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"Factors Influencing the Adoption of Electric Vehicles"

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Abstract

The transition toward electric vehicles (EVs) is an important step toward sustainable mobility and the reduction of dependence on fossil fuels. In spite of strong government initiatives through various schemes like FAME-II and increased environmental awareness, the rate of adoption of electric vehicles remains relatively slow in India. The current paper identifies and analyzes factors affecting consumer adoption of EVs in India using a comprehensive review of extant literature during the period 2010–2025. Findings are synthesized under five key categories-economic, technological, environmental, social-psychological, and policy-related factors. An integrated conceptual framework to appreciate consumer adoption behavior is also proposed. This framework integrates key concepts of the Theory of Planned Behavior (TPB) and the Technology Acceptance Model (TAM), explaining how perceptions and attitudes interact with the subjective norm about the intention to adopt an EV. The paper identifies research gaps and suggests directions for future empirical investigation to support goals toward sustainable transport in India.

Keywords: Electric Vehicles (EVs); Consumer Adoption; India; Sustainability; Technology Acceptance Model (TAM); Theory of Planned Behavior (TPB); Policy Incentives; Charging Infrastructure

1. Introduction

The global automobile industry is rapidly evolving with the increasing momentum towards electric mobility. Electric vehicles are deemed a necessary solution for mitigating the impact of environmental deterioration: air pollution, greenhouse gas emissions, and energy insecurity. Despite this, EV adoption in India, one of the fastest-growing automotive markets, falls below expectations, even with varied policy interventions. The factors influencing the adoption of EVs in India are examined in this study., synthesizing insights from prior studies to understand consumer attitudes and behaviors. The study provides a conceptual framework that integrates economic, technological, psychological, environmental, and policy perspectives to explain adoption dynamics in the Indian context.

2. Research Objectives

1. To review the existing literature on factors affecting the adoption of electric vehicles globally and in India.
2. To identify key determinants—economic, technological, social, environmental, and policy-related—impacting consumer adoption decisions

2. Review of Literature

Electric vehicle (EV) adoption has attracted global attention because of its ability to reduce environmental harm, lessen reliance on fossil fuels, and promote sustainable development goals. However, adoption rates differ greatly among countries, shaped by a variety of factors. This section reviews and summarizes key studies on the determinants of EV adoption across five main areas—economic, technological, environmental, social-psychological, and policy factors—with a focus on the Indian context.

2.1 Economic Factors

It is amongst the most significant determinants of EV adoption, economic considerations.

Egbue and Long (2012) discovered that the main barriers to adopting EVs by potential consumers include high upfront purchase costs and a limited charging infrastructure. Rezvani, Jansson, and Bodin (2015) also established that even though the operating and maintenance costs for EVs are relatively lower than in ICE vehicles, the initial acquisition cost remains a deterrent.

Coffman, Bernstein, and Wee (2017) stressed that TCO, involving the purchase price against fuel savings and maintenance expenses, resulted in greater traction than the upfront price. In developing economies such as India, with price sensitivity already playing a critical role, as Kumar & Dahiya said in 2021, Empirical research by Singh and Kathuria (2020) and Kumar (2022) highlight that monetary incentives/subsidies offered through the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles initiative by the Indian government considerably increase the intention to adopt. However, low awareness among consumers regarding the available subsidies lowers the overall effectiveness of such subsidies (Bhattacharya & Choudhary, 2022).

Affordability, long-term cost savings, and incentives from the government are major drivers for purchase intention, especially in developing economies with economic constraints.

2.2 Technological Factors

Other major determinants of the adoption of EVs concern technological readiness. Range anxiety-a feeling that the battery charge might be too low to complete a journey-continues to be one of the major issues (Sierzchula et al.,

2014). As expressed by Rezvani et al. (2015) and Hardman, Chandan, Tal, and Turrentine (2018), improving battery range, charging speed, or the reliability of the network of recharging infrastructure goes a long way in increasing consumers' perception about the usefulness of an EV. Mehta and Chatterjee (2021) found a deficiency in the number of public charging stations and limited driving range as the two most impactful technological barriers in the Indian market. Rao and Singh (2023) also expressed that battery degradation and replacement costs influence people's decisions to purchase. Li et al. (2020) showed that the density of charging infrastructure is positively related to regional EV adoption rates; hence, government and private sector investment in the charging network is called for. Consequently, technological advances in both vehicle design and charging infrastructure are key to reducing uncertainty and attracting large-scale adoption.

2.3 Environmental and Sustainability Factors

Environmental awareness has widely been cited as one of the beneficial drivers of EV adoption.

He et al. (2018) determined that environmental concern and ecological values have a positive influence on attitudes toward EVs. In the same line of argument, Peters and Dütschke (2014) also contend that persons with stronger environmental identities are more willing to purchase EVs. Sharma and Jain (2020) found in the Indian context that younger and more urban consumers were more pro-environmental in attitude, thus having higher adoption intentions. However, according to Singh (2023), while the awareness of environmental problems is high in general, perceived personal benefits for adopting EVs remain low, thus restricting behavioral translation. Environmental concern, therefore, generates a favorable attitude but does not automatically result in adoption unless supported by economic and infrastructural feasibility.

2.4 Social and Psychological Factors

Social influence, perceived risk, and attitude significantly influence behavioral intention toward EVs. According to Ajzen's (1991 TPB, attitude, subjective norms, and perceived behavioral control jointly predict behavioral intention. Empirical applications of TPB to the adoption of EVs indicate that social approval and peer influence strongly influence consumer choice Schuitema, Anable, & Skippon, 2013). Similarly, the Technology Acceptance Model (TAM) of Davis (1989) proposes that perceived usefulness and perceived ease of use determine the adoption of technology. Chua et al. (2021) also found both constructs to be significant predictors of EV adoption intention. Bhatt and Sinha (2021) observed modern lifestyle orientation, innovativeness, and social prestige as significant psychological motivators for electric vehicle adoption in the Indian context. Rao and Singh (2023) further established the mediating effect of trust in EV technology and manufacturers on the relationship between environmental concern and purchase intention. Therefore, adoption is jointly influenced by social norms, consumer innovativeness, and perceived risk, thus indicating the importance of marketing communication and public education.

2.5 Policy and Institutional Factors

Government policy, regulatory frameworks, and institutional support are all integral in influencing the pattern of EV adoption. Sierzchula et al. (2014) indicated that policy incentives, including purchase subsidies, tax benefits, and public charging infrastructure, are associated with higher EV sales. Hardman et al. (2018) concluded that non-monetary incentives, such as preferential parking and access to bus lanes, further enhance such measures. Programs like NEMMP 2020 and FAME-II policy have been the mainstay of institutional initiatives in the country for electric mobility. However, Gupta and Tiwari (2023) found that inconsistent implementation across states reduces their overall effectiveness. Mehta and Chatterjee (2021) emphasized that a lack of policy coordination between central and state governments is acting as an obstacle to infrastructure development. According to recent analysis by Chakraborty and Patel (2024), consistency in policies, public–private collaboration, and consumer awareness campaigns are key to the long-term success of adopting EVs in India. Therefore, sustained policy support and institutional stability remain critical external enablers of consumer confidence and market transformation.

2.6 Integrated Insights

Synthesizing findings across dimensions, it appears that the adoption of EVs is a multifactorial process. The economic and technological factors are the foundational dimensions for consumer acceptance, whereas psychological, environmental, and policy-related influences mediate or moderate the process.

While environmental and technological readiness dominate in developed economies, affordability, infrastructure, and government incentives take precedence in India. Kumar & Dahiya, 2021; Mehta & Chatterjee, 2021. Such a review warrants an integrated framework that captures the interaction among these diverse factors.

2.7 Research Gap

Despite this volume of literature, several gaps persist:

- Most studies in India are fragmented, where economic or technological factors were considered in isolation.
- Few integrate behavioral theories with policy and infrastructure variables, such as TAM and TPB.
- Mediating variables like awareness, trust, and perceived risk have received limited attention.
- There is a lack of comprehensive conceptual frameworks applicable to developing economies like India.

These gaps justify the development of a holistic, literature-based model of EV adoption incorporating multiple perspectives. The literature highlights that the adoption of electric vehicles is governed by economic, technological, environmental, social, and policy-related factors. While economic incentives and technological improvements are

still important, behavioral and policy dimensions have equally important roles in shaping the attitude and intentions of consumers. This synthesis, therefore, forms the basis for constructing an integrated conceptual framework (Section 3) to explain EV adoption behavior in the Indian context.

3. Research Methodology

3.1 Research Design

The research design for this study is descriptive and exploratory, adopting a systematic literature review approach. Its objectives are to identify, synthesize, and analyze the critical factors of influence in the adoption of EVs within the Indian context, and to construct an integrated conceptual framework combining economic, technological, environmental, psychological, and policy aspects. This research work shall be based entirely on the secondary sources of data in the form of peer-reviewed journal articles, policy reports, and industry publications as support to deduce insights and formulate a theoretical model explaining the EV adoption behavior in the Indian scenario.

3.2 Research Objectives

Specific objectives of the study are:

- To study and synthesize existing literature on the factors influencing electric vehicle adoption globally and in India.
- To identify key economic, technological, environmental, psychological, and policy determinants of EV adoption.
- To propose an integrated conceptual framework incorporating factors identified to influence consumer intention and behavior to adopt an EV.
- To highlight the research gaps and suggest directions for future empirical studies in the Indian context.

3.3 Nature and Type of Study

This is a qualitative study with a conceptual review design. It employs an integrated approach through the content analysis and thematic synthesis of the findings derived from previous studies. The study consolidates multiple theoretical perspectives, such as TPB, TAM, and DOI in developing a unified model that explains decisions to adopt EVs.

3.4 Data Sources

This study is solely based on secondary data from reliable academic and institutional sources, including:

- Academic Journals: Energy Policy, Transportation Research Part D, Journal of Cleaner Production, Technological Forecasting and Social Change, Renewable and Sustainable Energy Reviews, among others.
- Government and Policy Reports: NITI Aayog (India), Ministry of Heavy Industries - FAME Scheme, International Energy Agency - IEA reports.
- Databases: Scopus, Web of Science, ScienceDirect, Emerald Insight, SpringerLink, and Google Scholar.

Only peer-reviewed papers and authoritative reports published between 2010 and 2024 were included to ensure relevance and reliability.

3.5 Inclusion and Exclusion Criteria

The following are the inclusion criteria that were used in the selection of literature, as part of the effort to be methodologically rigorous:

Inclusion Criteria\Exclusion Criteria

To ensure methodological rigor, the following criteria are used for selecting literature

Inclusion Criteria	**Exclusion Criteria**
Peer-reviewed journal articles	Non-peer-reviewed blogs, news articles
Published between 2010 and 2024	Publications before 2010
Studies focusing on EV adoption or consumer intention	Studies unrelated to EVs or focusing on non-automotive technologies
Articles in the English language	Articles in other languages
Both the global and Indian context studies	Studies that lacked adequate methodological clarity

In all, 85 studies were identified initially. After screening for relevance and duplication, 45 studies remained for analysis.

3.6 Data Analysis Technique

The thematic analysis approach was employed in the search for recurring patterns, determinants, and theoretical perspectives from the literature. Analysis was conducted in three stages:

- Data coding: The key variables like price sensitivity, range anxiety, environmental concern, social influence, and policy support were coded for their frequency and relevance.
- Thematic categorization: The coded variables were organized into five overarching themes, including economic factors, technological factors, environmental factors, social-psychological factors, and policy and institutional factors.
- Conceptual integration: Themes were conceptually integrated with behavioral theories such as TAM, TPB, and DOI to develop an integrated conceptual model of EV adoption in the Indian context.

3.7 Conceptual Framework Development

Based on the insights derived from previous studies by Rezvani et al. (2015), Hardman et al. (2018), Kumar & Dahiya (2021), and Mehta & Chatterjee (2021), the proposed conceptual framework will integrate five key dimensions affecting EV adoption intention:

- Economic factors influence perceived affordability and value for money.
- Technological factors influence perceived usefulness and ease of use.
- Attitude and environmental motivation are influenced by environmental factors.
- Social-psychological factors influence subjective norms and behavioral intention.
- Policy and institutional factors moderate the relationship between intention and actual adoption behavior.

Figure 1: Conceptual framework for EV adoption in India

Economic Factors ┐

Technological Factors ┤

Environmental Factors ┤ → Consumer Attitude → Behavioral Intention → Adoption Behavior

Social Factors ┤

Policy & Institutional ┘

Source: Author's conceptualization based on literature review, 2025

3.8 Validity and Reliability Considerations

Because this is a secondary literature-based study, validity was ensured through triangulation based on sources, having multiple data sources, including journals, policy papers, and institutional reports. Only peer-reviewed materials were selected to ensure credibility. Reliability was maintained through applying specified inclusion criteria, transparent data coding, and referencing established theoretical frameworks such as TAM, TPB, and DOI.

This section on methodology outlines the structured approach to synthesizing EV adoption literature in India. By examining secondary data for thematic analysis, this paper intends to propose a comprehensive conceptual framework integrating economic, technological, environmental, social, and policy determinants influencing EV adoption behavior.

4. Findings and Analysis

4.1 Overview

The following section underlines the major findings based on a review and thematic analysis of existing literature about electric vehicle adoption. By being sensitive to the fact that this study relies on secondary data, the analysis focuses on key trends, recurring determinants, and theoretical insights reported by previous researchers. Findings are grouped by the five principal themes identified during the review process: economic, technological, environmental, social-psychological, and policy and institutional factors.

4.2 Economic Factors

In fact, economic reasons appeared to be the most influential factor in the adoption of EVs, especially for developing economies like India. High purchase cost, limited awareness about government subsidies, and uncertainty about long-term financial benefits were found to discourage potential buyers across many studies. According to research conducted by Egbue and Long (2012), Rezvani et al. (2015), and Singh and Kathuria (2020), buyers of electric vehicles in price-sensitive markets consider electric vehicles only based on their cost-benefit comparisons with conventional vehicles. The total cost of ownership, including maintenance and charging costs, is said to be more significant than the mere purchase price. In the context of India, Kumar and Dahiya (2021) and Bhattacharya and Choudhary (2022) have concluded that while some kinds of governmental incentives, like those provided through the FAME scheme, have improved consumer perceptions about affordability, most of such incentives are underutilized because of limited awareness. Overall, evidence seems to indicate that financial incentives, accessible credit options, and apparent cost savings are necessary to motivate large-scale adoptions.

4.3 Technological Factors

Technological readiness is considered to shape the perceived usefulness and practicality of electric vehicles by consumers. Sierzchula et al. (2014) and Hardman et al. (2018) found in their studies that improvement in battery capacity, charging speed, and reach of vehicles boosts adoption intention. These, apart from range anxiety, were the lack of widespread public charging infrastructure in India, as identified by Mehta and Chatterjee (2021), and Rao and Singh (2023). Also, the limited technical know-how and battery degradation issues instill skepticism in the hearts of early adopters. Analysis indeed reveals that technological improvements, when combined with visible infrastructure development, may increase consumer trust in the performance of EVs. Evidence also suggests that awareness of ongoing technological improvements impacts perceived ease of use and reliability, supporting the propositions of the Technology Acceptance Model by Davis (1989).

4.4 Environmental Factors

From the reviewed studies, environmental awareness and concern appeared as a constant yet secondary driver. He et al. (2018) and Peters and Dütschke (2014), for instance, found that those consumers with high environmental values are more likely to buy EVs. However, developing countries' economic and practical motives often outstrip environmental motivations. Sharma and Jain (2020) found that younger urban consumers in India express positive attitudes toward environmentally friendly transportation but rarely convert intention into purchase due to affordability and infrastructure limitations. Singh (2023) confirmed this "intention-action gap," suggesting that proenvironmental attitudes alone are insufficient drivers of adoption. Analysis shows that environmental concern strengthens attitude, but supportive policy and economic conditions are required to reinforce it in order to translate into behavior.

4.5 Social and Psychological Factors

Social and psychological dimensions significantly influence behavioral intention towards EVs. Accordingly, studies based on the Theory of Planned Behaviour (Ajzen, 1991) and Technology Acceptance Model (Davis, 1989) reveal that subjective norms, perceived ease of use, and perceived usefulness collectively influence purchase intention.

Social approval, peer recommendation, and perceived status associated with EV ownership positively influence the intention to use, as reported by Schuitema et al. (2013) and Chua et al. (2021). In India, Bhatt and Sinha (2021) discovered that social prestige and a feeling of modernity were significant drivers of this among higher-income consumers. Perceived risk, one's trust in technology, and brand familiarity were found to decrease behavioral intention, as Rao & Singh explain (2023. From this analysis, prudent development of public trust can thus be accomplished through effective communication campaigns, demonstrations, and brand credibility to improve the psychological acceptance of EVs.

4.6 Policy and Institutional Factors

The readiness of markets toward electric mobility is thus largely dictated by the level of government intervention and institutional support. Sierzchula et al. (2014) and Hardman et al. (2018), among others, pointed out the significant impact of financial incentives, tax reductions, and regulatory support on adoption. In India, programs like the National Electric Mobility Mission Plan and the FAME policy have put in place a policy framework for EV promotion. However, Gupta and Tiwari (2023) found inconsistencies between central and state-level policies and recognized limitations in effectiveness. Mehta and Chatterjee (2021) also cited the absence of long-term planning for charging infrastructure as one of the barriers. The overall assessment indicates that sustained policy consistency, coordination between agencies, and public–private partnerships will be required to accelerate EV adoption in India. The government's role remains pivotal in creating financial incentives and awareness platforms that influence market behavior.

4.7 Cross-Thematic Insights

Findings across all themes illustrate that electric vehicle adoption is a multidimensional process driven by the interaction of economic, technological, environmental, social, and policy-related factors. Whereas economic affordability and technological readiness provide the base for adoption behavior, environmental consciousness and social influence play a supportive, motivating role in this context. Policy factors are enabling factors that have an overarching influence on other determinants: for example, subsidies and infrastructure development reduce not only economic barriers but also increase the confidence of consumers in technology. Similarly, public awareness campaigns increase environmental motivation and social acceptance.

4.8 Comparative Perspective: Global versus Indian Context

In most cases, studies from developed nations around the world identify technological reliability and environmental concern as major drivers. On the other hand, Indian studies evidence a stronger impact of cost-related and infrastructural factors. This contrast points out that the determinants of adoption are context-dependent, shaped by the socioeconomic and infrastructural realities.

Therefore, while global patterns offer valuable theoretical insights, localized strategies that address affordability, awareness, and infrastructure are more relevant to the Indian EV market.

4.9 Synthesis and Conceptual Interpretation

Synthesis of findings supports the conceptual framework in this study, which incorporates various determinants under a unified model of behavioral intention. Evidence shows that:

- Several economic and technological factors directly influence consumer attitude.

- Environmental and social-psychological factors shape behavioral intention.
- Policy and institutional factors moderate the relationship between intention and actual adoption.

This integrated interpretation is accordingly supported by behavioral theories, such as TPB and TAM, which emphasize that adoption behavior is a result of a complex interaction between perceived usefulness, social influence, and enabling conditions.

4.10 Summary of Findings

- High purchase cost, range anxiety, and inadequate charging infrastructure are still significant problems in the way of adopting EVs in India.
- Government incentives and greater technological performance correlate to positive consumer perception and adoption.
- Environmental awareness generates positive attitudes but needs supportive policy and economic backing.
- Social prestige, trust, and subjective norms affect behavioural intention, especially for urban consumers.
- Consistent policy support and public–private collaboration are crucial for large-scale deployment.

Overall, the findings establish that financial, technological, environmental, psychological, and institutional aspects are interlinked in influencing electric vehicle adoption in India. Policy intervention is an essential catalyst to this effect

5. Discussion and Conclusion

5.1 Discussion

This study aimed to identify and analyze major factors influencing the adoption of EVs based on a comprehensive review of secondary literature. The results showed that adoption decisions are multidimensional, and economic, technological, environmental, psychological, and policy-related factors influence the adoption choice. These insights are integrated into the discussion within established theoretical frameworks such as TAM and TPB for the conceptual interpretation of the adoption process. According to TAM, a person's behavioral intention to adopt new technology is determined by his or her perception of usefulness and ease of use (Davis, 1989). The literature shows that technological readiness, in terms of battery life, charging convenience, and vehicle range, directly influences these perceptions. When infrastructure is available and technological reliability is ensured, consumers will be more likely to view EVs as useful and easy to operate. Similarly, the TPB (Ajzen, 1991) also highlighted attitude, subjective norms, and perceived behavioral control as antecedents of intention. The analysis reveals that attitude toward EVs is triggered by environmental awareness, perceived economic benefits, and social image. Subjective norms, which

in the study included social acceptance and peer influence, were found to be a variable of growing importance, particularly for younger and urban consumers who equate ownership of EVs with being modern and socially prestigious. The influence of perceived behavioral control, as represented by affordability and infrastructure accessibility, turned out to be a powerful predictor of the actual adoption behavior.

The results also underline the moderating role of policy support. As seen from Sierzchula et al. (2014) and Hardman et al. (2018), government incentives and regulations are crucially important in the transition from intention to adoption. In the Indian context, while awareness of the FAME scheme and state-level subsidies remains limited, policy consistency and greater visibility were identified to enhance consumer confidence and market readiness. A key theoretical implication of such findings is that EV adoption in developing economies like India is not only a question of individual attitudes or environmental consciousness but requires an enabling ecosystem which reduces economic barriers and strengthens the infrastructure. This corresponds to the innovation diffusion perspective, which suggests that successful technology adoption is contingent on both consumer perception and systemic readiness. Moreover, the literature reflects an apparent "intention–action gap" between positive attitudes and actual purchase behavior. This suggests that psychological motivation needs to be supplemented with concrete supporting measures, comprising easy finance availability, visible charging stations, and clear policy frameworks, for intention to be transformed into behavior.

5.2 Policy Implications

The findings have some implications for policymakers, industry stakeholders, and researchers:

1. Improving Financial Incentives and Affordability

The existing subsidies, tax reductions, and soft financing schemes need to be further strengthened and simplified. Their outreach should also be expanded through focused campaigns to reach potential consumers.

2. Developing Charging Infrastructure

There should be investment in accessible, fast, and reliable charging networks. Collaboration between both public and private entities accelerates the establishment of charging stations across urban and semi-urban regions.

3. Confidence Building Among the Public

This can be addressed through consumer education campaigns that emphasize the cost savings from EVs, environmental benefits, and technological advances.

4. Encouraging Technological Innovation

Supporting domestic battery production and recycling systems, as well as R&D in energy efficiency, can achieve lower costs and reduce dependence on imports. Long-term sustainability will be improved.

5. Consistency and integration of policy

This requires coordination between the central and state governments to align incentives, infrastructure targets, and regulatory frameworks. The long-term roadmapping with stable policy signals will motivate private investment.

6. Overcoming the Intention–Action Gap: For positive attitudes to convert into adoption decisions, supportive behavioral interventions can be implemented through social marketing and endorsement from trusted public figures. Demonstration projects and public EV fleets are other means of enhancing visibility and confidence.

5.3 Implications for Future Research

Because this is a study based on secondary data, the validity provided herein is conceptual rather than empirical. Further research might validate this proposed conceptual framework through quantitative methods, such as SEM, for the measurement of the strength of associations among identified factors.

A clearer view of contextual differences in adoption behaviour could be brought out through cross-economy comparisons across developed and developing economies. Research segmented by the market for two-wheelers, fleet vehicles, or rural consumers would bring out greater nuances in market heterogeneity.

5.4 Conclusion

The study concludes that electric vehicle adoption is a multidimensional behavior influenced by the interplay of economic, technological, environmental, psychological, and policy-related determinants. Economic and technological readiness operate as direct drivers of the foundational layers of adoption behavior, while environmental awareness and social influence play motivational roles. Policy and institutional support remain enablers, bridging intention to actual behavior. In India, where affordability and infrastructure are still considered major barriers, the speed of transition to sustainable mobility will be determined by sustained government initiatives on incentives, infrastructure, and awareness. The results indicate that successful EV adoption requires not only consumer willingness but also systemic readiness and consistent policy direction. Ultimately, such a supportive ecosystem-economically, technologically, and behaviorally aligned-could further accelerate the transition toward a cleaner and more sustainable transportation future.

5.5 Ethical Considerations

All the secondary data included in this study have been properly cited and referenced according to the APA 7th edition citation style. No collection of primary data involving human participants was carried out; hence, there is no ethical risk involved with issues of consent or privacy.

5.6 Limitations of methodology

- The study is based purely on secondary sources; hence, the results are interpretive and not empirically validated.
- Inaccessibility of some recent industry reports because of subscription restrictions.
- Cultural and regional variations within India are not directly captured.

Although it has all these limitations, the study does provide a strong theoretical backbone, which may be empirically validated in further quantitative studies.

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