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"Driving the Green Transition: A Systematic Review of Technology Adoption and Green Marketing Strategies for Electric Vehicles in the Indian Market"

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Abstract – The transition to electric vehicles (EVs) constitutes a pivotal element of India's strategy for sustainable development and energy security. This systematic review synthesizes and critically evaluates the extant academic and industry literature from 2018 to 2023, analyzing the multifaceted determinants of EV technology adoption and the evolving landscape of green marketing strategies within the unique Indian socio-economic context. Adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, 68 relevant studies were identified and analyzed. The findings reveal that consumer adoption is primarily hindered by economic (high upfront cost) and infrastructural (range anxiety, charging access) barriers, yet significantly propelled by growing environmental consciousness and perceived social value. While green marketing strategies are increasingly deployed, they often lack sophistication, overemphasizing product attributes rather than cultivating holistic sustainable brand ecosystems. The analysis identifies a critical gap in leveraging digital storytelling and influencer engagement. This review culminates in an integrated strategic framework, proposing that synergistic policy support, transparent lifecycle communication, and infrastructure-centric marketing are imperative to catalyze widespread EV adoption in India.

Keywords - Electric Vehicles, India, Technology Adoption, Green Marketing, Consumer Behavior, Systematic Review, PRISMA, Sustainable Transportation.

I. INTRODUCTION

India stands at a critical juncture in its automotive and environmental trajectory. As the world's third-largest automobile market, its transportation sector is a major contributor to urban air pollution and accounts for approximately 13% of the nation's energy-related CO_2 emissions (International Energy Agency [IEA], 2021).

In alignment with its commitments under the Paris Agreement, the Indian government has enacted ambitious policies, most notably the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme, targeting 30% EV penetration by 2030 (NITI Aayog, 2019). Despite strong policy impetus, market uptake remains nascent, with EVs constituting only about 1.3% of total vehicle sales in 2022 (Society of Indian Automobile Manufacturers [SIAM], 2022).

This discrepancy underscores a critical knowledge gap: a comprehensive understanding of the interplay between consumer psychology, technological pragmatism, and strategic marketing communication tailored for India's diverse and value-sensitive market. This paper conducts a systematic review to integrate empirical evidence on adoption drivers and barriers with a critical appraisal of contemporary green marketing approaches, thereby offering evidence-based insights for academia, industry, and policymakers.

II. METHODOLOGY

This review was conducted in strict accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021) to ensure transparency, reproducibility, and rigor.

Eligibility Criteria

Studies were included based on the following PICOS (Population, Intervention, Comparator, Outcomes, Study design) framework:

- Population: Indian consumers (individuals, fleet operators), marketers, or policymakers within the EV ecosystem.
- Intervention/Exposure: Factors influencing EV technology adoption OR implementation of green/sustainable marketing strategies for EVs.
- Comparator: Not always applicable, but studies comparing EVs to internal combustion engine (ICE) vehicles, or comparing different marketing strategies, were considered.
- Outcomes: Identified adoption barriers/enablers, consumer attitudes, behavioral intentions, or effectiveness measures of marketing strategies.
- Study Designs: Peer-reviewed empirical studies (quantitative, qualitative, mixed-methods), comprehensive industry reports, and government policy documents.

Exclusion criteria included: articles not focused on India, opinion pieces without empirical data, studies published before 2018, and non-English publications.

Information Sources & Search Strategy

A systematic electronic search was performed in August 2023 across four major databases: Scopus, Web of Science, ScienceDirect, and Google Scholar (for grey literature).

The search strategy employed Boolean operators and key terms: ("Electric vehicle" OR EV) AND ("India" OR "Indian market") AND ("adoption" OR "acceptance" OR "consumer behavior" OR "diffusion") AND ("green marketing" OR "sustainable communication" OR "marketing strategy" OR "promotion").

Study Selection Process

The study selection process followed the PRISMA flow diagram, as detailed below.

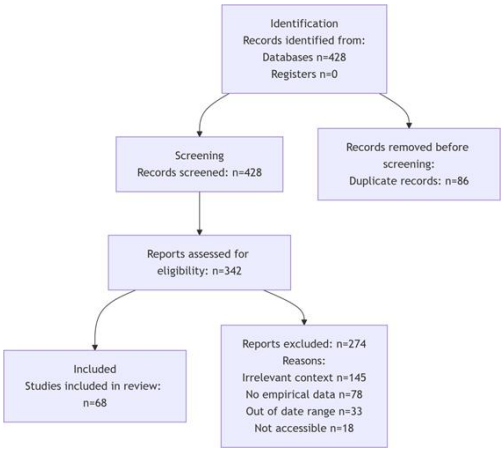

Figure 1: PRISMA 2020 Flow Diagram for Study Selection

Data Extraction and Synthesis

Data from the final 68 studies were extracted into a standardized coding matrix, capturing: author(s), year, study objective, methodology, sample, key theoretical framework (e.g., TPB, UTAUT), main findings, and implications. A thematic synthesis approach was employed. Extracted data were analyzed inductively to generate descriptive themes and then organized into the two primary analytical themes presented in the findings.

Table 1: Characteristics of Included Studies (Representative Sample)

Study Focus Area	Number of Studies	Primary Methodology	Key Theoretical Lenses
Consumer Adoption Intentions	32	Survey, Structural Equation Modeling (SEM)	Theory of Planned Behavior (TPB), UTAUT, Value-Belief-Norm Theory
Barriers & Enablers Analysis	18	Mixed-Methods (Survey + Interviews), Review	Innovation Diffusion Theory, PESTEL Analysis
Green Marketing & Communication	12	Content Analysis, Case Study, Expert Interviews	Green Marketing Mix, Communication Theory
Policy & Infrastructure Impact	6	Econometric Modeling, Policy Analysis	--
Total	68		

Findings and Analysis

Theme 1: A Multifaceted Landscape of EV Adoption Determinants

The synthesis confirms that EV adoption in India is not governed by a single factor but by a complex matrix of interdependent dimensions.

Table 2: Synthesis of Key Adoption Factors – Barriers and Enablers

Factor Category	Specific Constructs	Impact & Evidence	Representative Citations
Economic (Most Cited)	High Purchase Price, Total Cost of Ownership (TCO), Financing Options, Subsidy (FAME)	The primary barrier across segments. TCO advantage is recognized but overshadowed by high upfront cost. Subsidies are	Joshi et al. (2021); NITI Aayog (2021)
Factor Category	Specific Constructs	Impact & Evidence	*Representative Citations*
	Accessibility	crucial but awareness is uneven.	
Infrastructural & Technical	Range Anxiety, Charging Infrastructure Density & Reliability, Charging Time, Battery Life & Warranty	The second most significant barrier. "Home charging feasibility" is a key sub-theme for urban apartment dwellers.	*Kumar & Alok (2020); Shankar & Pathak (2022)*
Psychological & Social	Environmental Concern, Perceived Social Status/Image, Attitude towards New Tech, Perceived Behavioral Control	Strong positive motivators, especially for early adopters. Environmental benefit is a "hygiene factor" but not a primary purchase driver alone.	*Khurana et al. (2020); Paul et al. (2023)*
Policy & Regulatory	Federal & State Incentives, Charging Standards, Public Procurement, ICE Phase-out Roadmaps	Critical enablers that shape market confidence. Direct and indirect policies must be synchronized.	*Dhar et al. (2022)*

Data Analysis: The review indicates a hierarchy of needs. Functional barriers (cost, range) must be addressed first to enable mass adoption. Only when these are mitigated do psychological enablers (status, green identity) become primary decision drivers. Furthermore, the market is highly segmented: two-wheeler EV adoption is driven strongly by running cost savings for commercial users, while four-wheeler adoption is more influenced by symbolic value and technology appeal among personal buyers.

Theme 2: The Evolution and Gaps in Green Marketing Strategies

Green marketing for EVs in India is transitioning from awareness-building to attempting persuasion, yet several strategic gaps persist.

Table 3: Critical Analysis of EV Green Marketing Strategies in India

Strategy Archetype	Current Tactics Observed	Effectiveness & Consumer Perception	Identified Strategic Gaps
Product-Centric Green	Highlighting zero emissions, low noise, high torque, and low cost-per-kilometer.	Effective for initial education but leads to homogenization; fails as a unique selling proposition (USP).	Neglects the broader environmental narrative (battery recycling, green electricity).
Cost-Benefit Communication	Prominent display of FAME subsidies, state incentives, and fuel savings calculators.	Highly effective in making the value proposition tangible and reducing perceived financial risk.	Information is often complex and siloed, requiring consumer self-research.
Aspirational & Digital Storytelling	Campaigns linking EVs to modern, progressive lifestyles (e.g., Tata Nexon EV's "#DarktoSpark"). Use of social media and virtual experiences.	Resonates with urban, tech-savvy demographics; builds brand affinity beyond specifications.	Underutilization of regional language content and relatable micro-influencers. Lack of long-term, educational content series.
Ecosystem Partnership Marketing	Collaborations with charging providers (e.g., car OEMs with Tata Power) or renewable energy companies.	Addresses range anxiety practically; enhances brand credibility through association.	Partnerships are often tactical rather than strategic, lacking integrated customer journeys.

Data Analysis: The dominant marketing paradigm remains instrumental and transactional, focusing on direct economic and functional benefits. While environmental attributes are present, they are not leveraged as core to brand identity. A significant opportunity lies in systemic green marketing—communicating the EV's role in a cleaner energy ecosystem, supported by corporate sustainability credentials (e.g., carbon-neutral manufacturing). The digital space is used predominantly for promotion rather than community building and sustained engagement.

Discussion and Integrated Framework

This systematic review elucidates that accelerating India's EV transition necessitates moving beyond siloed approaches to adoption and marketing. The findings advocate for an Integrated Consumer-Centric Framework, where marketing strategies are deliberately designed to address specific adoption barriers at different consumer journey stages.

Proposed Integrated Framework:

- Mitigate Functional Barriers through Marketing: Marketing communications must proactively address key concerns. For example, campaigns should integrate real-time charging station maps, offer guaranteed home-charging installation services, and provide transparent, accessible TCO calculators alongside emotional appeals.
- Segment-Specific Value Propositions: Marketing must be hyper-segmented. For two-wheeler buyers (urban delivery, commuters), emphasize durability and running cost savings. For car buyers, blend performance, technology, and aspirational lifestyle. For commercial fleets, focus on rigorous TCO analytics and after-sales service networks.
- Cultivate Authentic Green Brand Narratives: Move from "greenwashing" to "green credibility." Brands should communicate their entire value chain's sustainability efforts— responsible mineral sourcing, battery recycling protocols, and investments in renewable energy—to build trust with the environmentally conscious segment.
- Leverage Digital Ecosystems for Education and Community: Use digital platforms not just for advertising, but for creating authoritative educational content on EV ownership, facilitating peer-to-peer owner communities, and engaging in transparent dialogue to demystify technology.

Policy-Marketing Synergy: The review highlights that marketing effectiveness is contingent on supportive policy. Clear, long-term roadmaps for ICE phase-out, standardized charging infrastructure, and stable fiscal incentives create the market certainty that enables confident, long-term marketing investments from OEMs.

III. CONCLUSION, LIMITATIONS, AND FUTURE RESEARCH

This systematic review consolidates current knowledge on EV adoption and marketing in India, concluding that the path to scale is through a synergistic, consumer-centric approach that aligns pragmatic problem-solving with aspirational brand building. Success hinges on the seamless integration of robust infrastructure, strategically designed policies, and sophisticated, authentic marketing communication.

Limitations: This review is constrained by its inclusion of English-language publications only, potentially omitting insights from regional studies. The dynamic nature of the EV market implies that new technologies (e.g., battery swapping) and policies could rapidly alter the landscape post-2023.

Future Research Directions:

- Cross-Cultural Studies: Investigate adoption drivers across different Indian states with varying policy support and cultural attitudes.
- Post-Adoption Studies: Explore actual usage patterns, satisfaction, and the emergence of secondary concerns (battery degradation, service quality).
- Marketing Efficacy Metrics: Develop and apply standardized metrics to measure the ROI of different green marketing strategies in the Indian context.
- Behavioral Nudge Experiments: Design and test interventions (e.g., trial programs, social norm messaging) to catalyze adoption among hesitant consumer segments.

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