

## Article

# Understanding Product Attachment to Battery Electric Vehicles: Evidence from Indonesian Owners

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## Abstract

Battery electric vehicle (BEV) adoption does not always result in long-term ownership, because some owners may return to internal combustion engine vehicles after purchase. This study examines how internal customer factors influence the formation of product attachment, an emotional bond between owners and their BEVs. This issue is important because such attachment may support long-term commitment, expressed through advocacy and loyalty after adoption. The study focuses on instrumental, affective, and symbolic car use motivation, customer innovativeness, and direct experience. Data were collected through face-to-face surveys with 392 Indonesian BEV owners who had driven their vehicles for more than 5000 km. ANOVA and PLS-SEM were used to examine segment differences and test the structural model. Affective motivation had the largest positive path coefficient for product attachment ( $\beta = 0.451$ ), followed by symbolic motivation ( $\beta = 0.370$ ), direct experience ( $\beta = 0.301$ ), and instrumental motivation ( $\beta = 0.229$ ). Customer innovativeness was not significant ( $\beta = -0.026$ ,  $p = 0.324$ ). Product attachment showed strong relationships with customer advocacy ( $\beta = 0.649$ ) and loyalty ( $\beta = 0.686$ ). This study extends the product attachment literature by explaining how internal customer factors are related to the development of product attachment and the extent to which owners become attached to their BEVs.

**Keywords:** battery electric vehicle; product attachment; post-adoption; car use motivation; customer innovativeness; direct experience; customer advocacy; customer loyalty



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## 1. Introduction

Private fossil-fuel vehicles remain significant contributors to greenhouse gas emissions within the passenger transport sector [1]. Therefore, reducing car dependency is essential for a low-carbon transition [2]. Auto-mobility theory helps explain why decarbonizing the transport system remains a major challenge [3,4]. This theory views car use as part of a larger transport system, rather than a series of isolated individual decisions [3]. Structural factors, including infrastructure, land use, and every day travel habits, consistently reinforce car dependence, making car use highly convenient and difficult to replace [4,5]. Over time, the vehicle becomes emotionally significant, as it supports personal autonomy and identity expression [6].

This perspective is especially relevant to BEV adoption. Electrification can significantly reduce carbon emissions from cars and lower the negative environmental impacts of daily driving [7], while maintaining most of the benefits of traditional car ownership that many

drivers still highly value [8,9]. Therefore, BEVs reinforce a reconfigured form of automobility organized around replacing conventional propulsion with cleaner technology rather than moving away from private car ownership [10]. Automobile research suggests that cars can become emotionally meaningful objects for their owners, as vehicles often play an important role and are deeply integrated into their daily lives [11]. Private vehicles provide a certain degree of autonomy and are not merely practical tools for mobility; they are also highly valued for the sense of independence, the pleasure of driving, and the social status associated with ownership [12]. In this setting, BEVs hold significant potential to foster product attachment. They possess a unique capability to create strong emotional bonds by maintaining the practical benefits of ICEVs [8,9] while providing new and distinct experiential and symbolic advantages [13]. Owners often perceive BEV features, such as quiet driving, smooth acceleration, lower effort in routine operation, and the feeling of using modern technology, as superior to those of ICEVs, even though in some contexts, BEV use may still require a certain degree of adaptation [14,15].

However, these cues do not guarantee the formation of product attachment during BEV ownership. Compared with ICEVs, owning a BEV is a significantly different experience, as it requires a shift in habits due to altered conditions of use, such as charging dependency, range management, and infrastructure-related planning [16]. Such changes often lead to resistance, as individuals do not always accept innovations easily, specifically when technology disrupts existing routines or forces users to rethink their expectations [17,18]. In the context of the electric mobility transition, this tension does not disappear after purchase, as users must adjust to new driving habits and routines. The vehicle can become fully integrated into daily life only if users succeed in changing their driving patterns [19]. However, if users perceive the ownership experience as poor and constrained by range concerns, limited charging access, long recharge times, or cost-related worries, they will evaluate the vehicle less favorably. Consequently, they are less likely to remain committed to electric vehicles over the long term [20].

The formation of product attachment is partly shaped by internal differences among owners. Even under similar ownership conditions, individuals may interpret and respond differently [21]. According to appraisal theory, emotional responses to a given situation depend not only on the event itself but also on how individuals interpret their experience based on their own concerns, goals, and expectations [22,23]. This suggests that positive BEV features alone are not enough to secure a stable owner vehicle relationship because product attachment develops through continuous interaction between the owner and the object, rather than emerging automatically after purchase [24]. This process is also contingent on the owner's personal motivations and internal standards [22,25]. However, despite its relevance, BEV post-adoption attachment remains insufficiently explained. Existing BEV research has mainly examined adoption intention, satisfaction, or brand attachment, while less is known about how owners develop product attachment toward the BEV they already use. This gap is important because BEV ownership requires users to adjust to new routines, including charging, range management, and different driving habits.

Therefore, understanding how this bond develops and how individual owners' internal factors shape its formation is important, as sustained market growth depends on whether BEV owners become committed over time rather than treating BEV ownership as a short-term experiment [26,27]. Product attachment may serve as an important predictor of continued use [28], resistance to switching [24], repeat purchase intentions [29], and positive word of mouth [30].

This study addresses this gap by operationalizing internal factors through instrumental, affective, and symbolic car use motivations [31], customer innovativeness [32], and direct experience. In the present study, direct experience is treated not as mere exposure

or accumulated usage, but as a form of self-generated learning through product interaction [33]. For battery electric vehicles, which introduce novel attributes and new usage routines, these constructs are especially relevant, as they represent not only what owners value in the vehicle, but also their openness to novelty and how they learn from evolving patterns of routine use over time. This study uses data drawn from real BEV owners in Indonesia, aiming to explain why owners do not develop the same level of attachment, even when ownership conditions are broadly similar. Without considering these internal factors, attachment formation through a clear psychological pathway becomes difficult to explain.

This study offers several theoretical contributions to the battery electric vehicle (BEV) and sustainable mobility literature. First, it extends product attachment theory within the BEV context by examining product attachment in the post-adoption phase, whereas existing BEV studies primarily focus on brand attachment during the pre-purchase phase rather than attachment to the owned vehicle itself. Second, by integrating individual internal factors, this study enriches the attachment literature as a psychologically grounded post-purchase process and clarifies how and why emotional bonds are formed during daily interactions with the product. To the best of the authors' knowledge, prior studies have often focused on identifying who develops attachment to an object based solely on user profiles or external product attributes.

The remainder of this paper is organized as follows. Section 2 reviews the literature and develops the hypotheses related to car use motivation, customer innovativeness, direct experience, product attachment, customer advocacy, and customer loyalty. Section 3 explains the research methodology, including the study process, measurement development, data collection, and analysis using ANOVA and PLS-SEM. Sections 4 and 5 present the results and discussion, while the final section provides the conclusions, implications, limitations, and future research directions.

## 2. Literature Review

### 2.1. Current Studies on EV Post-Adoption Behavior

Current studies on EV post-adoption behavior have gradually shifted the discussion from purchase intention to what happens after users live with the vehicle in everyday settings. A systematic review by Daramy-Williams et al. [15] showed post-adoption research has examined driving and travel behavior, interactions with vehicle attributes, and subjective aspects of use. Daramy-Williams et al. [15] already suggested EV use cannot be reduced to a simple functional evaluation, because owner experience also includes meanings related to environmentalism, futurism, and status or identity.

The most established stream in this literature explains post-adoption outcomes through user satisfaction. In China and South Korea, Su et al. [34] and Kwon et al. [35] similarly reported EV owner satisfaction as being shaped by several ownership-related attributes, such as perceived usefulness, cost, driving range, and charging conditions. In Japan, Okada et al. [36] added an important nuance by showing pre-adoption perceptions among non-users differ from post-adoption evaluations among actual owners. These studies indicate post-adoption evaluation is shaped by practical ownership experience and does not simply mirror the factors driving pre-adoption purchase intention.

Recent studies also extend satisfaction research toward continuance and repeat purchase. For example, Cruz-Jesus et al. [37] and Hasan [38] showed satisfaction with EV-related attributes is closely linked to overall satisfaction, which later supports continued use and repurchase intention. Hamed et al. [39] demonstrated satisfaction with the first EV shortens the time until a second EV purchase. These studies show post-adoption behavior is shaped not only by pre-adoption preferences toward EVs, but also by whether

ownership develops into repeated commitment over time. In this sense, the literature increasingly treats retention as a central issue in EV market development.

Several studies suggest post-adoption behavior is not only functional or economic. Prior research shows BEV use is also shaped by affective, symbolic, social, and psychological meanings, including how owners interpret the vehicle in everyday [14,15,40]. This line of work is especially relevant because it suggests owners respond not only to objective vehicle attributes, but also to how they interpret those attributes in everyday life.

Another stream focuses on discontinuance and market retention. Evidence from the United States and China shows some EV owners may discontinue EV ownership or become less willing to repurchase when post-purchase experience is weakened by range, charging access, recharge time, purchase cost, performance, or limited vehicle options [20,26,41]. Yet these barriers do not affect all owners in the same way. Some owners return to ICEVs or become less willing to repurchase, while many others continue using EVs despite broadly similar ownership conditions [20,26,41].

This difference matters because BEVs are not only vehicles with new technical requirements [17], they can also become emotionally meaningful objects by preserving the autonomy of car ownership [8,9] while adding experiential and symbolic value [13]. For this reason, product attachment offers a suitable lens for explaining why continued BEV ownership may become more than repeated use. It captures the emotional bond with the owned product [42] and is theoretically linked to continued use [28], resistance to switching [24] and positive word of mouth [30]. However, despite its relevance, current research on BEV-specific product attachment formation and owners' internal factors remains limited.

## 2.2. Product Attachment

According to self-concept theory, emotional attachment develops when an object fulfills an individual's core needs. This emotional bond can develop through three primary pathways: gratifying the self through hedonic pleasure, enriching the self through symbolic significance, and enabling the self through dependable functional performance [43]. Product attachment reflects the strength of the emotional connection between a consumer and a particular object [42]. Such attachment is fostered when a product carries memories of people, places, or important life events. Product attachment is also reinforced when a product strengthens a consumer's sense of identity, provides esthetic and sensory enjoyment, and functions as a reliable tool that helps individuals achieve their everyday goals [44]. Research in the automotive domain uses the term car identity to capture both how a car reflects an individual's identity and how strongly that person identifies with the car [45]. This concept may help explain why attachment develops, especially when the car becomes an integral part of the owner's self-concept [46]. After accumulating emotional meaning over time, the product becomes irreplaceable as it integrates into the user's sense of self [24,44].

## 2.3. Psychological Needs, Goal Pursuit, and Product Attachment

People vary in personality [47], in how they learn from experience [33], and in their psychological needs [48], and these differences influence the formation and strength of emotional connections with a brand, product, or service [49]. Furthermore, appraisal theories suggest that emotional responses are determined not only by external events but also by an individual's interpretation of those events relative to their own goals, concerns, and expectations [22,23].

This explains why the same experiences can lead to different emotional responses among customers [50]. Individuals with varying internal factors may prioritize different goals, leading them to pursue distinct end states and adopt specific actions based on their

underlying needs [51]. According to Ryan and Deci [52], behaviors are initiated and sustained when people believe that such actions help them attain desired outcomes or valued end states. These motivational orientations act as a lens through which individuals evaluate events, shaping their immediate emotional responses and influencing their subsequent actions [53]. Consequently, differences in psychological needs and goal pursuits help explain why specific consumption experiences become more emotionally significant than others [54].

However, attachment is likely to emerge only when a product is perceived as essential to those specific needs and helps consumers achieve significant goals [43,55]. According to Park et al. [43], attachment grows through three pathways. The first pathway is gratifying the self, where an object provides enjoyment; second is enriching the self, where the object reflects symbolic meaning, and the third is enabling the self, where the object provides reliable functional support [43].

#### 2.4. Car Use Motivation and BEV Attributes

##### 2.4.1. Instrumental Car Use Motivation and BEV

The term instrumental car use refers to using a car to meet daily mobility needs and to complete necessary tasks. The vehicle is simply seen as a practical tool for managing daily demands with minimal hassle [31]. This motive focuses on convenience, dependable mobility, and the ability to coordinate daily activities efficiently [11]. Studies often describe BEVs as offering quieter, low-vibration cabins that feel calmer than those of an ICEV [15,56], while also producing fewer harmful environmental effects. Consequently, BEVs allow drivers to maintain their mobility freedom while simultaneously helping to preserve the environment [57]. In addition, many BEV models are equipped with advanced driver assistance features [58], as well as seamless smartphone connectivity and voice control systems [59,60]. Regarding safety, the structural characteristics of BEVs allow them to match or exceed the safety performance of conventional cars [61]. Effective battery thermal management is also important for maintaining battery performance, safety, and thermal stability during vehicle operation [62].

##### 2.4.2. Affective Car Use Motivation and BEV Attribute

From an affective perspective, individuals use a car to obtain pleasure, excitement, and the sensory gratification associated with driving [31]. Driving can occasionally become an immersive experience due to its multi-sensory nature [63], which can strengthen the emotional appeal of car ownership [31]. For many drivers, a modern car serves as a “mobile living room” where personalized interior features including ambient lighting, scent, and advanced audio make travel more pleasant [64]. This experience may be further enhanced in BEVs because their unique characteristics produce less noise and vibration, creating a calmer and more relaxing cabin environment [65]. The term “driving pleasure” refers to the intrinsic enjoyment individuals derive from the act of driving itself. BEVs may offer a superior driving experience because instant acceleration and smoother handling are among their distinct advantages. These features are often perceived as significant contributors to driving pleasure [66,67].

##### 2.4.3. Symbolic Car Use Motivation and BEV Attribute

BEVs reshape the symbolic meaning associated with ICEVs rather than completely replacing it. High-performance BEVs can still signal speed and power, although their symbolic meaning is now less about engine strength and more tied to technological capability, responsible consumption, and environmental awareness [68]. For women, BEVs may align with concerns regarding practicality, safety, and sustainability while also allowing them to move beyond the “small and sensible” stereotypical image often associated with

environmentally friendly cars [69]. At a broader level, BEVs may be viewed as lifestyle symbols of innovation and a future-oriented way of life, which can shape an owner's image as progressive and forward-looking [70].

### 2.5. Relationship Between Car Use Motivation and Product Attachment

Product attachment can be understood as the emotional bond that grows between users and their owned physical objects [71]. This bond develops and becomes stronger when owners perceive that the product helps them achieve meaningful everyday goals [6]. In the context of car use, these goals are expressed through three motives: instrumental, affective, and symbolic [31]. These motives closely align with the self-relevance framework proposed by Park et al. [43], which explains attachment development through three pathways: enabling the self, gratifying the self, and enriching the self.

Car owners with a strong instrumental motive highly value the practical benefits of the vehicle [31]. When the vehicle performs well on practical attributes, it can reinforce the owner's sense of efficacy, control, and autonomy in meeting daily mobility needs [72,73], reflecting the idea of enabling the self [43]. Conversely, owners with high affective car use motivation seek the emotional and experiential aspects of driving, such as responsive acceleration, smooth cruising, and ride comfort [31,74]. This aligns with the idea of gratifying the self [43]. Finally, owners who emphasize the symbolic status of the car may do so because it reflects who they are and how they wish to be seen by others [31]. This symbolic meaning can be linked to status, self-identity, and the projection of success [75], which aligns with enriching the self [43].

Prior research shows that BEV features can match, and in several cases exceed, those of conventional vehicles in terms of everyday usability, driving experience, and symbolic meaning [14,15,66,76]. This suggests that BEVs are capable of meeting the practical, experiential, and symbolic goals that owners typically expect from a vehicle. Motivation functions as a mental filter that affects how individuals understand and judge their experiences [77]. Individuals are more likely to notice, emphasize, and value product attributes that align with the goals they consider important [78]. In the context of car use, these goals are tied to practical utility, driving enjoyment, and symbolic meaning [31]. Research shows that individuals highly value BEV features related to these three dimensions [14,15,66,76]. Furthermore, individuals place even greater value on attributes that align with the goals they prioritize [79]. As the vehicle continues to reinforce goal progress over time, owners may transition from functional use to becoming deeply attached to the product [24,44]. Based on the above discussion, we hypothesize that:

**H1.** *Instrumental car use motivation positively related to users' product attachment to BEVs.*

**H2.** *Affective car use motivation positively associated with users' product attachment to BEVs.*

**H3.** *Symbolic car use motivation positively linked to users' product attachment to BEVs.*

### 2.6. Relationship Between Customer Innovativeness and Product Attachment

The automobile literature considers BEVs to be a disruptive technology because they alter how individuals perceive cars and how they use them. Electrification significantly changes vehicle attributes and the associated conditions of use, including refueling routines and infrastructure dependence [17,80]. These changes disrupt established routines and conflict with prior belief structures, which can create resistance during evaluation [18]. This effect extends into the post-purchase ownership stage as users adapt to new habits and behaviors [19]. Gradually, these adjustments become integrated into the owner's everyday mobility routine [19]. This adjustment process is likely to be easier for innovative

owners, as they typically respond more positively to novelty [81]. Furthermore, these individuals are more willing to learn new information and try unfamiliar consumption experiences [82]. Individuals with stronger innovative tendencies may also express their uniqueness by adopting innovative products [83], especially when the product is visible and adoption serves recognition and prestige goals [84]. Taken together, those with high levels of innovativeness are more likely to perceive highly visible, innovative products like BEVs as personally meaningful and worth deeper engagement. Consequently, such owners may gradually build a stronger personal bond with the vehicle. Based on the above discussion, we hypothesize:

**H4.** *Customer innovativeness is positively associated with product attachment.*

#### 2.7. Relationship Between Direct Experience and Product Attachment

Experience is often represented by accumulated use, but exposure and learning are not equivalent. Alba and Hutchinson [85] distinguish familiarity, reflected in the amount of product-related experience, from expertise, reflected in the ability to perform product-related tasks successfully. More contact may increase familiarity without producing a comparable gain in task ability. Despite repeated use, skill development can plateau once behavior becomes routine and attention to feedback declines [86]. If users differ in prior knowledge, motivation, or information processing, similar levels of exposure may also produce different learning outcomes [33,87]. For experience attributes, this distinction is important because product understanding depends on how users interpret contact and feedback, not only on the frequency of use [88]. For this reason, accumulated mileage should be treated as exposure quantity rather than as a direct measure of learning.

Direct experience refers to learning that arises from first-hand product use rather than from description alone [33]. Consumer learning from experience involves a four-stage process of hypothesizing, exposure, encoding, and integration. Such experience allows customers to compare expectations with reality and revise their understanding over time [33]. Because this learning is self-generated, consumers often attribute significant weight to it, particularly when judging experience attributes that can only be assessed through the five senses during actual use or contact [88]. Experience also provides vivid and engaging input, which makes it easier to remember and often more persuasive than indirect information [87].

In the BEV context, repeated driving and ownership episodes allow users to evaluate firsthand whether the vehicle supports practical goals, provides enjoyable driving experiences, and holds significant meaning for them [89]. Evidence from a BEV trial program suggests that direct experience can transform perceptions of the vehicle and its attributes [90]. BEV post-purchase studies provide evidence that owners successfully learn, adjust their routines, and gradually integrate the vehicle into everyday life. This process allows owners to evaluate whether the BEV is instrumentally useful, affectively rewarding, and symbolically meaningful [14]. Product attachment is commonly associated with products perceived as conveying pleasure, self-expression, and personal meaning over time. Therefore, we hypothesize:

**H5.** *Direct experience is positively related to the product attachment of BEV owners.*

#### 2.8. Post Purchase Behavior

Customer loyalty is often treated as a critical source of long-term advantage because it reflects a customer's willingness to consistently choose the same product or service over time, even when other options or situational pressures make switching attractive [91]. Existing literature shows that the attitudinal dimension is shaped by satisfaction, trust,

perceived value, and emotional ties, and it often manifests in the form of advocacy, positive word-of-mouth, and resistance to competing offers [92,93]. At the same time, behavioral loyalty is reflected in actual repurchase or continued usage, although repeat purchase alone can also result from inertia, limited alternatives, or incentives rather than true loyalty [91,94]. Because of this, true loyalty is best understood as a combination of strong attitudes and consistent behavior, and loyalty typologies help explain how customers differ across these two dimensions [94].

The term “advocacy” has its roots in the Latin *advocare*, meaning to call to, to vouch for, or to justify [95]. In marketing, it is framed as a highly influential communication style aimed at shaping or swaying others’ perspectives [95]. Customer advocacy, however, is not merely ordinary positive word-of-mouth. Rather, it is a more potent and relational form of support than general positive word-of-mouth (PWOM) [95,96], expressed through strong and explicit recommendations [92,95] and, at stronger levels, through the defense of the focal offering against criticism or market alternatives [97]. At its highest levels, advocacy also becomes proactive, as consumers may initiate recommendations spontaneously and actively promote the focal offering to others [95].

Some scholars have argued that advocacy is a more potent indicator of loyalty than repeat buying because the willingness to recommend places the customer’s own reputation at stake, while repeat buying is often attributed to habit and may reflect inertia [98,99]. Bendapudi and Berry [96] argue that the ultimate test of the strength of a customer bond is whether customers are willing to become advocates for the service or product. According to Mugge et al. [71], product attachment is a strong psychological bond between a consumer and a product. Such a bond is more than a temporary feeling, as it represents a state of enduring closeness, emotional meaning, and self-relevance [42]. Consequently, when consumers become attached to a product, they move beyond viewing it merely as a functional object and begin to see it as part of their lives, incorporating the item into their “extended self” [100].

This deep personal bond is associated with a greater tendency to retain, protect, and maintain the relationship over the long term [24,101]. This helps explain why attachment is closely associated with loyalty, since attached consumers are naturally more committed to the focal product or service and show less willingness to switch to alternatives [102,103]. This idea is also supported by evidence that product attachment shows direct and indirect statistical relationships with loyalty through both direct and indirect paths by making the product feel more indispensable and less replaceable to the customer [24,104]. Customer advocacy reflects a stronger and more public form of commitment than positive word-of-mouth. It is characterized by strong, passionate, and explicit recommendations, as well as a willingness to defend the focal offering against criticism [95]. Sweeney et al. [95] further argue that advocacy is more closely associated with richer emotional states such as delight than with mere satisfaction. Drawing on the delight literature, they explain that delight is a state defined by positive affect and arousal, whereas satisfaction is more limited in emotional intensity [105]. The concept of product attachment, which is defined as a deep, enduring, and emotionally meaningful bond between a user and a product [42], makes product attachment theoretically relevant in relation to advocacy. Based on the above discussion, we hypothesize that:

**H6.** *A positive relationship is expected between product attachment and customer advocacy among BEV owners.*

**H7.** *Stronger product attachment is expected to correspond with higher customer loyalty among BEV owners.*

The conceptual model is shown in Figure 1.

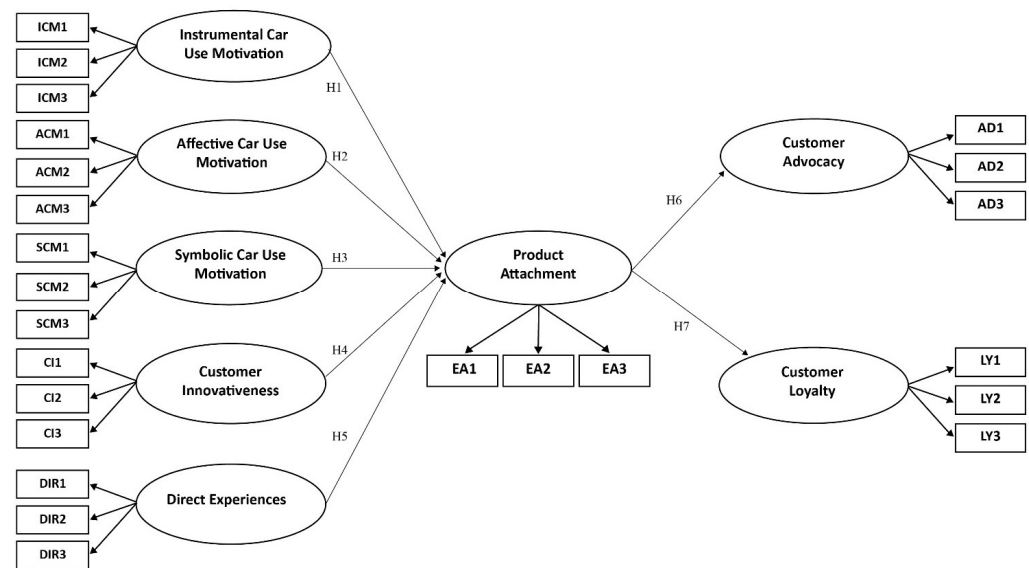


Figure 1. Conceptual Model.

### 3. Research Methodology

#### 3.1. Research Design and Data Collection

##### 3.1.1. Survey Instrument Development and Structure

The survey instrument was developed to reflect the conceptual model of this study and to collect data from actual BEV owners with sufficient ownership experience. Since the study examined product attachment after purchase, the questionnaire was designed to capture both respondent characteristics and psychological evaluations related to BEV ownership. The questionnaire began with a short introduction explaining the purpose of the study, the voluntary nature of participation, and the criteria for eligible respondents.

The first section collected demographic and ownership-related information, including gender, age, income, education, accumulated BEV mileage, daily travel distance, number of cars owned, and BEV segment. These variables were included to describe the respondent profile and provide context for interpreting the sample characteristics. The second section contained the measurement items for the research constructs. The items were adapted from established scales and adjusted to fit the BEV ownership context. Instrumental, affective, and symbolic car use motivation were adapted from Steg [31]. Customer innovativeness was adapted from Morton et al. [106]. Direct experience was developed based on Hoch and Deighton's [33] view of first-hand learning through product use. Product attachment was adapted from Mugge et al. [71]. Customer advocacy was adapted from Sweeney et al. [95], while customer loyalty was adapted from Hellier et al. [107] and Zeithaml et al. [108].

Since the original scales were developed in English, the items were translated and adapted into Indonesian for data collection. The translation process focused on conceptual equivalence rather than literal wording, so that each item remained consistent with the intended construct while being understandable for Indonesian respondents. All constructs in this study were operationalized as reflective latent variables. The item codes in Table 1 correspond to the indicators used to measure the constructs shown in Figure 1. Instrumental, affective, and symbolic car use motivation, customer innovativeness, and direct experience were specified as exogenous constructs associated with product attachment. Product attachment was specified as the focal endogenous construct, while customer advocacy and customer loyalty were specified as post-purchase endogenous constructs. All questionnaire items were answered using a six-point Likert-type agreement scale ranging

from 1, “extremely disagree,” to 6, “extremely agree.” The six-point format was selected to encourage respondents to state their level of agreement without a neutral midpoint. In total, the final questionnaire consisted of 24 measurement items covering eight variables. The complete measurement items are presented in Table 1.

**Table 1.** The Measurement Items.

| Latent Variable                 | Code | Measurement Items                                                                   | Reference                                     |
|---------------------------------|------|-------------------------------------------------------------------------------------|-----------------------------------------------|
| Instrumental car use motivation | ICM1 | I use my BEV to meet my everyday travel needs.                                      | Steg [31]                                     |
|                                 | ICM2 | I use my BEV because it is practical for my daily activities.                       |                                               |
|                                 | ICM3 | I use my BEV because it lets me go where I need to go.                              |                                               |
| Affective car use motivation    | ACM1 | I use my BEV because it makes my trips enjoyable.                                   | Steg [31]                                     |
|                                 | ACM2 | I use my BEV because I like the calm feeling when I drive it.                       |                                               |
|                                 | ACM3 | I use my BEV because driving it feels fun.                                          |                                               |
| Symbolic car use motivation     | SCM1 | I use my BEV because it fits the kind of person I am.                               | Steg [31]                                     |
|                                 | SCM2 | I use my BEV because it helps me express who I am.                                  |                                               |
|                                 | SCM3 | I use my BEV because it improves my social image.                                   |                                               |
| Customer innovativeness         | CI1  | I am usually among the first to acquire new technology.                             | Morton et al. [106]                           |
|                                 | CI2  | I quickly apply new ideas in my daily life.                                         |                                               |
|                                 | CI3  | I enjoy learning about new technologies.                                            |                                               |
| Direct experience               | DIR1 | I use my BEV in different situations to learn how it performs.                      | Derived from Hoch and Deighton [33]           |
|                                 | DIR2 | During use, I pay attention to specific cues about my BEV's performance.            |                                               |
|                                 | DIR3 | With continued use, I adjust my views about my BEV based on my observation.         |                                               |
| Product attachment              | EA1  | My BEV feels special to me.                                                         | Mugge et al. [71]                             |
|                                 | EA2  | I feel a strong connection to my BEV.                                               |                                               |
|                                 | EA3  | My BEV is very dear to me.                                                          |                                               |
| Advocacy                        | AD1  | I actively tell other people about my positive experiences with my BEV.             | Sweeney et al. [95]                           |
|                                 | AD2  | When someone criticizes my BEV, I defend it using what I know.                      |                                               |
|                                 | AD3  | I strongly encourage people I know to consider buying my BEV.                       |                                               |
| Loyalty                         | LY1  | I will continue using a BEV in the future.                                          | Hellier et al. [107]<br>Zeithaml et al. [108] |
|                                 | LY2  | When I need to replace this vehicle, I will choose a BEV again.                     |                                               |
|                                 | LY3  | Even if gasoline or diesel vehicles are offered discounts, I will stick with a BEV. |                                               |

### 3.1.2. Sampling Design

A field-based face-to-face survey was used to collect data from actual BEV owners in Indonesia. Face-to-face field data collection provided better control over respondent eligibility, response quality, and questionnaire administration. Respondents were approached in public urban settings where BEV owners could reasonably be accessed, including public charging stations, cafes, shopping centers, office parking areas, public parking areas, and other commonly visited urban locations. These sites were selected because they are connected to owners' regular mobility and daily activities, allowing the study to reach BEV users in more natural ownership-related settings. By approaching owners in different everyday public settings rather than relying on a single recruitment channel, the field-intercept survey captured naturally occurring variation in gender, income, education, vehicle segment, and BEV usage characteristics.

The sampling process was organized using stratified sampling. Since detailed demographic data on BEV owners in Indonesia were not available, the strata were developed using available BEV sales data in July 2025. The first stratification dimension was vehicle segment. BEVs were grouped into mini, medium, and luxury segments because each vehicle class may represent different ownership patterns, price levels, usage expectations, and symbolic meanings [109,110]. Vehicle segment was determined based on vehicle size, price class, and market positioning in the Indonesian BEV market. Based on the available BEV sales data, mini BEVs accounted for approximately 28% of the observed BEV market, medium BEVs accounted for approximately 48%, and luxury BEVs accounted for approximately 24%. These proportions were used to guide the distribution of respondents across vehicle segments.

The second stratification dimension was data collection location. Based on the available BEV sales data in July 2025, BEV sales were highly concentrated in Java, with approximately 90% located in the Greater Jakarta area and around 9% distributed across other areas in Java. Only around 1% of BEV sales were located outside Java. Therefore, the field survey was conducted in Java, covering Greater Jakarta and selected major urban areas outside Greater Jakarta. This geographic focus was used because Java represented the dominant area of BEV ownership and BEV-related activity in Indonesia during the study period.

The 5000 km threshold was selected to ensure that respondents had sufficient accumulated experience with their BEVs. Based on an estimated daily driving range of around 30 to 60 km among BEV users in Indonesia, this threshold generally represents several months of regular use, which was considered sufficient for owners to experience daily commuting, urban traffic, range management, longer trips, home and public charging [90,111].

### 3.1.3. Sampling Process

After the sampling design was defined, the questionnaire was tested before the main data collection. A pilot test was conducted with 33 BEV owners to assess whether the items were clear, understandable, and suitable for the BEV ownership context. The pilot test also helped identify whether respondents had difficulty answering particular items. At this stage, the questionnaire still included an initial pool of candidate items adapted from established scales and adjusted to the BEV context. The pilot data were used for two purposes. First, participant feedback was used to refine item wording, especially for items that were considered unclear or too similar to other items. Second, preliminary item diagnostics were conducted to check item performance, including reliability, validity, and possible redundancy among indicators. Items that showed weak performance, high redundancy, or unclear wording were revised or removed before the main survey. Since several adjustments were made after the pilot test, the pilot responses were not included in the final dataset.

Data collection took place between 1 October and 31 December 2025. The main survey was conducted as a face-to-face field survey using offline questionnaires. Respondents were approached directly in public urban settings where BEV owners could reasonably be accessed, such as public charging stations, cafes, shopping centers, office parking areas, public parking areas, and other commonly visited urban locations. Before completing the questionnaire, each respondent was screened to confirm whether they personally owned a BEV and whether the vehicle had been driven for more than 5000 km. Respondents who did not meet these criteria were not included in the main questionnaire. Eligible respondents then proceeded to the measurement items and sociodemographic questions. The face-to-face field format helped the researchers control respondent eligibility, reduce misunderstanding during questionnaire administration, and improve respondent engagement. After data collection, responses with missing data, unusually short completion times, and highly uniform answering patterns across most items were removed. After these screening and cleaning procedures, 392 valid responses were retained for the final analysis.

### 3.2. Analysis Methods

Common method bias was assessed using Harman's single-factor test before the main analysis. All measurement items were entered into an un-rotated exploratory factor analysis. The first factor explained 24.5% of the total variance, below the 50% threshold, indicating that common method bias was not a major concern.

One-way ANOVA was carried out to assess whether key psychological antecedents differed significantly across the mini, medium, and luxury segments. The test helped

confirm the relevance of the segmentation and provided valuable context for interpreting the structural model results.

To test the hypotheses, the study applied PLS-SEM following a two-stage sequence. First, the measurement model was assessed to determine whether the criteria for indicator loadings, internal consistency reliability, average variance extracted [112], and the Heterotrait-Monotrait ratio of correlations [113] were met. Second, the structural model was examined by estimating path coefficients through bootstrapping, which produced *t*-statistics and *p*-values [112].

## 4. Results

### 4.1. Demographic Characteristics

The detailed demographic statistics of the respondents are summarized in Table 2. The results confirm some earlier findings and offer some new information on BEV users.

**Table 2.** Respondents Demographic Profile.

| Profile           | Description   | Count | (%) | Profile       | Description       | Count | (%) |
|-------------------|---------------|-------|-----|---------------|-------------------|-------|-----|
| Gender            | Male          | 340   | 87  | Car Owned     | 1                 | 70    | 18  |
|                   | Female        | 52    | 13  |               | 2                 | 197   | 50  |
| Age (years)       | 18–24         | 10    | 2   | Type of Car   | >2                | 125   | 32  |
|                   | 25–34         | 92    | 23  |               | Mini              | 105   | 27  |
|                   | 35–44         | 105   | 27  |               | Medium            | 188   | 48  |
|                   | 45–54         | 124   | 32  |               | Luxury            | 99    | 25  |
|                   | >55           | 61    | 16  | Income        | <20               | 27    | 7   |
| BEV Mileage (km)  | 5000–10,000   | 138   | 34  | (IDR million) | 20–34             | 114   | 29  |
|                   | 11,000–15,000 | 151   | 39  |               | 35–49             | 119   | 30  |
|                   | 16,000–20,000 | 57    | 15  |               | 50–74             | 65    | 17  |
|                   | 21,000–25,000 | 23    | 6   |               | >75               | 67    | 17  |
|                   | >25,000       | 23    | 6   | Education     | High school       | 4     | 1   |
| Daily Travel (km) | <20           | 19    | 5   |               | Diploma           | 16    | 4   |
|                   | 20–39         | 68    | 17  |               | Bachelor's degree | 185   | 47  |
|                   | 40–59         | 153   | 39  |               | Master's degree   | 163   | 42  |
|                   | 60–79         | 98    | 25  |               | Doctoral degree   | 24    | 6   |
|                   | >80           | 54    | 14  |               |                   |       |     |

Overall, the respondent profile suggests that the sample population is primarily composed of established BEV users rather than occasional users. The sample is heavily dominated by males, who account for 87% of the respondents. A similar pattern is observed in the age distribution, which is concentrated in the working-age groups of 35 to 44 years (27%) and 45 to 54 years (32%). Only a very small share of respondents is younger than 25 years (2%). The data suggest that the socioeconomic profile of the respondents points to a relatively well-established group. Respondents' household income is concentrated in the middle-to-upper brackets, with the two largest shares in the IDR 20 to 34 million range (30%) and the IDR 35 to 49 million range (29%). This is followed by the IDR 75 million and above category, which accounts for 17%. Educational attainment shows a similar tendency, as 47% hold a bachelor's degree and 42% hold a master's degree.

The vehicle ownership profile shows that BEV ownership is often part of a multi-car arrangement, with 50% of respondents reporting that they own two cars and 32% reporting ownership of more than two. The vehicle segment distribution is weighted toward the medium segment (48%), followed by mini models (27%) and luxury models (25%). The usage pattern also suggests that these respondents are active BEV users, as many have already accumulated a significant level of driving experience. Around 34% report cumulative driving of 5000 to 10,000 km, while 39% report 11,000 to 15,000 km. Their

daily travel pattern is also substantial, with 39% traveling 40 to 59 km per day, followed by 25% who travel 60 to 79 km, and 14% who travel more than 80 km.

These respondent characteristics are relevant to the conceptual model because they describe the ownership context in which product attachment may develop. The mileage and daily travel profiles show that the respondents were not occasional BEV users, but active owners with enough direct experience to assess their vehicles through repeated use. This is important because direct experience in the model refers to first-hand learning from using the BEV in everyday situations. The BEV segment profile also confirms that the planned stratified sampling structure across mini, medium, and luxury segments was achieved. In addition, the high proportion of multi-car owners, together with the income and education profiles, indicates that many respondents were relatively established owners who could evaluate BEV ownership beyond initial trial or short-term curiosity. Table 2 helps position the sample as suitable for examining how internal owner factors relate to product attachment, customer advocacy, and customer loyalty.

#### 4.2. ANOVA Test

ANOVA results indicate that significant differences across constructs are limited to instrumental and symbolic car-use motivation. The ANOVA results can be seen in Table 3. Mini BEV owners report significantly higher instrumental motivation compared to those in the medium and luxury categories. Meanwhile, luxury BEV owners demonstrate statistically higher symbolic motivation than their counterparts in the mini and medium segments. No significant differences were found in affective car-use motivation, customer innovativeness, or direct experience across segments. Overall, the findings suggest that the mini segment prioritizes practical utility, whereas the luxury segment is more strongly driven by self-expression.

**Table 3.** ANOVA Test Result.

| Construct                       | Mini Mean (SD) | Medium Mean (SD) | Luxury Mean (SD) | F (2,389) | <i>p</i> | $\eta^2$ | Tukey Post-Hoc Test               |
|---------------------------------|----------------|------------------|------------------|-----------|----------|----------|-----------------------------------|
| Instrumental Car Use Motivation | 4.993 (1.040)  | 3.727 (1.081)    | 3.819 (1.138)    | 47.927    | <0.001   | 0.198    | Mini > Medium;<br>Mini > Luxury   |
| Affective Car Use Motivation    | 3.892 (1.243)  | 4.027 (1.283)    | 4.076 (1.283)    | 0.580     | 0.561    | 0.003    |                                   |
| Symbolic Car Use Motivation     | 3.616 (1.171)  | 3.858 (1.218)    | 4.533 (1.153)    | 16.990    | <0.001   | 0.080    | Luxury > Mini;<br>Luxury > Medium |
| Customer Innovativeness         | 3.822 (1.257)  | 3.968 (1.155)    | 4.048 (1.162)    | 0.962     | 0.383    | 0.005    |                                   |
| Direct Experience               | 4.057 (1.213)  | 4.051 (1.241)    | 4.257 (1.102)    | 1.112     | 0.330    | 0.006    |                                   |

Before conducting the pairwise MGA, measurement invariance was assessed using the MICOM procedure [114]. Configural invariance was established because the same indicators, data treatment, and algorithm settings were applied across the segments. Compositional invariance was also established for all constructs involved in the reported comparisons. For mini vs medium, the permutation *p*-values were 0.061 for instrumental motivation and 0.131 for product attachment. For mini versus luxury, the values were 0.202 for instrumental motivation, 0.109 for symbolic motivation, and 0.148 for product attachment. Thus, partial measurement invariance was established for the reported MGA comparisons. A pairwise MGA showed no significantly stronger instrumental motivation–product attachment relationship in the mini segment compared with medium (*p* = 0.737) or luxury (*p* = 0.897). The symbolic motivation–product attachment relationship was also not significantly stronger in the luxury segment compared with mini (*p* = 0.237).

#### 4.3. Assessment of the Measurement Model

The measurement model was assessed by examining indicator loadings, internal consistency reliability, convergent validity, and discriminant validity. In this assessment, outer loading indicates how strongly each item represents its construct, CA and CR indicate internal consistency reliability, and AVE indicates convergent validity. The results show that all indicator loadings exceeded the recommended threshold of 0.70, indicating acceptable indicator reliability for reflective constructs [112]. Most indicators loaded above 0.80, while AD3 and LY3 remained above 0.70 and were therefore retained. Internal consistency reliability was also supported, as all composite reliability (CR) values exceeded the recommended threshold of 0.70 [112]. Convergent validity was established because all average variance extracted (AVE) values were above 0.50 [115]. Cronbach's alpha values also exceeded the minimum recommended value of 0.70 [112]. The detailed results for construct reliability and validity are presented in Table 4.

**Table 4.** Construct Reliability and Validity.

| Construct                       | Items | Outer Loading | Mean (SD)     | CA    | CR    | (AVE) |
|---------------------------------|-------|---------------|---------------|-------|-------|-------|
| Instrumental Car Use Motivation | ICM1  | 0.859         | 4.204 (1.385) | 0.858 | 0.913 | 0.778 |
|                                 | ICM2  | 0.920         | 4.026 (1.377) |       |       |       |
|                                 | ICM3  | 0.867         | 3.985 (1.346) |       |       |       |
| Affective Car Use Motivation    | ACM1  | 0.880         | 3.980 (1.478) | 0.834 | 0.901 | 0.751 |
|                                 | ACM2  | 0.848         | 3.944 (1.452) |       |       |       |
|                                 | ACM3  | 0.872         | 4.094 (1.465) |       |       |       |
| Symbolic Car Use Motivation     | SCM1  | 0.884         | 3.901 (1.410) | 0.889 | 0.931 | 0.818 |
|                                 | SCM2  | 0.921         | 4.107 (1.295) |       |       |       |
|                                 | SCM3  | 0.908         | 3.926 (1.393) |       |       |       |
| Customer Innovativeness         | CI1   | 0.838         | 4.003 (1.369) | 0.840 | 0.903 | 0.756 |
|                                 | CI2   | 0.879         | 3.852 (1.366) |       |       |       |
|                                 | CI3   | 0.890         | 4.003 (1.337) |       |       |       |
| Direct Experience               | DIR1  | 0.888         | 4.130 (1.404) | 0.832 | 0.899 | 0.748 |
|                                 | DIR2  | 0.861         | 4.143 (1.361) |       |       |       |
|                                 | DIR3  | 0.846         | 4.051 (1.386) |       |       |       |
| Product Attachment              | EA1   | 0.848         | 3.885 (0.895) | 0.810 | 0.888 | 0.725 |
|                                 | EA2   | 0.864         | 3.852 (0.847) |       |       |       |
|                                 | EA3   | 0.842         | 3.867 (0.822) |       |       |       |
| Customer Advocacy               | AD1   | 0.837         | 4.010 (0.929) | 0.767 | 0.866 | 0.684 |
|                                 | AD2   | 0.869         | 4.036 (0.900) |       |       |       |
|                                 | AD3   | 0.772         | 3.903 (0.926) |       |       |       |
| Customer Loyalty                | LY1   | 0.814         | 4.099 (0.876) | 0.717 | 0.843 | 0.642 |
|                                 | LY2   | 0.859         | 4.145 (0.852) |       |       |       |
|                                 | LY3   | 0.725         | 3.974 (0.997) |       |       |       |

Discriminant validity was assessed using the Heterotrait-Monotrait ratio of correlations (HTMT). Using the HTMT.90 criterion for conceptually related constructs, all HTMT values were below 0.90, indicating acceptable discriminant validity [113]. The highest HTMT value was observed between product attachment and customer loyalty (0.899). This close value is theoretically understandable because both constructs reflect a continuing relationship between the consumer and the BEV. However, they remain conceptually distinct. Product attachment refers to the emotional bond between owners and their owned product [42], whereas customer loyalty reflects a future-oriented commitment to continue using or choosing the product [99]. Therefore, the close relationship between product attachment and customer loyalty should be interpreted carefully. The HTMT results are presented in Table 5.

**Table 5.** Discriminant Validity Assessment (HTMT).

| Construct                             | ACM   | AD    | CI    | LY    | DIR   | ICM   | EA    | SCM |
|---------------------------------------|-------|-------|-------|-------|-------|-------|-------|-----|
| Affective Car Use Motivation (ACM)    |       |       |       |       |       |       |       |     |
| Customer Advocacy (AD)                | 0.466 |       |       |       |       |       |       |     |
| Customer Innovativeness (CI)          | 0.061 | 0.223 |       |       |       |       |       |     |
| Customer Loyalty (LY)                 | 0.477 | 0.746 | 0.337 |       |       |       |       |     |
| Direct Experience (DIR)               | 0.090 | 0.308 | 0.079 | 0.439 |       |       |       |     |
| Instrumental Car Use Motivation (ICM) | 0.066 | 0.209 | 0.062 | 0.205 | 0.026 |       |       |     |
| Product Attachment (EA)               | 0.676 | 0.821 | 0.159 | 0.899 | 0.436 | 0.288 |       |     |
| Symbolic Car Use Motivation (SCM)     | 0.057 | 0.389 | 0.134 | 0.522 | 0.050 | 0.041 | 0.587 |     |

Additional support for the distinction between product attachment and customer loyalty was obtained from the cross-loading results. The product attachment indicators loaded more strongly on product attachment than on loyalty, including EA1 (0.844 versus 0.611), EA2 (0.864 versus 0.575), and EA3 (0.840 versus 0.548). Similarly, the loyalty indicators loaded more strongly on loyalty than on product attachment, including LY1 (0.817 versus 0.540), LY2 (0.861 versus 0.567), and LY3 (0.723 versus 0.531). These results provide further support for the empirical separation of the two constructs.

To provide additional evidence of discriminant validity, the Fornell-Larcker criterion was also examined. The square root of AVE for each construct exceeded its correlations with other constructs, supporting the distinction among the latent variables [115]. Therefore, discriminant validity was considered acceptable based on both the HTMT results and the Fornell-Larcker criterion. The Fornell-Larcker results are presented in Table 6.

**Table 6.** Fornell-Larcker Criterion.

| Construct                             | ACM    | AD    | CI    | LY    | DIR   | ICM   | EA    | SCM   |
|---------------------------------------|--------|-------|-------|-------|-------|-------|-------|-------|
| Affective Car Use Motivation (ACM)    | 0.866  |       |       |       |       |       |       |       |
| Customer Advocacy (AD)                | 0.372  | 0.827 |       |       |       |       |       |       |
| Customer Innovativeness (CI)          | −0.012 | 0.186 | 0.860 |       |       |       |       |       |
| Customer Loyalty (LY)                 | 0.367  | 0.555 | 0.339 | 0.803 |       |       |       |       |
| Direct Experience (DIR)               | 0.073  | 0.248 | 0.073 | 0.339 | 0.867 |       |       |       |
| Instrumental Car Use Motivation (ICM) | −0.041 | 0.172 | 0.061 | 0.162 | 0.012 | 0.882 |       |       |
| Product Attachment (EA)               | 0.554  | 0.646 | 0.149 | 0.681 | 0.358 | 0.240 | 0.849 |       |
| Symbolic Car Use Motivation (SCM)     | −0.011 | 0.322 | 0.127 | 0.420 | 0.03  | 0.034 | 0.499 | 0.905 |

#### 4.4. Assessment of the Structural Model

The structural model explained 71.6% of the variance in product attachment, 41.7% in customer advocacy, and 46.4% in customer loyalty, with adjusted  $R^2$  values of 0.712, 0.416, and 0.463, respectively. The  $f^2$  results showed large effect sizes for affective motivation ( $f^2 = 1.050$ ) and symbolic motivation ( $f^2 = 0.796$ ) on product attachment, while direct experience ( $f^2 = 0.305$ ) and instrumental motivation ( $f^2 = 0.200$ ) showed medium effect sizes. Customer innovativeness had a negligible effect size ( $f^2 = 0.012$ ). Product attachment also showed large effect sizes for customer advocacy ( $f^2 = 0.716$ ) and customer loyalty ( $f^2 = 0.866$ ). The inner VIF values ranged from 1.000 to 1.025, indicating no structural collinearity concern [112]. In addition, the estimated model produced an SRMR value of 0.060, below the commonly used threshold of 0.080 [113]. The  $Q^2$  values were 0.510 for product attachment, 0.282 for customer advocacy, and 0.294 for customer loyalty. Since all values were above zero, the model demonstrated predictive relevance for all endogenous constructs [112]. PLSpredict showed positive  $Q^2$  predict values for all indicators, ranging from 0.209 to 0.548, while the PLS-SEM RMSE values were lower than the linear model benchmark for eight of the nine indicators, supporting the model's out-of-sample predictive performance.

The structural model results show the relationships between product attachment and the three car use motivations and direct experience. Affective car use motivation has the largest path coefficient with product attachment ( $\beta = 0.451$ ,  $t = 16.804$ ,  $p < 0.001$ ), followed by symbolic car use motivation which contributes significantly to the model ( $\beta = 0.370$ ,  $t = 13.205$ ,  $p < 0.001$ ), while direct experience shows a slightly weaker influence ( $\beta = 0.301$ ,  $t = 12.729$ ,  $p < 0.001$ ). Instrumental car use motivation is also a significant predictor, but its impact is modest ( $\beta = 0.229$ ,  $t = 9.845$ ,  $p < 0.001$ ) compared to the more dominant affective and symbolic motives, as well as direct experience. However, an interesting finding reveals that customer innovativeness is irrelevant to the emotional bond ( $\beta = -0.026$ ,  $t = 0.986$ ,  $p = 0.324$ ), indicating that in this sample, being an individual with high innovativeness does not translate to product attachment. The downstream consequences show that product attachment is a strong catalyst for both post-purchase outcomes. The path coefficients from product attachment are high for both customer loyalty ( $\beta = 0.686$ ,  $t = 22.444$ ,  $p < 0.001$ ) and customer advocacy ( $\beta = 0.649$ ,  $t = 17.708$ ,  $p < 0.001$ ). Overall, the structural results show that a user's bond with their BEV is not driven by innovativeness as a general personal tendency, but instead reflects how the vehicle feels to use, what it signals about the owner, and what owners experience directly over time. The structural model results are presented in Table 7.

**Table 7.** Hypothesis Assessment.

| Hypothesis | Relationship                                          | Path Coef. | T Statistics | p Values | Decision |
|------------|-------------------------------------------------------|------------|--------------|----------|----------|
| H1         | Instrumental Car Use Motivation -> Product Attachment | 0.229      | 9.845        | <0.001   | Accepted |
| H2         | Affective Car Use Motivation -> Product Attachment    | 0.451      | 16.804       | <0.001   | Accepted |
| H3         | Symbolic Car Use Motivation -> Product Attachment     | 0.370      | 13.205       | <0.001   | Accepted |
| H4         | Customer Innovativeness -> Product Attachment         | -0.026     | 0.986        | 0.324    | Rejected |
| H5         | Direct Experience -> Product Attachment               | 0.301      | 12.729       | <0.001   | Accepted |
| H6         | Product Attachment -> Customer Advocacy               | 0.649      | 17.708       | <0.001   | Accepted |
| H7         | Product Attachment -> Customer Loyalty                | 0.686      | 22.444       | <0.001   | Accepted |

As an additional robustness analysis, gender, age, income, education, BEV mileage, daily travel distance, number of vehicles owned, and vehicle segment were included as control variables for product attachment, customer advocacy, and customer loyalty. Most control relationships were not statistically significant. Daily travel distance showed a very small negative relationship with product attachment ( $\beta = -0.070$ ,  $p = 0.035$ ). Vehicle segment was also significantly related to customer loyalty, with owners in the medium segment ( $\beta = 0.109$ ,  $p = 0.044$ ) and luxury segment ( $\beta = 0.126$ ,  $p = 0.034$ ) reporting slightly higher loyalty than owners in the mini segment. Importantly, the direction and significance of the focal structural relationships remained substantively unchanged after the control variables were included.

## 5. Discussion

This study suggests motives and direct experience are related to attachment, and which is in turn supports post-adoption BEV continuity through loyalty and advocacy. The study results identify affective motivation as the factor most strongly related to product attachment, followed by symbolic motivation, direct experience, and instrumental motivation.

BEV attachment is not mainly associated with usefulness alone but appears stronger when the BEV is pleasant to drive, emotionally rewarding, and identity-relevant. Instrumental value still matters, but the path coefficients suggest it serves more as a necessary enabling base than as the deepest source of attachment, which helps distinguish functional acceptance from emotional attachment. This pattern is consistent with Pedeliento et al. [24] and is also supported in the EV post-adoption context by Ingeborgrud and Ryghaug [14] and Daramy-Williams et al. [15], whose studies identify affective driving attributes and

symbolic meanings as important components of the post-adoption EV user experience. This interpretation also needs to be read alongside external ownership conditions. Recent post-adoption EV studies show range, charging access, cost, and daily-use fit as recurring concerns in EV ownership evaluations [20,35,37,38]. These findings help explain why the path coefficient of instrumental car use motivation is lower than those of affective and symbolic motivation. The ANOVA results are informative because they show both heterogeneity and commonality in post-adoption attachment. The commonality is seen in affective motivation, which does not differ significantly across mini, medium, and luxury segments. The heterogeneity appears in the stronger instrumental motivation among mini BEV owners and the stronger symbolic motivation among luxury BEV owners.

The non-significant correlation between customer innovativeness and product attachment may stem from the nature of the trait itself. Innovativeness is commonly associated with curiosity, novelty seeking, and the search for new knowledge [82,116]. Such tendencies may encourage owners to try BEVs, explore new features, or follow newer technological versions [106,117]. In the ownership stage, the same tendency may also appear as variety seeking, where consumers look for new alternatives because change itself provides psychological reward [118–120]. Customer innovativeness may therefore be more relevant to adoption than to attachment to the currently owned BEV. The non-significant relationship between customer innovativeness and product attachment helps separate adoption-oriented novelty seeking from post-adoption attachment formation. In the BEV context, this is an important insight. Early enthusiasm for new technology may be more relevant to trying a BEV than to the emotional bond owners report after living with the vehicle.

In the current research, we conceptualize direct experience as self-generated learning through use, attention to vehicle cues, and the gradual updating of owners' views over time, rather than treating it simply as owners having positive experiences. BEV attachment appears to reflect not only initial preferences but also owners' learning and verification of the vehicle's value through daily interaction. The present study moves this experience-based logic into the post-purchase stage and extends [121], which reported a relationship between BEV driving experience and psychological evaluations in the adoption stage.

Research findings suggest attachment is not the endpoint of the owner–vehicle relationship; rather, it is closely connected with owners' willingness to continue choosing and publicly supporting the BEV. The positive relationship between product attachment and advocacy is broadly consistent with Kwon et al. [35], who examined BEV recommendation intention. This research extends the aforementioned study and the PWOM literature by showing product attachment, as a deeply embedded emotion, is linked to advocacy, a more active and demanding form of positive word-of-mouth. This distinction is important because recommendation intention mainly reflects a willingness to suggest BEVs to others, whereas advocacy reflects a stronger tendency to publicly support, defend, and promote the owned BEV. Nevertheless, the strong associations of product attachment with loyalty and advocacy should be interpreted cautiously. The conceptual proximity between product attachment and loyalty, together with common-source self-reported measurement, may have contributed to the magnitude of the observed coefficients.

### 5.1. Theoretical Implications

This study does not merely argue for the possibility of BEV owners becoming attached; it contributes to refining product attachment theory by indicating how in post-adoption ownership of a complex durable technology, attachment does not appear to be a simple carryover from innovativeness or novelty-seeking. Attachment appears more likely when repeated use verifies the product's capacity to gratify, enrich, and enable the self, and when

owners learn this through direct experience. The study therefore distinguishes adoption-oriented openness from attachment-generating ownership processes and positions direct experience as a post-purchase self-verification pathway in attachment formation.

The study extends product attachment theory to the BEV context by examining attachment in the post-adoption stage and by focusing specifically on the owned vehicle itself.

This study also provides empirical evidence for the argument by Sweeney et al. [95] linking advocacy to deeply embedded emotions, since product attachment reflects a profound and enduring emotional bond [42].

## 5.2. Practical Implications

This study offers several practical implications for firms and policymakers seeking to increase BEV market share by boosting both initial adoption and long-term retention. Firms should treat the initial ownership period as a strategic phase for the attachment building stage by actively helping owners explore, understand, and bond with their BEVs.

Second, BEV segmentation and communication strategies should prioritize everyday mobility motives over technological innovativeness when building product attachment. BEV positioning should emphasize emotional rewards, including enjoyable driving, comfort, and sensory pleasure. Since motivational orientations may differ across BEV segments, communication for the mini BEV market should highlight functional benefits, while luxury BEV communication should focus more on symbolic meaning. For the medium BEV segment, a balanced positioning approach may be more suitable.

Rather than treating customer advocacy as only an ownership outcome, firms should use it as a growth mechanism for BEV adoption and sales. Owner advocacy reduces perceived risk by offering credible information and social proof. Firms can strengthen this advocacy role through referral programs, owner communities, user stories, showroom activities, test drives, and social media.

## 5.3. Limitations and Future Research

### 5.3.1. Limitations

This study has several limitations. First, it uses a cross-sectional survey design, so the data capture only one point in time and cannot fully explain how product attachment changes during BEV ownership. Therefore, the observed paths from internal owner factors to product attachment, loyalty, and advocacy should not be interpreted as evidence of causal relationships. Second, all variables were measured using self-reported items in the same questionnaire. Although this approach is practical for owner-based research, the use of a single data source may inflate the observed relationships. Third, the sample consisted of BEV owners who had accumulated at least 5000 km of driving experience. This threshold ensured that respondents had sufficient ownership experience, but it may not fully represent new owners who are still adjusting to BEV use. Fourth, the study focused on Indonesian BEV owners, and the sample was predominantly male and drawn mainly from urban areas in Java. The findings may therefore not fully represent BEV owners in other market, geographical, or demographic contexts. Finally, the model focused on internal psychological factors and did not include external ownership conditions, such as charging convenience, after-sales support, incentive exposure, and community involvement. These conditions may be related to ownership experience and may alter the strength of the relationships examined in the model.

### 5.3.2. Future Research

Future research should employ longitudinal designs to examine BEV owners from vehicle delivery through the early and later stages of ownership. Such studies could examine how product attachment changes in relation to initial motivation, innovativeness,

and accumulated direct experience. They could also assess whether loyalty and advocacy vary with longer ownership duration or higher mileage. Since innovative owners may value novelty more strongly at the beginning of ownership, longitudinal research could determine whether customer innovativeness is more relevant during the early ownership stage. Future studies may also combine survey responses with objective indicators, such as app usage, charging history, service records, or actual referral activity, to reduce reliance on self-reported data.

Further research should compare Indonesian BEV owners with owners in more mature BEV markets to examine whether attachment patterns differ across policy, infrastructure, and ownership contexts. Studies covering wider geographic areas and more demographically balanced samples could also assess whether product attachment and its related factors differ across gender, age, income, education, and other owner groups. Finally, future studies could examine charging infrastructure quality, after-sales support, incentive exposure, and community involvement as moderators of the relationships between owner motives, direct experience, product attachment, loyalty, and advocacy.

## 6. Conclusions

Achieving wider BEV diffusion requires more than initial adoption. Owners also need to stay with BEVs, repurchase them, and become credible advocates after living with the vehicle. To address this post-adoption issue, this study examined product attachment by incorporating internal owner factors and positioned attachment as a psychological process developing after purchase, while examining its relationships with internal owner factors, loyalty, and advocacy among experienced Indonesian BEV owners.

This study shows post-adoption BEV behavior is less closely related to general openness to new technology than to what ownership becomes in everyday life. Among experienced urban Indonesian BEV owners, product attachment was most strongly related to affective motivation, followed by symbolic motivation, direct experience, and instrumental motivation, while customer innovativeness showed no significant relationship.

These findings suggest that attachment to a BEV tends to be stronger among owners who perceive the vehicle as not only functionally useful but also enjoyable to drive, meaningful for self-expression, and repeatedly validated through first-hand use. Direct experience is therefore important not as mere exposure, but as a learning process through which owners interpret the BEV's performance in daily life and view ownership as a personally grounded relationship. In addition, product attachment was strongly associated with both BEV loyalty and advocacy, indicating that attachment is not simply a private emotional state toward the owned vehicle; it is also associated with continued commitment to BEV use and a willingness to recommend and defend BEVs to others. Overall, the findings position product attachment as a potential post-adoption mechanism linking lived BEV experience to longer-term owner retention and owner-driven diffusion.

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## Abbreviations

|         |                                                    |
|---------|----------------------------------------------------|
| ACM     | Affective Car Use Motivation                       |
| AD      | Customer Advocacy                                  |
| ANOVA   | Analysis of Variance                               |
| AVE     | Average Variance Extracted                         |
| BEV     | Battery Electric Vehicle                           |
| CA      | Cronbach's Alpha                                   |
| CI      | Customer Innovativeness                            |
| CR      | Composite Reliability                              |
| DIR     | Direct Experience                                  |
| EA      | Product Attachment                                 |
| HTMT    | Heterotrait-Monotrait Ratio                        |
| ICM     | Instrumental Car Use Motivation                    |
| ICEV    | Internal Combustion Engine Vehicle                 |
| IDR     | Indonesian Rupiah                                  |
| km      | Kilometer                                          |
| LY      | Customer Loyalty                                   |
| PLS-SEM | Partial Least Squares Structural Equation Modeling |
| PWOM    | Positive Word-of-Mouth                             |
| SCM     | Symbolic Car Use Motivation                        |
| SD      | Standard Deviation                                 |

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