
MODELING CONSUMER INTENTION TO ADOPT ELECTRIC VEHICLES IN INDONESIA: EXTENDING UTAUT2 WITH RISK, TRUST, AND DIGITAL LITERACY

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ABSTRACT

The transition toward sustainable mobility has positioned electric vehicles (EVs) as a strategic solution to reduce carbon emissions and dependence on fossil fuels. However, the adoption rate of EVs in Indonesia remains relatively low, indicating the need to better understand the factors influencing consumer adoption intentions. This study aims to examine consumers' behavioral intention to adopt electric vehicles in Indonesia by extending the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) with perceived risk, trust, and digital literacy. A quantitative research design was employed using a cross-sectional survey of 185 respondents who are familiar with electric vehicle technology. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4. The results indicate that UTAUT2 has a significant positive effect on consumers' behavioral intention to adopt electric vehicles. Furthermore, perceived risk was found to negatively mediate the relationship between UTAUT2 and behavioral intention, while trust and digital literacy positively mediate this relationship. These findings suggest that although technological benefits encourage EV adoption, psychological barriers and digital readiness play a crucial role in shaping consumer intentions. This study contributes to the technology adoption and sustainable mobility literature by providing an extended UTAUT2 model tailored to the Indonesian context. Practically, the findings offer insights for policymakers and industry stakeholders to develop strategies that reduce perceived risk, enhance trust, and improve digital literacy to accelerate electric vehicle adoption in Indonesia.

Keywords: Electric vehicles; UTAUT2; perceived risk; trust; digital literacy; behavioral intention.

INTRODUCTION

The global transition toward clean energy and sustainable mobility has become a strategic priority in response to climate change and the growing dependence on fossil fuels. The transportation sector is widely recognized as one of the largest contributors to carbon emissions, making decarbonization in this sector

essential for achieving environmental sustainability targets (Ritchie et al., 2023). In this context, electric vehicles (EVs) are regarded as a key solution for reducing emissions, improving energy efficiency, and supporting sustainable transportation systems (Harisandi et al., 2024). Countries such as China, the United States, and members of the European Union have experienced

rapid growth in EV adoption, driven by strong policy incentives, extensive charging infrastructure, and increasing consumer acceptance of environmentally friendly technologies (IEA, 2023; Ritchie & Roser, 2024).

In Indonesia, the government has demonstrated its commitment to accelerating EV adoption through various policy initiatives, including Presidential Regulation No. 55 of 2019 on the Acceleration of Battery Based Electric Vehicle Programs (President of Republic of Indonesia, 2019). This regulation positions EVs as an integral component of Indonesia's clean energy transition and long term emission reduction strategy (Harisandi, Yahya, Chandra, et al., 2025). Despite these efforts, the adoption rate of electric vehicles in Indonesia remains relatively low compared to other countries in the region (Jiang et al., 2021). Key barriers include high purchase prices, limited charging infrastructure, concerns regarding battery durability and technological reliability, and uneven consumer readiness to adopt digitally integrated mobility solutions (Uljanah et al., 2024).

Beyond economic and technical constraints, consumer behavior literature highlights the importance of psychological and cognitive factors in the adoption of new technologies. Prior studies indicate that consumer attitudes, perceived quality, and brand communication play a crucial role in shaping purchase intention and loyalty toward environmentally friendly products, including electric vehicles (Kumar & Alok, 2020).

However, in developing countries such as Indonesia, adoption decisions are often accompanied by

heightened uncertainty (Harisandi, Yahya, Yusriani, et al., 2025). Consumers tend to evaluate not only the functional benefits of EVs but also the perceived risks associated with financial costs, technological performance, infrastructure availability, and regulatory assurance. In addition, trust in manufacturers, brands, and government policies, as well as consumers' digital literacy, increasingly influence their willingness to adopt EV technology (Ajanovic & Haas, 2018; Brelje & Anderson, 2020).

To explain technology adoption behavior, numerous studies have employed the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) proposed by (Venkatakrishnan et al., 2023). This model has been empirically validated across various sectors, including healthcare, education, and e-commerce, demonstrating strong explanatory power through constructs such as performance expectancy, effort expectancy, social influence, facilitating conditions, and price value (Venkatesh & Bala, 2008). Nevertheless, in the context of electric vehicles, particularly within developing economies, UTAUT2 may not fully capture the complexity of consumer decision-making processes that are shaped by perceived risk, trust, and digital capability (Bryła et al., 2023).

Previous research in Indonesia has primarily focused on consumer attitudes, usage experience, and brand communication as determinants of loyalty and repurchase intention toward electric vehicles. While these studies provide valuable insights, they offer limited explanation of how

perceived risk, trust, and digital literacy interact with core UTAUT2 constructs in influencing EV adoption intentions (Bellet & Banet, 2023). This limitation is critical, as low digital literacy and high perceived risk may weaken adoption intentions even when consumers recognize the environmental and economic benefits of EVs. Addressing this gap, the present study extends the UTAUT2 framework by integrating perceived risk, trust, and digital literacy to examine consumer adoption intentions toward electric vehicles in Indonesia (Utami et al., 2020).

Perceived risk encompasses financial, functional, and infrastructure related uncertainties; trust reflects consumer confidence in EV brands, manufacturers, and government regulations; and digital literacy refers to consumers' ability to understand and utilize digital features and supporting applications associated with electric mobility. By incorporating these variables, this study aims to provide a more comprehensive understanding of the determinants of EV adoption in a developing country context.

The novelty of this research lies in its integrative approach, combining UTAUT2 with risk, trust, and digital literacy perspectives to explain EV adoption behavior in Indonesia. The findings are expected to contribute theoretically to the technology adoption and sustainable marketing literature, while offering practical insights for automotive manufacturers, policymakers, and regulators in designing effective strategies to accelerate electric vehicle adoption.

LITERATURE STUDY

Technology Adoption and UTAUT2

The adoption of new technology has long been a central topic in information systems and consumer behavior research. One of the most widely used theoretical frameworks is the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), developed to explain individual intentions and actual usage behavior of technology (Harisandi, Yahya, & Purwanto, 2025). UTAUT2 extends the original UTAUT model by incorporating consumer context variables such as hedonic motivation, price value, and habit. Empirical studies consistently demonstrate that performance expectancy, effort expectancy, social influence, and facilitating conditions significantly influence consumers' behavioral intentions across various technological domains (Ates & Polat, 2025).

In the context of sustainable technologies, including electric vehicles, UTAUT2 provides a useful foundation for understanding adoption behavior (Puttamanjaiah et al., 2024). Performance expectancy reflects consumers' beliefs regarding the functional benefits of EVs, such as energy efficiency and cost savings, while effort expectancy relates to perceived ease of use, including vehicle operation and charging processes. Social influence captures the impact of social norms and peer opinions, whereas facilitating conditions represent the availability of infrastructure and institutional support necessary for EV usage. Despite its robustness, several studies argue that UTAUT2 alone may be insufficient to explain adoption

behavior in high uncertainty environments, particularly in developing countries.

Perceived Risk in Electric Vehicle Adoption

Perceived risk refers to consumers' subjective expectations of potential losses associated with purchasing or using a product. In the context of electric vehicles, perceived risk commonly includes financial risk (high purchase and maintenance costs), functional risk (battery performance and durability), and infrastructure risk (limited availability of charging stations) (Venkatesh et al., 2012). Prior research indicates that high perceived risk negatively affects consumers' adoption intentions toward innovative and environmentally friendly technologies. In emerging markets, where technological ecosystems are still developing, perceived risk often plays a more prominent role in shaping consumer decision making processes (Mitchell, 1999).

Trust and Sustainable Technology Adoption

Trust is a critical psychological factor that reduces uncertainty and facilitates technology adoption. In EV adoption, trust encompasses consumers' confidence in manufacturers, brand reliability, technological safety, and government policies supporting electric mobility (Alhomaid, 2025). Studies in sustainable marketing and green technology adoption suggest that trust enhances positive attitudes and strengthens behavioral intentions by mitigating perceived risk (Sin & Ismail, 2021). In countries where EV markets are relatively new, trust in regulatory frameworks and long term policy

consistency becomes particularly important in encouraging consumer adoption.

Digital Literacy and Consumer Readiness

Digital literacy refers to individuals' ability to understand, evaluate, and effectively use digital technologies and applications. Electric vehicles increasingly rely on digital interfaces, mobile applications, and smart mobility systems, making digital literacy a critical determinant of adoption readiness (Guandalini, 2022). Consumers with higher levels of digital literacy tend to perceive lower complexity and greater control over technology use, which positively influences adoption intention. Conversely, low digital literacy may intensify perceived risk and reduce confidence in using EV related technologies, particularly in developing economies with uneven digital capabilities (Fauzi et al., 2024).

Research Gap and Conceptual Contribution

Previous studies in Indonesia have primarily focused on consumer attitudes, usage experience, and brand communication as drivers of loyalty and repurchase intention toward electric vehicles. While these studies offer valuable insights into post adoption behavior, limited attention has been given to pre adoption intentions and the integrative role of perceived risk, trust, and digital literacy within a unified technology acceptance framework. Consequently, there is need for an extended UTAUT2 model that captures both technological and psychological determinants of electric vehicle adoption in the Indonesian context.

Research Questions

Based on the literature review and the identified research gap, this study addresses the following research questions:

1. How does UTAUT2 influence consumers' behavioral intentions to adopt electric vehicles in Indonesia?
2. How does UTAUT2 influence consumers' behavioral intentions to adopt electric vehicles in Indonesia, as mediated by perceived risk?
3. How does UTAUT2 influence consumers' behavioral intentions to adopt electric vehicles in Indonesia, as mediated by perceived trust?
4. How does UTAUT2 influence consumers' behavioral intentions to adopt electric vehicles in Indonesia, as mediated by perceived digital literacy?

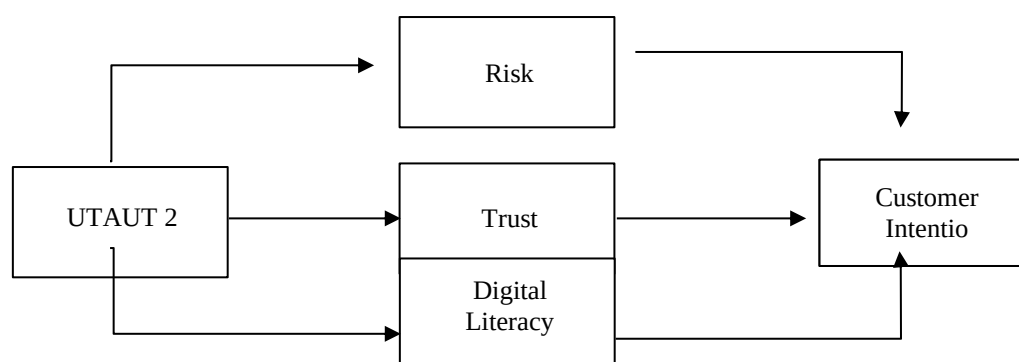


Figure 1: Research Framework

Source: Researcher's Personal Documentation, 2025

METHOD

This study adopts a quantitative research approach using a cross sectional survey design to examine the determinants of consumers' behavioral intention to adopt electric vehicles (EVs) in Indonesia. A quantitative approach is considered appropriate as the study aims to test a theoretical model and examine causal relationships among latent variables within the extended UTAUT2 framework. The research model integrates core UTAUT2 constructs with perceived risk, trust, and digital literacy to capture both technological and psychological dimensions of EV adoption. The target population of this study consists of potential and current

users of electric vehicles in Indonesia, including individuals who have knowledge of or interest in EV technology. A purposive sampling technique was employed to ensure that respondents met the following criteria: aged 18 years and above, familiar with electric vehicles or EV related information, and capable of completing an online questionnaire independently.

The minimum sample size was determined using the 10 times rule commonly applied in Partial Least Squares Structural Equation Modeling (PLS-SEM), which requires the sample size to be at least ten times the maximum number of structural paths pointing at a single construct. Based on the proposed model, a minimum

sample of 150 respondents was deemed adequate to ensure statistical power and model stability (Sarstedt et al., 2019).

Data were collected using a structured online questionnaire distributed through social media platforms and professional networks. The questionnaire was designed in English (or Bahasa Indonesia, depending on journal requirement) and consisted of two main sections:

- Demographic information, and
- Measurement items for all latent variables in the research model.

Respondents were informed about the purpose of the study and assured of the confidentiality and anonymity of their responses. Participation was voluntary, and only fully completed questionnaires were included in the final analysis. Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) with the assistance of SmartPLS version 4. PLS-SEM was selected due to its suitability for exploratory research, prediction-oriented models, and complex frameworks involving This study adhered to ethical research principles (Hair & Alamer, 2022). Respondents' identities were not recorded, and all data were used solely for academic purposes. Informed consent was obtained prior to participation, and respondents were given the option to withdraw from the survey at any time.

RESULT and DICUSSION

Demographic profile of the respondents involved in this study. In terms of gender distribution, the majority of respondents were male (60%), while female respondents accounted for 40% of the sample. This

distribution reflects the current market condition in which interest and exposure to electric vehicle technology remain relatively higher among male consumers in Indonesia. Regarding age, most respondents were within the productive age range of 26–35 years (36%) and 36–45 years (28%). This indicates that the sample largely consists of economically active individuals who are more likely to consider adopting innovative and capital intensive technologies such as electric vehicles. Younger respondents aged 18–25 years represented 18% of the sample, while respondents above 55 years accounted for a smaller proportion (4%). In terms of educational background, nearly half of the respondents held a bachelor's degree (49%), followed by those with a master's degree (19%). This suggests that the sample is relatively well educated, which is relevant for studies examining technology adoption, as education level is often associated with higher technology awareness and digital literacy.

With respect to occupation, private sector employees constituted the largest group (35%), followed by entrepreneurs (23%) and government employees (16%). This occupational diversity indicates that the respondents come from varied professional backgrounds, providing a broad perspective on electric vehicle adoption intentions.

Regarding experience with electric vehicles, 43% of respondents had not used EVs but were aware of the technology, while 57% had some level of direct experience using EVs. This mix of experienced and potential users is appropriate for examining

behavioral intention to adopt EVs, as it captures both pre adoption and early adoption perspectives.

Finally, the income distribution shows that most respondents earned between IDR 5–10 million (34%) and IDR 10–20 million (27%) per month. This income range represents the emerging middle class segment, which is considered a key target market for electric vehicle adoption in Indonesia. Overall, the demographic profile indicates that the sample is

heterogeneous yet relevant for investigating electric vehicle adoption behavior, providing sufficient variation in age, education, income, and experience to support robust statistical analysis..

Descriptive statistics were used to examine respondents’ general perceptions of the research variables, including UTAUT2, perceived risk, trust, digital literacy, and behavioral intention to adopt electric vehicles.

Table 1. Descriptive Statistics

Variable	Mean	Standard Deviation
UTAUT2	4.12	0.68
Perceived Risk	3.01	0.81
Trust	4.08	0.64
Digital Literacy	4.15	0.59
Behavioral Intention	4.02	0.72

Source: Results Processing Data by Authors (2025)

Table 1 shows that the mean values of UTAUT2 (4.12), trust (4.08), digital literacy (4.15), and behavioral intention (4.02) are relatively high, indicating that respondents generally hold positive perceptions regarding the usefulness, ease of use, social support, and readiness to adopt electric vehicles in Indonesia. The perceived risk variable recorded a moderate mean score of 3.01, suggesting that although respondents are aware of potential risks related to electric vehicles such as cost, battery durability, and charging infrastructure these concerns do not dominate their overall evaluation.

Standard deviation values across all variables range between 0.59 and 0.81, indicating acceptable variability and suggesting that respondents’ perceptions are relatively consistent. Overall, the descriptive statistics indicate a favorable tendency toward electric vehicle adoption, supported by high trust and digital readiness, despite the presence of moderate perceived risk.

The measurement model was evaluated using Cronbach’s Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE) to ensure internal consistency and convergent validity of the constructs.

Table 2. Validity and Reliability

Construct	Cronbach’s Alpha	Composite Reliability	AVE
UTAUT2	0.891	0.915	0.642
Perceived Risk	0.812	0.874	0.581

Construct	Cronbach's Alpha	Composite Reliability	AVE
Trust	0.846	0.902	0.697
Digital Literacy	0.823	0.889	0.668
Behavioral Intention	0.857	0.911	0.719

Source: SmartPLS Output (2025)

As presented in Table 2, all constructs demonstrate strong internal consistency, with Cronbach's Alpha values exceeding the recommended threshold of 0.70. This indicates that the measurement items within each construct are reliable and consistently measure the same underlying concept. Composite Reliability (CR) values range from 0.874 to 0.915, further confirming the robustness of the constructs. In addition, the Average

Variance Extracted (AVE) values for all constructs exceed 0.50, indicating satisfactory convergent validity. This suggests that each construct explains more than half of the variance of its indicators. Overall, these results confirm that the measurement model exhibits excellent reliability and convergent validity, making it suitable for subsequent structural model analysis and hypothesis testing within the extended UTAUT2 framework.

Table 3. Summary of Structural Model Results and Hypotheses Testing

Hypothesis	Structural Relationship	Effect Type	Path Coefficient (β)	T-Statistic	P-Value	Result
H1	UTAUT2 → Behavioral Intention	Direct Effect	0.462	7.985	0.000	Supported
H2	UTAUT2 → Perceived Risk → Behavioral Intention	Indirect (Mediation)	-0.148	3.614	0.000	Supported (Partial Mediation)
H3	UTAUT2 → Trust → Behavioral Intention	Indirect (Mediation)	0.231	4.982	0.000	Supported (Partial Mediation)
H4	UTAUT2 → Digital Literacy → Behavioral Intention	Indirect (Mediation)	0.194	4.126	0.000	Supported (Partial Mediation)

Source: SmartPLS Bootstrapping Results (5,000 resamples), 2025

Table 3 presents a comprehensive summary of the structural model results, including both direct and mediated relationships between UTAUT2 and consumers' behavioral intention to adopt electric

vehicles in Indonesia. The results show that UTAUT2 has a strong and significant direct effect on behavioral intention ($\beta = 0.462$; $p < 0.001$), confirming that core UTAUT2 constructs effectively explain

consumers' intention to use electric vehicles. This result confirms that core UTAUT2 constructs such as performance expectancy, effort expectancy, social influence, facilitating conditions, price value, and habit play a crucial role in shaping consumers' intention to use EVs in Indonesia (Jun et al., 2019). This finding supports prior technology adoption research, emphasizing that consumers are more likely to adopt EVs when they perceive clear functional benefits, social endorsement, and adequate infrastructural support. This finding supports Hypothesis 1.

Regarding mediation effects, perceived risk partially mediates the relationship between UTAUT2 and behavioral intention with a negative coefficient ($\beta = -0.148$; $p < 0.001$). This indicates that higher perceived risk weakens the positive influence of UTAUT2 on adoption intention (Rivaldi et al., 2022). This indicates that although UTAUT2 positively influences EV adoption intention, perceived risks related to cost, battery reliability, and charging infrastructure reduce the strength of this relationship (Harisandi, Yahya, & Purwanto, 2025). This finding highlights perceived risk as a critical psychological barrier, particularly relevant in developing countries like Indonesia where EV infrastructure and long term policy certainty are still evolving. supporting Hypothesis 2.

In contrast, trust serves as a significant positive mediator ($\beta = 0.231$; $p < 0.001$), strengthening the relationship between UTAUT2 and behavioral intention. This indicates that when consumers trust EV manufacturers, technology reliability,

and government regulations, the positive effects of UTAUT2 constructs are strengthened (Rivaldi et al., 2022). Trust functions as an uncertainty reducing mechanism, enabling consumers to translate perceived benefits and facilitating conditions into stronger adoption intentions. This finding reinforces the importance of institutional credibility and regulatory consistency in accelerating EV adoption. This finding confirms Hypothesis 3, highlighting trust as an important uncertainty reducing mechanism in electric vehicle adoption.

Similarly, digital literacy positively mediates the relationship between UTAUT2 and behavioral intention ($\beta = 0.194$; $p < 0.001$), supporting Hypothesis 4. This result indicates that consumers with higher digital competence are more likely to translate perceived technological benefits into actual adoption intentions. Higher digital literacy enhances consumers' confidence in using EV related digital applications, charging systems, and smart mobility features, thereby strengthening adoption intention (Adiratna & Wulansari, 2021; Chen et al., 2021). This result indicates that digital readiness amplifies the effects of effort expectancy and facilitating conditions, making consumers more comfortable with EV technology. In the Indonesian context, where digital capability varies widely, digital literacy becomes a decisive factor in EV adoption. Overall, the integrated results demonstrate that while UTAUT2 directly influences behavioral intention, its effect is significantly shaped by risk, trust, and digital literacy, validating the

proposed extended UTAUT2 model for electric vehicle adoption in Indonesia.

CONCLUSION

This study aimed to examine consumers' behavioral intentions to adopt electric vehicles (EVs) in Indonesia by extending the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) with perceived risk, trust, and digital literacy. Using a quantitative approach and PLS SEM analysis, the study provides several important theoretical and practical insights. The findings demonstrate that UTAUT2 significantly influences consumers' behavioral intentions to adopt electric vehicles in Indonesia. Core UTAUT2 constructs such as performance expectancy, effort expectancy, social influence, facilitating conditions, price value, and habit collectively explain consumers' willingness to adopt EV technology. This confirms the robustness of UTAUT2 in explaining sustainable technology adoption within the Indonesian context.

Furthermore, the results reveal that perceived risk plays a significant negative mediating role in the relationship between UTAUT2 and behavioral intention. Concerns related to financial cost, battery durability, and charging infrastructure weaken consumers' adoption intentions, even when the perceived benefits of EVs are high. This finding highlights perceived risk as a critical psychological barrier that must be addressed to accelerate EV adoption in developing economies. In contrast, trust significantly and positively mediates the relationship between UTAUT2 and behavioral

intention. Higher levels of trust in EV manufacturers, technology reliability, and government policies strengthen consumers' confidence and encourage them to translate positive expectations into adoption intentions. Trust therefore acts as an essential uncertainty reducing mechanism in the EV adoption process.

Additionally, digital literacy was found to be a significant positive mediator, indicating that consumers with higher digital competence are more likely to adopt electric vehicles. Digital literacy enhances consumers' ability to understand and use EV related digital features and smart mobility systems, thereby reinforcing the effects of effort expectancy and facilitating conditions.

Overall, this study concludes that electric vehicle adoption in Indonesia is influenced not only by technological evaluations but also by psychological assurance and digital readiness. The integration of perceived risk, trust, and digital literacy into the UTAUT2 framework provides a more comprehensive understanding of consumer adoption behavior in a developing country context. From a theoretical perspective, this research extends UTAUT2 by incorporating critical contextual factors relevant to sustainable mobility. From a practical standpoint, the findings suggest that policymakers and industry stakeholders should focus on risk reduction strategies, trust building initiatives, and digital literacy enhancement to accelerate electric vehicle adoption in Indonesia.

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