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Research Article

Formulating an Electric Vehicle Adoption Model in Indonesia: Product Quality, Consumer Characteristics, Adoption Context, and Perception

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Abstract: In Indonesia, the transition to electric vehicles (EVs) is a crucial strategy for promoting sustainable mobility and reducing carbon emissions. This study investigates the key factors influencing EV acceptance in the Indonesian context, focusing on four primary constructs: product quality, consumer characteristics, adoption context, and perception. Data were collected from 181 respondents who are financially able to purchase an EV and currently own a private vehicle using a two-stage partial least squares structural equation modeling (PLS-SEM) approach. The study found that consumer characteristics (e.g., innovative personality and environmental awareness) and adoption context factors (e.g., government incentives and charging infrastructure) significantly influence EV acceptance. However, product quality (including performance, reliability, and durability) and perception of EVs (e.g., range anxiety, battery concerns) had weaker effects on adoption decisions. Interestingly, the perception of EVs had a positive influence, suggesting that public education and effective communication can mitigate consumer concerns. The quantitative results indicate that consumer characteristics and adoption context together explain 61.8% of the variance in EV acceptance. This study contributes to the literature on technology adoption in emerging markets by highlighting the specific challenges and opportunities in Indonesia's context of EV adoption. It provides actionable recommendations for policymakers and industry stakeholders to accelerate the transition to low-emission transportation through enhanced infrastructure, optimized incentives, and targeted marketing strategies.

Keywords: Consumer acceptance; Electric vehicles; financial capability; Indonesia; Product quality

1. Introduction

The global transition to electric vehicles (EVs) is a cornerstone of decarbonization and reduced fossil-fuel dependence, with adoption in developed markets (e.g., Norway, Germany, China, United States) propelled by targeted fiscal incentives, regulation, and dense charging networks (Steinhilber et al., 2013, Figenbaum, 2017, Hildermeier and Villareal, 2014, Gorevaya and Spiridonova, 2023). Beyond climate and energy goals, several countries also treat electrification as an industrial and geostrategic policy to strengthen automotive competitiveness (Chinen et al., 2023, Dua, 2024, Fan et al., 2024, Dhairiyasamy and Gabiriel, 2025). In Indonesia, EVs are expected to reduce emissions and urban air pollution, lower oil-import dependence, and catalyze green industrial development in line with the Paris Agreement and the national energy transition (IEA, 2024, Sovacool et al., 2018). However, mass uptake remains constrained by high upfront costs and limited charging infrastructure. Critically, evidence is still limited

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on how product quality, perceived value, and social influence, particularly among Millennials and Generation Z (Gen Z, born 1̃997–2012), shape EV adoption in Indonesia. This study addresses this gap by testing a PLS-SEM model on Indonesian consumers and deriving policy and managerial implications.

As a developing country with significant automotive market potential, Indonesia still faces various obstacles to accelerating the adoption of electric vehicles (Lazuardy et al., 2024). EV penetration remains relatively low, accounting for less than 10% of total vehicle sales in 2023 (Gaikindo, 2023), despite the government offering various fiscal and non-fiscal incentives (Habiburrahman et al., 2024, Setyoko et al., 2022). Key challenges to customer acceptance include limited charging infrastructure, high initial vehicle prices, and unstable consumer confidence levels in EV performance and reliability (PwC, 2024, IESR, 2023).

Although numerous studies have investigated the factors influencing the adoption of electric vehicles (EVs), most have focused on developed countries where psychological drivers, such as environmental awareness and moral norms, play a dominant role, supported by well-established infrastructure and consistent policy frameworks (Rezvani et al., 2015, Sierzchula et al., 2014, Aravindan et al., 2023). In contrast, limited attention has been given to developing countries such as Indonesia, where a unique interplay of economic limitations, evolving infrastructure, and policy uncertainty shapes the adoption of EVs. However, in addition to environmental benefits, EVs also offer significant personal economic benefits. For example, Suwignjo et al., 2023 demonstrated that EVs can improve personal economic sustainability by reducing long-term operating costs compared with conventional vehicles. Although several local studies have acknowledged the role of technical performance, such as battery life, charging time, and maintenance convenience (Widiawati et al., 2022, Yusuf et al., 2022), these studies typically focus on performance alone and rarely capture the broader aspects of product quality. Existing research integrates technical, psychological, and contextual factors within a unified empirical model.

The main objective of this study is to examine the factors influencing consumer acceptance of EVs in Indonesia, focusing on four key constructs: product quality, consumer characteristics, adoption context, and perception. The study employs a two-stage partial least squares structural equation modeling (PLS-SEM) approach, applied to data from 181 respondents who have the financial capability to purchase an EV and currently own a conventional vehicle. While the existing literature predominantly focuses on EV adoption in developed countries, this study fills the gap by exploring how these factors interact within the context of a developing nation. This research not only contributes to theoretical understanding by expanding the technology acceptance model but also provides practical insights for policymakers and industry players in emerging markets. Ultimately, the study aims to provide a deeper, context-sensitive framework for developing targeted EV adoption strategies, helping stakeholders in Indonesia navigate the challenges and accelerate the transition to sustainable mobility.

Thus, this study theoretically and empirically contributes by offering a comprehensive framework for understanding consumer acceptance of EVs in Indonesia, setting the stage for the subsequent discussion of the methodology.

2. Theoretical framework

This study adopts a model developed by Wang et al., 2018, which highlights the importance of the interaction between external and psychological factors in the decision to adopt new technologies. In this model, the adoption context includes external factors, including cost of ownership, government policies, infrastructure availability, and marketing efforts. These are positioned alongside psychological factors, including consumer characteristics such as innovative personality, conformist mentality, and environmental awareness, as well as consumer perception, particularly regarding perceived risk and communication effectiveness.

However, a key limitation of Wang's model is that it does not explicitly consider product quality as a distinct or multidimensional factor, even though product-related concerns often play a critical role in the acceptance of new technologies, especially in developing countries where

trust in innovation is still evolving. Consumers may hesitate to adopt EVs if they doubt their performance, reliability, ease of maintenance, or durability.

This study addresses this gap by expanding Wang's model to include a dedicated dimension of product quality, drawing on Garvin, 1984 framework, which outlines eight core aspects of quality: performance, features, reliability, conformance, durability, serviceability, esthetics, and perceived quality (Figure 1). The inclusion of product quality is further supported by recent studies, which found that product quality significantly influences adoption decisions for high-involvement products such as EVs (Bhat et al., 2021, Ma et al., 2017, Gunawardane and Dk, 2019). In the context of EVs, dimensions such as battery durability, ease of charging, and service availability directly affect consumer acceptance (Yusuf et al., 2022, Widiawati et al., 2022).

2.1 Adoption of Electric Vehicles and Determining Factors

Adopting electric vehicles (EVs) has become essential in studying energy transition, emphasizing the factors that encourage or hinder their acceptance. Preliminary studies have indicated that a combination of technical, psychological, social, and structural factors influences the decision to adopt EVs (Sierzchula et al., 2014, Rezvani et al., 2015). However, this approach tends to be developed in the context of developed countries, so it does not necessarily reflect the dynamics of developing countries, such as Indonesia.

2.1.1 Product Quality

The technical performance of EVs significantly influences consumer purchasing decisions. Studies have shown that factors such as acceleration, speed, energy efficiency, and battery reliability drive EV adoption (Shmueli et al., 2016; Mariasiu et al., 2023; Skippon, 2014). One of the main concerns remains the driving range and battery life, which continue to hinder the widespread adoption of this technology (Agrawal et al., 2023; Naeem et al., 2019).

In addition to performance, lower EV noise levels improve driving experience and user satisfaction, promoting adoption. Daramy-Williams et al., 2019, Brand et al., 2013. Cost considerations, such as lower maintenance costs and positive perceptions of product quality, also influence consumer choices. Although EVs have higher upfront costs, lower operating costs and product reliability can increase the purchase intent.

The interior design and integration of advanced technology further enhance the appeal of EVs. Features such as infotainment systems and automated driver assistance attract tech-savvy consumers, accelerating their adoption (Gomez et al., 2024). By prioritizing product quality—which is determined through performance, features, reliability, fit, durability, serviceability, esthetics, and perceived quality—automakers can increase consumer acceptance and facilitate the transition to sustainable transportation (Wang et al., 2018, Jansson et al., 2017).

H1: EV product quality (performance, features, reliability, suitability, durability, serviceability, esthetics, and perceived quality) positively influences EV acceptance.

2.1.2 Consumer Characteristics

Demographic factors, personality traits, and social influences influence consumer preferences for electric vehicles (EVs). Studies have shown that younger consumers with higher education and environmental awareness are more likely to adopt Evs (Gulzari et al., 2022, Ponsree et al., 2020). In addition, the high-income group shows greater interest due to a better understanding of long-term benefits such as energy efficiency and emission reductions (Guo et al., 2023, Hidrue et al., 2011). However, financial barriers remain challenging, especially in developing countries such as Indonesia (Deloitte, 2023).

Millennials and Gen Z (Gen Z, born Ĩ997–2012) in Indonesia are more accepting of EVs, driven by climate issues and interest in technology (PwC, 2023). However, high upfront costs and limited charging infrastructure hamper mass adoption. Social influence plays a more dominant role in Indonesia than in developed countries, where EV buyers tend to be technically inclined

(Plötz et al., 2014). In contrast, Indonesian consumers' decisions are significantly shaped by public support, social media trends, and peer recommendations (Deloitte, 2023). Therefore, community- and influencer-based marketing strategies are essential for promoting EV adoption.

Technology and innovation drive EV interest, with consumers preferring innovative features, smartphone integration, and advanced navigation systems (PwC, 2024). However, limited infrastructure and after-sales support pose challenges for widespread adoption (Chidambaram et al., 2022). Government policies and fuel price regulations are also essential for EV penetration (Mekky and Collins, 2024, Jing et al., 2023).

Overall, the pattern of EV adoption in Indonesia is in line with global trends related to young consumer interest, environmental awareness, and technological enthusiasm but differs in a more significant role from social influences and cost ownership (Muhammad Idris, 2025). Consumers with innovative mindsets, conformist tendencies, and sustainability awareness are more likely to adopt EVs (Wang et al., 2018; Schuitema et al., 2013), highlighting the need for targeted marketing and policy interventions to accelerate EV adoption.

H2: Consumer characteristics (innovative personality, conformist mentality, and environmental awareness) positively influence EV acceptance.

2.1.3 Context of adoption

EV adoption is shaped by the cost of ownership, government policies, incentives, charging infrastructure availability, and marketing strategies (Xue et al., 2021). Charging availability is a key determinant, with research showing that inadequate infrastructure slows down EV adoption even when financial incentives are available (Sierzchula et al., 2014). Consumer confidence in EVs remains low without a reliable charging network.

The cost of ownership is an important factor in EV adoption. The study highlights that initial purchase prices, operating costs, and long-term maintenance costs influence consumer decisions (Moon and Lee, 2019; Choi and Oh, 2010; Wu et al., 2015). Fluctuations in fuel prices and electricity tariffs further affect purchasing behavior (Avci et al., 2015, Jiang and Gao, 2024). Purchase prices, operating costs, and maintenance costs are the main concerns of consumers (Moon and Lee, 2019; Choi and Oh, 2010; Wu et al., 2015). Fluctuations in fuel prices and electricity tariffs also affect the decision to switch to EVs (Avci et al., 2015; Jiang and Gao, 2024).

Government policies and incentives play a crucial role in increasing EV adoption. Tax reductions and purchase subsidies have made EVs more attractive to consumers (PwC, 2024). However, challenges, such as inadequate charging infrastructure, perceived high maintenance costs, and a lack of consumer awareness, including tax and subsidy reductions and increased EV appeal, continue to hinder adoption (Pamidimukkala et al., 2024, Sasongko et al., 2024). However, the limited charging infrastructure, perception of high maintenance costs, and low public awareness remain barriers to adoption. Many consumers still view EVs as more expensive and inconvenient than conventional vehicles.

Marketing strategies significantly impact EV adoption. Effective communication campaigns highlighting cost savings, environmental benefits, and technological advancements are needed to reshape consumer perceptions. Digital marketing, influencer support, and community-based promotional efforts can further drive adoption. Collaboration among government, industry, and private sector stakeholders is critical for creating a sustainable and accessible EV ecosystem. A comprehensive approach incorporating stronger policies, expanded infrastructure, and consumer education on the economic and environmental benefits of EVs is needed. Collaboration between the government, industry, and the private sector is essential for creating a sustainable and accessible EV ecosystem.

The broader adoption context—including the cost of ownership, government incentives, charging infrastructure, and marketing—is shaping consumer attitudes toward EVs (Dua et al., 2021, IEA, 2022). Supportive infrastructure policies and environments are expected to drive higher EV adoption by reducing economic and logistical issues.

H3: The EV adoption context (consisting of ownership costs, government policies and incentives, charging infrastructure availability, and marketing) positively affects EV acceptance.

2.1.4 Perception and Communication of Values

EVs are increasingly seen as a symbol of identity and lifestyle. Herziger et al., 2025 found that the symbolic value of EVs influences purchasing decisions, with consumers associating EV ownership with maturity, intelligence, and environmental awareness. Similarly, research in China and the UK shows that some consumers are proud of the environmental benefits of EVs. In contrast, others are hesitant due to perceived performance and design limitations (Huang and Ge, 2019, Graham-Rowe et al., 2012)

Perceived risks—concerns about charging availability, battery life, and resale value negatively impacted EV adoption (Rezvani et al., 2015, Hardman and Tal, 2016). In Indonesia, inadequate charging infrastructure increases uncertainty and reduces the willingness to adopt. Ineffective communication about long-term cost savings further discourages potential buyers.

H4: EV perception (consisting of risk perception and communication effectiveness) harms EV acceptance.

Based on the literature review and proposed hypotheses, a conceptual model of EV acceptance was developed that integrates product quality, consumer characteristics, adoption context, and perceptions. These dimensions are modeled as a second-order (higher-order) construct, and Figure S2 (Supplementary Materials) depicts the structural relationships among variables.

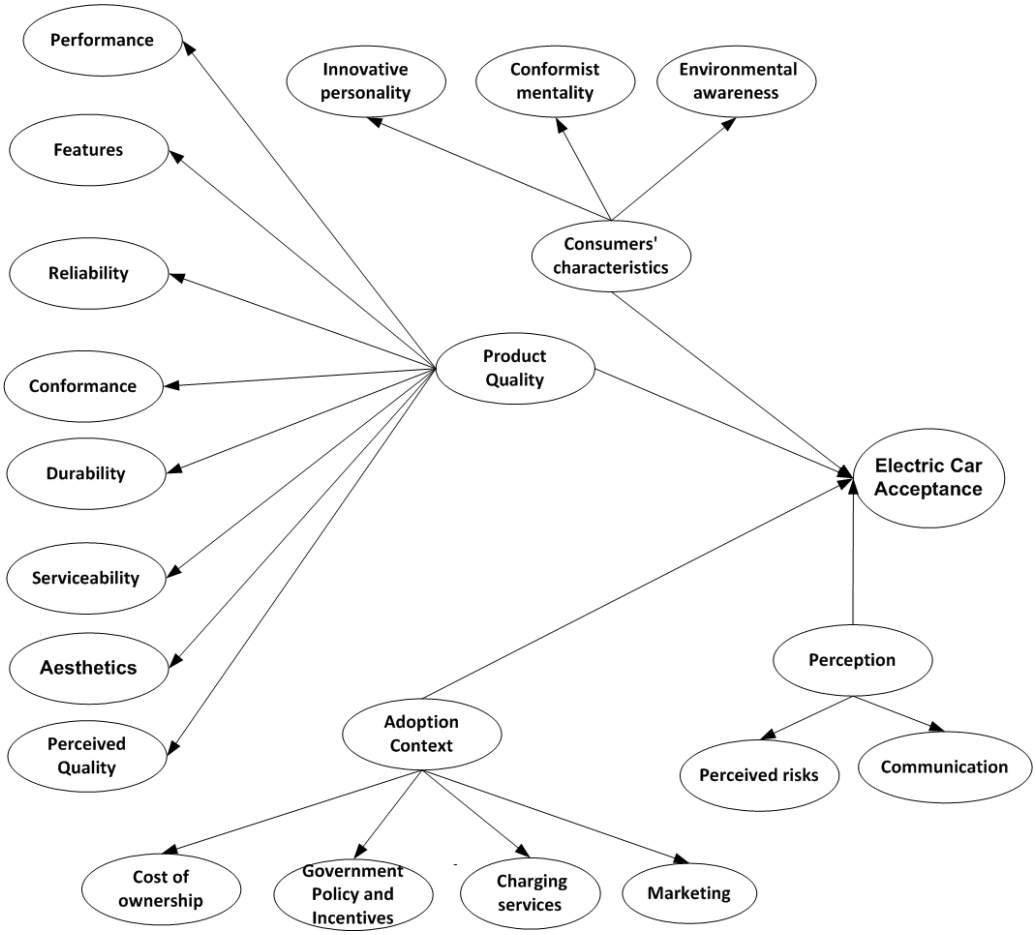

Figure 1 Proposed model an Electric Vehicle Acceptance in Indonesia

3. Methods

3.1 Population and sample size

The population in this study is a projected number of BEVs that will operate in Indonesia by 2030. Based on data from the Ministry of Energy and Mineral Resources (EMR), in 2030, it is projected that 2,197,780 electric car units will be operating in Indonesia in 2030. The sampling technique used was random sampling with the following inclusion criteria:

(1) Can afford an electric vehicle,

(2) Living in a big city,

(3) A private vehicle with conventional fuel and

(4) Expression of interest in electric cars

The number of respondents who were successfully collected was 181. This amount follows the minimum guidelines for PLS-SEM. The sample size in this study was determined based on the pilot study approach, as suggested by Hair et al., 2022. In the pilot study, the initial sample size tested ranged from 30 to 40 respondents, which was then compared with the minimum sample size table. Based on the calculation results, with a significance level of 5% (Pmin = 0.184), the minimum number of respondents required is 155. A detailed calculation of the minimum sample size is provided in Table S1 (Supplementary Materials).

3.2 Instruments and Measurements

The online questionnaire, consisting of 79 Likert-type items (6-point scale: 1 = strongly disagree to 6 = strongly agree), was adapted from a previous study. Content validity was established through two rounds of expert review involving three experts (a manufacturing production quality manager, a senior quality assurance officer from a testing/calibration company, and a senior lecturer in industrial engineering). Items were revised between rounds and ensure clarity, specificity to standards, and contextual relevance. After Round 2, a consensus was reached, and 87% of the items received positive validation, indicating strong content validity. Table S3 (Supplementary Material) presents item-level ratings and expert comments.

As market context, we referenced the top-selling EV models in Indonesia (2023) as reported by Gaikindo, 2023; detailed brand–model listings are provided in Table S4 (Supplementary Materials).

Figure 2 provides a visual overview of the research methodology used in this study. This section outlines the key steps, including sampling, instrument development, data collection, and data validation, to clarify the process and how each stage contributes to the overall study.

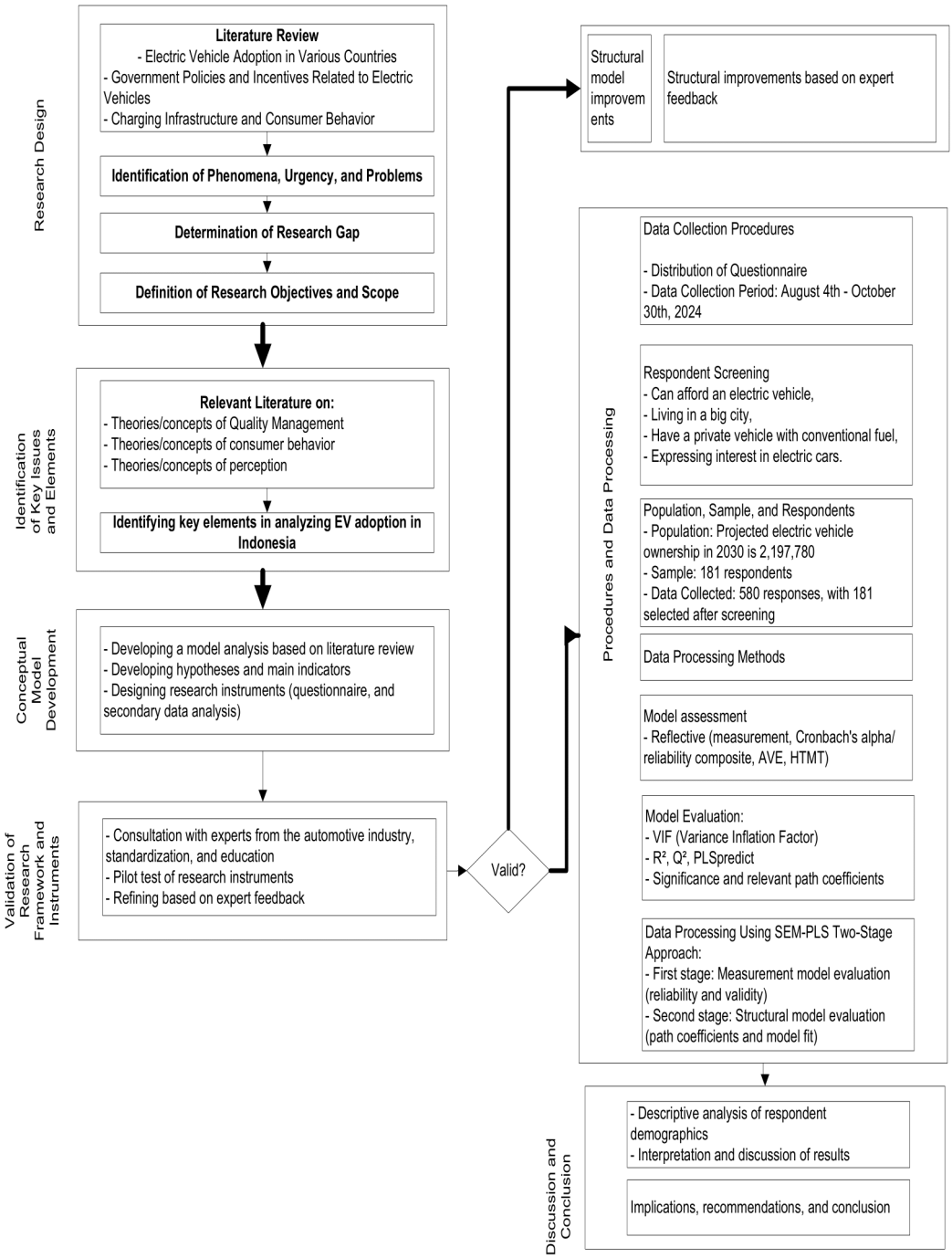

Figure 2 Flowchart of the research methodology an Electric Vehicle Acceptance Model in Indonesia

3.3 Data collection procedure

Data were collected via an online survey (Google Forms) from August to October 2024, and written consent was obtained before survey completion. The inclusion criteria required respondents to (i) be able to afford an EV, (ii) reside in a major Indonesian city, (iii) own a private ICE vehicle, and (iv) express interest in EVs. Of 580 responses, 181 met the criteria and were retained. Records with missing critical variables were excluded, whereas missing noncritical variables were imputed using the mean/mode; the supplementary materials provide detailed settings. Nonresponse bias was assessed using a pre-posttest (Armstrong and Overton, 1977), and no significant differences were found.

3.4 Validity and Reliability

Validity and reliability tests were conducted using an outer model evaluation in SmartPLS 4 under an academic research license.

- Convergent validity is assessed from an AVE value of >0.50
- Discriminant validity is seen from cross-loading and the FLR criterion
- Reliability is measured through composite reliability values, and Cronbach's alpha > 0.70.

3.5 Common method bias

To minimize the potential for common method bias (CMB), we have taken several important steps at the beginning of the research process. First, the respondents were informed that there were no right or wrong answers in this survey, and their participation was guaranteed to be anonymous and confidential. This affirmation aims to create a sense of security and comfort so that respondents can provide honest, pressure-free answers (Halder et al., 2020).

This research has met the ethical aspect, as evidenced by all respondents' online written consent. The researcher guarantees data confidentiality, respondent anonymity, and data use only for academic purposes. An ethics statement letter from the home institution can be attached at the end of the document.

4. Results and Discussion

4.1 Results

4.1.1 Descriptive Statistics

Demographics, personality traits, and social factors influence EV consumer preferences. Studies indicate that younger, highly educated, and environmentally aware consumers are more likely to adopt EVs (Raj and Kumar, 2024, Bindhya et al., 2024, Gulzari et al., 2022). Higher-income groups show greater interest due to understanding long-term benefits such as energy efficiency and reduced emissions (Bindhya et al., 2025, Naik et al., 2024, Zhang and Li, 2011). However, financial barriers remain challenging, especially in developing countries such as Indonesia (Deloitte, 2023).

The study sample consists predominantly of men (73.48%), whereas women comprise 26.52%. Men tend to focus on performance and technology, whereas women prioritize safety, comfort, and environmental impact. Interestingly, women globally adopt EVs faster than men, suggesting that gender-specific marketing strategies could help increase EV adoption. Most respondents (40.88%) fall within the 27-46 age group, a highly productive demographic with higher purchasing power. This aligns with research indicating that 72% of potential EV buyers are Millennials. Younger individuals (18-25) exhibit less interest in EVs, whereas older age groups (41-50) are more inclined to replace conventional vehicles with EVs. Additionally, higher education levels correlate with greater acceptance of EVs. Among the respondents, 47.51% hold a bachelor's degree, 36.46% have a master's degree, and 16.02% possess a Ph.D. Higher education individuals tend to be more aware of the long-term cost savings and environmental benefits of EVs, whereas those with lower education may lack sufficient knowledge about EV technology (PwC, 2023). Table S5 summarizes these findings (see supplementary section).

Employment type significantly influences EV adoption. Private sector employees (62.43%) represent the largest group, followed by government employees (14.92%), self-employed individuals (12.71%), and academics (9.94%). Stable income and corporate incentives in the private and government sectors encourage greater EV adoption, whereas self-employed individuals and academics may adopt EVs at a slower rate due to financial uncertainties and varying transportation needs. In terms of income, 61.33% of respondents earn between 100 and 250 million IDR annually, 28.18% earn between 250 and 500 million IDR, and 10.50% earn above 500 million

IDR. Higher-income individuals are more likely to purchase EVs as a second vehicle, whereas middle-income individuals are more likely to view EVs as a primary replacement for fuel-based vehicles (PwC, 2023). Table S5 presents detailed data on employment and income groups.

4.1.2 Consumers' willingness to buy EVs

Table S6 shows that 100% of respondents own at least one private car, yet only 10.51% currently own an EV, confirming the low EV penetration among existing car owners (PwC, 2023). However, 74.03% of the respondents were willing to purchase an EV as a second car, while 25.97% were open to replacing their current vehicle with an EV. This suggests that many consumers still view EVs as supplementary rather than primary cars, likely because of concerns about range and infrastructure (PwC, 2024). Regarding daily mileage, most respondents (60.27%) travel 21-50 km daily, making EVs feasible for commuting. However, 18.78% of drivers drive more than 50 km daily, underscoring the need for expanded charging networks and extended battery ranges (PwC, 2024).

Correspondingly, 35.36% of the respondents expected an EV range of 400-600 km, while 28.73% were satisfied with 200-400 km, indicating a preference for a moderate to high battery capacity. Price remains a significant consideration, with 56.91% of respondents preferring an EV priced between 200 and 300 million IDR, while only 7.73% are willing to pay over 500 million IDR, reinforcing the demand for more affordable EV models (IESR, 2023). In terms of model preference, SUVs were the most favored (38.67%), followed by hatchback/city cars (23.76%) and MPVs (20.99%). These trends highlight consumer interest in spacious and practical electric vehicles.

4.1.3 Evaluation of the Outer Model

Indicators with outer loadings < 0.70 (e.g., Kin1, Ki3, Mkom1, and Bk3) were eliminated and the model was re-estimated, after which all retained indicators loaded ≥ 0.70; item-level loadings and the list of dropped indicators are reported in Table S7

(Supplementary Materials), with the Phase-1 output shown in Figure S2.

Convergent validity and reliability were established: all constructs exhibited AVE > 0.50 (Fornell and Larcker, 1981; Henseler et al., 2016; Hair Jr et al., 2021) and internal consistency above recommended thresholds Cronbach's α s> 0.70 (Nunnally and Bernstein, 1994; Hair Jr et al., 2021; Raykov and Marcoulides, 2011). Discriminant validity was confirmed using the Fornell–Larcker criterion (✓AVE on the diagonal exceeds inter-construct correlations) and HTMT all values below the conventional cutoffs of 0.85–0.90 (Hair Jr et al., 2021). Detailed statistics, including reliability/AVE summaries, the Fornell–Larcker matrix, HTMT ratios, and indicator loadings, are reported in the Supplementary Materials (S 8–11). Collectively, these results indicate that the measurement model meets the validity and reliability requirements and is suitable for the structural model.

4.1.4 Internal Model Evaluation and Hypothesis Test

After the measurement model was validated through outer model testing, the next step was to evaluate the structural model was evaluated to examine the causal relationships among latent constructs. The analysis employed the PLS-SEM approach with the embedded two-stage method, and the results of the R^2 analysis are presented in Supplementary Table S11.

The structural model was evaluated using five indicators. First, the multicollinearity test showed that all exogenous constructs had VIF values below 5, confirming the absence of collinearity issues that might bias the estimation of path coefficients. Second, the coefficient of determination (R^2) for the EV acceptance construct was 0.618, indicating that the independent variables explained 61.8% of the variance, which reflects strong explanatory power. Third, predictive relevance (Q^2) was also established, with a value of 0.465, suggesting that the model based on blindfolding procedures has high predictive accuracy.

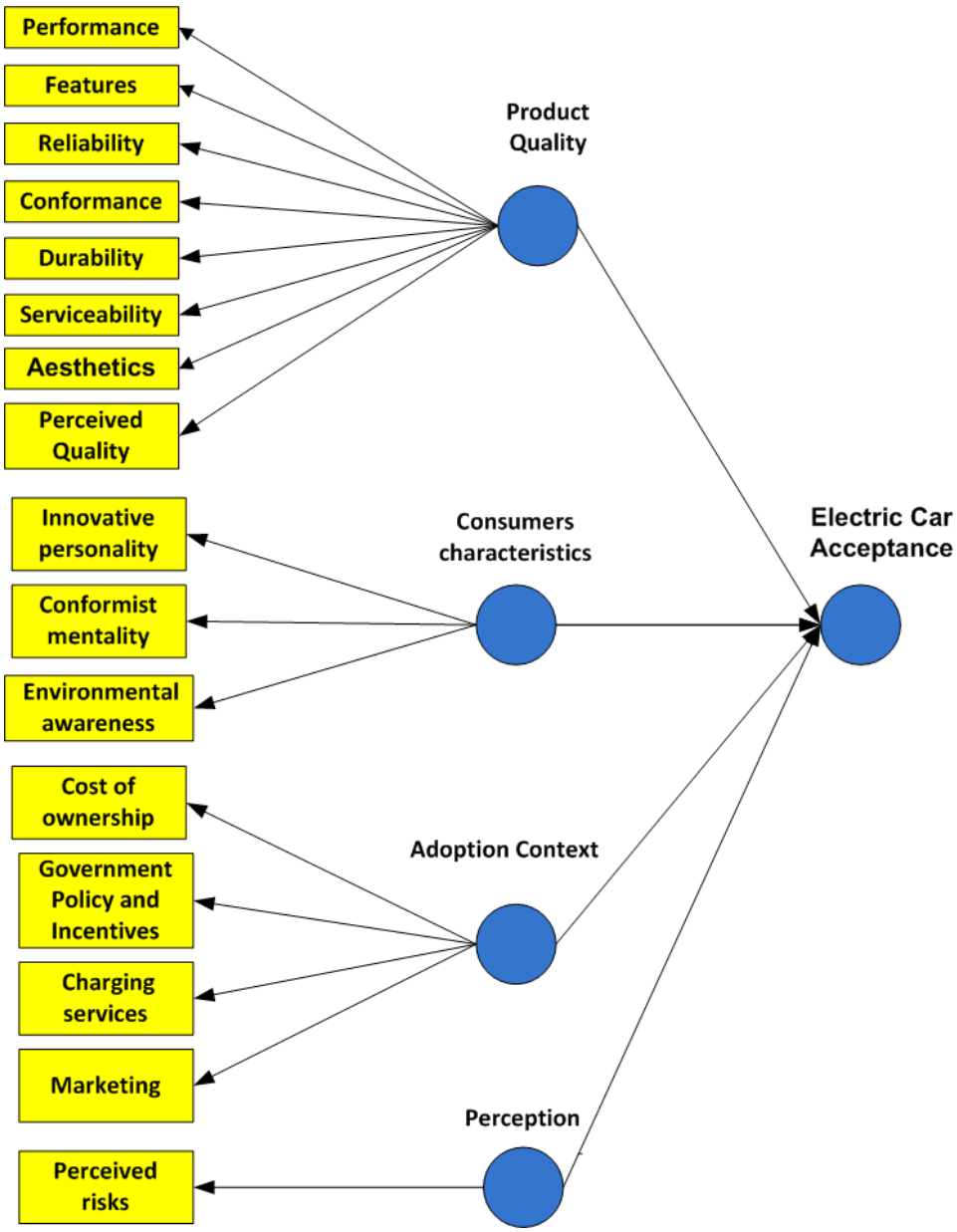

Figure 3 Structural Model of Electric Vehicle Acceptance Based on PLS-SEM Analysis

In terms of effect size (f^2), Consumer Characteristics exert a moderate effect on EV acceptance ($f^2 = 0.195$), while Adoption Context contributes a small effect ($f^2 = 0.060$). Perception and Communication demonstrates only a very small effect ($f^2 = 0.028$), and Product Quality shows an insignificant effect ($f^2 = 0.002$). Finally, model fit was assessed using the SRMR and the GoF index. The SRMR value was 0.073, which is below the recommended threshold of 0.08, indicating a good fit between the model and the empirical data. In addition, the GoF index was 0.685, which is substantially higher than the minimum benchmark of 0.36, confirming an excellent overall model fit.

The analysis revealed that the quality of EV products ($\beta = 0.034$, $t = 0.292$, $p = 0.385$) does not significantly affect EV acceptance. In the Indonesian context, product quality, such as performance, features, reliability, or esthetics, is not a decisive factor for adoption.

Consumer characteristics ($\beta = 0.464$, $t = 4.386$, $p < 0.001$) have a strong and significant impact on EV acceptance. Individuals with innovative personalities, a conformist mentality, and high environmental awareness are more likely to adopt EVs, confirming the importance of psychological and social traits in shaping adoption decisions.

The context of adoption ($\beta = 0.263$, $t = 2.312$, $p = 0.010$) also shows a significant effect,

Table 1 Hypothesis Testing Results an Electric Vehicle Acceptance Model in Indonesia

	Hypothesis	Path Coefficient (β)	t-statistic	p-value	Decision
H1	Product Quality → EV Acceptance	0.034	0.292	0.385	Not Supported: Product quality (performance, reliability, durability, aesthetics) does not significantly influence EV adoption in Indonesia.
H2	Consumer Characteristics → EV Acceptance	0.464	4.386	0.000	Supported: Innovative personality, conformist mentality, and environmental awareness strongly increase EV acceptance.
H3	EV Adoption Context → EV Acceptance	0.263	2.312	0.010	Supported: Ownership costs, government incentives, charging infrastructure, and marketing significantly drive EV acceptance.
H4	EV Perception → EV Acceptance	0.121	1.837	0.033	Supported: Positive perceptions and effective communication of EV benefits enhance acceptance, contrary to initial expectations of negative influence.

highlighting the critical role of ownership costs, government incentives, charging infrastructure, and marketing in driving consumer decisions. This confirms that structural and policy-related factors remain central to EV acceptance.

Finally, EV perception ($\beta = 0.121$, t = 1.837, p = 0.033) exerts a positive and significant effect on acceptance, contrary to the initial hypothesis predicting a negative relationship. This suggests that when consumers perceive EVs positively—supported by clear communication and growing social influence, their willingness to adopt increases despite concerns over range anxiety or battery life.

4.2 Discussion

This study reveals several significant findings regarding the factors that influence the acceptance of EVs in Indonesia.

Product quality and EV acceptance Surprisingly, product quality did not significantly influence EV acceptance ($\beta = 0.034$, p = 0.385). This contrasts with previous research that has emphasized the importance of perceived quality, performance, and reliability in driving purchase decisions (Jansson et al., 2017; Huang and Ge, 2019; Li et al., 2017; Wang et al., 2018). However, this result can be explained by several Indonesian context-specific factors.

First, the public's understanding of EV product quality may be limited due to insufficient information or education. Given that EVs are still relatively new to the Indonesian market, many consumers may not fully comprehend their long-term benefits and technical capabilities. Without clear and accessible information, consumers are more likely to prioritize more familiar and immediate factors, such as price and the availability of charging infrastructure, over product quality (Sovacool et al., 2018, Bryła et al., 2023).

Second, trust in local brands and institutions may still be low. As the EV industry in Indonesia is in its early stages, many consumers may be skeptical about local products or emerging brands. This skepticism could reduce consumer attention to product quality, with greater em-

phasis placed on more immediate factors, such as government incentives and availability of after-sales service (Chidambaram et al., 2022).

Lastly, because EV adoption in Indonesia is still in its early stages, product quality may not yet be a top priority for consumers. Many are more concerned with practical issues, such as affordability and the availability of charging stations, than the quality of vehicles. Product quality may increasingly be a factor in adoption decisions as the EV market grows and consumers become more familiar with the technology (Hakam and Jumayla, 2024, Lazuardy et al., 2024, Sasongko et al., 2024).

However, in the Indonesian context, this result may be explained by consumers' high price sensitivity, where affordability, incentives, and infrastructure availability are prioritized over product quality (IESR, 2023). This is consistent with the findings of Moon and Lee, 2019 and Chinen et al., 2023, who found that cost considerations often outweigh product quality in EV adoption decisions in emerging markets. Furthermore, PwC, 2024 and Habiburrahman et al., 2025 noted that Indonesian consumers remain hesitant due to high upfront costs, limited model options, and concerns over long-term maintenance expenses.

Consumer characteristics and acceptance of EVs, Consumer characteristics had a significant impact on EV acceptance ($\beta = 0.464$, p = 0.000). Individuals with innovative personalities, conformist mentalities, and environmental awareness are more likely to adopt EVs. This finding is consistent with Schuitema et al., 2013 and Rezvani et al., 2015, who emphasized the role of openness to innovation and environmental concern in promoting EV adoption. Additionally, as highlighted by Wang et al., 2018 and Siregar et al., 2024, social influence remains an important factor, where widespread community adoption encourages others to follow. PwC, 2024 found that 78% of Indonesian consumers intend to buy an EV in the next five years, with the primary motivation being fuel cost savings and reduced environmental impact. Li et al., 2017 emphasized that environmental awareness significantly contributes to EV purchase decisions. Moreover, Axsen and Kurani, 2012 and Nurdini et al., 2023 suggested that individuals engaging in pro-environmental behaviors are more likely to switch to EVs. However, despite strong intentions, financial constraints and infrastructure concerns remain significant obstacles, in line with findings from Aqmarina et al., 2024. The study further emphasizes that a conformist mentality also plays a key role in influencing adoption decisions based on societal trends.

Adoption Context: Policies and Infrastructure, The adoption context also significantly influenced EV acceptance ($\beta = 0.264$, p = 0.019). Financial incentives, supportive government policies, and the availability of charging infrastructure were found to play crucial roles, supporting the findings of Sierzchula et al., 2014, Xia et al., 2022, and Pangeran et al., 2024. However, IESR, 2023 highlights that existing incentives in Indonesia are still perceived as insufficient, particularly due to the high upfront costs of EVs despite subsidies. Nonetheless, EVs offer lower operational costs, reduced maintenance, and environmental benefits, as emphasized by Lazuardy et al., 2025 and Onggaria et al., 2023. PwC, 2023 also revealed that concerns over charging time (60%), limited range (59%), and battery lifespan (47%) persist among Indonesian consumers, reinforcing the need for more aggressive policy support and infrastructure development.

Perception of EVs and their adoption, Hypothesis H4 posited that the perception of EVs would negatively influence EV acceptance based on the assumption that consumers' concerns about range anxiety, battery life, and overall product reliability would deter adoption. However, contrary to the expected negative influence, our results indicate a positive relationship ($\beta = 0.121$, p = 0.033, t = 1.837), suggesting that positive perceptions of EVs are a significant driver of EV adoption in Indonesia.

This shift toward influence can be attributed to several key factors. First, increasing public familiarity with EVs, coupled with ongoing efforts to provide clear, accurate information about the benefits and capabilities of EVs, has likely led to more positive consumer perceptions. Research indicates that improved communication and education campaigns can significantly shift consumer attitudes toward adopting green technologies (Sovacool et al., 2018). Government campaigns promoting environmental sustainability and offering financial incentives for EV buy-

ers have played an essential role in shaping more favorable attitudes toward EVs (Chidambaram et al., 2022). The growing influence of social media communities and influencers advocating for sustainable living has also helped raise awareness and build consumer trust in EVs. This is consistent with the findings that social media influencers and community-based campaigns can significantly affect consumer behavior and attitudes toward new technologies (Sovacool et al., 2018, Chidambaram et al., 2022). These factors have contributed to the observed positive influence of EV perception on acceptance, reflecting a broader societal shift toward sustainable transportation.

4.2.1 Theoretical implications

This research makes four main contributions to the development of the literature on the adoption of EVs, especially in the context of developing countries such as Indonesia:

First, this study expands the theoretical understanding of factors that affect consumer acceptance of EVs by focusing on four key variables: product quality, consumer characteristics, adoption context, and perception. Note that product quality is a multidimensional construct based on eight quality dimensions. One of the key theoretical contributions of this study is the inclusion of product quality as a multidimensional construct based on Garvin, 1984 framework. Garvin defines product quality across eight dimensions: performance, features, reliability, conformance, durability, serviceability, esthetics, and perceived quality. This approach adds depth to the analysis of EV acceptance by considering not only technical aspects, such as performance and reliability but also factors like esthetics and perceived quality, which are often overlooked in technology adoption models.

Rather than repeating full adoption theories, we integrate Garvin, 1987 multidimensional product quality into an EV acceptance model and test it as a higher-order construct. While TAM (Davis, 1989) and UTAUT (Venkatesh et al., 2003) foreground perceived usefulness/ease of use and performance/effort expectancy (plus social influence), they do not explicitly model quality attributes such as durability, serviceability, conformance, esthetics, and perceived quality (Rogers, 2003). DOI highlights relative advantage, compatibility, complexity, and trialability, but likewise does not offer a multidimensional operationalization of product quality for high-involvement goods. We extend mainstream adoption models by embedding Garvin's dimensions alongside consumer characteristics, adoption context, and perceptions (Wang et al., 2018) to better reflect EV purchase decision-making in an emerging market. Empirically, the quality construct functions as a second-order driver that helps explain acceptance beyond utility/ease and social influence, clarifying which quality facets matter for Indonesian consumers and where policy/managerial levers (e.g., after-sales service, build quality disclosure) can be most effective.

Second, the study highlights the importance of social characteristics, such as conformist tendencies and openness to innovation, in influencing consumer behavior. These factors play a crucial role in shaping behavioral intentions in the context of EV adoption. For example, individuals with a conformist mentality are more likely to adopt EVs due to their increasing popularity within their communities and social circles (Ajzen, 1991, Venkatesh et al., 2003, Aravindan et al., 2023). Conversely, those with an openness to innovation may be more willing to explore EVs due to their interest in new technologies and environmental sustainability (Rogers, 2003, Venkatesh et al., 2016). This study broadens the theoretical understanding of consumer behavior in Asian cultures, where both conformist mentality and innovation adoption are particularly important (Higueras-Castillo et al., 2023), by focusing on these social characteristics. These social factors not only impact individual decision-making but also contribute to collective attitudes toward technology adoption, especially in countries with strong cultural norms and community-based decision-making, such as Indonesia (Triandis, 1995, Wang et al., 2018, Bindhya et al., 2025).

Third, the study integrates external factors in the adoption context (e.g., cost of ownership, government policies, incentives, and infrastructure) and EV perceptions (e.g., risk perception and clarity of information). This integration reinforces previous findings that external factors are

often powerful triggers in decision-making, especially when technology is new and consumer understanding is limited. This research also shows that negative perceptions, along with improved communication and education, can be transformed into positive ones.

Fourth, this study's findings also make an empirical contribution to the literature, highlighting Indonesia's consumer price sensitivity in purchasing decision-making (PwC, 2024). The results show that price incentives, tax deductions, and financial promotions drive EV acceptance. This reinforces the understanding that pricing strategies and fiscal policy support not only have an economic impact but also serve as psychological signals that will strengthen the perception of the value of EVs.

Thus, this study not only adds a new dimension to the literature on EV acceptance but also provides a strong theoretical foundation for developing marketing strategies, public policies, and product innovation in the context of sustainable technology adoption in developing countries.

4.2.2 Policy implications

Based on the findings of this study, several implications can be applied to increase the promotion and acceptance of EVs in developing countries such as Indonesia.

First, although product quality did not directly predict EV acceptance in our sample, price and operating costs remain the dominant considerations, with government incentives and charging infrastructure exerting greater influence than quality attributes (Tsurvey, 2025). This pattern is consistent with findings from emerging markets, where affordability and access typically precede perceived product quality in the early stages of product adoption (Sovacool et al., 2018). Accordingly, policy and promotional efforts should prioritize affordability (targeted incentives and accessible financing) and rapid expansion of charging infrastructure. Manufacturers should improve and transparently communicate reliability, serviceability, durability, and environmental benefits to address consumer skepticism about "green" claims and build sustained trust.

Second, charging infrastructure and reliability. A balanced rollout of home/workplace AC charging and public DC-fast hubs at high-traffic locations (transit nodes, malls, and CBDs) should be prioritized, underpinned by enforceable uptime SLAs/KPIs and open data on location, status, and pricing. Streamline permitting and utility interconnection with service-level guarantees; enable interoperability/roaming and unified payment standards; and improve network efficiency by adopting time-of-use tariffs and demand management. These measures directly target the infrastructure bottlenecks documented for Indonesia and comparable markets (Zulkarnain et al., 2014; Yudan, 2023).

Third, public communication, social proof, and trust. Implement evidence-based communication that demonstrates everyday relevance (household savings, urban mobility benefits) and deploy community pilots, user testimonials, and influencer/peer programs—particularly for Millennials/Gen Z—to normalize EV use. Mandate standardized environmental labels (real-world range/charging time) and after-sales transparency (battery warranties, service availability) while enforcing anti-greenwashing rules to protect consumer trust. These steps complement infrastructure policies and address perception barriers highlighted in prior work (Zulkarnain et al., 2014; Yudan, 2023), while reinforcing Indonesia's broader competitiveness and technological-advancement goals (Wibowo et al., 2021). Table S12 (Supplementary)—Comparison of Key Factors Influencing EV Adoption: This Study vs. Previous research—for detailed contrasts.

5. Conclusions

In conclusion, while product quality, encompassing performance, reliability, conformance, durability, serviceability, aesthetics, and perceived quality, does not significantly affect the acceptance of electric vehicles (EVs) in Indonesia, other factors are found to play a more dominant role. Specifically, consumer characteristics such as innovative personality, conformist mentality, and environmental awareness positively influence EV acceptance. Adoption context factors, including cost of ownership, supportive government policies, and charging infrastructure availabil-

ity, also emerge as key drivers in promoting EV adoption. Furthermore, consumer perception, particularly regarding effective communication of EV benefits and practical value, is vital in building trust and fostering public acceptance. However, this study is limited by its data, which is specific to Indonesia and may not reflect adoption dynamics in other emerging markets, where differences in government incentives, infrastructure, and cultural factors exist. The proposed model may need to be adapted to account for these regional variations. Future research could explore how these factors evolve as the Indonesian EV market matures, as well as examine the role of cultural and regional differences in consumer behavior and the impact of long-term EV ownership on decision-making.

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AI-assisted tools were used only for language polishing and formatting (e.g., grammar, style, and reference formatting). No AI tools were used to generate ideas, conduct data analysis, create tables/figures, or draft substantive content. All AI-suggested phrasing was reviewed, edited, and verified by the authors, who assume full responsibility for the manuscript's integrity and originality.

Author Contributions

Ardhy Lazuardy contributed to the original draft writing, visualization, resource gathering, project administration, investigation, formal analysis, data curation, and research concept development, while Rahmat Nurcahyo was involved in original draft writing, validation, methodological design, investigation, and conceptualization. Farizal contributed to the writing of the original draft, validation, methodology, investigation, and conceptual development, and Rahma Oktavina wrote the original draft, provided validation, methodological support, investigation, data curation, and conceptual formulation.

Conflict of Interest

The authors declare no conflicts of interest. No personal or financial relationships were perceived as influencing the representation or interpretation of the findings in this study.

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