

## # Paper Summary

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Title: Investigating the electric vehicle adoption initiatives for achieving sustainable development goals

Authors: Shashi Kant Tripathi, Ravi Kant, Ravi Shankar

DOI: <https://doi.org/10.1016/j.sftr.2025.100469>

Year: 2025

Publication Type: Journal

Discipline/Domain: Sustainable Transportation / Industrial Engineering

Subdomain/Topic: Electric Vehicle Adoption; Sustainable Development Goals; Multi-Criteria Decision-Ma

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit, through prioritization framework and link to SDGs)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Mixed Methods (Systematic Literature Review, Expert Elicitation, MCDM, Machine

Study Context: EV sector in India as a case study

Geographic/Institutional Context: India; Sardar Vallabhbhai National Institute of Technology; Indian Institu

Target Users/Stakeholders: Policymakers, EV manufacturers, charging infrastructure developers, sustain

Primary Contribution Type: Prioritization framework for EV adoption initiatives linked to SDGs

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

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Investigating the electric vehicle adoption initiatives for achieving sustainable development goals

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**\*\*Discipline/Domain:\*\***

Sustainable Transportation / Industrial Engineering

**\*\*Subdomain/Topic:\*\***

Electric Vehicle Adoption; Sustainable Development Goals; Multi-Criteria Decision-Making

**\*\*Contextual Background:\*\***

The study focuses on identifying and prioritizing Electric Vehicle Adoption Initiatives (EVALs) to advance s

**\*\*Geographic/Institutional Context:\*\***

India; conducted by SVNIT Surat and IIT Delhi

**\*\*Target Users/Stakeholders:\*\***

National and state policymakers, EV manufacturers, charging infrastructure developers, environmental re

**\*\*Primary Methodology:\*\***

Mixed Methods — Systematic Literature Review (PRISMA), Expert Elicitation, Multi-Criteria Decision-Ma

**\*\*Primary Contribution Type:\*\***

Decision-support framework for aligning EV adoption with prioritized SDG targets

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## General Summary of the Paper

The paper develops a hybrid decision-making and machine learning framework to identify, prioritize, and

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## Eligibility

Eligible for inclusion: **\*\*Yes\*\***

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## How Actionability is Understood

Actionability is conceptualized as the ability of initiatives to directly and measurably advance specific SDG

> “The priority of these EV adoption initiatives (EVALs) will aid policymakers and stakeholders in streamlining

> “These assessments offer valuable insights for EV stakeholders, assisting them in stratifying critical initiatives

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## ## What Makes Something Actionable

- Direct contribution to measurable SDG targets
- Contextual relevance to national sustainability and transport policies
- Feasibility in terms of infrastructure, technology, and socio-economic conditions
- Policy alignment and potential for government or stakeholder support
- Scalability and replicability across regions
- Integration of environmental, social, and economic considerations

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## ## How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Hybrid Spherical Fuzzy MCDM + Machine Learning Framework
  - **Methods/Levers:** Systematic literature review, expert elicitation, SF-BBWM, SF-CM, SF-EDAS
  - **Operational Steps / Workflow:**
    1. Identify EVALs and associated SDG targets via PRISMA-guided SLR and PyPDF2 sentence extraction
    2. Expert validation and categorization of EVALs and SDGs
    3. Prioritization of initiatives using SF-BBWM
    4. SDG clustering with SF-CM to find most critical ones
    5. SDG ranking with SF-EDAS
    6. Sensitivity analysis and method comparison with SF-TOPSIS and SF-CODAS
  - **Data & Measures:** Expert weight assignments, linguistic scale to fuzzy number conversion, appraisal
  - **Implementation Context:** Indian EV market, national and state policy framework
- > “The findings... highlight the top two key initiatives, namely, subsidizing solar-powered EV charging, and
- > “SF-BBWM... to prioritize these EVALs... SF-EDAS ranks the shortlisted SDGs.” (p. 3)

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## ## Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — clearly defined initiative categories and sub-initiatives linked to SDGs (p. 5)
- **CR (Contextual Relevance):** Yes — tailored to Indian EV sector and policy framework (p. 2)
- **FE (Feasibility):** Yes — initiatives assessed on policy, infrastructure, and economic viability (p. 10–11)
- **TI (Timeliness):** Yes — urgent alignment with 2030 SDG targets (p. 2)
- **EX (Explainability):** Yes — transparent methodology and ranking process (p. 7–9)

- **GA (Goal Alignment):** Yes — explicit linkage to specific SDG targets (p. 6–12)
- **Other Dimensions Named by Authors:** Policy coherence, scalability, environmental impact reduction

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## ## Theoretical or Conceptual Foundations

- Fuzzy set theory (Zadeh, 1965)
- Spherical fuzzy sets (Kutlu Gündoğdu & Kahraman, 2019)
- Best-Worst Method (Rezaei, 2015) and Bayesian BWM
- Multi-Criteria Decision-Making and clustering methods

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## ## Indicators or Metrics for Actionability

- Criteria weights from SF-BBWM
- SDG appraisal scores from SF-EDAS
- Spearman's rank correlation in sensitivity testing

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## ## Barriers and Enablers to Actionability

- **Barriers:** Limited charging infrastructure, high upfront costs, coal-dependent charging, low public awareness
- **Enablers:** Government incentives (FAME I & II), renewable integration in charging, battery swapping

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## ## Relation to Existing Literature

Positions itself as filling a gap in linking specific EV initiatives to prioritized SDG targets using a formalized methodology

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## ## Summary

This study presents a novel hybrid methodology combining Spherical Fuzzy Bayesian Best-Worst Method and SF-EDAS

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## ## Scores

- **Overall Relevance Score:** 90 — Strong conceptual framing of actionability through explicit linkages to SDGs
- **Operationalization Score:** 95 — Highly detailed, step-by-step operationalization with tested robustness

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## ## Supporting Quotes from the Paper

- “The priority of these EV adoption initiatives (EVALs) will aid policymakers and stakeholders in streamlining EV adoption and achieving SDGs”
- “Identification of the main and sub-categories of EVALs and the achievable SDGs... Prioritization... Shows the importance of EV adoption in achieving SDGs”
- “Affordable and sustainable transportation (SDG11.2) is found to be the most significant SDG... followed by climate action (SDG13) and clean energy (SDG7)”

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## ## Actionability References to Other Papers

- Lipu et al. (2022) — EV benefits and SDG alignment
- Asgarian et al. (2023) — Policy support and sustainable transportation
- Peng & Bai (2023) — Holistic policy approaches
- Hannan et al. (2021) — Battery energy storage and SDGs
- Omahne et al. (2021) — Social aspects and SDG connections