Ecological Behaviour of New Energy Vehicle Purchase: The Mediating and Moderating Roles of Ecological Beliefs and Voluntariness

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Abstract

Purpose: This study explores ecological behaviour in the context of new energy vehicle (NEV) purchase in Malaysia. Drawing on the Value-Belief-Norm (VBN) theory, it examines the influence of eco-altruistic values and openness to change on ecological beliefs and behaviour, with ecological beliefs tested as a mediator and voluntariness as a moderator. **Design/methodology/approach:** Data were collected through a survey of 152 NEV purchasers. Established scales were used to measure the constructs, and Structural Equation Modelling with SmartPLS 4.0 was applied to assess both measurement and structural models. **Findings:** Eco-altruistic values and openness to change significantly influenced ecological beliefs, but not ecological behaviour directly. Ecological beliefs predicted NEV purchasing behaviour and mediated the link between openness to change and behaviour. However, the mediating role between eco-altruistic values and behaviour was not supported. Voluntariness moderated the belief–behaviour relationship, suggesting that ecological beliefs translate into NEV adoption only when consumers perceive freedom and willingness in their decisions. **Research limitations/implications:** The study focuses on NEV purchasers and is limited by its cross-sectional design. Future research should adopt longitudinal and cross-cultural approaches to validate and extend these findings. **Practical implications:** Results highlight the need for policies and marketing strategies that embed ecological beliefs and enhance voluntariness through incentives, financing, and infrastructure to support NEV adoption. **Originality/value:** This study extends VBN theory by incorporating voluntariness as a moderator and employing a simplified ecological belief construct, offering new insights into NEV adoption in emerging markets.

Introduction
The study of ecological behaviour has increasingly shifted its emphasis from the macro level—such as industry and community practices—to the micro level, focusing on individual decision-making (Upham et al., 2024). This transition reflects growing awareness that personal actions contribute significantly to environmental challenges. Thus, influencing and changing harmful individual behaviours can play an important role in moderating and mitigating environmental problems (Chan & Lee, 2016).

Ecological behaviour refers to actions that support environmental preservation and conservation (Omarova & Jo, 2022). In the transportation sector, this includes adopting sustainable mobility options such as purchasing new energy vehicles (NEVs). While research on consumer behaviour toward green products in general is extensive (Duarte et al., 2024; Hung & Chang, 2024), studies specifically focused on NEV adoption remain relatively scarce, particularly in Malaysia (Lee et al., 2025).

Historically, environmental programmes related to improving energy efficiency and reducing emissions were designed and implemented at the industrial level. However, these initiatives often encountered difficulties and limited effectiveness (Bera et al., 2025). As a result, attention has increasingly turned toward strategies at the consumer level, encouraging individuals and households to adopt technologies such as NEV (Noor et al., 2025). Evidence from Yang and Lin's (2016) study shows that the adoption of energy-efficient technologies between 1985 and 2011 reduced carbon emissions in China by 13.54%, underscoring the potential environmental impact of consumer-level behavioural change.

The Value-Belief-Norm (VBN) theory provides a useful foundation for understanding how personal values and beliefs influence pro-environmental behaviour (Ghazali et al., 2019). According to this framework, ecological beliefs act as key antecedents of behaviour (Batool et al., 2024; Lopez & Arango, 2008). Within the theory, ecological beliefs are shaped by three dimensions: ecological worldview (NEP), awareness of adverse consequences (AC), and perceived ability to reduce threats (AR) (Chan & Lee, 2016; Dunlap et al., 2000). Hence, this value-belief relationship has not been measured or tested directly in many studies and measuring these belief constructs become complicated (Chan et al., 2021). As such, a simpler and direct approach in measuring the belief component is desired.

Although ecological beliefs are often assumed to be strong predictors of pro-environmental behaviour (Haltinner & Sarathchandra, 2021), real-world patterns suggest otherwise. For example, many consumers openly acknowledge the environmental and economic benefits of NEVs, including lower carbon emissions, reduced fuel expenditure, and long-term sustainability. Government-led awareness campaigns, incentives, and policy support have also increased public understanding of NEV advantages. The actual NEV adoption rate remains unsatisfactory where only 2.54% of total registered vehicles in Malaysia are NEVs, according to Road Transport Department Malaysia (2025) statistics. This stark discrepancy highlights that rising awareness and positive beliefs alone are insufficient to drive widespread behavioural change (Noordin & Zailani, 2025). Such a belief–behaviour gap indicates that the

relationship between ecological beliefs and ecological behaviour is more complex than what traditional behavioural theories might predict (Colombo et al., 2023).

Unlike some countries where governments strongly push or even mandate the transition toward NEVs by imposing strict emission regulations, banning new petrol-car registrations or differentiating licensing and taxation procedures (Chen & Li, 2024; Xu & Mo, 2024). Malaysian government does not enforce stringent rules that compel consumers to adopt NEVs. Purchasing an NEV in Malaysia follows procedures highly similar to buying a petrol car and consumers face no coercive policy forcing them toward NEV. Thus, NEV adoption is largely driven by personal motivation and free choice rather than regulatory pressure (Nordin & Zailani, 2025). This may limit individuals' ability to translate beliefs into concrete action, resulting in weakened belief–behaviour consistency.

Guided by VBN theory (Stern, 2000), this study examines: (i) the influence of eco-altruistic values and openness to change on ecological beliefs and NEV purchase behaviour; (ii) the impact of ecological beliefs on NEV purchase; (iii) the mediating role of ecological beliefs between personal values and behaviour; and (iv) the moderating effect of voluntariness in shaping the relationship between ecological beliefs and NEV purchase behaviour.

This research also seeks to introduce a simplified approach to measuring ecological beliefs. In addition to evaluating ecological beliefs as a mediator, voluntariness is examined as a moderator of the belief–behaviour relationship. This dual focus provides a fresh perspective in pro-environmental studies, particularly in the emerging area of NEV purchase in Malaysia. This research paper is organized into several sections. It begins with an overview of the study's background and introductory discussion. This is followed by a review of relevant literature, the formulation of hypotheses, and the development of the conceptual framework. The subsequent sections present the research methodology and key findings. The research paper concludes with a summary, along with managerial implications and recommendations for future research.

Literature Review

Underpinning Theory
This study adopts the VBN theory as the foundation for its conceptual framework. As highlighted by Zulkepeli et al. (2024), the VBN theory is widely recognized and frequently applied in environmental behaviour research. Some scholars have employed the full model in their investigations, while others have selectively applied parts of it (Dcosta et al., 2024; Kulkarni et al., 2025). The core proposition of the VBN theory is that personal values and ecological beliefs act as key drivers of pro-environmental behaviour (Chou, 2014; Huang, 2016). Within this framework, ecological beliefs play a mediating role, linking individuals' value orientations to their actual ecological behaviours.

Ecological Beliefs as Mediator
Research in environmental studies often highlights ecological beliefs, which are typically seen as outcomes of a cost–benefit assessment associated with ecological behaviour (Alam et al., 2025). These beliefs reflect how individuals perceive the relationship between humans and the natural environment, considering the consequences of protecting or neglecting it based

on personally valued aspects (Lopez & Arango, 2008). In essence, ecological beliefs capture the way people understand and evaluate the human–environment connection (Stern, 2000). Existing studies on ecological beliefs generally fall into two streams: the multiple-component approach and the single-component approach. The VBN theory (Stern, 2000) supports the multiple-component perspective, where ecological beliefs are shaped by three elements— ecological worldview (NEP), awareness of adverse consequences (AC), and perceived ability to reduce threats (AR). Schultz (2001) explained that these components represent attitudes about how environmental problems affect oneself, other people, and other living beings. Several studies have confirmed a strong link between ecological beliefs and ecological behaviours (Chan et al., 2021), with evidence from past research showing that these belief components influence a range of pro-environmental actions (Chou, 2014; Huang, 2016; Raineri & Paille, 2016).

However, this approach has faced criticism. Steg et al. (2005) argued that the direct relationship between values and beliefs within the VBN framework has not been adequately measured or tested. Moreover, the use of three separate belief components has been said to complicate the measurement of ecological beliefs (Gonzalez et al., 2015). Stern et al. (1995) also suggested that NEP, AC, and AR may in fact represent a single underlying construct. Subsequent studies (Ryan & Spash, 2012; Snelgar, 2006) further questioned whether these dimensions truly capture distinct cognitive processes, implying the need for a revised and simplified model.

This has led to an alternative perspective that treats ecological beliefs as a single variable. For example, Chua et al. (2016) applied the NEP scale to represent general environmental beliefs when studying agrochemical purchases, while Singh (2011) employed a single ecological belief construct to profile ecological consumers in India. Both studies found that ecological beliefs exerted a direct influence on ecological behaviour. This single-component approach aims to streamline measurement and reduce complexity, although additional validation is still necessary (Mezghenni & Zouari, 2016). In line with this perspective, the present study adopts the simplified single-variable approach to operationalize ecological beliefs.

Voluntariness as Moderator
Within the field of technology acceptance, voluntariness is understood as the degree to which an individual is willing—without external obligation—to adopt or use a new innovation or technology (Venkatesh & Davis, 2000). Importantly, prior research has shown that it is not actual voluntariness, but rather the perception of voluntariness, that shapes individual behaviour (Moore & Benbasat, 1991). Empirical studies, such as Luo et al.'s (2025) work on employee green behaviour and Azmi and Daud's (2024) research into tax compliance behaviour, demonstrate a positive link between voluntariness and behavioural outcomes.

The assumption that human behaviour is always guided by attitudes or perceived consequences of an action does not fully hold (Kollmuss & Agyeman, 2022). Instead, the level of effort required plays a critical role in determining behaviour (Cheval et al., 2025). When an action is easy and requires little effort, individuals are more likely to repeat it frequently. Conversely, when the behaviour is perceived as difficult or demanding, individuals may abandon it. Supporting this, Chiu and Ku (2015) as well as Chen et al. (2015) found that voluntariness significantly moderated system usage among their study participants.

Given these insights, it becomes clear that factors influencing the belief–behaviour relationship proposed in the VBN theory have often been overlooked. To address this gap, voluntariness should be explicitly considered as a moderating variable in pro-environmental studies, since many ecological behaviours—including the adoption of sustainable technologies—are largely voluntary rather than mandated.

Hypotheses Development and Research Framework
Human behaviour can be understood as a function of the expectations individuals hold and the value they attach to the goals they pursue (Fishbein & Ajzen, 1975). People are more likely to act in ways they perceive as important and meaningful. Put differently, in any given situation, individuals weigh the positive and negative values associated with a particular action, and this evaluation shapes the behaviour they ultimately adopt (Lucian, 2017). This perspective provides a clear link between personal values and behavioural choices. For example, if protecting the environment is regarded as a strongly positive value, individuals are more inclined to engage in pro-environmental actions. In the context of transportation, this means that environmental attitudes, ecological concerns, and openness to change play a crucial role in explaining consumers' decisions to purchase NEVs. Hence, the following hypotheses are proposed:
H1: Ecoaltruistics values positively affect ecological behaviour.
H2: Openness to change positively affects ecological behaviour.

According to Stern's (2000) VBN theory, strong ecological values play a pivotal role in shaping ecological beliefs, which in turn influence pro-environmental actions. This framework clarifies the link between ecological values and ecological beliefs (Jahangiri & Zarei, 2016). Put simply, personal ecological values function as a cognitive lens or mindset that guides how individuals form environmental beliefs, ultimately encouraging behaviours that benefit society and the natural environment (Steg et al., 2014). In this context, values act as antecedents to key variables such as attitudes and behavioural intentions (Perrea et al., 2014; Stern & Dietz, 1994). These values shape beliefs, which then manifest in actual behaviours—such as the decision to purchase NEVs—as a means of protecting the environment and contributing to the collective good. Hence, the following hypotheses are proposed:
H3: Ecoaltruistic values positively affect ecological beliefs.
H4: Openness to change positively affects ecological beliefs.

Ecological beliefs have consistently been linked to a wide range of pro-environmental behaviours (Al-Taie et al., 2015). For example, Amerigo et al. (2005) found in their Spanish study that both anthropocentric and eco-centric beliefs significantly shaped individuals' relationship with the natural environment. Similarly, Schultz (2001) demonstrated that environmental beliefs are tied to people's perceptions of how ecological problems affect themselves, other human beings, and all living organisms. In the context of sustainable transportation, consumers who hold strong ecological beliefs—particularly those who recognize the importance of environmental protection—are more likely to adopt NEV. Moreover, such consumers are often less hesitant to pay the relatively higher price of an NEV, viewing the purchase as a meaningful contribution to environmental preservation rather than merely a financial decision. Hence, the following hypothesis is proposed:
H5: Ecological beliefs positively affect ecological behaviour.

Different theoretical perspectives assign varying roles to personal values in shaping behaviour. Within Social Cognitive Theory (SCT), personal values are considered direct determinants of individual behaviour (Bandura, 1997). Similarly, Gifford and Nilsson (2014) emphasized that personal factors strongly influence ecological behaviour. In contrast, Cognitive Behavioural Theory (CBT) suggests that an individual's emotional response to a situation shapes their beliefs, which in turn drive behavioural outcomes (Beck, 1979). From this standpoint, beliefs serve as a mediating factor between personal values and behaviour (Beck et al, 1979).

Empirical studies on ecological behaviour have produced mixed findings regarding the predictive strength of personal values. Gatersleben et al. (2014) argued that values are relatively stable and exert broad influence across various ecological behaviours. On the other hand, Corral-Verdugo et al. (2006) noted that individuals may not always act consistently with their environmental values. Adding another dimension, Paille et al. (2014) found that contextual elements, such as organizational support, could mediate the link between personal values and ecological behaviour.

However, relying solely on personality traits or knowledge may not be sufficient to explain consumer purchase decisions (Beck et al., 1979). Gonzalez et al. (2015) observed that ecological beliefs, understood as an overarching worldview, often act as direct precursors to ecological behaviour. In practice, these beliefs encourage consumers to engage in environmentally supportive actions. In the case of new energy vehicles (NEVs), even though they are generally more costly than conventional cars, consumers with strong ecological beliefs demonstrate a willingness to invest in them, motivated by their value systems and environmental commitments.

Introducing ecological beliefs as a mediating factor strengthens the causal chain between personal values and ecological behaviour (Jose, 2013). Despite its importance, this mediating role has received limited attention in prior research. Therefore, examining how ecological beliefs bridge the relationship between personal values and behaviour is crucial, especially in the context of environmentally significant actions such as NEV purchase. Therefore, the following hypotheses are proposed:
H6: Ecological belief mediates the relationship between ecoaltruistic values and ecological behaviour.
H7: Ecological belief mediates the relationship between openness to change and ecological behaviour.

Belief is a central construct in understanding human behaviour. Numerous theories that examine the link between attitudes, beliefs, and actions suggest that positive beliefs are closely tied to behavioural outcomes (Hagger et al., 2016; Paul et al., 2016; Teo, 2016; Venkatesh et al., 2003). The VBN framework further demonstrates that individuals' belief systems strongly shape their ecological behaviours (Poortvliet et al., 2018). Accordingly, consumers who believe that NEVs protect the environment should, theoretically, be more inclined to adopt them.

Unfortunately, this belief–behaviour relationship does not always hold true. Prior research has shown that individual beliefs alone may not consistently lead to actual behaviours. For

instance, Alcock et al. (2017) found discrepancies between pro-environmental attitudes and actual air travel choices, while Balabanis and Siamagka (2017) reported similar inconsistencies in luxury brand purchases. In the domain of water conservation, Biagi and Mariano (2011) concluded that ecological beliefs were not reliable predictors of conservation behaviours. Comparable evidence can be observed in Malaysia, although many consumers acknowledge the environmental benefits of NEVs, adoption remains low, highlighting that beliefs alone do not guarantee action (Nordin & Zailani, 2025).

Human behaviour is largely volitional, involving personal choice and determination (Wegner & Wheatley, 1999). This highlights the need to examine additional factors—particularly voluntariness—that may weaken or moderate the conventional belief–behaviour relationship (Jose, 2013; Tajeddini & Ratten, 2017). Under high voluntariness, individuals may behave based on personal desires rather than ecological beliefs. When individuals feel more autonomous, their ecological beliefs become less predictive of their actual behaviour. Thus, voluntariness can dilute the influence of ecological beliefs, causing beliefs play a smaller role in predicting behaviour. Understanding this dynamic is crucial, as voluntariness may influence whether beliefs about NEVs translate into real purchasing decisions.

The Theory of Apparent Mental Causation offers useful insight, suggesting that individuals experience a sense of "conscious will" when they perceive their own thoughts as the cause of their actions (Wegner & Wheatley, 1999). In this sense, conscious will represents the intention or mental state preceding action (Wegner, 2002). This perspective provides a theoretical foundation for considering situational variables—such as voluntariness—as moderators of the attitude–behaviour relationship (Davidson & Jaccard, 1979). Based on the aforementioned rationale, the following hypothesis is proposed:
H8: Voluntariness negatively moderates the relationship between ecological beliefs and ecological behaviour.

Thus, this study proposes the following research model that presents ecological behaviour as a consequence of direct and indirect relationships between ecological belief and ecological values (see Figure 1).

H6: Ecoaltruistic Values → Ecological Beliefs → Ecological Behaviour
H7: Openness to Change → Ecological Beliefs → Ecological Behaviour
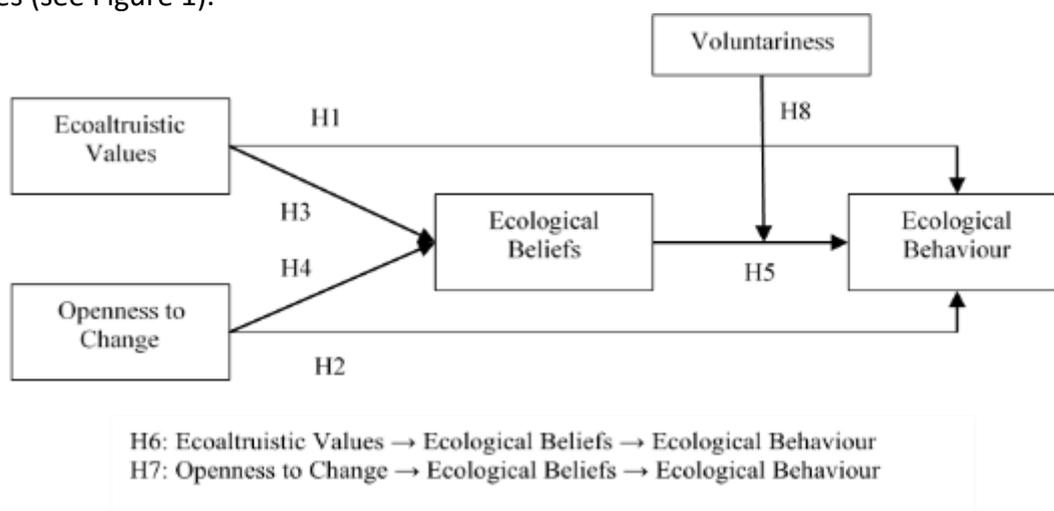
Research Methodology

Population and Sample

Given the absence of a complete sampling frame, this study employed a non-probability judgmental sampling method to collect the required data. This approach was chosen to ensure that only appropriate and relevant respondents were targeted (Calder et al., 1981). Specific eligibility criteria were outlined to determine who qualified as respondents, in line with Sekaran's (2003) recommendation. The target population for this research consisted of Malaysian consumers who had purchased a NEV within the last six months. To verify eligibility, a screening question regarding recent NEV purchase was included at the beginning of the questionnaire. Data collection was conducted online, in collaboration with four major car manufacturers operating in Malaysia. Using their customer databases, these manufacturers distributed the questionnaire to verified NEV buyers via email between January and March 2025. This approach ensured that the study reached genuine NEV adopters while expanding coverage beyond specific geographical boundaries such as Klang Valley. Following Hair et al.'s (2014) guideline, the minimum required sample size was set at five times the number of questionnaire items. With 23 items in the survey, at least 115 usable responses (23 × 5) were necessary. The actual number of responses exceeded this threshold, ensuring sufficient data for meaningful analysis.

Measurement Instrument

All measurement items in this study were adapted from well-established scales in prior research. NEV purchase behaviour was assessed using four items adapted from Sinnappan and Rahman (2011), while ecological beliefs were measured with six items adapted from Singh (2011). Eco-altruistic values were captured through items adapted from Kaiser et al. (1999). Openness to change was measured using six items derived from Susskind et al. (1998). Finally, voluntariness was assessed with three items adapted from Venkatesh et al. (2012). Each construct was measured using a five-point Likert scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree").

Demographic Information

Out of the 250 questionnaires distributed, 152 were completed and deemed valid for analysis, yielding a response rate of 60.8%. The demographic profile indicated that slightly more than half of the respondents were male (52.0%). A majority fell within the 20–30 age group (57.2%), suggesting that younger consumers are more actively represented among NEV buyers. In terms of ethnicity, most respondents were Malay (55.3%), while marital status data showed that 71.1% were single. Regarding religion, Muslims formed the majority at 57.2%. Educational background revealed that most participants held a bachelor's degree (53.9%), and their monthly income predominantly ranged between RM2,001 and RM3,999.

Data Analysis

Since both predictor and criterion variables were collected from the same respondents, it was essential to test for the possibility of common method variance (CMV) (Podsakoff et al., 2003). CMV occurs when a single factor accounts for more than 50% of the total variance (Malhotra et al., 2006). To examine this, Harman's single-factor test was conducted by entering all items into a principal component analysis and running factor analysis without rotation using SPSS. The results showed that no single factor explained more than 50% of the variance, indicating that CMV was not an issue in this study (Malhotra et al., 2006).

To further assess the model, SmartPLS 4.0 was employed to evaluate both the measurement model and the structural model. Partial Least Squares (PLS) is a variance-based approach that aims to maximize the explained variance of endogenous constructs (Hair et al., 2014). It is particularly suitable for handling complex models that include both reflective and formative constructs. In this study, PLS path modelling was applied using the path-weighting scheme for internal approximation (Quoquab et al., 2017). A non-parametric bootstrapping procedure with 5,000 resamples was then conducted to obtain reliable standard errors for the parameter estimates (Chin, 1998).

Measurement Model
The measurement model, which outlines the relationship between each construct and its corresponding indicators, was evaluated in terms of both validity and reliability. Reliability was assessed by examining factor loadings and composite reliability values (Hair et al., 2014). As shown in Table 1, all factor loadings exceeded the minimum acceptable threshold of 0.60 (Chin, 1998), while the composite reliability scores for every construct were above the recommended cut-off value of 0.70 (Henseler et al., 2009). These results confirm that the measurement model achieved an acceptable level of reliability.

Table 1
Factor loadings, composite reliability and AVE

Construct	Item	Loadings	Composite reliability	AVE
Ecoaltruistic Values	EAV1	0.844	0.902	0.697
	EAV2	0.871		
	EAV3	0.865		
	EAV4	0.753		
Ecological Behaviour	EB1	0.605	0.828	0.549
	EB2	0.840		
	EB3	0.754		
	EB4	0.746		
Ecological Beliefs	EF1	0.741	0.860	0.554
	EF2	0.746		
	EF3	0.850		
	EF4	0.711		
	EF5	0.662		
Openness to Change	OTC1	0.750	0.845	0.576
	OTC4	0.782		
	OTC5	0.733		
	OTC6	0.770		
Voluntariness	VL2	0.713	0.779	0.641
	VL3	0.880		

Notes: Item EF6, OTC2, OTC3 and VL1 were deleted to improve AVE.

Following the reliability assessment, the validity of the measurement model was examined through convergent validity and discriminant validity. Convergent validity was evaluated using the average variance extracted (AVE) and composite reliability values (Hair et al., 2017). As presented in Table 1, all constructs recorded AVE values above the minimum threshold of 0.50 and composite reliability values exceeding 0.70 (Fornell & Larcker, 1981; Henseler et al., 2009). These results confirm that convergent validity was satisfactorily achieved.

Discriminant validity was then assessed using two approaches. The first was Fornell-Larcker's (1981) criterion, which requires the square root of a construct's AVE to be greater than its correlations with other constructs in the model. This condition was met, confirming that discriminant validity was established at the construct level. The second method applied was the Heterotrait-Monotrait (HTMT) ratio of correlations, proposed by Henseler et al. (2015). This approach evaluates discriminant validity by comparing correlations across constructs. According to the recommended thresholds, HTMT values should be below 0.90 for conceptually similar constructs and below 0.85 for conceptually distinct constructs. As displayed in Table 2, all HTMT values in this study were well below the 0.85 benchmark, confirming that discriminant validity was successfully established.

Table 2
HTMT's discriminant validity

	EAV	EB	EF	OTC	VL
EAV					
EB	0.115				
EF	0.581	0.299			
OTC	0.669	0.351	0.700		
VL	0.310	0.483	0.339	0.473	

Structural Model
At the next stage, the structural model—which depicts the causal relationships among the constructs in the proposed framework—was assessed (see Figure 2). The evaluation followed the criteria recommended by Hair et al. (2014), which include the significance of path coefficients, the coefficient of determination (R^2), effect size (F^2), and predictive relevance (Q^2). Using SmartPLS 4.0, the PLS algorithm was applied, followed by a bootstrapping procedure with 5,000 resamples to generate the R^2 values, F^2 values, path coefficients, and corresponding t-statistics.

A path relationship was considered significant when the t-value exceeded 1.645 (Hair et al., 2014). As presented in Table 3 and illustrated in Figure 2, eco-altruistic values (EAV: β = 0.258, p < 0.01) and openness to change (OTC: β = 0.420, p < 0.01) both showed positive and significant effects on ecological beliefs, together explaining 38% of its variance. This provided support for H3 and H4. Similarly, ecological beliefs (EF: β = 0.389, p < 0.01) had a significant impact on ecological behaviour, accounting for 19.3% of the variance, thereby supporting H5. However, the direct effects of eco-altruistic values (H1) and openness to change (H2) on ecological behaviour were not supported.

Next, the effect sizes of the exogenous variables were examined, reflecting the individual contribution of each construct to explaining variance in the endogenous variables (Mohammad et al., 2016). Using Cohen's (1988) formula—F^2 = (R^2 included − R^2 excluded) / (1 − R^2 included)—effect sizes of 0.02, 0.15, and 0.35 were interpreted as small, moderate, and large, respectively. Results in Table 3 show that the effect sizes of EAV and OTC on ecological behaviour were negligible, while other exogenous variables demonstrated small to moderate effects.

Finally, predictive relevance (Q^2) was tested using the Blindfolding procedure. Q^2 values indicate how well the model can predict observed values based on parameter estimates (Hair

et al., 2017). A Q^2 greater than zero suggests that the model has predictive relevance (Hair et al., 2011; Henseler et al., 2009). In this study, Q^2 values were 0.212 for ecological beliefs and 0.099 for ecological behaviour (Table 4), confirming that the structural model possessed predictive relevance.
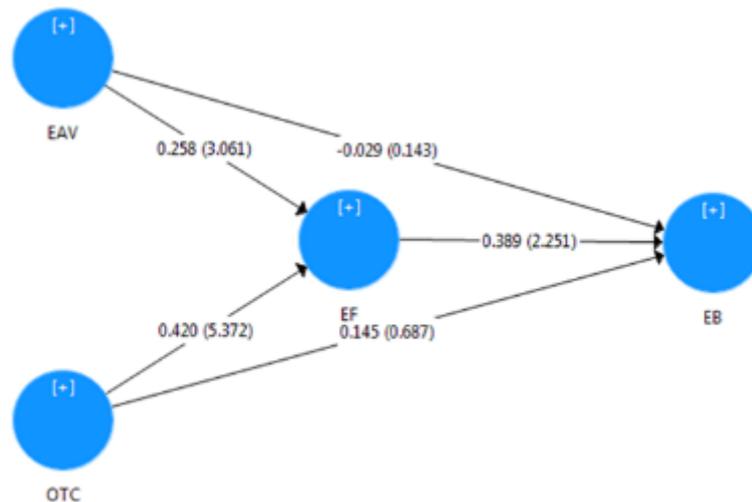

Figure 2. PLS path model for direct and indirect effects.

Table 3
Direct relationships

Hypothesis	Path	Coefficient	SD	t-value	R2	F2	Q2	Supported
H1	EAV→EB	0.029	0.202	0.143	0.380	0.001	0.212	No
H2	OTC→EB	0.145	0.150	0.687	0.193	0.016	0.99	No
H3	EAV→EF	0.258	0.096	3.061		0.073		Yes
H4	OTC→EF	0.420	0.162	5.372		0.193		Yes
H5	EF→EB	0.389	0.142	2.251		0.124		Yes

The study then tested for mediation effects using the bootstrapping procedure recommended by Preacher and Hayes (2004). A mediation relationship is considered significant when the t-value of the indirect path exceeds 1.96 (Hair et al., 2014). Findings revealed that the indirect effect of β = 0.164 (95% CI: 0.074, 0.123) was statistically significant, with a t-value of 2.071. This indicates that ecological beliefs served as a mediator between openness to change and ecological behaviour, thereby supporting H7. In contrast, the mediating role of ecological beliefs in the relationship between eco-altruistic values and ecological behaviour (H6) was not supported (see Table 4).

Table 4
Indirect relationships

Hypothesis	Path	Coefficient	SD	t-value	Supported
H6	β1:EAV→EF→EB	0.100	0.065	1.786	No
H7	β2:OTC→EF→EB	0.164	0.031	2.071	Yes

The study also examined whether voluntariness moderated the relationship between ecological beliefs and ecological behaviour. To begin, voluntariness was added to the model and tested for validity and reliability. Results from Tables 1, 2, and 3 confirmed that both convergent and discriminant validity were established for this construct. The interaction

effect was then generated using the product indicator approach, which involved multiplying the indicators of ecological beliefs with those of voluntariness (Hair et al., 2017). To minimize multicollinearity, the indicators of both the exogenous and moderator variables were standardised prior to creating the interaction term.

A moderating effect is considered significant when the t-value exceeds 1.645 (Hair et al., 2014). The bootstrapping results revealed that the path coefficient linking the interaction construct to ecological behaviour was β = –0.135, with a t-value of 2.104 and a 95% confidence interval ranging from –0.310 to 0.384. These findings, shown in Table 5 and Figure 3, confirm that voluntariness significantly moderated the relationship between ecological beliefs and ecological behaviour, thus providing support for H8. The moderating analysis shows a negative interaction effect (β = –0.135) between ecological beliefs and ecological behaviour of NEV purchase when voluntariness is included as a moderator. This means that voluntariness weakens the strength of the relationship between ecological beliefs and the actual purchase of NEVs. This negative interaction suggests that high voluntariness reduces the behavioural impact of ecological beliefs, whereas lower voluntariness (e.g., when policies, incentives, or social expectations are stronger) may actually strengthen the belief–behaviour link (see Figure 4).
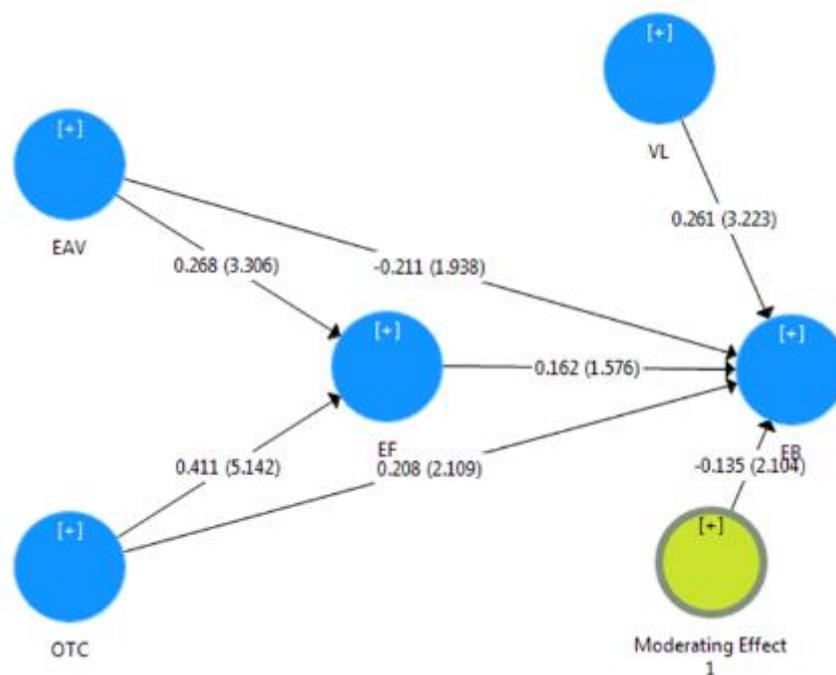

Figure 3. PLS path model for moderating effect.

Table 5
Moderating relationship

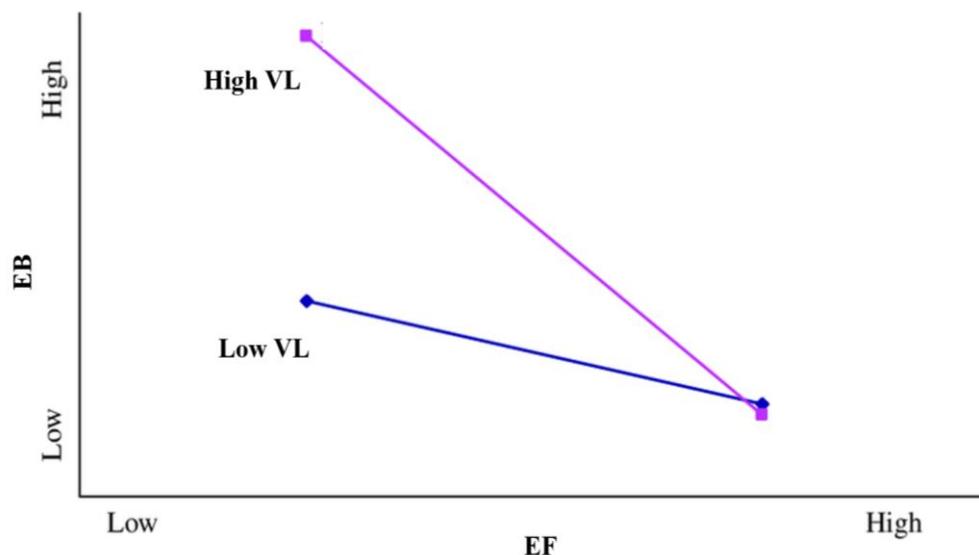| Hypothesis	Path	Coefficient	SD	t-value	Supported
H8	EF→VL→EB	-0.135	0.065	2.104	Yes

Figure 4. Moderating effect of VL on the relationship between EF and EB.

Conclusion

This chapter set out to investigate both the direct and indirect effects of personal values and ecological beliefs on ecological behaviour within the Malaysian consumer context. The findings show that eco-altruistic values and openness to change were significantly associated with ecological beliefs, but not directly with ecological behaviour. These results are consistent with prior studies, such as Chua et al. (2016) in the agricultural sector and Jansson et al. (2010) in the context of alternative fuel vehicles. This aligns with the VBN theory (Stern, 2000), which suggests that individuals who care for others and are receptive to new ideas are more likely to cultivate positive beliefs about protecting the environment and conserving natural resources.

However, the hypothesised direct influence of eco-altruistic values and openness to change on ecological behaviour was not supported. Theoretically, one would expect individuals with strong eco-altruistic values to demonstrate ecological actions in their daily lives. While previous research has supported this relationship (Nordlund & Garvill, 2002), the present study did not. This discrepancy may be explained by cultural and contextual differences. Earlier studies were largely conducted in developed nations, where consumers often enjoy greater financial stability and have higher exposure to environmental education, compared to Malaysian consumers (Quoquab et al., 2017).

On the other hand, ecological beliefs were found to significantly predict ecological behaviour. This finding supports established theories such as the Theory of Planned Behaviour (TPB) (Ajzen, 1991), which posits that beliefs and attitudes are important determinants of action. In the context of this study, Malaysian consumers who strongly believe in the importance of environmental protection are more likely to purchase NEVs, even at a higher cost, viewing their decision as a contribution to environmental and societal well-being.

Furthermore, ecological beliefs were found to mediate the relationship between openness to change and ecological behaviour. This supports the CBT (Beck et al., 1979), which highlights the central role of beliefs in shaping behaviour. Consumers who are open to new ideas are more inclined to adopt innovative technologies such as NEVs, but this occurs primarily when

such openness is reinforced by ecological beliefs (Venkatesh et al., 2003). This result also supports the practicality of using a simplified ecological belief construct in behavioural research.

Finally, the Theory of Apparent Mental Causation (Wegner, 2002) suggests that beliefs alone do not always translate into action. This was confirmed in the study, as voluntariness was found to moderate the link between ecological beliefs and ecological behaviour. In other words, even when consumers acknowledge the environmental benefits of NEV, this recognition alone does not guarantee purchase. Instead, the decision largely depends on their perceived willingness and freedom to act—such as affordability, convenience, or access to charging infrastructure (Chen et al., 2015). In simpler terms, although people may strongly believe that NEVs are good for the environment, this belief is less likely to translate into actual purchasing behaviour when they feel that the choice is completely voluntary. When consumers perceive that they have full freedom and no external pressure to adopt NEVs, they may delay or avoid acting on their beliefs. As a result, the positive effect of ecological beliefs on NEV adoption becomes weaker.

Theoretical and Practical Contributions
Overall, both the theoretical and practical implications of this study must be emphasized to highlight its originality, contribution, and relevance for future scholarship and real-world practice. This research paper provides a comprehensive perspective on the factors shaping ecological behaviour, particularly in relation to NEV purchasing decisions in Malaysia. The findings reveal that eco-altruistic values and openness to change play significant roles in influencing consumers' ecological beliefs, which in turn strongly predict the likelihood of NEV adoption. These insights underline the importance of communication and education initiatives in fostering positive environmental perceptions. Effective awareness campaigns and educational programmes may encourage the public to view NEVs not just as advanced technologies but as purposeful contributions to environmental sustainability.

The results further show that ecological beliefs mediate the relationship between openness to change and actual NEV purchasing behaviour. This indicates that ecological beliefs should be intentionally integrated into consumer education, marketing approaches, and public communication, as they serve as a key mechanism driving NEV adoption. Additionally, the moderating role of voluntariness suggests that even when consumers recognise the environmental benefits of NEVs, they are more likely to convert these beliefs into actual behaviour only when the adoption process feels voluntary, accessible, and convenient. Therefore, government agencies and automotive manufacturers must provide supportive pathways—such as attractive incentives, flexible financing schemes, and enhanced charging infrastructure—to reduce friction in the adoption process.

This research paper also highlights both enablers and barriers to NEV adoption that can guide industry players in crafting more effective strategies for diverse consumer groups. Recognizing variations in consumers' motivations allows companies to segment their markets more precisely and tailor strategies that align with specific needs and expectations. Such targeted approaches can improve the effectiveness of marketing efforts and accelerate NEV uptake.

Moreover, manufacturers and dealers can further strengthen consumer confidence by offering educational sessions, test-drive programmes, and robust after-sales support to address concerns related to cost, maintenance, and charging availability. These initiatives can help reduce perceived risks and uncertainties associated with NEV ownership.

Ultimately, the insights derived from this study contribute to a clearer understanding of Malaysian consumers' ecological behaviour in the context of NEV purchasing. The findings provide valuable guidance for policymakers, industry stakeholders, and related organisations in designing future strategies aimed at increasing NEV adoption, thereby supporting Malaysia's broader sustainability objectives and carbon-reduction commitments.

Limitation and Future Research Direction
This study is not without limitations, and these constraints open avenues for future research. First, the scope of this investigation was confined to examining the proposed relationships among Malaysian consumers who had purchased NEVs. While this provides valuable insights, future studies could expand the context to include other sustainable practices, such as recycling, the purchase of organic products, or the use of renewable energy solutions, to gain a broader understanding of ecological behaviour.

Second, the research employed a cross-sectional design, with data collected at a single point in time. As the study also considered situational factors that may evolve, future research could adopt a longitudinal approach to track changes in consumer perceptions and behaviours over time, particularly as NEV technology and infrastructure continue to advance in Malaysia.
Finally, cross-cultural comparisons would enrich this field of study. By examining NEV adoption across different cultural and demographic groups, future research could determine whether the relationships identified here hold true universally or vary by region, income levels, or societal norms. Such comparative studies would help to generalize findings and provide deeper insights into the global dynamics of NEV adoption.

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