

# Challenges of electric vehicle adoption in Indonesia: Revealing the hidden factors affecting purchase intention

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## Abstract

**Purpose** – Recently, electric vehicles (EVs) have seen significant development worldwide. Indonesia has responded by implementing various policies to support the adoption of EVs, which are touted as the future environmentally friendly transportation solution. However, in Indonesia, the purchase intention for EVs still needs to reach expectations, reaching only 14,93% of the target in 2023. This study analyzes the antecedents of benefit factors determining the intention to buy an electric vehicle. This study will fill the gap in earlier research by comprehensively examining the factors that influence EV purchase intention in Indonesia.

**Design/methodology/approach** – This study will fill the gap in earlier research by comprehensively analyzing the factors that influence EV purchase intention in Indonesia. This study will empirically examine the relationship between perceived usefulness, perceived ease of use, perceived risk, EV knowledge, public involvement, and purchase intention, as well as the antecedents of perceived usefulness, perceived ease of use, and perceived risk. This study uses a quantitative method with a survey design to gain an in-depth understanding of the factors influencing the purchase intention of electric vehicles in Indonesia. The survey involved 957 potential electric vehicle users in Indonesia who have never bought an EV but have sufficient interest and knowledge about EVs. The research instrument was a validity and reliability-tested questionnaire used to collect accurate and consistent data.

**Findings** – This study found that although respondents had strong perceptions of the benefits of electric vehicles (perceived usefulness), this did not automatically lead to high purchase intentions. Another surprising finding was that perceived risk also did not directly affect purchase intention. This suggests the presence of other factors inhibiting purchase intention, which need to be identified and addressed.

**Research limitations/implications** – This research contributes significantly to the literature on adopting electric vehicles (EVs). Perceived ease of use has a positive effect on purchase intention. The results of this study indicate that perceived ease of use does not significantly affect the purchase intention of electric vehicles.

**Practical implications** – The findings of this study provide several practical implications for electric vehicle manufacturers, marketers, and policy makers.

**Originality/value** – This research offers a comprehensive approach to understanding the factors that influence electric vehicle (EV) purchasing interest in Indonesia, by including previously overlooked variables such as risk perception, public involvement, and knowledge about EVs.

Additionally, this research focuses on the Indonesian context, providing valuable insights into the unique challenges and opportunities in EV adoption in the country, which can form the basis for strategies and policies to promote sustainable transportation.

**Keywords:** Perceived Usefulness, Purchase Intention, Electric Vehicles, Perceived Risk, Technology Acceptance Model, Costumer Behavior

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## Introduction

The development of technology led to the birth of Electric Vehicles (EV) as a mode of transportation as an environmentally friendly mode of transportation. This shift towards electric mobility is driven by various factors, such as the need for energy efficiency, reduction of greenhouse gas emissions, and the search for sustainable transportation solutions (Chawla et al., 2023). EV development is linked to the broader context of energy systems and environmental considerations, highlighting the importance of integrating renewable energy sources and increasing energy system flexibility to support widespread EV adoption (Theeb et al., 2020). Integrating EVs into urban transport systems has implications for air quality, energy consumption, and overall environmental sustainability (Chawla et al., 2023). Research has explored the potential impacts of EVs on urban air quality, highlighting the need for effective policies to promote and manage the adoption of EVs in cities (Fu, 2024; Koreny et al., 2022).

The transition to electric vehicles is important for reducing air pollution because they use clean energy. Electric cars produce no emissions, thus reducing harmful pollutants in the air (Baker et al., 2021). This shift is critical to mitigating air pollution problems from the transportation sector, a significant source of greenhouse gas emissions and air pollutants (Hunsberger & Awâsis, 2019). Adoption of electric vehicles is substantial in densely populated urban areas where high concentrations of pollutants such as CO<sub>2</sub>, NO<sub>x</sub>, and SO<sub>2</sub> pose health risks and contribute to climate change (Hajhashemi et al., 2024; Huang et al., 2021a; Krishnan & Sreekumar, 2023). Research shows that switching to electric vehicles can substantially reduce carbon emissions, helping combat the adverse impacts of air pollution on public health and the environment (Khalid & Khuman, 2022). The development and adoption of electric vehicles is a promising strategy to reduce air pollution, combat climate change, and promote sustainable transportation systems (Dey et al., 2020). By transitioning towards electric mobility and supporting the growth of electric vehicle infrastructure, countries can progress towards cleaner air and a healthier environment for current and future generations.

Purchase intentions are essential in shaping consumers' desire to make purchases. Purchase intention is an important factor influencing consumers' willingness to purchase in various contexts (Hou & Poliquin, 2023). The importance of purchase intentions in shaping consumer behavior and decision-making (Dash et al., 2021; Jiang et al., 2023). Purchase intentions are often influenced by trust, perceived risk, brand image, social media marketing, and personalized recommendations (Graciola et al., 2020). Purchase intentions mediate the relationship between various factors and actual purchase decisions (Chibuogwu et al., 2021). Research has also explored the relationship between purchase intention and other variables such as brand image, perceived quality, perceived value, and brand trust, highlighting the interconnected nature of these factors in influencing consumer behavior (Abdelwahed & Soomro, 2023; Xie et al., 2022).

Many factors can influence the purchase of electric vehicles that need to be explored further (Yang et al., 2020). Research conducted by Shanmugavel & Micheal (2022) raises a new gap by basing the assumptions of consumer decision models on trade-off calculations. The trade-off calculation model assumes consumers decide between risk and benefit when purchasing. Consumer decision models on calculating risk-benefit trade-offs for decision modeling. The finding is that the perceived benefits outweigh the risks when an individual bases their buying decision on a trade-off calculation. Some consumers may choose not to expose themselves to the financial risks of using electric vehicles, while for others, those risks are 'not taken into account' at all, and adoption decisions focus solely on the benefits of adoption (Featherman et al., 2021).

This comprehensive literature review highlights global trends and challenges in EV adoption, emphasizing the need for further research in Indonesia, where EV adoption is still in its infancy. By identifying shadows of knowledge and contradictory findings in the existing literature, especially regarding the influence of benefit and risk factors on consumers' intention to purchase EVs, these observations emphasize the importance and originality of this research, which aims to fill these shadows and provide a more nuanced understanding of the factors –factors influencing the adoption of EVs in Indonesia. In addition, the results of a review conducted by Ivanova & Moreira (2023) still have contradictory results on the study of benefit and risk factors as determinants of consumer intentions in buying electric vehicles. For this reason, studies related to benefit and risk factors as determinants of consumer intention to buy electric vehicles need to be analyzed further to achieve generalization. Limited supporting infrastructure, such as electric vehicle charging stations, poses a significant challenge to the widespread adoption of electric vehicles. The availability of reliable charging infrastructure is critical to successfully deploying electric vehicles, especially in densely populated urban areas (Schelte et al., 2022). Studies emphasize the importance of fast charging infrastructure to meet the current and future needs of electric vehicles and highlight the need for continued development in this area (Deumlich et al., 2022; Schelte et al., 2022). Strategic planning for the deployment of charging infrastructure is essential to drive market penetration of battery electric vehicles and increase the range of electric vehicles, thereby supporting the growth of the electric vehicle industry (An, 2020). Solar-powered charging infrastructure is recognized as a sustainable solution that can generate renewable energy, provide shaded parking, and ease travel distances for electric vehicle users (Y. Wang et al., 2022). Addressing the challenges of limited charging infrastructure requires a comprehensive approach, including policy support, public-private partnerships, and innovative solutions to optimize power utilization and improve user experience.

Although the Indonesian government has launched various incentives and policies to encourage the adoption of electric vehicles, the adoption rate remains relatively low. The Ministry of Industry of the Republic of Indonesia noted that the absorption of the electric motorcycle subsidy program in 2023 reached only 11,532 units or worth Rp80.7 billion. Meanwhile, the target set was 200,000 units with a total budget of Rp1.4 trillion (Admin, 2024). Many consumers are unaware of the benefits of electric vehicles, which hinders their adoption and integration into daily transportation practices. Various studies have highlighted the importance of educating consumers about the benefits of electric vehicles (EVs) to increase their acceptance and utilization. For example, S. Wang et al. (2024) emphasized the need for consumer education on the environmental benefits of EVs, such as reduced greenhouse gas emissions and improved air quality, as well as the economic advantages, like lower operating costs. However, this study primarily focuses on the factors influencing consumer purchase intention and does not delve into the specific strategies or channels for effective consumer education. Hu et al. (2023) explored the technical aspects of integrating EVs into the power system, emphasizing the need for a comprehensive approach that includes communication infrastructure and management solutions to accommodate individual and clustered EVs at different voltage levels. While this study provides valuable insights into the technical challenges of EV integration, it does not directly address the broader issue of consumer adoption and the role of charging infrastructure in influencing consumer behavior.

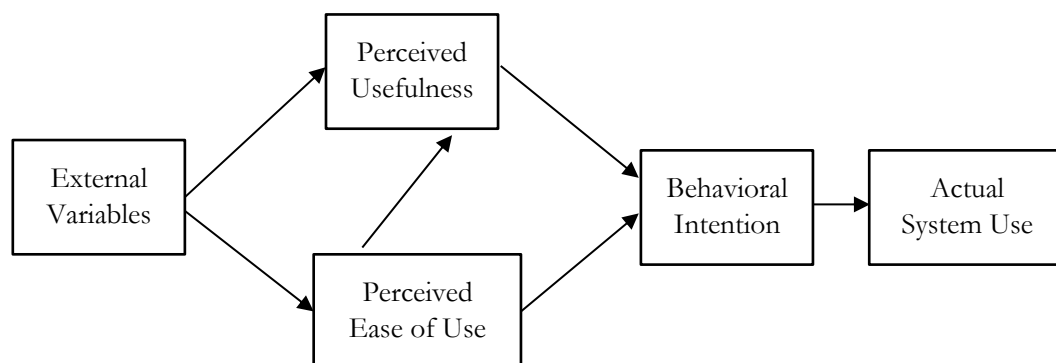
Qin et al. (2024) investigated the utilization of public charging infrastructure, revealing that openly accessible infrastructure is currently more prevalent than proprietary options. This study sheds light on the importance of public charging infrastructure in promoting EV adoption, but it does not explore the reasons behind the preference for open access infrastructure or the potential impact of different charging models on consumer behavior. Government policies, such as the Presidential Regulation of the Republic of Indonesia No. 55 of 2019, aim to provide direction and legal certainty for accelerating battery electric vehicle programs, including strategies for developing charging infrastructure (Peraturan Presiden (PERPRES) Nomor 55 Tahun 2019 Tentang Percepatan Program Kendaraan Bermotor Listrik Berbasis Baterai (Battery Electric Vehicle) untuk Transportasi Jalan, 2019). Efforts are underway to standardize and upgrade charging station infrastructure to address existing bottlenecks and facilitate the widespread adoption of electric vehicles (Venegas et al., 2021).

The novelty of this study is by adding perceived risk aspects as previously conducted. Abudayyeh et al. (2023) based their model of thinking on gaps in earlier studies that ignored certain essential variables that could significantly affect the acceptance of electric vehicles. These variables cover various aspects, such as perceived ease of use, community involvement, knowledge related to electric vehicles, and perceived risk. Each plays an essential role in shaping the trend toward electric vehicle adoption. This study aims to analyze the antecedents of benefit factors that determine the intention to buy an electric vehicle. This study will fill the gap in earlier research by comprehensively analyzing the factors that influence EV purchase intention in Indonesia. This study will empirically examine the relationship between perceived usefulness, perceived ease of use, perceived risk, EV knowledge, public involvement, and purchase intention, as well as the antecedents of perceived usefulness, perceived ease of use, and perceived risk.

## Literature Review and Hypotheses

### Technology Acceptance Model

The Technology Acceptance Model (TAM) is an adaptation model of the Theory of Reasoned Action (TRA), namely the Technology Acceptance Model (TAM), specifically formulated to understand user acceptance of information systems or technology. TAM describes factors that generally affect computer reception, which inform user behavior in various end computing technologies and user groups (Davis, 1989). This TAM model underwent two model changes, and the final version was developed by Venkatesh & Davis (1996). The following is an overview of the final version of the TAM model developed by Venkatesh & Davis (1996):



**Figure 1.** Original Technology Acceptance Model  
Source: Venkatesh & Davis (1996)

Figure 1 is the final version of the Technology Acceptance Model developed by Venkatesh & Davis (1996). The main findings are perceived usefulness and ease of use, which directly influence behavioral intentions, thus eliminating the need for attitude variables. The final version of the Technology Acceptance Model includes and tests two specific beliefs: perceived usefulness and perceived ease of use. A person's belief in a system may be influenced by other factors (other than perceived usefulness and perceived ease of use) referred to as external variables in TAM (Venkatesh & Davis, 1996).

The premise is that technology with a higher perceived usefulness will increase usage, i.e., technology will improve individual performance in performing tasks. Therefore, users are more likely to use it. Second, if technology is perceived as easy to use, that is “the use of technology that is free from effort”, the intention to use the technology will be higher (Pelaez et al., 2019). Although the TAM model explains employees’ acceptance of computer technology, it has also gained wider acceptance in other fields where new technologies are introduced, such as green technology adoption studies (Shanmugavel & Micheal, 2022). The adoption of all kinds of technological innovation by end users is considered an important step that precedes the implementation of such technology (Al-qaysi et al., 2020).

## **EV Purchase Intention**

Consumer purchase intention has been widely discussed in various research models, such as the Theory of Reasoned Action (TRA), the Theory of Planned Behavior (TPB), and the Technological Acceptance Model (TAM) (Yang et al., 2020). Consumer purchase intention will be analyzed using the TAM model framework. Purchase intent can be defined as behavioral intent that describes how likely a buyer will purchase a particular product or service. Identifying the factors underlying customer purchase intent has been concluded from various studies as one of the main objectives of sellers and brands in maximizing business benefits and bringing business success (N'da et al., 2023)

According to Ewing & Sarigöllü (1998) price, performance, usage cost, and time cost factors are key factors that can influence the purchase of electric vehicles. However, consumers lack understanding of the overall impact of electric vehicles on the environment and the cost of owning an electric vehicle (Krupa et al., 2014). This is one of the reasons why electric vehicles have not been widely used (Yang et al., 2020). Electric vehicle battery life is another factor influencing its popularity (Franke & Krems, 2013); therefore, some consumers choose plugged hybrid automobiles (Carley et al., 2013). If the battery life problem is resolved, then it is likely that consumers will have a stronger intention to buy an electric vehicle (Koetse & Hoen, 2014). Liao et al. (2017) classify and summarize factors influencing consumer preferences, such as socioeconomic variables, psychological factors, mobility conditions, and social influences. In addition to the above factors, this study will try to focus and look at positive/benefit factors (perceived usefulness and perceived ease of use) and negative/risk factors (perceived risk) as determinants of consumer intention in buying electric vehicles along with antecedents of positive factors/benefits and adverse factors/risks.

## **Perceived Usefulness**

Perceived usefulness refers to the subjective assessment made by users regarding the extent to which they believe using or owning an electric vehicle will increase overall effectiveness, comfort, or utility in meeting their transportation needs and preferences (Abudayyeh et al., 2023). TAM was developed to explain the attitude of employees working in the technology sector in accepting new technology and the perception of the usefulness of new technology for them in their work and career advancement. This model also states that the user's intention to use technology is influenced by two main factors, namely perceived usefulness and perceived ease of use. If users find a technology valuable and easy to use, they are more likely to have a positive intention to adopt it (Davis, 1989). However, perceived usefulness has been used in many areas where new technologies are introduced, and the usefulness of those new technologies is evaluated by consumers (Shanmugavel & Micheal, 2022). TAM has been confirmed to be an accurate and efficient framework for analyzing user technology adoption in various scenarios based on earlier research (Wu et al., 2019). Applying it to the acceptance of electric vehicles can help predict intent levels and buying patterns, thus aiding in planning and decision-making (Shaikh et al., 2023).

## **Perceived Ease of Use**

Perceived ease of use refers to how easily a person feels using technology or a new system (Davis, 1989). Unlike PU, the impact of PEU on adoption intentions is unknown, and different technology products or systems have different impacts (Wu et al., 2019). This is inseparable from the many differences in the perception of convenience of various forms of technology to be adopted. Like new energy vehicles (NEVs), accessing license plates easily is one of ease of use. In some cities in China with strict traffic restrictions, NEV owners can get special license plates without waiting for the lottery (Zhang et al., 2023). As in the previous study by L. Zhang et al. (2023) which refers to the research of and considers the technical and performance aspects of NEVs, the study considers convenience aspects based on the ease of applying for license plates, ease of travel, and ease of operation. Meanwhile, in the research of Abudayyeh et al. (2023) the perception of convenience is aimed at the perception of ease in operation, interaction, and overall experience using EVs.

## Perceived Risks

The main problem of consumer behavior has to do with choice. Since some outcomes of a choice can only be known in the future, consumers are forced to face uncertainty or risk (Karunanayake & Wanninayake, 2015). This happens because consumer perceptions are based on assessments made in environments with uncertainty and ambiguity regarding their satisfaction with potential product outcomes (Ballester & Alemán, 2001). Perceived risk usually involves uncertainty, the consequences or possible losses, and the importance of those losses. Perceived risk captures a consumer's evaluation of the likelihood and severity of future negative consequences due to the consumption experience or the chance of loss multiplied by the magnitude of the loss (M. Featherman et al., 2021). Perceived risk refers to the uncertainty consumers experience when they cannot predict the consequences of their purchase decisions. (Schiffman & Wisenblit, 2019). In the context of electric vehicles, perceived risk can be defined as a user's subjective evaluation of uncertainty or anxiety that may have a negative relationship with decision-making on the use of electric vehicles (Jaiswal et al., 2021; S. Wang et al., 2018).

Low consumer acceptance of new products or services occurs due to subjective expectations of losses or potential unpleasant consequences (Roy et al., 2017). The problem is that the more excellent consumers' perception of the risks of new technologies, the less positive value they feel in adopting these innovative offerings (Kim et al., 2018). With this point of view, various literature shows that user uncertainty towards innovative technologies, especially when consumers consider adopting or purchasing technology products such as electric vehicles, is related to doubt or anxiety factors will relate to financial losses and utility risks such as uncertainty related to performance, convenience, long recharge times, charging infrastructure, and safety issues, etc (M. Featherman et al., 2021; W. Li et al., 2017; S. Wang et al., 2018).

## Hypothesis Development

### The Effect of Perceived Usefulness on The Purchase Intention of An Electric Car

The perceived usefulness of a technology is closely related to individual attitudes and acceptance of technology (Liu et al., 2018). Individuals are more likely to maintain a positive attitude toward the use of new technologies if they prove helpful and efficient (Wang et al., 2018; Liu et al., 2018). Electric vehicles have the potential to change travel patterns and lifestyles and reduce travel and living costs (Huang et al., 2021b). According to Zhang et al. (2018), parked electric vehicles can generate profits by charging during off-peak periods and injecting extra power into the power grid during peak hours, based on vehicle-to-grid (V2G) systems. Wang et al. (2018) showed that electric vehicles help reduce household transportation costs and improve travel efficiency and quality of life. In the Indonesian context, examined the intention of university students to become entrepreneurs using information technology and found that perceived usefulness significantly and positively influences the intention to adopt a technolog (I'jahjono et al., 2013) . Therefore, it is reasonable to believe that, in electric vehicle diffusion, the perceived usefulness of electric vehicles is positively correlated with high consumer intent to purchase electric vehicles. Therefore, the study hypothesizes that:

H<sub>1</sub>: Perceived usefulness significantly and positively affects EV purchase intention.

The perception of ease of using technology or innovation will support user attitudes toward the usefulness of the technology or innovation. It can be explained that when individuals assume the technology or innovation they will adopt will be easy to use, the benefits that will be felt for the technology or innovation will be greater (Davis, 1989):

H<sub>2,a</sub>: Perceived ease of use has a significant and positive effect on perceived usefulness.

In a study conducted by Kim et al. (2018), perceived risk is the most detrimental element that affects users' perception of how helpful electric vehicles are. It can be interpreted that the higher the perception of risk in using electric vehicles, the lower the perception of using them.

This is in line with empirical evidence conducted by (Abudayyeh et al., 2023; Tjahjono et al., 2013), where perceived risk significantly and negatively affects perceived usefulness. Based on the description and results of the study, the formulation of hypotheses that can be proposed is as follows:

H<sub>2.b</sub>: Perceived risks negatively and significantly affect perceived usefulness.

Individuals with a lower understanding of investment knowledge are less likely to use robo-advisor features because they don't see the benefits. Conversely, in another study, robo-advisor features were seen as more useful and valuable by those who considered themselves to have a high level of financial knowledge (Ashraf, 2023). In line with these findings, S. Wang et al. (2018) research explains that when users have a comprehensive understanding of electric vehicles, it often leads them to think of electric vehicles as vehicles that can provide benefits to individuals and society at large. By referring to the various petition results above, the formulation of hypotheses that can be proposed as follows:

H<sub>2.c</sub>: EV knowledge has a significant and positive effect on perceived usefulness.

If empirical research related to the impact of incentive perceptions on the benefits of environmentally friendly products such as electric vehicles, fate has not been studied much (Shanmugavel & Micheal, 2022). Incentive policies carried out by the government can undoubtedly increase the economic benefits consumers feel because they help reduce the cost of purchases. Meanwhile, consumers can easily understand and appreciate electric vehicles' environmental advantages (Zhang et al., 2018). This can be interpreted as the incentive policy positively perceiving the benefits that the use of electric vehicles will feel. Empirical research conducted by (Shanmugavel & Micheal, 2022) has proven that perceived incentive positively affects perceived usefulness. Based on the description and empirical evidence above, the formulation of hypotheses that can be proposed is as follows:

H<sub>2.d</sub>: Perceived incentives have a significant and positive effect on perceived usefulness.

E-vehicles require appropriate communication strategies to motivate customers to switch to cleaner products instead of high-polluting vehicles. Despite this, research was conducted to establish a relationship between eco-friendly advertising and consumer purchase intent (Arshad et al., 2014). As far as we know, the relationship between promotional efforts and perceived product usability has still not been widely studied. An initial study conducted by Shanmugavel & Micheal (2022) shows that the higher the promotional efforts made in promoting electric vehicles, the higher the perception of the use of electric vehicles. Therefore, further research is needed and provides an initial hypothesis that:

H<sub>2.e</sub>: Relative promotional effort has a positive and significant effect on perceived usefulness.

Economically rational buyers generally see price as essential to financial costs (Chiang & Jang, 2007). Dodds et al. (1991) state that if a price is unacceptable, consumers will value the product with little or no net value. Seeking the best price is indeed the primary motivation of consumers (Chiang & Jang, 2007). The high price of electric vehicles is due to the use of advanced technology and expensive lithium-ion batteries due to limited manufacturing facilities. Since price plays a decisive role in purchasing electric vehicles, high prices are the main reason for the low penetration and acceptance of electronic vehicles. However, there is also a perception of a similarity between price and high product quality. There are still relatively limited studies that try to establish a relationship between relative price advantage and perceived usefulness, with initial findings conducted by Shanmugavel & Micheal (2022) where relative price advantage has a significant positive effect on perceived usefulness so that researchers take hypotheses based on these initial findings and formulate hypotheses as follows:

H<sub>2.f</sub>: Relative price advantage has a positive and significant effect on perceived usefulness.

Products that offer a significant advantage over competing products tend to be unique. Radical new products are more differentiated from competing products and have more significant

product advantages. Relative product excellence is considered as an individual customer's evaluation of product attributes that may differ from one person to another. Having a product that is superior to competitors can improve performance. Product excellence as one of the most closely related strategic factors to performance (McNally et al., 2010). Practical research conducted by McNally et al. (2010) shows that a product's advantages positively affect the product's financial performance. However, related to this study, the influence of marketing-related stimuli on consumer perceptions of vehicle usability has not been explored by any further researcher. Initial research conducted by Shanmugavel & Micheal (2022) has proved that the superior the electric vehicle products produced, the higher the perception of the usefulness of electric vehicle products. However, the research needs to be studied further so that based on the results of the study, formulate the following hypothesis:

H<sub>2,g</sub>: Relative product advantage has a positive and significant effect on perceived usefulness.

A high level of product innovation increases product excellence, reduces consumer familiarity with new products, and harms consumer intentions, further resulting in market failure (Calantone et al., 2006). Electronic vehicles are considered highly innovative products with new technologies, fuel usage, and new features (Shanmugavel & Micheal, 2022). In other words, electric vehicles can be categorized as a form of radical innovation. Radical innovation is new in technology, unique, or sophisticated in the product category created, and can significantly change a market's consumption pattern (Zhou et al., 2005). Individual innovative behavior is a personality trait prevalent in a person compared to others. It is described as personal innovativeness, individuals with the potential risk-taking ability to try something new and innovative (Agarwal & Prasad, 1998). Empirical evidence that Shanmugavel has carried out shows that the higher the innovation attitude inherent in individuals, the higher one's ability to understand the usefulness of electric vehicles. Therefore, the formulation of hypotheses that can be proposed is:

H<sub>2,i</sub>: Personal innovativeness has a positive and significant effect on perceived usefulness.

### **The Effect of Perceived Ease of Use on Purchase Intention**

The cognitive measurement of perceived ease of use is the user's subjective assessment of the extent to which the use of a particular technology can be done quickly and free from physical and psychological stress, thus positively affecting consumer attitudes toward that technology offering and intent to own it (Davis, 1989; Wu et al., 2019). For new technologies a high level of participation and interaction between consumers and new technologies is an effective way to increase understanding of the technology and consumer intent to adopt it. Electric vehicles are high-interaction products, and the technology is easy for consumers to operate. Both factors give consumers a greater sense of participation and interaction. Therefore, Huang et al. (2021) believe that perceived ease of use is essential in encouraging the use of electric vehicles and is highly correlated with consumers' willingness to own them. Based on the results of this description, the author formulates the following hypothesis:

H<sub>3</sub>: Perceived ease of use significantly and positively affects EV purchase intention.

### **The Effect of EV knowledge on Perceived Ease of Use**

An organization with individual employees with a broad level of knowledge about innovation and technology tends to face fewer confrontations and problems when introducing and practicing new technologies. In other words, when users have a comprehensive understanding of EVs, it often makes it easy to use them. This aligns with Muthahhari et al. (2020), who show that better knowledge of technology can increase perceived ease of use because users feel more confident and competent. This is empirically evident from Holden & Rada (2011) research, which reveals a positive relationship between individuals' knowledge of contemporary technology and their perception of its ease of use. Therefore, the formulation of hypotheses that can be proposed is:

H<sub>4</sub>: EV knowledge significantly and positively affects perceived ease of use.



### **The Effect of Perceived Risk on Purchase Intention**

The decision to adopt electric vehicles carries risks for many target markets because the products are very different, expensive technologies requiring significant initial costs, behavioral changes (charging plans), and the possibility of improving home infrastructure (M. Featherman et al., 2021). In China, the financial risks associated with electric vehicles include relatively high maintenance costs and low residual value of use (Brand et al., 2017). Electric vehicles are a new product; therefore, some technologies are still underdeveloped compared to fossil fuel vehicles, such as limited mileage and long charging times (Schuitema et al., 2013). As a result, consumers consider convenience risks before purchasing an electric vehicle, including time losses and disappointing product functionality (Featherman & Pavlou, 2003). Of course, the convenience of having a charging facility at home is essential for potential buyers of electric vehicles (Qian et al., 2019). Inadequate charging infrastructure creates inconvenience for consumers (Wang et al., 2017). Consumer safety assurance (e.g., spontaneous combustion) is a further issue when purchasing electric vehicles (Brand et al., 2017). Based on the explanation that has been done, the formulation of the hypothesis can be as follows:

H<sub>5</sub>: Perceived risks negatively and significantly affect EV purchase intention.

One of the main components of perceived risk is uncertainty and consequences or possible losses (Filho et al., 2020). This uncertainty can be reduced by obtaining more information about the product; thus, a consumer's previous experience with the brand influences his opinion of the offering (Herbeth et al., 2017; Pandowo, 2016). When consumers conclude that they can rely on the brand and the information provided regarding product attributes, it implies that they have a deeper understanding of product advantages and their perception of risk changes (Folkes, 1988). In other words, extensive knowledge will help individuals reduce the perception of risk that they face. Research (Abudayyeh et al., 2023) has empirically proven that knowledge related to electric vehicles negatively affects the perception of risk arising from electric vehicles. Therefore, the formulation of hypotheses that can be proposed is:

H<sub>6.a</sub>: EV knowledge has a negative and significant effect on perceived risks.

Public involvement is essential to increase acceptance of controversial technologies and issues like nuclear energy development. Lack of community involvement can lead to community resistance and protests (Wang et al., 2019). Low consumer acceptance of new products or services occurs due to subjective expectations of losses or potential unpleasant consequences (Roy et al., 2017). This can be due to low public engagement with electric vehicles, which impacts their high-risk perception. This is proven empirically, where public involvement negatively affects the perceived risks of electric vehicles. Based on this research, the following hypotheses can be formulated:

H<sub>6.b</sub>: Public involvement has a negative and significant effect on perceived risks

### **The Effect of Perceived Incentives on purchase intention**

Economic costs have always been one of the main factors influencing consumer purchase intent (Zhang, 2014). Jenn et al. (2013) found that sales of hybrid vehicles increased by 0.0046% per dollar of incentives by looking at the effectiveness of the Energy Policy Act of 2005 in the United States. The study of Fearnley et al. (2015) also showed that electromobility incentives could effectively develop electric vehicle markets after analyzing electromobility incentives across Europe. Another study by Li et al. (2015) analyzed factors influencing the development of electric vehicles in 14 international cities/regions – New York, Los Angeles, Portland, Kanagawa, Rotterdam, North Brabant, Amsterdam, Paris, Barcelona, Berlin, Hamburg, northeast England, Helsinki, and Stockholm – that have successfully promoted the use of electric vehicles. The results show that electric vehicle development requires subsidies and tax incentives at an early stage, and effective policies and sustained industry investment are essential for the sustainability of electric vehicle development. Based on the results of the above research, the formulation of hypotheses that can be proposed is as follows:

H<sub>7</sub>: Perceived incentives significantly and positively affect EV purchase intention.

### The Effect of Public Involvement dan EV Knowledge

More involved citizenship in government programs is expected to generate broad support for public policy decisions that align with the broader public interest (Schmid et al., 2016). This can mean broad support for public policies will also be followed by higher knowledge of these public policies. In the Indonesian context, public involvement significantly influences the adoption of information and communication technology (ICT) among Micro, Small, and Medium Enterprises (MSMEs) in Yogyakarta. Muthahhari et al. (2020) This can be proven empirically by Abudayyeh et al. (2023), who found that high public involvement positively correlates with knowledge of electric vehicles. From the findings of this study, the following hypotheses can be proposed:

H<sub>8</sub>: Public involvement has a positive and significant effect on EV knowledge

Thus, to respond to the formulation of the problem and achieve the appropriate research objectives, the steps taken in research based on the model will be carried out more completely research by adding perceived ease of use and perceived risk in detailing the variables, as shown in Figure 2 below:

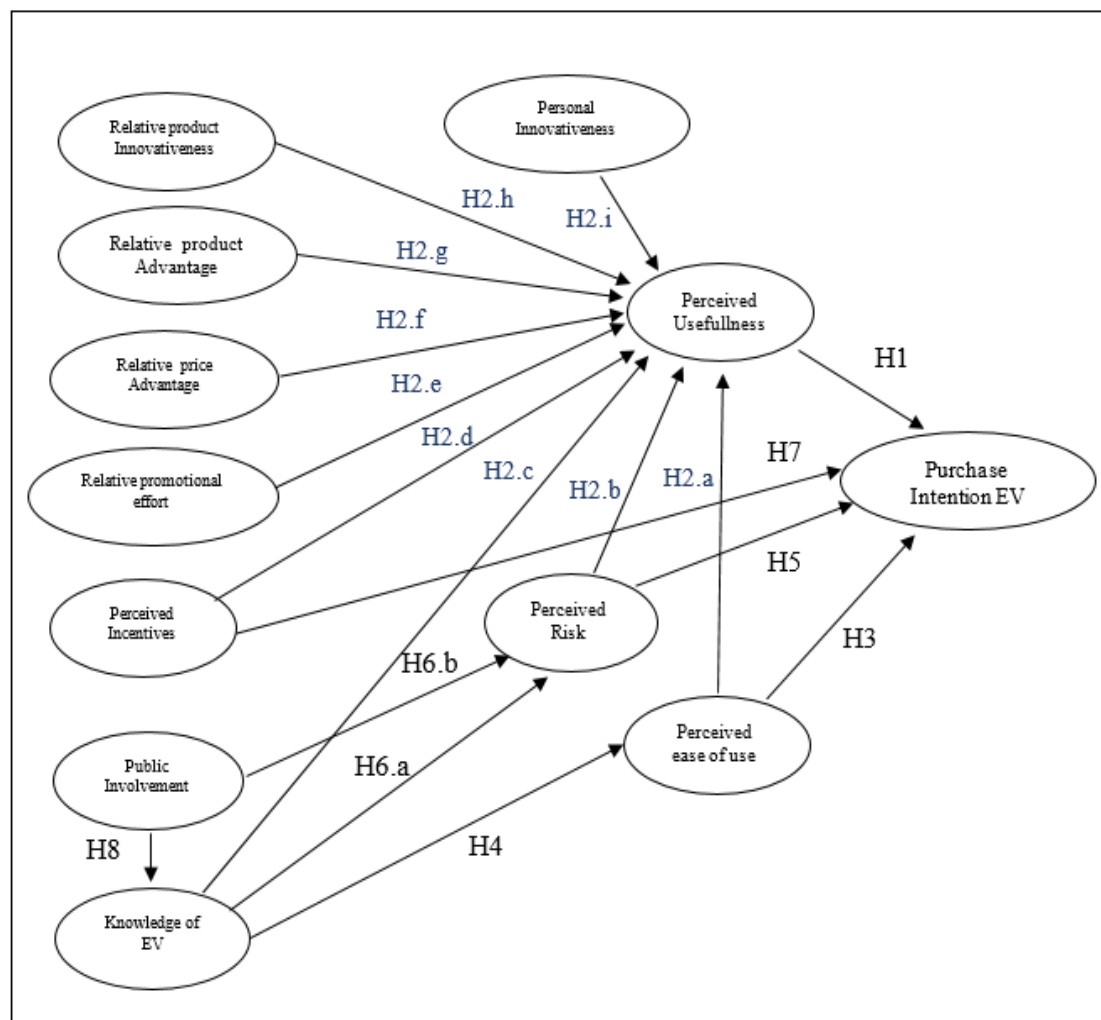


Figure 2. Research conceptual framework

Combining with the research model of Abudayyeh et al. (2023), this research model will place additional aspects of consideration of the benefits of adopting electric cars, namely the variable perceived ease of use and one aspect of consideration of the risk of adopting electric cars, namely the variable perceived risk. In addition, the proposed research model will get new

antecedents on perceived usefulness, perceived ease of use, and perceived risk, namely public involvement and EV knowledge. Although in the research of Abudayyeh et al. (2023), EV knowledge does not have a significant effect on perceived risk, and perceived risk does not have a significant effect on behavior intention, the variables EV knowledge and perceived risk are maintained. The EV knowledge variable is maintained because the study of Abudayyeh et al. (2023) reveals the critical role of knowledge about electric vehicles in shaping individual perceptions and attitudes toward these vehicles.

## Research Methods

This study uses quantitative methods with a survey design to understand the factors influencing the purchase intention of electric vehicles in Indonesia. Broad Participation of EV Users: This survey involved 957 prospective electric vehicle users in Indonesia who have never purchased an EV but have adequate interest and knowledge about EVs. Research instruments in the form of questionnaires that have been tested for validity and reliability are used to collect accurate and consistent data (Sekaran & Bougie, 2016). This study measures purchase intent and explores underlying factors, such as perceived usefulness, perceived risk, EV knowledge, and public involvement. To examine complex relationships between research variables (Hair et al., 2014). Unit analysis refers to the rate at which data is collected and aggregated during the next stage of data analysis (Sekaran & Bougie, 2016). Related to this study, the unit of analysis used is the individual level related to his intention to buy an electric vehicle in Indonesia. The temporal aspect of this study utilizes cross-sectional data, namely data collected at the same time or almost the same (Sekaran & Bougie, 2016). The researchers' level of intervention and the research background will be explained further in the sampling method section. The collected data was analyzed using Structural Equation Modeling – Partial Least Square (SEM-PLS).

## Results and Discussion

### Respondent Characteristics

Data collection was done using a questionnaire that obtained 996 respondents. From this number, screening was carried out based on the respondents' sampling criteria, where respondents were taken with the criteria of Indonesian citizens over 20 years of age, respondents who understood about electric vehicles, and respondents who had never bought an electric vehicle. Therefore, the number of respondents will be included in this study is 957 respondents.

**Table 1.** Characteristics of respondents

Demographic Variables	N	%
<i>Gender</i>		
Man	622	64,99%
Woman	335	35,01%
<i>Age</i>		
21 – 35 years old	532	55,59%
36 – 60 years old	425	44,41%
<i>Recent Education</i>		
High School	168	17,55%
Diploma	153	15,99%
Bachelor	523	54,65%
Postgraduate (S2)	105	10,97%
Doctoral (S3)	8	0,84%
<i>Income</i>		
< Rp 5.067.381	287	29,99%
Rp 5.067.381 – Rp 10.134.762	259	27,06%
Rp 10.134.762 – Rp 15.202.143	222	23,20%
Rp 15.202.143 – Rp 20.269.524	78	8,15%
> Rp 20.269.524	111	11,60%

The characteristics of respondents were obtained based on gender from 957 respondents who had passed the initial screening 622 male respondents (64.99%) and 335 female respondents (35.01%). The majority of male respondents can be attributed to the general view of society where the automotive world is more attractive to men. This case mainly includes understanding electric vehicles, which men who guarantee are a matter of more profound knowledge and interest to understand. However, it is also interesting to find that the number of women who have an interest and understanding in the automotive field, especially in electric vehicles, is quite a lot, which can also show that women are now starting to open their knowledge to the world of the electric vehicle industry.

The characteristics of respondents were obtained based on the age of a total of 957 respondents who had passed the initial screening, respondents with an age range of 21 - 35 years as many as 532 respondents (55.59%) and respondents with an age range of 36 - 60 years as many as 425 respondents (44.41%). The majority of respondents obtained were in the range of 21-35 years and then in the age range of 36-60 years, where that age is the productive age of someone with high activity and a generation still very concerned about the times. Electric vehicles are considered an innovation that can solve the problem of oil-fueled vehicles and provide benefits in supporting every activity.

The characteristics of respondents were obtained based on the domicile of 957 respondents who have passed the initial screening spread across 30 provinces in Indonesia. The results of the questionnaire show that most respondents came from DKI Jakarta province, with as many as 206 respondents (21.53%), then West Java province, as many as 193 respondents (20.17%), and third place in Central Java province as many as 115 respondents (12.02%). Most of the responses are still bearable on the island of Java, especially in the DKI Jakarta area and its surroundings. This also gives a general picture of the existence of electric vehicles, which are still dominant on the island of Java. In contrast, the existence of electric vehicles in other regions is still minimal, so public knowledge and interest have become very small.

The characteristics of respondents obtained based on education from a total of 957 respondents who had passed the initial screening were obtained by respondents with the last education of SMA / SMK / MA as many as 168 respondents (17.55%), respondents with the last diploma education as many as 153 respondents (15.99%), respondents with the last education of bachelors as many as 523 respondents (54.65%), respondents with the last education postgraduate (S2) as many as 105 respondents (10.97%), and respondents with the last doctoral education as many as eight respondents (0.84%). These results illustrate that people from various educational backgrounds are interested in driving electricity.

The characteristics of respondents obtained based on income from a total of 957 respondents who have passed the initial screening were obtained by respondents with income less than Rp 5,067,381 as many as 287 respondents (29.99%), respondents with an income range between Rp 5,067,381 - Rp 10,134,762 as many as 259 respondents (27.06%), respondents with an income range between Rp 10,134,762 - Rp 15,202,143 as many as 222 respondents (23.20%), respondents with an income range between IDR 15,202,143 - IDR 20,269,524 as many as 78 respondents (8.15%), respondents with income more than IDR 20,269,524 as many as 111 respondents (11.60%).

### **Convergent Validity**

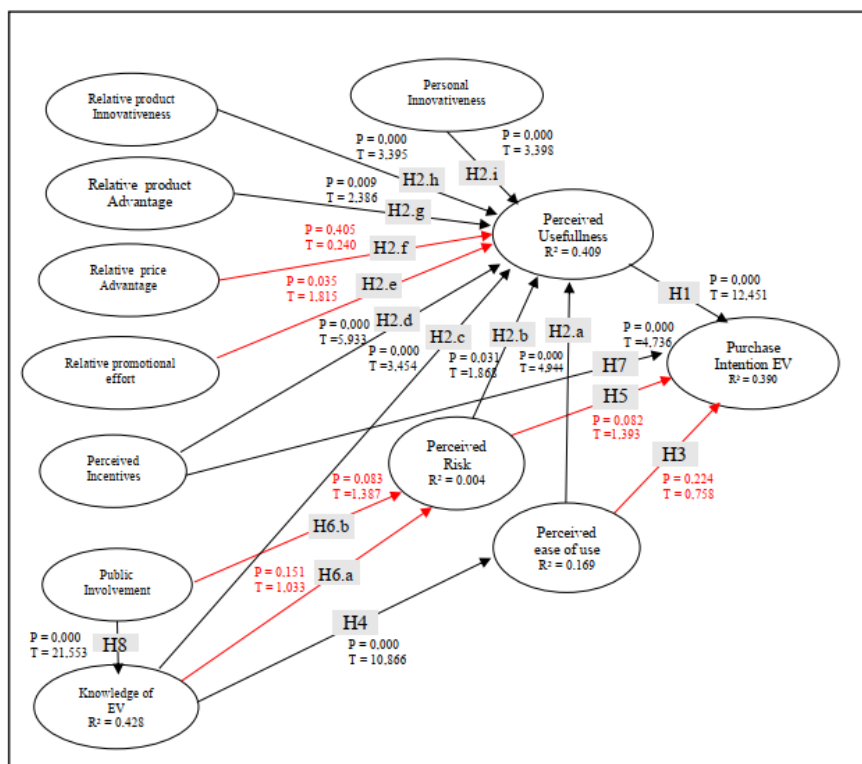
The AVE value is calculated by summing the squares of the factor loadings of all indicators associated with the construct and then dividing it by the total number of indicators associated with the construct, including relevant factor loadings. In SmartPLS, AVE is expressed as a percentage or in the range 0 to 1. The AVE value that is considered reasonable is at least 0.5. If the AVE value is lower than 0.5, then the construct may not have high enough convergent validity. Meanwhile, factor loading describes the strength of the relationship between each indicator and the measured construct. Generally, a factor loading that is considered reasonable is above 0.7. The AVE Value table can be seen in table 2 below.

**Table 2.** Average Variance Extracted (AVE)

Variable	Average Variance Extracted (AVE)
Knowledge of EV	0.683
Perceived Incentives	0.716
Perceived Risk	0.616
Perceived Usefulness	0.593
Perceived ease of Use	0.535
Personal Innovativeness	0.624
Public Involvement	0.712
Purchase Intention	0.612
Relative Price Advantage	0.863
Relative Product Advantage	0.623
Relative Product Innovations	0.669
Relative Promotion Effort	0.646

**Table 3.** Fornell-Lacker Test Results

	Knowledge of EV	Perceived Incentives	Perceived Risk	Perceived Usefulness	Perceived Ease of Use	Personal Innovativeness	Public Involvement	Purchase Intention	Relative Price Advantage	Relative Product Advantage	Relative Product Innovations	relative Promotion Effort
Knowledge of EV	0.827											
Perceived Incentives	0.361	0.846										
Perceived Risk	0.005	-0.017	0.785									
Perceived Usefulness	0.419	0.461	-0.091	0.770								
Perceived Ease of Use	0.395	0.377	-0.109	0.483	0.732							
Personal Innovativeness	0.309	0.267	-0.035	0.403	0.383	0.790						
Public Involvement	0.832	0.372	-0.032	0.449	0.367	0.295	0.844					
Purchase Intention	0.414	0.421	-0.009	0.601	0.335	0.349	0.426	0.782				
Relative Price Advantage	0.151	0.182	0.079	0.144	0.159	0.151	0.142	0.161	0.929			
Relative Product Advantage	0.330	0.411	-0.037	0.418	0.354	0.452	0.388	0.436	0.308	0.789		
Relative Product Innovations	0.399	0.335	-0.034	0.412	0.291	0.409	0.390	0.394	0.186	0.530	0.818	
relative Promotion Effort	0.275	0.372	0.106	0.246	0.320	0.347	0.335	0.232	0.307	0.442	0.233	0.804



**Figure 3.** Results of P-Value, T-Value, and R Square

**Table 4.** R Square Result

	R Square	R Square Adjusted
Knowledge of EV	0.692	0.692
Perceived Risk	0.004	0.002
Perceived Usefulness	0.410	0.405
Perceived ease of Use	0.156	0.155
Purchase Intention	0.390	0.387

Source: SmartPLS output results processed by researchers

**Table 5.** Hypothesis Test

	Hypothesis	Original Sample	T Statistics	P Values	Result
H1	Perceived usefulness → EV purchase intention	0.511	12.451	0.000	Supported
H2.a	Perceived ease of use → Perceived usefulness	0.231	4.944	0.000	Supported
H2.b	Perceived risks → Perceived usefulness	-0.045	1.868	0.031	Supported
H2.c	EV knowledge → Perceived usefulness	0.130	3.454	0.000	Supported
H2.d	Perceived incentives → Perceived usefulness	0.234	5.933	0.000	Supported
H2.e	Relative promotional Effort → Perceived usefulness	-0.060	1.815	0.035	Not Supported
H2.f	Relative price advantage → Perceived usefulness	-0.007	0.240	0.405	Not Supported
H2.g	Relative product advantage → Perceived usefulness	0.102	2.386	0.009	Supported
H2.h	Relative product innovativeness → Perceived usefulness	0.121	3.395	0.000	Supported
H2.i	Personal innovativeness → Perceived usefulness	0.141	3.398	0.000	Supported
H3	Perceived ease of use → EV purchase intention.	0.026	0.758	0.224	Not Supported
H4	EV knowledge → Perceived ease of use	0.411	10.866	0.000	Supported
H5	Perceived risks → EV Purchase intention	0.043	1.393	0.082	Not Supported
H6.a	EV knowledge → Perceived risks	0.073	1.033	0.151	Not Supported
H6.b	Public involvement → Perceived risks	-0.080	1.387	0.083	Not Supported
H7	Perceived incentives → EV purchase intention.	0.177	4.736	0.000	Supported
H8	Public involvement → EV knowledge	0.654	21.553	0.000	Supported

Perceived usefulness has a significant and positive influence on EV purchase intention. The hypothesis test results show the original sample value of 0.511 with t-statistics of 12.451 and P-Values of 0.0000, which means H1 is accepted. Technology knowledge and perceived usability play an essential role, with earlier research supporting this positive relationship. Respondents understood EV performance, risks, and benefits well, as reflected by an average perceived usefulness score of 4,129. Other factors such as perceived ease of use, perceived risks, EV knowledge, perceived incentives, and relative product advantage were also found to significantly influence perceived usefulness, suggesting that comfort, knowledge, incentives, and product advantages influence perceptions of EV benefits.

Perceived ease of use also significantly affects perceived usefulness, with an original sample value of 0.231, t-statistics of 4.944, and P-values of 0.000. This study supports the Technology Acceptance Model (TAM) model, which states that ease of use increases perceived usefulness. Respondents who recognize ease of use are likelier to have higher intentions toward EVs. However, other variables, such as relative promotional effort and relative price advantage, did not always show the expected results, indicating that promotion and price do not always increase the perceived benefits of EVs. The results show that aspects of technological knowledge, incentives, and product advantages play a more significant role in shaping the perceived benefits of EVs than promotion and price factors.

Overall, increasing consumer awareness of the benefits of electric vehicles and expanding charging infrastructure are essential steps in driving the transition to a sustainable transportation system and maximizing electric mobility's environmental and economic benefits. Increasing consumer awareness of the benefits of electric vehicles and expanding charging infrastructure are essential steps in driving the transition to a sustainable transport system and maximizing electric mobility's environmental and economic benefits (Tran et al., 2021). Despite the Indonesian government's efforts to introduce incentives and policies to encourage the adoption of electric

vehicles, uptake is still low, indicating the existence of hidden factors that hinder consumers' purchase intentions (Yusuf et al., 2021). Educating consumers about the advantages of electric vehicles, such as reduced emissions and lower operating costs, is critical to increasing acceptance and utilization (Krishnan & Sreekumar, 2023). The availability of public charging infrastructure plays an essential role in driving the adoption of electric vehicles, with openly accessible infrastructure being more commonly used than proprietary options (Hasan et al., 2024). Government regulations, such as the Presidential Regulation of the Republic of Indonesia Number 55 of 2019, aim to provide guidance and legal certainty to accelerate the battery-based electric vehicle program, including strategies for developing electric charging infrastructure. Ongoing initiatives focus on standardizing and improving charging station infrastructure to overcome challenges and facilitate the widespread adoption of electric vehicles (MacInnis et al., 2023). Overall, increasing consumer awareness and expanding charging infrastructure are critical to promoting sustainable transportation systems and maximizing the benefits of electric mobility.

Interestingly, this study found that perceived risk associated with electric vehicles did not directly influence purchase intentions. This study reveals that the perceived risk of electric vehicles does not directly influence purchase intentions (Lee et al., 2021). However, this risk perception indirectly influences purchase intentions through perceived benefits. Research has shown that educating consumers about the benefits of electric vehicles, such as reduced emissions and lower operating costs, is critical to increasing acceptance and utilization (Lin et al., 2023). The availability of public charging infrastructure is essential in driving electric vehicle adoption, with openly accessible infrastructure more commonly used than proprietary options (Ahmed et al., 2020). Increasing consumer satisfaction through optimizing energy use at fast charging stations can increase the resilience of electric vehicles during system disruptions (Chibuogwu et al., 2021). High public involvement in discussions about electric vehicles has increased consumer knowledge. This shows the importance of education and outreach to the broader community to increase understanding and acceptance of electric vehicles.

### **Theoretical Implication and Managerial Implication**

This research contributes significantly to the literature on adopting electric vehicles (EVs). First, This research significantly contributes to the existing literature on electric vehicle (EV) adoption by challenging previous findings regarding the role of perceived ease of use. While prior studies, such as those within the Technology Acceptance Model (TAM) framework, have often posited a positive relationship between perceived ease of use and purchase intention, the results of this study contradict this notion. In the Indonesian context, perceived ease of use was found to not have a significant effect on EV purchase intention. This divergence from established research suggests that the Indonesian market may have unique characteristics or that other factors, such as cultural norms, economic considerations, or infrastructure limitations, may play a more dominant role in shaping consumer decisions regarding EVs. This finding opens up new avenues for research to explore these alternative factors and their relative importance in the Indonesian EV market, ultimately contributing to a more nuanced understanding of EV adoption in diverse cultural and economic contexts. Second, the study supports the finding that EV knowledge significantly affects perceived ease of use, suggesting that a better understanding of the technology can reduce user uncertainty. Third, the finding that perceived risks do not significantly affect purchase intent highlights the importance of exploring other factors that may influence risk perception, such as brand image and direct experience. Fourth, the results show that public engagement significantly affects EV knowledge and emphasizes the importance of education and community engagement in driving the adoption of new technologies. Finally, the results, which show that perceived incentives positively affect purchase intent, confirm the importance of incentive policies in increasing the adoption of electric vehicles.

From a managerial perspective, The study's findings offer valuable insights into the factors influencing EV adoption in Indonesia, shedding light on various aspects crucial for the growth of the EV industry in the country. Firstly, the research suggests that EV manufacturers need to broaden their focus beyond just the ease of use of EVs. While ease of use is essential, it's not the

sole determinant of consumer purchase intent. Instead, manufacturers should prioritize enhancing product features, strengthening brand image, and highlighting the environmental benefits of EVs to attract consumers effectively. Second, the study underscores the significant role of marketers in promoting EV adoption. Marketers should invest in comprehensive education and training programs to increase consumer knowledge about EVs. By addressing misconceptions and uncertainties surrounding EVs, these programs can improve consumers' perceptions of the ease of use and benefits, ultimately boosting adoption rates. Third, policymakers play a crucial role in shaping the EV landscape. The study highlights the importance of continued support for incentive policies, such as subsidies and tax exemptions, to make EVs more financially attractive to consumers.

Additionally, policymakers should focus on fostering public involvement in EV campaigns and discussions to raise awareness and promote technology acceptance among the general population. By addressing these implications, stakeholders across various sectors can collaborate to create a more conducive environment for EV adoption in Indonesia. This collaborative effort will contribute to a more sustainable transportation system and lead to a cleaner environment for future generations. From a managerial perspective, the study's findings provide several practical implications for electric vehicle manufacturers, marketers, and policymakers. First, electric vehicle manufacturers should focus on factors other than ease of use to drive consumer purchase intent, such as product features, brand, and environmental impact. Second, education and training programs on electric vehicles must be improved to increase consumer knowledge, which in turn can improve perceptions of ease of use. Third, given that risk perception does not significantly affect purchase intent, manufacturers can focus more on managing brand image and providing clear, transparent information to reduce unfounded fears. Fourth, high public involvement in campaigns and discussions on electric vehicles can increase knowledge and acceptance of this technology, so community engagement programs must be strengthened. Finally, incentive policies such as subsidies and tax exemptions should continue to be encouraged by the government to increase the financial attractiveness of electric vehicles and encourage consumers to make purchases.

## Conclusion and Future Direction

This research concludes that perceived usefulness is the most significant factor influencing the intention to purchase electric vehicles in Indonesia. This shows that consumers' perceptions of the benefits of electric vehicles, such as operational cost savings, energy efficiency, and better environmental impact, are essential in their purchasing decisions. In other words, when consumers feel that electric vehicles offer tangible benefits that can improve their quality of life, they tend to have stronger intentions to purchase them. These benefits include lower operating costs than conventional vehicles, as electric charging costs less than fossil fuels, and electric vehicles require less maintenance. Additionally, electric vehicles are known to be more efficient in energy use, saving costs and supporting wiser use of resources. Environmental impact also plays an essential role in increasing perceived usefulness. Consumers increasingly aware of the importance of protecting the environment will be more likely to be interested in electric vehicles because of their lower carbon emissions than fossil fuel vehicles. The perception that using an electric vehicle is a fundamental step in reducing your carbon footprint may encourage stronger purchase intentions. This shows that the perceived ease of use of electric vehicles, such as ease of charging and operation, can increase consumers' perceptions of the benefits of electric vehicles.

Perceived risk does not significantly affect the intention to purchase an electric vehicle, although perceived risk harms perceived benefits. This suggests that consumers' concerns about the risks associated with EVs, such as safety or price issues, do not directly hinder their intention to purchase EVs. This means that while consumers may have concerns or uncertainties regarding electric vehicles, such as doubts about battery safety, maintenance costs, or service life, these concerns are not strong enough to deter their purchase intentions. Instead, these concerns have more of an impact on how consumers assess the overall benefits of electric vehicles. If the perceived benefits are strong enough, consumers tend to remain interested in buying an electric



vehicle even though they perceive some risks. Strengthening perceived usefulness is the key to increasing purchase intentions for electric vehicles in Indonesia. By understanding and optimizing the factors that influence these perceptions, stakeholders can encourage wider adoption of electric vehicles, providing significant economic and environmental benefits. This research makes an essential contribution to understanding the factors that influence the purchase intention of electric vehicles in Indonesia. The results of this study can serve as a reference for the government, electric vehicle manufacturers, and other related parties in formulating effective strategies and policies to accelerate the adoption of electric vehicles in Indonesia.

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