	Involvement in maintenance, restoration and development asserts in agriculture development.	45	50	80	175	1.45	III
	Total mean score					1.49	
5.	In monitoring and evaluating of the agricultural scheme						
a.	Involvement in evaluating the effectiveness and impact of different component of schemes.	33	58	80	171	1.42	IV
b.	Involvement in assessing the causes for failure or success of schemes.	60	52	74	186	1.55	III
c.	Involvement in identification of deficiencies in planning and implementation of overall schemes.	69	50	72	191	1.59	II
d.	Involvement in providing opinions and suggestions about the schemes (feedback)	72	60	66	198	1.65	I
	Total score	1371	1302	1303		1.55	
	Mean of total score	68.55	65.10	65.15		1.57	

(Source: Computed Data)

Distribution of respondents according to their overall involvement in government scheme for agriculture development

Table 3 categorises farmers based on their overall involvement in government agricultural schemes. The data reveals that 63.33% of the respondents had a medium level of involvement (scores between 29 and 36), 24.17% had low involvement (up to 28), and 12.50% demonstrated high involvement (37 and above). The mean score of 31.90 with a standard deviation (S.D.) of 3.92 indicates that most farmers fell within the medium involvement range. The minimum score observed was 24, and the maximum was 45. These statistical values reflect the general tendency of the farmers in the study area to be moderately engaged with agricultural development schemes.

Overall, it was found that while awareness is relatively high for certain schemes, involvement varies significantly across different stages of implementation. It is recommended that policymakers and extension agencies emphasize deeper engagement strategies, especially during the maintenance and monitoring phases of government agricultural programs.

Table 3: Distribution of respondents according to their overall involvement in government scheme for agriculture development

Sl. No.	Category	Respondents	
		Frequency	Percentage
1.	Low involvement (up to 28)	29	24.17
2.	Medium involvement (29 to 36)	76	63.33
3.	High involvement (37 and above)	15	12.50
	Total	120	100.00

(Source: Computed Data) *Mean = 31.90, S.D. = 3.92, Minimum = 24, Maximum = 45*

Discussion

The data for this study was collected from loan providers who play a vital role in disseminating awareness about agricultural schemes. Information regarding schemes such as Pradhan Mantri Fasal Bima Yojana, Soil Health Card Scheme and Livestock Insurance Scheme is usually spread through community meetings and announcements organized by local agricultural teams. The responses retrieved offer insight into the attitudes of farmers toward these government initiatives.

As shown in Table 3.3, farmers demonstrated varied awareness levels regarding agricultural development schemes. The highest awareness was observed for PMFBY, with 89% of farmers acknowledging it as mandatory for loanee farmers. Similarly, 86% were aware of the crops covered under this scheme. Farmers also showed notable awareness of the Agricultural Technology Management Agency (ATMA) (72%), the Soil Health Card Scheme (68%), and the Promotion of Agricultural Mechanization for In-Situ Crop Residue Management (70%). On the other hand, awareness of schemes like the Pradhan Mantri Krishi Sinchai Yojana (PMKSY) and the Small Farmers Agri-business Consortium (SFAC) was relatively low. Only 56% were aware of PMKSY, and as low as 14% recognized the purpose of SFAC. The e-NAM facility also had low recognition, with just 28% awareness. This discrepancy underscores the need for more strong and targeted awareness campaigns to ensure equitable access to information across all government initiatives.

Despite awareness of major government agricultural schemes among farmers in Coimbatore district is relatively high, especially for widely publicised initiatives, such as the Pradhan Mantri Fasal Bima Yojana, significant gaps in knowledge about other important schemes are identified, particularly those related to organic farming, micro-irrigation and agri-business. The involvement of farmers is the strongest during initial stages of scheme implementation, viz., surveying and planning, but it declines in later phases, such as maintenance and monitoring. This pattern suggests that while initial mobilisation and information dissemination are effective, sustained engagement and support mechanisms may be lacking. These findings align with broader research indicating that awareness does not always translate into active participation, often due to systemic challenges in outreach, accessibility and ongoing support (Ravikumar & Chandrasekaran, 2025). The role of loan providers and local agricultural teams in spreading awareness is crucial, but the study also underscores the need for more targeted and continuous engagement strategies to ensure equitable access and deeper involvement across all scheme stages.

The findings of this study underscore the complex landscape of farmer awareness and involvement in government agricultural schemes. Consistent with national objectives, these schemes are designed to enhance productivity, ensure food security, promote sustainable practices, and improve the socio-economic well-being of rural communities (Tripathi et al., 2023; Varma, 2020). The high awareness and involvement in flagship programs like the Pradhan Mantri Fasal Bima Yojana and Soil Health Card Scheme reflect the effectiveness of targeted outreach and the perceived relevance of these schemes to farmers' immediate needs (Singh & Rathore, 2023; Tripathi et al., 2023). However, lower awareness and engagement with initiatives, such as e-NAM, PKVY and SFAC highlight persistent gaps in information dissemination and accessibility, particularly for programmes focused on market integration and organic farming (Singh & Rathore, 2023).

Studies show that the success of agricultural development schemes is closely tied to their ability to address local challenges, such as fragmented landholdings, limited access to technology, and market volatility (Tripathi et al., 2023). For example, facilitating grassroots-level linkages and collaboration between government agencies, NGOs, and the private sector has been shown to significantly improve scheme accessibility and impact, especially among vulnerable populations (Maniar et al., 2025). Furthermore, the adoption of modern technologies and sustainable practices has led to measurable increases in farm income, cropping intensity, and nutritional security, supporting the broader goals of inclusive and sustainable agricultural growth (Jangde et al., 2024; Venkatesan et al., 2023).

Despite these advances, several studies highlight ongoing barriers, including administrative complexity, lack of awareness, and insufficient support during later stages of scheme implementation, viz., maintenance and

monitoring (Maniar et al., 2025; Singh & Rathore, 2023; Tripathi et al., 2023). These challenges can limit the transformative potential of government interventions, particularly for marginalized groups and in less-developed regions. Addressing these issues requires not only improved communication and extension services but also policy reforms that streamline processes and foster participatory, community-driven approaches (Maniar et al., 2025; Venkatesan et al., 2023).

While government agricultural schemes in India have made significant progress to fulfil their objectives, a more holistic, inclusive and adaptive approach is required to maximise their impact and ensure that benefits reach all segments of the farming community. The study findings underscore the necessity for policy enhancements focusing not just on scheme formulation but on farmer-centric delivery models, awareness initiatives tailored to marginalized groups, and improved monitoring mechanisms to sustain long-term agricultural development.

Conclusion

In conclusion, this study highlights the critical role of awareness and involvement of farmers in utilizing government agricultural schemes to access financial support from banks in Coimbatore District. The findings indicate that while many farmers demonstrate a significant understanding of various schemes, there remains a considerable gap in their overall involvement in the loan application processes, particularly with banks compared to co-operative societies and NGOs. Enhancing awareness through targeted educational initiatives and tailored financial products can empower farmers to leverage available resources effectively. By fostering stronger relationships between banks and the agricultural community, alongside government incentives to promote banking services, the potential for increased agricultural productivity and improved rural livelihoods can be significantly realized, contributing to the overall reduction of rural poverty.

The present study has certain limitations. The use of purposive sampling, with a specific focus on high-performing loan officers, may have introduced sampling bias, potentially limiting the representativeness of the findings across the broader population of loan providers. Furthermore, the reliance on self-reported data obtained through structured questionnaire could have led to response bias, as participants might have overstated their level of awareness or involvement in government schemes. The cross-sectional nature of the study also restricts its ability to capture temporal variations or trends, thereby limiting the assessment of changes in awareness or engagement over time. Additionally, the generalisability of the findings is constrained, as the study was conducted exclusively in Coimbatore district, and its conclusions may not be directly applicable to other regions with differing socio-economic or institutional conditions. Lastly, the survey-based methodology, common in agricultural research, faces challenges such as declining response rates and non-response bias, which may affect the overall reliability and validity of the results

Future research can build upon the current study by addressing its limitations and deepening the understanding of farmer involvement in government agricultural schemes. One promising direction is the use of longitudinal studies to track changes in awareness and engagement over time. Such an approach would enable researchers to assess the impact of evolving policy interventions, outreach programmes or communication strategies on farmer participation. Another important avenue lies in conducting comparative regional analyses across diverse districts or states. By including areas with varying socio-economic, cultural and institutional contexts, researchers can identify region-specific challenges and find best practices that may be adaptable elsewhere. This would enhance the generalisability and policy relevance of findings at the national level. Employing mixed-methods research designs can offer more comprehensive insights. The integration of quantitative surveys with qualitative techniques, such as in-depth interviews or focus group discussions, can help explore the underlying motivations, perceptions and challenges experienced by both farmers and loan providers. Future studies should incorporate policy and administrative evaluations to examine the effectiveness of different dissemination and engagement strategies. Research could explore how bureaucratic processes, institutional capacity and inter-agency coordination influence farmers' sustained participation in schemes. A significant potential exists in evaluating innovative outreach mechanisms. The impact of digital tools, such as mobile apps, SMS alerts

and agri-portals, participatory extension models and community-based awareness campaigns could be systematically tested to determine their effectiveness in increasing awareness and involvement, especially for lesser-known schemes and among marginalised farmer groups.

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RESEARCH ARTICLE

Impact of perceived discrimination on students' behavioural changes: Role of cultural background and societal influence

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Abstract: Student behaviour is substantially influenced by discrimination in educational settings. The specific impact of teacher discrimination on students' behavioural shifts remains underexplored despite it being increasingly acknowledged in research. The present study used the Phenomenological Variant of Ecological Systems Theory (PVEST) to examine students' behavioural changes being influenced by their perceptions of teacher discrimination and whether this relationship is affected by societal and cultural factors. Questionnaires were used for a survey in rural and urban areas in Krishnagiri district Tamil Nadu, India, and subsequently gather data from 215 students studying in grades 8 to 10. The data was analysed via partial least squares-structural equation modeling (PLS-SEM). It was found that students' behaviour was significantly influenced by their perceptions of teacher discrimination based on caste, creed and socioeconomic status. Societal influence did not significantly influence the impact of perceived discrimination on behavioural changes, whereas cultural background played a vital role in moderating this relationship.

Keywords: *Cultural background, Family background, Perceived discrimination, Societal influence, Students' behavioural changes*

Introduction

Supportive teaching environments are closely linked to positive student interactions. However, perceived discrimination remains widespread in educational settings (Hagiwara et al., 2017) and contributes to disparities in student engagement and behaviour, particularly along the lines of caste, creed and other social divisions (Mittal, 2020). Perceived discrimination refers to the belief that individuals or groups are treated differently or excluded based on personal traits, such as appearance, gender, race or other social factors. (Giurgiu et al., 2015). This perception is associated with a range of negative outcomes, including declines in mental and physical health, as well as strained social relationships (Brondolo et al., 2009). When teachers display discriminatory attitudes, students may feel less connected to their school community, become disengaged in class and experience disruptions in their behaviour and academic performance (Kidger et al., 2016). The impact of discrimination is shaped by cultural and societal contexts, with students from different backgrounds experiencing and responding to discrimination in varied ways (Sisask et al., 2014; Banerjee et al., 2018). For example, studies in India have documented caste-based exclusion from extracurricular activities and discrimination based on socio-demographic factors, such as family background and age (Wu et al., 2015; Yasui et al., 2015). The perception of discrimination among students is shaped not only by caste and creed, but also by the interplay of cultural background and societal context (Assari and Lankarani, 2017). Studies have documented that in some regions, such as Telangana and Andhra Pradesh, students from lower castes are denied opportunities in sports and cultural events, highlighting the persistence of

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exclusionary practices (Dongre, 2017). Discrimination is not limited to caste alone; factors such as age, family background, and parenting styles also influence students' experiences of exclusion, as reported in primary schools in places such as Mangalore, India (Joseph et al., 2021).

Although some research has explored the link between teacher-student relationships and students' perceptions of discrimination, a comprehensive investigation into how perceived discrimination by teachers directly affects changes in student behaviour is still required. While perceived discrimination is widespread among students (Rosenbloom and Way, 2004), studies examining how cultural background and societal factors influence the impact of teacher discrimination on student behaviour remain limited (Bryan et al., 2018). Studies with larger sample sizes are required to better understand how these moderating factors affect the relationship between perceived discrimination and behavioural outcomes. Thus, to address these gaps, the present study set out to examine the influence of perceived teacher discrimination on students' behavioural changes and to determine whether cultural background and societal influence affect this association.

Literature Review and Hypotheses Development

Integrated theoretical frameworks that clarify mechanisms and causal relationships are essential for understanding and improving academic performance, especially when considering how individual and environmental risk factors shape student outcomes. The Phenomenological Variant of Ecological Systems Theory (PVEST) (Spencer, 1997) provides a valuable lens for examining how social, cultural, and familial contexts influence youth development (Spencer, 1999). PVEST emphasises the importance of contextual influences and highlights how risk factors, such as caste-based discrimination can lead to negative outcomes for students (Spencer et al., 2003). The impact of perceived discrimination by teachers on students in investigated using the PVEST and this experience is conceptualised as a form of total stress involvement.

Discrimination refers to the unequal treatment of individuals based on factors, such as race, religion, caste, creed or economic status (Smart Richman and Leary, 2009). In India, educational institutions have unfortunately become common sites for various forms of student discrimination, including those based on caste and religion (Desai and Kulkarni, 2008). Jain and Narayan (2011) highlighted that students from marginalised castes often face exclusions, such as being denied participation in classroom activities or extracurricular events. Ramachandran and Naorem (2013) pointed out the students were sometimes not allowed to sit with students from higher castes. Discriminatory attitudes from teachers and peers can lead to social isolation, emotional distress, and negative behavioural responses among affected students (Sitlhou, 2017). Rueger and Jenkins (2014) highlighted that students' mental and physical health deteriorates due to discrimination. Despite the existence of policies aimed at promoting inclusion, the lived experiences of students from marginalised backgrounds reveal persistent exclusion and prejudice, which can hinder academic performance and reinforce social inequalities (Ali et al., 2019). Based on this discussion, the following hypothesis is proposed:

H1: Perceived discrimination of students by teachers based on caste, creed and economic backgrounds has a significant impact on students' behavioural changes

Researchers have observed that cultural background is rooted in social identity theory (Tajfel and Turner, 1986), which suggests that a strong identification with one's cultural group can sometimes buffer the negative effects of perceived discrimination (Phinney, 2003). However, in educational settings, this identification may also lead to negative outcomes, as students become more aware of negative stereotypes and may not benefit from positive societal influences on their cultural identity (Oyserman, 2008; Wildhagen, 2011). For example, in a longitudinal study by Cheng and Klugman (2010), students from minority cultural backgrounds often report feeling less connected to their schools. Banerjee et al. (2018) highlighted that teacher discrimination based on cultural background can further impact learning outcomes. While perceived discrimination can occur in various contexts, each form poses unique risks to different aspects of social identity, influencing behavioural changes in students (Verkuyten et al., 2019). Based on these insights, the following hypotheses are proposed.

H2: Cultural background moderates the effect of perceived discrimination by teachers on students' behavioural changes

H3: Societal influence moderates the effect of perceived discrimination by teachers on students' behavioural changes

A conceptual framework was established based on the previously stated hypotheses (Figure 1). In this model, teacher discrimination against students – based on caste, creed or socioeconomic status – was identified as the independent variable directly influencing students' behavioural changes, which served as the dependent variable. Additionally, cultural background and societal influence were included as moderating variables, potentially affecting the relationship between perceived discrimination and behavioural outcomes.

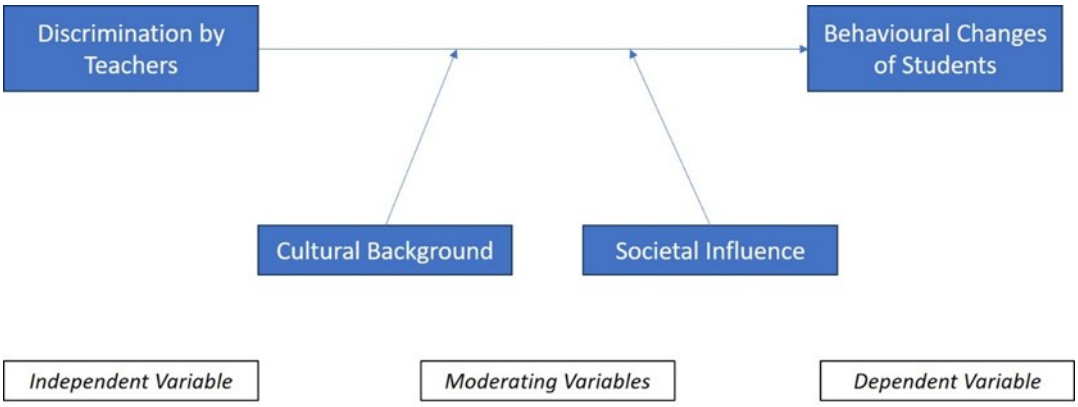

Figure 1: Conceptual model

Methodology

A deductive approach was adopted and quantitative methods were utilised. Data were collected from 215 students in grades 8 to 10, attending both rural and urban schools in Krishnagiri district, Tamil Nadu, India, using a random sampling technique.

A structured questionnaire was utilised to gather the primary data. The questionnaire included 30 items designed to assess five key variables in the study. To evaluate students' perceptions of discrimination, eight items were adapted from Fox and Stallworth (2005), Gelisli (2007) and Ali et al. (2019). Six items, adapted from the study of Ali et al. (2019) measured changes in student behaviour. Societal factors and cultural background were assessed using six and three items, respectively, based on a study conducted by Soric (2011). All responses were recorded on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

SPSS software was used to analyse the data. Demographic information was summarised by using descriptive statistics, such as frequencies and percentages. Partial least squares-structural equation modelling (PLS-SEM) was employed to test the hypothesised relationships among variables. This approach allowed for the examination of latent constructs and hypothesis testing. The statistical significance of the model's path estimates was determined using a bootstrapping method with 10,000 sub-samples to enhance precision. The study outcomes were generated via data analysis conducted using IBM SPSS and SmartPLS.

Results

Demographic characterization of participants

A total of 215 students participated in the present study. Of these, 116 were male (54.0%) and 99 were female (46.0%). The majority of the participants (63.3%) were between 16 and 18 years of age. In terms of academic level, most students were from Class 10 (52.5%), followed by Class 9 (27.0%) and Class 8 (20.5%). Regarding the occupation of the family head, 30.7% of students reported their family head as a skilled worker, 27.9% as farmers, 20.7% as unskilled workers, 18.1% as government employees and 2.8% as unemployed. The detailed demographic distribution is presented in Table 1.

Table 1: Demographic profile of respondents

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	116	54
	Female	99	46
Age (years)	Below 16	79	36.7
	16-18	136	63.3
Class level	Class 8	44	20.5
	Class 9	58	27
	Class 10	113	52.5
Occupation of Family Head	Skilled workers	66	30.7
	Unskilled workers	44	20.7
	Farmers	60	27.9
	Government Employees	39	18.1
	Unemployed	6	2.8

Reliability and validity analysis

The measurement model was assessed to ensure relevant reliability, composite reliability and construct validity of the scales used (Table 2). Composite reliability (CR) of the variables was above the threshold of 0.70 and it ranged between 0.78 and 0.81 (Hair et al., 2017). It can be inferred that constructs had high internal consistency for items associated with each variable. Most of the item loadings for constructs used were above 0.7, indicating strong individual contributions. The convergent validity was evaluated by determining the average variance extracted (AVE) values for constructs (Engellant et al., 2016), with recommended thresholds of 0.5 or higher (Ahmad et al., 2016). In this study, the AVE values exceeded 0.5, thus highlighting their robust convergent validity.

Table 2: Construct reliability and validity

Latent constructs	Cronbach's Alpha	CR	AVE
Perceived teachers' discrimination	0.65	0.81	0.59
Cultural background	0.60	0.80	0.66
Societal influence	0.60	0.78	0.54
Students' behavioural changes	0.60	0.78	0.54

Note: CR=composite reliability; AVE=average variance extracted

Discriminant validity was assessed for all construct variables in the model. The analysis presented in Table 3 showed that the AVE square root values of each construct were higher than the multiple correlation values for the respective constructs, which demonstrated the discriminant validity of all construct variables in the model (Hair et al., 2017). The Heterotrait-Monotrait (HTMT) criterion was also used to assess discriminant validity. Findings revealed that the HTMT values were below 0.90, thereby confirming the absence of any issues on discriminant validity (Fornell and Larcker, 1981).

Table 3: Discriminant validity

Construct	BCS	CB	DS	SF
Behavioural changes	0.73			
Cultural background	0.45	0.81		
Perceived teachers' discrimination	0.64	0.37	0.77	
Societal influence	0.70	0.34	0.62	0.74

Hypotheses testing

The level of perceived students' discrimination can be explained by 61.0% variation in students' behavioural changes, thereby explaining nearly moderate to high variance (Chin, 1998). The PLS-SEM allows for in identifying the direct relationships between the variables (Table 4). Based on PLS-SEM procedure of direct effects, it is established that the direct effects (cultural background → students' behavioural changes: β= 0.18, t = 3.39; societal influence → students' behavioural changes: β = 0.43, t = 7.86; family background → students' behavioural changes: β = 0.13, t = 2.01) were significant.

Table 4: Bootstrapping direct effects at 95% confidence intervals

	β	Sample Standard Deviation (STDEV)	T Statistics	P Values
Cultural background -> Behavioural changes	0.18	0.05	3.39	0.00
Family background -> Behavioural changes	0.13	0.05	2.01	0.04
Societal influence -> Behavioural changes	0.43	0.05	7.86	0.00

Further, the PLS-SEM allows for identifying the significance of the relationships between the variables (Table 5). In considering their effect on each other, the association between students' behavioural changes and perceived discrimination showed a highly (0.29) significant effect in the model, thereby confirming H1. Concerning the influence of moderating variables on the association between dependent and independent latent variables, the results showed that cultural background significantly but negatively moderated the effect of perceived students' discrimination on behavioural changes ($\beta = -0.12$, $T = 2.13$, $p < 0.001$), implying that cultural background can significantly reduce the effect of perceived students' discrimination on their behavioural changes. However, societal influence did not significantly moderate the effect of perceived students' discrimination on their behavioural changes ($\beta = 0.03$, $t = 0.70$, $p > 0.05$) (Table 5).

Table 5: Structural paths and related indicators

DV	IV	Hypothesis	Path estimates	t-Value	Significance (result)
BCS	DS	H1	0.29***	4.47	Supported
	DS*CB	H2	-0.12*	2.13	Supported
	DS*SF		0.03	0.70	Not supported

*** $p < 0.001$, * $p < 0.05$

The moderating roles of cultural background and societal influence in the relationship between perceived discrimination and students' behavioral changes were examined. Effect sizes for each predictive model were evaluated using Cohen's f^2 criteria. The findings revealed that the models incorporating the direct effect and the interaction term for cultural background as a moderator demonstrated comparatively higher effect sizes than other conditions. Specifically, the model including cultural background as a moderator yielded an f^2 value of 0.12, indicating a small effect size. This result provides partial support for Hypothesis H2.

Discussion

This study investigated how students' behavioural changes are affected by their perceptions of discrimination by teachers, based on caste, creed and socioeconomic status. It also explored whether the relationship between school-based discrimination and student behaviour was moderated by societal influence and cultural background. Focusing on an Indian context, the research found that perceived discrimination from teachers significantly influenced students' behavioural changes, with higher levels of discrimination linked to more pronounced negative behaviours. Alfaro et al. (2009) proposed similar arguments by stating that students experiencing discrimination were less likely to participate actively in class and showed reduced interest in learning. Smalls et al. (2007) found that teacher discrimination can lead to disengagement and absenteeism among students. Ramachandran and Naorem (2013) highlighted that practices such as segregated seating based on caste could result due to discrimination. However, the present study outcomes differ from the findings by Bibi and Karim (2015) and Ali et al. (2019) that found no significant impact of perceived teacher discrimination on students' learning outcomes or psychological well-being.

This study provided empirical evidence that cultural background significantly, but negatively, moderated the relationship between perceived discrimination and students' behavioural outcomes. This result aligns with previous research suggesting that cultural socialisation can buffer the negative effects of discrimination on students' academic performance and behavioural adjustment, as cultural background shapes how students interpret and respond to discriminatory experiences (Banerjee et al., 2018). Assari and Caldwell (2018) reported that cultural socialisation has been found to reduce the risk of adverse behavioural changes in students who experience discrimination in classrooms. The interaction between individual and

environmental factors is crucial for understanding how discrimination influences student behaviour (Chavous et al., 2008), as cultural background influences both socialisation processes and the quality of teacher-student interactions (Brown and Harris, 2012). While students may encounter negative perceptions due to discrimination based on caste or creed, a strong cultural background can lead to positive outcomes (Banerjee et al., 2018). Both family background and socioeconomic status can influence how individuals experience and respond to perceived discrimination (Assari and Caldwell, 2017; Hudson et al., 2012). Factors such as cultural identity determine how ambiguous or challenging situations are interpreted, with cultural identity affecting the prominence of culture in these encounters. (Assari et al., 2015; Beatty Moody et al., 2016; Sellers et al., 2006). However, the current study's findings differ from some previous research that found cultural background did not moderate the relationship between students' academic outcomes and perceived discrimination by teachers based on caste or creed (Neblett et al., 2006). Additionally, societal influence was not found to be a significant factor in this sample, which may be due to the participants sharing similar local and ethnic backgrounds.

Conclusion

The present study examined how students' perceptions of teacher discrimination, based on caste, creed and financial status, affect their behavioural changes by using survey data from students in classes 8 to 10 in rural and urban schools in Krishnagiri district. The results showed that perceived discrimination by teachers had a significant impact on students' behaviour. Additionally, the study found that cultural background moderated the direct relationship between perceived teacher discrimination and changes in student behaviour.

However, this study has several limitations. The research focused solely on students' perspectives regarding teacher discrimination and their own behavioural responses. Future studies should include the viewpoints of teachers and parents to provide a more comprehensive understanding of the effects of perceived discrimination and to reduce potential bias from self-reported data. Another limitation is that the present study did not account for individual or organisational factors that might contribute to perceptions of teacher discrimination. Future research could explore additional influences, such as institutional policies, that may affect the link between teacher discrimination and student behaviour. Furthermore, the cross-sectional design of the study limits the ability to generalise the findings, as it only captures a snapshot in time. Therefore, longitudinal studies are recommended to better understand how perceived teacher discrimination related to caste, creed and financial background influences student behaviour over time.

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REVIEW ARTICLE

Understanding the influence of metaverse-driven virtual reality on consumer buying behavior in the solar energy sector: A theoretical perspective

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Abstract: The integration of Virtual Reality (VR) and the Metaverse is reshaping consumer engagement and marketing dynamics within the solar energy sector. As immersive technologies redefine digital interaction, they offer innovative avenues for consumer education, emotional engagement, and trust-building in sustainable energy solutions. VR allows potential customers to explore solar products through interactive environments, enhancing understanding and confidence. Through tools such as AI-driven simulations, virtual showrooms, and gamified learning experiences, solar companies can simplify complex technical information and support informed decision-making. Moreover, blockchain-enabled transactions and peer influence in virtual communities further shape consumer buying behaviour, making the metaverse a strategic frontier for solar marketing. Drawing on consumer behaviour models and psychological frameworks, this study presents a theoretical examination of how immersive technologies influence attitudes, behaviour, and decision-making in the solar context. While the opportunities are substantial, the study also recognizes challenges such as high implementation costs, technical constraints, and privacy concerns that currently hinder widespread adoption. Addressing these barriers through innovation, strategic planning, and policy support can accelerate the integration of VR in renewable energy marketing. The findings contribute to a deeper theoretical understanding of how metaverse-driven tools can transform consumer engagement, foster behavioural change, and support the broader transition to a sustainable digital economy.

Keywords: *Consumer behavior, Virtual reality, AI-powered simulations, Metaverse, Decision-making, Renewable energy, Technological barriers*

Introduction

The evolution of digital technologies has significantly transformed consumer behavior and marketing strategies across industries. One of the most groundbreaking advancements in recent years is the metaverse, a virtual space where physical and digital realities converge (Dwivedi et al., 2022). Initially conceptualized in science fiction, the metaverse has become a tangible reality through developments in Virtual Reality (VR), Augmented Reality (AR), and blockchain technology (Mystakidis, 2022). These innovations have influenced various industries, including renewable energy, by offering new ways to engage customers and streamline decision-making (Bourlakis et al., 2023). In the solar industry, where consumer awareness and trust are crucial, metaverse-enabled marketing is emerging as a powerful tool to bridge knowledge gaps, personalize experiences, and facilitate sustainable energy adoption (Gupta et al., 2023) By leveraging VR simulations,

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AI-driven customization, and blockchain transactions, solar companies can create seamless customer journeys that simplify complex information (Lee et al., 2022). As the demand for renewable energy grows, integrating these digital tools can help businesses enhance consumer confidence and accelerate the transition to clean energy. To understand how digital tools influence purchasing decisions, it is important to study consumer behavior. This behavior is driven by marketing elements such as product, price, promotion, and place, along with external factors like economic, political, technological, and cultural conditions (Kotler & Keller, 2016). These influences enter the consumer's "black box," which includes their beliefs, values, attitudes, and decision-making process. The final purchase decision is shaped by internal thought processes influenced by both marketing strategies and environmental forces (Solomon, 2018). This paper explores the evolution of VR, consumer buying behavior in the solar energy market, the impact of metaverse-driven marketing, psychological aspects of VR-based solar promotion, and the challenges and opportunities in leveraging these technologies for industry growth.

Statement of Problem

The rapid integration of immersive technologies such as Virtual Reality (VR) and the Metaverse into marketing strategies presents both opportunities and challenges within the solar energy sector. Despite their potential, the extent to which these technologies influence consumer perceptions and buying behavior remains insufficiently explored. Traditional marketing methods often fail to convey the technical and environmental benefits of solar products effectively, leading to consumer hesitation and low adoption rates. Given the growing relevance of digital engagement, it is essential to examine how metaverse-driven experiences can enhance trust, emotional involvement, and informed decision-making. This study aims to address this theoretical gap by investigating of immersive tools on consumer behavior in the context of solar energy.

Objective of the Study

This study aims to explore the theoretical evolution of Virtual Reality (VR) and the Metaverse, evaluating their potential to transform consumer experiences within the solar energy sector. By using the Stimulus-Organism-Response (S-O-R) model, it examines the consumer buying behavior specifically in the context of solar energy. Additionally, the study investigates how immersive virtual environments influence psychological and behavioral factors, shaping consumer perceptions, attitudes, and decision-making in relation to solar energy products and services.

Significance of the Study

This research is significant in revealing how emerging immersive technologies like VR and the metaverse are not just transforming consumer experiences but also playing a pivotal role in accelerating sustainable energy transitions. The study employs the Stimuli and Response model to explore how digital marketing elements influence consumer attitudes and purchasing decisions within the solar energy sector. By illustrating the interplay between digital innovation and renewable energy marketing, the study offers practical information for marketers, policymakers, and industry leaders to craft more effective, tech-driven consumer strategies in the solar sector. The findings provide a foundation for future research and innovation in integrating metaverse technologies with green energy initiatives.

Evolution of Virtual Reality - The Metaverse

The metaverse is a virtual space where digital and physical realities come together, allowing people to interact in immersive online environments (Mystakidis, 2022). Although the idea has existed for decades, it became widely known in the late 20th and early 21st centuries through science fiction books and media. The term "metaverse" was first used by Neal Stephenson in his 1992 novel Snow Crash, where he described a virtual world where users could connect and interact in real time (Stephenson, 1992). While the concept began in fiction, real technological progress started in the 1980s and 1990s with early virtual reality (VR) systems, which used headsets and gloves to create computer-generated experiences (Lee et al.,2021). Initially developed for military training, these early VR technologies inspired further advancements, leading to more

sophisticated virtual and augmented reality (AR) tools (Mutterlein, 2018). By the 2010s, innovations like the Oculus Rift, HTC Vive, HoloLens, and Pokémon Go made virtual experiences more immersive and interactive, allowing users to either enter a fully digital world or see digital elements overlaid onto the real world (Rauschnable et al., 2022). This evolution has transformed the metaverse into a space for gaming, education, training, and social interaction, while blockchain technology has enabled virtual economies where users can buy, sell, and trade digital assets (Dwivedi et al., 2022). As new technologies like 5G and edge computing continue to develop, the metaverse will likely become even more realistic and integrated into everyday life (Zhang et al., 2022). However, this shift also brings challenges, such as unequal access to technology, changes in social interactions, and legal and ethical concerns related to data privacy, virtual crimes, and ownership of digital assets (Kye et al., 2021). To ensure that the metaverse benefits society, policymakers and industry leaders must address these issues and create a secure, fair, and inclusive digital world.

Consumer Buying Behavior in the Solar Energy Sector

The decision to buy solar energy products depends on several factors, including cost, technology, social influence, and consumer awareness (Jaiswal et al., 2021; Yadav& Pathak,2021). The high initial cost of solar panels is a major concern, but incentives, tax benefits, and financing options help make them more affordable. Financial support like subsidies and net metering policies encourages more households to adopt solar energy (Kumar et al., 2022). Environmental awareness also plays a key role, as people who prioritize sustainability are more likely to invest in solar power (Kesari et al., 2021). Advancements in technology have improved the efficiency and reliability of solar panels, making them more attractive to consumers. Better photovoltaic cells and battery storage systems have increased interest in solar energy. Social influence is another important factor, as people are more likely to switch to solar energy when they see their neighbors using it. Government policies significantly impact adoption, with strong incentives like feed-in tariffs and tax credits leading to higher usage (Sahu, 2021). However, some consumers remain hesitant due to perceived risks around system reliability, installation complexity and long-term maintenance. Recent studies suggest that immersive VR demonstrations and personalized simulations can reduce these concerns by enhancing transparency and building consumer confidence (Gupta et al., 2023) Additionally, a lack of awareness about the benefits and functioning of solar energy remains a challenge. Virtual reality (VR) is now being used to educate consumers through interactive and immersive experiences, making solar energy more accessible and understandable (Gupta et al., 2023).

Stimulus-Response Model

Consumer buying behavior is based on stimuli coming from a variety of sources from marketers in terms of the 4Ps (Product, Price, Promotion and Place) as well as from environmental stimuli, such as economic factors, legal/political factors and technological and cultural factors (Kotler & Keller, 2016). These stimuli go into "black box" which consists of two parts: buyer characteristics such as beliefs and attitude, motives, perceptions and values and the buyer decision-making process, which is covered later in the chapter. Response is the outcome of the thinking that place in that black box. What will buy, where, when, how often, and how much and how often- is the result of internal processing influenced by both marketing and external environmental factors (Solomon, 2018).

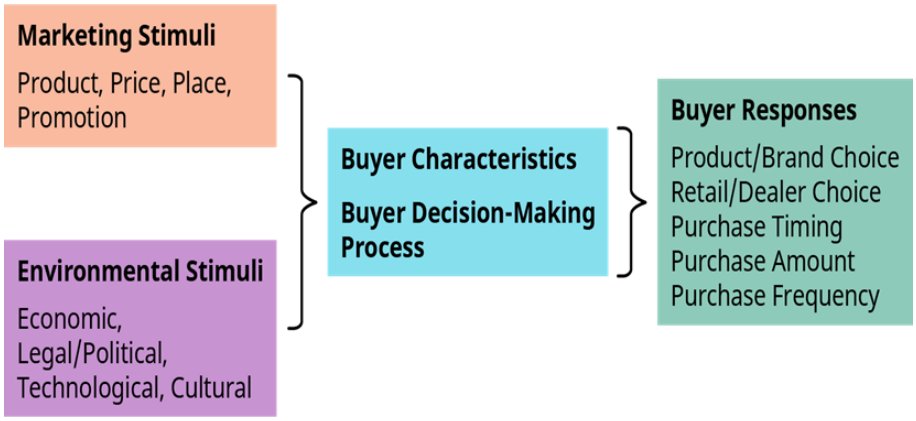

Figure 1: Stimulus-Response Model

(Source: Stimulus-Response Model/Buyer's Black Box (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

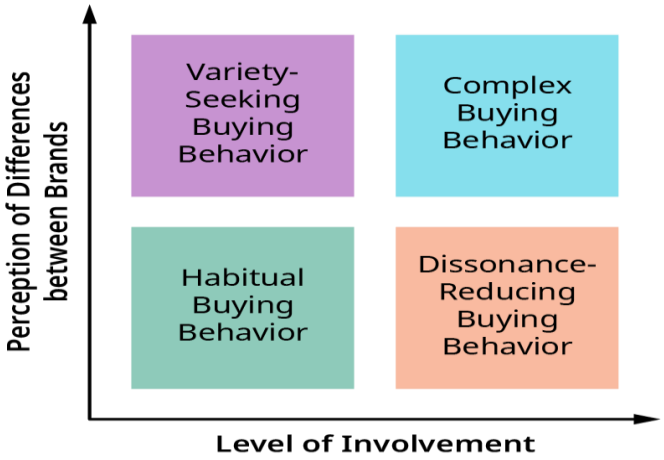

Figure 2: Level of involvement in analysis of consumer buying behavior

(Source: Types of Consumer Buying Behavior (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

Types of Consumers Buying Behavior

There are four types of consumers buying behavior. Variety-Seeking Buying Behavior where consumers perceive only minor differences between brands but still switch for the sake of variety, not dissatisfaction. For example, a consumer exploring different VR-based solar product demos not because one is better, but to experience the novelty each brand offers. (Schiffman et al. 2020). The next is Complex Buying Behavior which occurs when the purchase involves high involvement and significant perceived brand differences. Example is choosing a residential solar energy system using a metaverse simulation involves research, comparison, and high engagement due to cost and technical complexity (Kotler & Keller 2016). Additionally, Habitual Buying Behavior takes place when consumers have low involvement and see little difference between brands purchases become routine. For example, when customers repeatedly choose the same solar company's app for bill tracking without exploring alternatives due to habit, not preference (Solomon 2018). There is Dissonance-Reducing Buying Behavior also where consumers are highly involved in the purchase but see few differences between brands, leading to post-purchase doubts. For example: A customer selects a solar product via VR tour but later worries if they chose the right brand due to similar offers in the market (Schiffman et al.2020).

Kotler and Keller (2016) state that complex buying decisions arise when products are expensive, infrequent, and self-expressive—like solar installations. Schiffman et al. (2020) explain that in low-involvement scenarios with multiple perceived options, consumers tend to switch brands for variety. Schiffman et al. (2020) explain that marketers can reduce dissonance through reassurance, follow-ups, and customer

support. Solomon (2018) notes that habitual behavior is common for low-risk, routine decisions where brand perception is minimal.

Psychological and Behavioral Effects of Immersive Experiences on Consumer Attitudes Solar Energy

Immersive experiences enabled by Virtual Reality (VR) are reshaping consumer attitudes toward solar energy by enhancing emotional engagement and understanding. Through lifelike simulations, consumers can visualize solar panels on their rooftops or interact within virtual communities, making complex technology easier to grasp (Gupta et al., 2023). This psychological immersion builds trust, reduces concerns about cost and complexity, and boosts confidence in adopting solar solutions (Chhaniwal et al., 2025). From a behavioral standpoint, VR influences both emotional and rational decision-making. Personalized experiences like real-time energy savings or visualizing home installations make solar products more appealing (Asghar, 2024). Additionally, seeing others adopt solar energy in virtual settings fosters social influence and strengthens buying intent (Bhattacharya & Bansal, 2024). These immersive tools also enhance memory, involvement, and satisfaction, leading to stronger purchase decisions (Schiffman et al., 2020).

Key Findings

The study reveals that Virtual Reality (VR) and metaverse environments significantly enhance consumer engagement by providing interactive and emotionally immersive experiences that build trust and confidence in solar energy solutions. These technologies simplify complex technical information through AI-driven simulations and virtual showrooms, enabling consumers to visualize solar installations and make more informed decisions. Moreover, personalized and gamified VR experiences strengthen psychological influence by fostering emotional connections, improving information retention, and increasing user involvement in the buying process. Despite these benefits, the widespread adoption of VR in solar marketing faces notable barriers, including high implementation costs, technical limitations, and concerns over data privacy. However, future opportunities are promising, as the metaverse can further support solar energy adoption through decentralized blockchain transactions, virtual training modules, and immersive educational platforms tailored to enhance consumer understanding and decision-making.

Conclusion

The study underscores the transformative potential of Virtual Reality (VR) and Metaverse-driven environments in enhancing consumer engagement within the solar energy sector. These technologies offer interactive and emotionally immersive experiences that help demystify complex solar solutions, build trust, and facilitate more informed decision-making. Features such as AI-powered simulations, virtual showrooms, and gamified content not only simplify technical details but also strengthen psychological influence by increasing user involvement and emotional connection throughout the buying journey. Furthermore, emerging innovations such as blockchain-enabled transactions and immersive educational modules present promising opportunities to further streamline solar adoption.

Despite these theoretical advancements, several limitations must be acknowledged. This study is limited to a theoretical exploration of Virtual Reality (VR) and the Metaverse within the solar energy sector only, which may restrict the generalizability of its insights to other industries or energy sectors. Secondly, the research considered a conceptual approach without any empirical analysis to support its claims. This indicates that the findings were not supported by data-driven validation. In addition, the study addressed the psychological and behavioral aspects of customers but did not extensively focus on related disciplines like neuroscience, environmental psychology, or human-computer interaction, which could provide a deeper understanding of consumer responses to immersive technologies. Given these limitations, future research should focus on empirical validation of the proposed theoretical constructs by conducting qualitative or quantitative studies to measure actual consumer responses to VR and Metaverse experiences in solar marketing. Comparative studies across different renewable energy sectors could also reveal how these technologies perform in varied contexts. Additionally, integrating insights from interdisciplinary fields

can help create a more comprehensive framework for understanding the cognitive, emotional, and behavioural impact of immersive technologies on consumer decision-making. By bridging theoretical insights with empirical research and expanding the disciplinary scope, future studies can play a critical role in guiding the effective integration of Metaverse-driven VR in promoting clean energy adoption and enhancing consumer engagement at scale.

Future Trends and Opportunities in Metaverse-Enabled Solar Sector

The metaverse is transforming solar marketing by creating interactive, immersive experiences that make it easier for consumers to learn about and adopt solar energy. Virtual showrooms allow customers to explore solar panels and energy systems in a 3D environment, making complex information more accessible. AI-powered simulations help homeowners visualize solar installations and estimate energy savings in real-time. Gamification adds an engaging element, encouraging users to learn about solar power through interactive challenges and rewards. Blockchain technology enables decentralized solar energy trading, making renewable energy transactions more transparent and efficient. Virtual conferences and training programs further expand access to solar knowledge, reducing costs and increasing participation. As these technologies evolve, solar companies leveraging the metaverse will enhance customer engagement, streamline decision-making, and drive faster adoption of sustainable energy solutions.

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REVIEW ARTICLE

Enhancing customer experience and shopping value in omnichannel retailing

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Abstract: In the contemporary retail environment, the convergence of physical and digital channels — known as omnichannel retailing — has become a pivotal strategy for enhancing customer experience and delivering superior shopping value. This paper explores how omnichannel integration creates a seamless, personalized, and convenient journey across mutliple consumer interaction points such as physical retail stores, online shopping websites, mobile apps and social media networks. Utilizing cutting-edge technologies like AI, big data analysis, and customer relationship management systems, retailers are increasingly capable of providing tailored experiences, real-time inventory insights, and dynamic promotional offerings that significantly enhance customer satisfaction. Furthermore, omnichannel strategies contribute to increased utilitarian, hedonic, and social value, fostering not only efficient and enjoyable shopping experiences but also meaningful community engagement through integrated social platforms. Despite its transformative potential, omnichannel retailing presents ongoing challenges, including technological integration issues, data fragmentation, and consumer privacy concerns. The study identifies these limitations and highlights the need for future research, particularly focusing on underexplored areas such as the role of emerging markets, cultural differences, and the impact of innovative technologies like augmented reality and blockchain. By addressing these gaps, future investigations can provide deeper insights into sustaining competitive advantage and evolving customer expectations. Overall, the paper underscores the critical importance of continuous innovation and strategic alignment in advancing omnichannel capabilities to enhance customer experience and drive long-term value creation in the retail sector.

Keywords: *Omnichannel retailing, Customer experience, Shopping value, Consumer behavior, Personalization, Technological integration, Artificial intelligence, Big data analytics, Customer satisfaction*

Introduction

In the rapidly evolving retail landscape, the combination of physical and digital channels — commonly commonly known as omnichannel retailing — has emerged as a transformative approach to enhance customer experience and increase shopping value (Cotarelo et al., 2021). Modern consumers no longer view shopping as a linear process confined to a single channel; instead, they expect a seamless, personalized, and convenient journey via numerous contact points, including in-store outlets, e-commerce platforms, mobile apps, and social media (Verhoef, Kannan, & Inman, 2015). Omnichannel strategies enable retailers to meet these expectations by providing a cohesive brand experience, regardless of where or how the customer engages with the brand (Massi, 2023). The customer experience in an omnichannel environment is significantly enriched by employing sophisticated technologies like AI, data analytics, and customer relationship management systems. These technologies enable retailers to offer personalized product

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recommendations, real-time inventory visibility, and tailored promotions that enhance customer satisfaction (Juaneda-Ayensa, Mosquera, & Murillo, 2016). Importantly, omnichannel systems allow for smooth transitions between online research and offline purchases (webrooming), or physical store browsing followed by online purchases (showrooming), thereby offering enhanced flexibility and autonomy for customers throughout their shopping experience (Gupta et al., 2024).

The customer experience in an omnichannel environment is significantly enriched by employing sophisticated technologies like AI, data analytics, and customer relationship management systems. These technologies enable retailers to offer personalized product recommendations, real-time inventory visibility, and tailored promotions that enhance customer satisfaction. Importantly, omnichannel systems allow for smooth transitions between online research and offline purchases (webrooming), or physical store browsing followed by online purchases (showrooming), thereby offering enhanced flexibility and autonomy for customers throughout their shopping experience.

Customers increasingly move fluidly across channels: they research products online, consult peers on social platforms, and complete purchases in-store or through mobile applications. This dynamic and evolving pattern is especially important in high-involvement categories such as electronics, where shoppers look for accurate information, interactive support, personalized recommendations, and reliable service. Omnichannel retailing brings together the convenience and reach of digital touchpoints with the sensory and advisory strengths of physical retail environments. With the growing use of mobile devices, voice interfaces, and connected smart products, the range of customer contact points continues to widen, making integrated communication, seamless service, and consistent value delivery across channels essential for retailers.

Beyond improving convenience, omnichannel retailing also enhances shopping value across three critical dimensions: utilitarian, hedonic, and social (Kokku, 2021). Utilitarian value is realized through efficient service, ease of navigation, and time-saving processes, which are particularly crucial in high-involvement sectors like electronics (Blázquez, 2014). Hedonic value is derived from enjoyable, immersive, and interactive shopping experiences, such as augmented reality try-ons or engaging store layouts that stimulate sensory satisfaction (Attri, Roy & Choudhary, 2024). Meanwhile, social value emerges from integrated social media platforms and peer review systems that enable customers to share experiences, seek advice, and feel connected to a community of like-minded shoppers (Pantano & Priporas, 2016).

Furthermore, as consumer expectations rise, the competitive advantage increasingly lies in the ability to deliver consistent, meaningful experiences across all channels. Research suggests that customers interacting through various channels are more likely to demonstrate stronger loyalty and greater lifetime value compared to single-channel users (Lemon & Verhoef, 2016). Retailers that synchronize their inventory, pricing, and promotional strategies across channels not only reduce operational inefficiencies but also create a frictionless customer journey that encourages repeat purchases and positive word-of-mouth (Cocco & Demoulin, 2022). Emerging technologies continue to redefine the boundaries of omnichannel excellence. Innovations such as AI-powered chatbots, virtual reality experiences, and blockchain for secure transactions are further empowering retailers to elevate customer experience and shopping value. As these advancements mature, omnichannel strategies will remain at the forefront of retail evolution, acting as a cornerstone for sustained customer engagement, loyalty, and business growth (Verhoef et al., 2021).

Objectives

While omnichannel retailing has attracted growing academic attention, most existing studies have been limited to specific sectors such as fashion and grocery, and are often based in mature markets like the United States and Western Europe. There is a noticeable lack of comprehensive reviews and empirical work focusing on electronics retailing, particularly in the context of emerging economies. Furthermore, while prior literature has examined customer satisfaction or purchase intention, few studies (Shi et al., 2020) have integrated the customer experience with shopping value dimensions (utilitarian, hedonic, and social) in a

unified framework. This study addresses these gaps by analyzing the role of omnichannel strategies in enhancing customer experience and examining their impact on shopping value—including utilitarian, hedonic, and social aspects—in the electronics sector. The novelty of this study lies in its sector-specific focus, its integration of multi-dimensional shopping value, and its contribution to a relatively underexplored area in omnichannel retailing research.

Omnichannel Strategies in Enhancing Customer Experience

The experience that customers acquire while interacting with a company through all of its integrated communication channels is known as the omnichannel customer experience (Lisnawati et. al., 2021). Omnichannel customer experience is viewed differently from traditional customer experience, and two factors—online and offline—are given particular weight when evaluating its effectiveness. In today's world, retailers must embrace technology to provide smooth, efficient, and all-encompassing customer experiences. Consequently, it becomes imperative to integrate the offline and online domains into a unified approach, offering retailers a substantial chance to enhance the client experience by delivering seamless transitions across channels, personalized interactions based on unified data, and flexible fulfillment options that improve convenience and satisfaction (Balbín et al., 2024). Compared to non-luxury shops, luxury retailers make greater investments in providing digital experiences through omnichannel methods. Perceived omnichannel customer experience refers to customers' assessments of their smooth interactions across all of a retailer's channels as they progress through different stages of the customer journey, based on several key dimensions (Rahman et al. 2022). The establishment of an omnichannel strategy to give clients a seamless experience is made possible by technological advancements. (Thaichon et al., 2023). distinguished between two categories of technologies in their study of technology-enabled omnichannel retailing: supportive and interactive. While supporting technologies assist retailers in facilitating essential omnichannel mechanisms, interactive technologies aim to enhance merchants' engagement with customers across both physical and digital channels.

Impact of Omnichannel Retailing on Shopping Value

The shopping value phenomenon has gained greater significance in the omnichannel environment, as this synchronized retail approach holds strong potential for capturing maximum value across customer touchpoints. Shopping value in an omnichannel context is typically conceptualized through three key dimensions: utilitarian, hedonic, and social shopping values (Ahmed & Syed, 2021). The contextual nature of shopping value means that experiences and perceptions derived from a shopping trip may vary based on the channel or touchpoint involved. For instance, hedonic value arises from multisensory, exciting, and enjoyable shopping experiences that provide entertainment and emotional satisfaction. (Widjaja et al. 2023) found that customers interacting with hedonic products or services—particularly through mobile and social apps—tend to process information in a more heuristic and less systematic manner, highlighting the importance of perceived enjoyment in such environments. From a utilitarian perspective, (Geng and Chang 2022) demonstrated that consumers' intention to continue using omnichannel services is significantly influenced by three utilitarian value dimensions: quality, cost savings, and convenience. Among these, convenience is identified as the primary driver of continued omnichannel usage. Their study also noted that customers with lower product involvement are more influenced by perceived quality than those with higher involvement. This highlights the importance of matching utilitarian features with the target audience's expectations. In terms of social shopping value, (Kang 2019) explored the behaviors of social-local-mobile (SoLoMo) consumers and found that their intentions to share product reviews were shaped by their omnichannel shopping intentions, which were themselves driven by the perceived value of showrooming and webrooming. Interestingly, while brand prestige-based fashion lifestyles negatively influenced the perceived value of these behaviors, information-based and practicality-based lifestyles had a positive effect, especially in the case of webrooming. However, personality-based fashion lifestyles did not significantly impact either showrooming or webrooming values. Collectively, these insights suggest that omnichannel retailing enhances shopping value through distinct pathways—cognitive and rational benefits for utilitarian

value, emotional engagement for hedonic value, and social interaction and identity expression for social value. Understanding these differentiated value dimensions can help retailers tailor experiences more effectively to diverse customer needs.

Suggestions

Omnichannel strategies significantly enhance customer experience in the electronics sector by ensuring seamless integration across online and offline channels. Unlike traditional retail, omnichannel retailing focuses on consistency, personalization, and convenience. Retailers leverage advanced technologies such as AI, CRM systems, and big data analytics to optimize customer interactions, inventory management, and personalized recommendations. Luxury retailers, in particular, invest heavily in digital experiences to create immersive shopping environments. Shopping value in omnichannel retailing consists of hedonic, utilitarian, and social dimensions. Hedonic value stems from engaging and interactive shopping experiences, while utilitarian value is driven by efficiency, cost savings, and convenience. Social shopping value emerges from peer interactions, product reviews, and social media engagement, influencing purchasing decisions. The ability to switch seamlessly between showrooming (viewing products in-store before purchasing online) and webrooming (gathering information online before buying in-store) highlights the dynamic nature of omnichannel shopping behavior. Retailers must continuously refine their strategies to meet evolving consumer expectations. Convenience remains a key driver, with synchronized product availability, smooth platform transitions, and reliable customer support being essential. Looking ahead, innovations such as AI-driven personalization, augmented reality (AR), and blockchain will further enhance omnichannel experiences, shaping the future of electronics retailing.

Research Gap

Although omnichannel retailing is gaining academic attention, its impact on customer experience and shopping value remains underexplored, with several research gaps still evident. Most existing studies have concentrated heavily on mature markets such as the United States and Western Europe (Asmare & Zewdie, 2022), with comparatively less attention paid to emerging economies where rapid digital adoption presents unique challenges and opportunities. Additionally, much of the current research is sector-specific (Salvietti,2022), focusing predominantly on areas like fashion and grocery retail, while other product categories and service-based industries remain underexplored in the context of omnichannel retailing.

Another key gap relates to the changing role of advanced technologies like artificial intelligence, blockchain, and augmented reality. While these innovations are reshaping customer journeys, their specific impact on perceived value dimensions (hedonic, utilitarian, and social) and customer satisfaction within an omnichannel context is still not fully understood (Pantano & Priporas, 2016). Furthermore, existing studies have tended to examine customer experience and shopping value separately, often overlooking the complex interrelationships between these constructs and how they vary across demographic groups and purchase situations.

Limitations of Current Research

One of the key limitations in the existing literature is its reliance on cross-sectional studies, which capture consumer perceptions at a specific point in time and thus restrict understanding of how customer expectations and behaviors evolve with technological advancements and changing market dynamics. Additionally, many studies depend heavily on self-reported data, which may be biased and fail to accurately represent actual consumer behavior across channels. There is also a lack of research incorporating internal organizational factors such as supply chain agility, employee engagement, and technological readiness, which are critical for delivering a seamless omnichannel experience but are often overlooked in customer-centric models. From a practical standpoint, implementing omnichannel strategies presents its own challenges, particularly in integrating data across multiple channels to create a unified customer view. Retailers often face technological silos, inconsistent data quality, and privacy concerns, all of which can hinder the effectiveness of omnichannel efforts. Furthermore, the financial and operational investments

required to develop and maintain a robust omnichannel infrastructure can be prohibitive, especially for small and medium-sized enterprises (SMEs) that may lack the necessary resources and capabilities.

Scope for Future Research

Future studies should adopt a more longitudinal approach to capture changes in consumer behavior over time, especially in the wake of technological shifts and evolving privacy concerns. Research should also expand to include emerging markets and diverse cultural contexts to provide a more comprehensive understanding of global omnichannel strategies. Moreover, integrating both customer and employee perspectives could offer richer insights into operational challenges and customer experience delivery. There is also an opportunity to explore the role of consumer trust, data privacy, and cybersecurity as critical factors influencing customer engagement in omnichannel environments. Finally, future research can benefit from experimental designs and behavioral tracking methods to validate findings and provide actionable insights for practitioners aiming to enhance both customer experience and shopping value in increasingly digital retail landscapes.

Conclusion

Omnichannel retailing has become a crucial approach for enhancing both customer experience and shopping value by integrating multiple touchpoints into a seamless and personalized journey. By utilizing cutting-edge technologies such as AI-driven personalization, big data analytics, and integrated CRM systems, retailers can deliver highly customized experiences that align with evolving consumer expectations. Furthermore, omnichannel approaches amplify utilitarian, hedonic, and social values, thereby enriching the overall shopping experience and fostering stronger customer engagement and loyalty. However, despite its advantages, omnichannel retailing is not without challenges. The current body of research predominantly focuses on developed markets and technologically advanced retail environments, leaving a gap in understanding the adoption and effectiveness of omnichannel strategies in emerging economies and across diverse cultural contexts. Moreover, while much attention has been given to customer satisfaction and purchase intention, there remains scope to explore long-term outcomes such as customer loyalty, re-purchase behavior, and the impact of post-purchase services in omnichannel settings. Future studies should explore the impact of emerging technologies such as augmented reality (AR), virtual reality (VR), and blockchain in enhancing omnichannel experiences. Additionally, more longitudinal studies are needed to understand how customer preferences and behaviors evolve over time in response to omnichannel initiatives. By addressing these gaps, future studies can offer deeper insights into optimizing omnichannel strategies for sustainable competitive advantage.

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REVIEW ARTICLE

Digital greenwashing and consumer skepticism: Trust, attitude, and sustainable consumption in the online marketplace

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Abstract: This review examines the relationships between digital greenwashing, consumer skepticism, trust, and sustainable consumption behavior, with a focus on the unique challenges and opportunities in the digital marketplace. Drawing on recent literature (2018–2025), it synthesizes evidence on consumer recognition of greenwashing, the dual role of skepticism, the impact of green marketing strategies, and the influence of contextual mediators and moderators. The review finds that while transparent and verifiable communication can strengthen trust and purchase intentions, repeated exposure to deceptive claims erodes credibility and may lead to "green fatigue." Effective countermeasures require both market-driven and regulatory interventions, including standardized certifications, ESG assurance frameworks, supply chain transparency, and public awareness campaigns. Research gaps are identified in areas such as digital-specific greenwashing mechanisms, cross-cultural comparisons, longitudinal effects, and intervention testing. The paper proposes a dual approach combining trust-building communication with systemic safeguards to limit greenwashing's prevalence and enhance consumer confidence, thereby aligning marketing practices with global sustainability goals.

Keywords: *Greenwashing, Sustainable consumption, Consumer skepticism, Trust, Green marketing, Digital marketing, Policy*

Introduction

In recent time, commercial organizations are getting inclined towards adopting pro-environmental behavior for addressing sustainable development goals and ecological issues (Sun et al., 2020). Redesigning in the production and marketing strategies are considered widely for a shift towards eco-friendlier version of the products/services which will help to create a balance among people, profit and the planet(Ara et al., 2019; Sun et al., 2020). For a cleaner industrial production and consumption, it is important to understand consumers' decision making with respect to organic items and their buying intention for sustainable products.

Recent consumer surveys pointed out that in 2022; global consumers have shifted more towards green products compared to the last five years. Now, almost 30% of the global consumers buy sustainable products significantly more often and 10 % of the surveyed consumers informed about adopting environmentally sustainable life-style (Tighe, 2023). This shift highlights the increasing relevance of green marketing strategies in engaging customers and capturing a larger share of the sustainability-conscious market.

Traditionally, green marketing strategies, most of the marketers focus on the 4Ps of traditional marketing strategies, i.e., product, place, price and promotion (Bokil & Sinha, 2021; Dangelico & Vocalelli, 2017).

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Green product is assumed to cause no harm to the environment and human health. The eco-friendlier processing of 'green product', limited chemical and less hazardous substance helped these products to be purchased by environment aware customers (Dangelico & Pontrandolfo, 2010). Along with the green product, green price is the premium price consumers are willing to pay for the eco-friendly features present in these products (Kaur et al., 2022). Green place provides the place for green product which include reduced inventory cost, enhanced service to customers and better inventory management (Bhalerao, 2015). The fourth one of the marketing mix is green promotion which plays an inevitable role in promoting the eco-friendly products (Kaur et al., 2022).

Beyond the 4Ps of marketing mix, other marketing strategies, such as green advertisement, green equity, brand loyalty and green brand innovativeness play critical role in modifying consumer behavior (Y. S. Chen et al., 2020; Lin et al., 2019; Pancić et al., 2023). Green advertisement helps in communicating sustainable nature and eco-friendliness of the brand to the consumers which eventually influence consumer attitude towards sustainable consumption (Nagar, 2013; Tan et al., 2022). In addition, green equity marketing strategies represents the benefit acquired by the brand due to its sustainable options and it enhances the perceived quality of the product and therefore increase customers' willingness to pay premium price for the product (Huang et al., 2014). On the other hand, green brand loyalty refers to the preference of consumers and their commitment towards eco-friendly product. Moreover, green brand innovativeness is the ability of the brand to addresses the environmental challenges (Pancić et al., 2023).

Green marketing technique reportedly increases consumers' sustainable consumption as well as it balances limited natural resources (Duong, 2022; Yu et al., 2019). Further, it helps the companies to be more environment friendly and more inclined towards waste reduction, higher recycling mechanism and developing of new technology (Ball & Kittler, 2019). It also helps to achieve sustainable goals and social responsibility by reducing environmental pressure and mitigating environmental problems (Geng et al., 2021; Sharma, 2021). Therefore, the companies have started to align their business models with green strategies and promise more environmental benefit to the customers (Sun et al., 2020). However, some companies could not achieve these promises and depict a greener outlook falsely (Rahman & Nguyen-Viet, 2022). Therefore, perceived greenwashing has become a threat in the trust of users regarding the products' quality and sustainability (Nygaard & Silkoset, 2022).

This review paper examines the literature on digital-era greenwashing and its relationship to consumer skepticism, trust, and sustainable consumption. It synthesizes research on how marketing strategies particularly in online and social media contexts can both promote and undermine sustainable consumption, and identifies the theoretical, empirical, and practical implications for marketers, policymakers, and researchers.

Conceptual Background

This section brings together the main ideas and theories related to sustainable consumption, green marketing, greenwashing in the digital age, and consumer skepticism and trust. It shows how digital marketing can influence both positive and negative consumer responses to sustainability concept.

Sustainable consumption in the digital age

The United Nations Environment Program (UNEP) defines sustainable consumption as the use of goods and services that meet basic needs and improve quality of life while minimizing the use of natural resources, toxic materials, and waste generation throughout the product life cycle (UNEP, 2021). The Organization for Economic Co-operation and Development (OECD) backed this definition by emphasizing that sustainable consumption must not compromise the needs of future generations (Strange & Bayley, 2008).

Drivers of sustainable consumption in the digital age include growing environmental awareness, with more people recognizing the impacts of climate change, biodiversity loss, and pollution on human and planetary health; socio-ethical concerns, which create demand for products that align with values such as social justice, fair labor, and ethical sourcing; and eco-literacy, or the ability to assess and understand environmental claims

and their consequences (Diego & Judith, 2024; Dwivedi et al., 2022; Hariram et al., 2023; Herrero et al., 2023; Shayan et al., 2022).

However, several barriers remain. Price sensitivity often discourages purchases, as sustainable products tend to be more expensive; convenience bias leads consumers to choose faster or easier but less sustainable options; and skepticism arises from doubts about the authenticity of sustainability claims, often fueled by previous experiences with greenwashing (Mabkhot, 2024; Sheikh et al., 2023; Wijekoon & Sabri, 2021). In today's digital marketplace, consumer decision-making is increasingly influenced by online reviews, social media influencers, targeted advertising, and AI-driven recommendations (Antczak, 2024). While these channels can support more informed purchasing, they also increase the risk of exposure to misleading or deceptive sustainability claims (Migkos et al., 2023).

Greenwashing and its digital variants

Greenwashing occurs when companies present false or misleading information about their environmental practices or the eco-friendliness of their products (Seberíni et al., 2024). The well-known TerraChoice framework outlines "Seven Sins" of greenwashing, such as vague claims, hidden trade-offs, or irrelevant environmental messaging (Nemes et al., 2022). In the digital age, these deceptive practices have taken on new forms that are harder to detect and spread more rapidly (Ayar, 2024). Examples include influencer misrepresentation, where paid endorsements promote products as sustainable without proof; the use of false or unverified eco-labels on e-commerce platforms; misleading visuals in social media ads that imply environmental benefits without evidence; and targeted green advertising, where algorithms push unsubstantiated claims to consumers identified as eco-conscious (Baltezarevic, 2023; Coman et al., 2025). These digital forms of greenwashing can damage trust not only in specific brands but also in sustainability marketing as a whole, making it harder for genuinely eco-friendly companies to stand out (Bateman & Jackson, 2024).

Consumer skepticism and trust

Consumer skepticism is the tendency to doubt the truthfulness of marketing claims and can act as a protective mechanism against deceptive messages (Khoirina et al., 2025). While moderate skepticism can encourage more critical thinking and informed decision-making, excessive skepticism can cause consumers to dismiss even legitimate sustainability claims (Urbański & Ul Haque, 2020). Trust, on the other hand, is the belief in the honesty, integrity, and reliability of a brand and it plays a key role in connecting marketing messages with sustainable purchasing behavior (Monfort et al., 2025). Without trust, even truly green products may fail to attract consumers (Handoyo, 2024). Three main theories help explain how skepticism and trust work in this context. Signaling theory suggests that credible sustainability claims act as costly signals that are difficult to fake, meaning false claims weaken their value (Vangeli et al., 2023). Attribution theory looks at whether consumers believe a company's environmental actions are motivated by genuine concern or profit-seeking (van Prooijen et al., 2021). The elaboration likelihood model (ELM) explains that people process marketing messages either through deep evaluation (central route) or through surface cues (peripheral route), with skepticism influencing which path they take (Kumar & Khanna, 2022).

Literature Review

Recognition and perception of digital greenwashing

Consumers differ in their ability to detect digital greenwashing. Fella & Bausa, (2024) found that people often fail to spot misleading claims unless prompted to think critically, but activating a "greenwashed product" mindset improves detection. Perceptions of greenwashing can also damage behavior: Sun & Shi, (2022) showed that it creates feelings of betrayal, reducing purchase intentions, especially among environmentally responsible consumers. Tu et al., (2024) found that clear communication, authentic engagement, and visible values reduce greenwashing perceptions and strengthen a brand's green image. On social media, Fang, (2024) reported that while perceived authenticity encourages purchases, skepticism

about greenwashing may not always stop consumers from acting on influencer-driven messages. Overall, recognition is shaped by awareness, communication strategies, and media context, with skepticism playing a mixed role in actual behavior.

Impact on consumer skepticism and trust

Green skepticism influences trust and purchase behavior in mixed ways. (Widjaja et al., 2024) found it can increase green purchase intentions when paired with trust and environmental concern, though price sensitivity reduces this effect. Other studies (Albayrak et al., 2011; Kreczmańska-Gigol & Gigol, 2022) show high skepticism often lowers perceived consumer effectiveness, concern, and willingness to pay for eco-friendly products, especially when caused by greenwashing. (Y. Zhang et al., 2025) note that post-purchase disclosure of credible green attributes can ease doubts and rebuild trust. Overall, skepticism can protect against false claims but, if persistent, undermines trust, making transparency vital for green brands.

Effects on sustainable consumption intentions

Green marketing, environmental attitudes, and consumption values strongly influence sustainable consumption intentions. Neiba & Singh, (2024) found that green advertising, word of mouth, eco-labeling, and product attributes significantly boost organic purchase intentions, especially when supported by emotional and functional value. Ogiemwonyi et al., (2023) reported that environmental attitude mediates the effects of awareness, concern, and responsibility on green purchase behavior, highlighting the role of positive attitudes in turning awareness into action. Chen et al., (2024) cautioned that strong green purchase intentions may lead to "compensatory consumption" if not reinforced by consistent pro-environmental behavior. Among younger consumers, Ali et al., (2023) showed that social media, eco-branding, and eco-labeling shape green consumption intentions and support a shift toward sustainable habits. Amin & Tarun, (2021) emphasized that emotional value and green trust are the strongest predictors of intention, while Nekmahmud et al., (2022) confirmed that environmental attitudes, knowledge, and perceived control significantly drive intentions across cultures. Together, these findings suggest that sustainable consumption intentions depend on credible marketing, emotional engagement, and sustained trust, supported by both individual values and social influences.

Moderating and mediating variables

Multiple studies show that green purchasing behavior is shaped by both mediating and moderating influences. Afridi et al., (2021) found that generative concern for future generations positively affects green purchasing, and this link strengthens when consumers have a strong man–nature orientation and high perceived behavioral control. Novela et al., (2025) identified environmental attitude as a key mediator between interpersonal influence, altruism, environmental knowledge, and green purchasing, particularly among younger consumers.

Other studies highlight contextual moderators. Jan et al., (2019) showed that government support and media exposure strengthen the impact of safety values on green buying attitudes. Naaman et al., (2025) found that perceived consumer effectiveness mediates the relationship between consumer spirituality and purchase intentions, with subjective norms acting as a moderator. Woo et al., (2025) demonstrated that retailer green investments can strengthen the intention–behavior link, while Wang et al., (2022) showed that green trust moderates the effect of green brand positioning and customer value on purchase intention.

In apparel consumption, Pandey & Yadav, (2023) found that consumer involvement mediates the relationship between attitude and intention, with generation (Z & Y) moderating the strength of this link. Overall, evidence suggests that personal values, attitudes, trust, institutional factors, and demographic characteristics all influence how green purchase intentions translate into sustainable consumption behavior.

Countermeasures and regulatory approaches

Addressing greenwashing requires a combination of regulatory, organizational, and behavioral strategies. Systematic reviews (Yusoff et al., 2023) emphasize that consumer behavior drivers such as motivation, perception, and environmental knowledge must be paired with stronger policy frameworks to guide sustainable purchasing. Supply chain research shows that greenwashing weakens integration with sustainability initiatives, but information sharing between partners can mitigate this effect and improve sustainability performance (Santos et al., 2024).

Evidence from procurement contexts indicates that even experienced managers struggle to distinguish false claims from certified products, underscoring the need for standardized certification systems and improved decision-making tools (Khan & Hinterhuber, 2025). Regulatory modeling in China suggests that a mix of incentives, penalties, and accountability mechanisms can deter both corporate greenwashing and collusion with third-party certifiers (Zhang et al., 2022).

From the consumer perspective, raising greenwashing awareness reduces confusion and increases the likelihood of choosing genuinely sustainable products Apostolopoulos et al., (2025). Globally, Mulenga et al., (2025) propose integrating behavioral economics with regulation to address industry-specific risks, while Sneideriene & Legenzova, (2025) stress the development of prevention tools and assurance standards for ESG disclosures to protect reporting credibility.

Together, these findings suggest that effective countermeasures involve not only legal enforcement but also clear communication, verified certifications, transparent supply chains, and consumer education to reduce susceptibility to misleading sustainability claims.

Synthesis and Discussion

The literature on digital greenwashing, consumer skepticism, trust, and sustainable consumption reveals a complex set of interactions between marketing strategies, consumer psychology, and regulatory environments. Three main themes emerge: the central role of trust, the dual nature of skepticism, and the importance of credible communication supported by systemic safeguards.

First, trust is the critical link between green marketing and sustainable consumption. Studies consistently show that verified claims through credible eco-labels, transparent supply chains, and post-purchase disclosures strengthen trust and increase purchase intentions (Tu et al., 2024; Y. Zhang et al., 2024). Conversely, perceptions of greenwashing quickly erode trust and can override prior positive brand associations (Sun & Shi, 2022). This dynamic is consistent with the Theory of Planned Behavior (Ajzen, 1991), where trust functions as a belief component shaping attitudes and perceived behavioral control.

Second, consumer skepticism acts both as a protective mechanism and a potential barrier. Moderate skepticism encourages deeper evaluation of sustainability claims, particularly important in digital contexts where information is abundant but uneven in quality (Widjaja et al., 2024). However, persistent skepticism caused by repeated exposure to greenwashing can lead to "green fatigue," reducing engagement even with authentic brands (Rana et al., 2025). This reflects Attribution Theory (Kelley, 1973) and the Elaboration Likelihood Model (Petty & Cacioppo, 1986), where skepticism influences the depth of message processing.

Third, communication quality and authenticity remain decisive. Clear, consistent, and values-driven messaging reduces perceptions of greenwashing, while influencer credibility and algorithm-driven targeting in digital spaces can amplify or undermine authenticity (Hossain et al., 2025). The literature indicates that adapting traditional green marketing to the transparency demands of online environments is vital for success.

Contextual moderators and mediators including generativity, environmental attitudes, consumer involvement, retailer green investments, and generational differences affect how intentions translate into behavior (Afridi et al., 2021; Novela et al., 2025; Pandey & Yadav, 2023). Mediators such as environmental attitude and perceived consumer effectiveness are especially important, suggesting that even strong

purchase intentions may not lead to behavior unless the right psychological and situational conditions are met (Naaman et al., 2025; Ogiemwonyi et al., 2023).

From a governance standpoint, the literature is clear: market forces alone cannot prevent digital greenwashing. Effective countermeasures require standardized certification systems, ESG assurance frameworks, stricter enforcement, and information-sharing within supply chains (Khan & Hinterhuber, 2025; Ogiemwonyi et al., 2023). Consumer education and awareness-building also emerge as essential tools to reduce susceptibility to deceptive claims (Apostolopoulos et al., 2025).

Despite these insights, several gaps remain in the current literature. Most studies still focus on traditional greenwashing, with limited investigation into digital-specific mechanisms such as influencer-driven marketing, platform algorithms, and user-generated reviews. There is also little understanding of the long-term effects of repeated exposure to greenwashing on trust, skepticism, and consumer behavior. Research is heavily concentrated in Asia and Europe, with minimal cross-cultural comparisons. Moreover, few studies empirically test which regulatory, certification, or communication interventions are most effective in countering digital greenwashing. While generational and value-based differences are recognized, there is limited exploration of how personality traits, environmental identity, or digital literacy influence vulnerability to deceptive green claims.

Overall, the literature suggests a dual approach building trust through transparent and verifiable communication while embedding systemic safeguards to reduce greenwashing's prevalence and impact. Addressing these gaps would help researchers and practitioners design interventions that are effective in specific contexts and scalable across diverse markets and cultures.

Practical and Policy Implications

The findings of this review highlight the need for marketers, policymakers, and regulators to adopt a dual strategy in addressing digital greenwashing. For practitioners, transparent and verifiable communication supported by credible eco-labels, third-party certifications, and post-purchase disclosures should be prioritized to build consumer trust and reduce harmful skepticism. Brands must adapt their green marketing to the digital environment by ensuring influencer credibility, consistent messaging, and active consumer engagement. For policymakers, standardizing certification systems, enforcing stricter penalties for false claims, and introducing ESG reporting assurance frameworks are essential to safeguard market integrity. Public awareness campaigns and consumer education programs can further equip individuals to identify misleading claims, creating a marketplace where authentic sustainability efforts are rewarded and deceptive practices are penalized.

Conclusion

This review has examined the interplay between digital greenwashing, consumer skepticism, trust, and sustainable consumption behavior, highlighting both the challenges and opportunities in fostering genuine sustainability in the marketplace. The evidence shows that while trust is a critical driver of green purchasing, it is highly vulnerable to erosion when consumers perceive deceptive claims. Skepticism can serve as both a safeguard and a barrier, depending on how it is shaped by communication quality, contextual factors, and repeated exposure to greenwashing.

The findings point to a dual approach for advancing sustainable consumption: building consumer confidence through transparent, verifiable, and value-driven communication, and embedding systemic safeguards through regulation, certification, and education to limit the prevalence of deceptive practices. Addressing the identified research gaps particularly in digital-specific mechanisms, cross-cultural contexts, and intervention testing will be vital for developing strategies that are both effective and scalable. Ultimately, reducing greenwashing and enhancing consumer trust are essential for aligning market practices with global sustainability goals.

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