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Are we thinking green? Determinants of green purchasing intention among the elderly towards green vehicles in sub-Saharan Africa

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ABSTRACT

Research background: Despite growing environmental concerns and active government promotion, electric vehicle (EV) uptake in sub-Saharan Africa remains notably low, representing a significant gap in the region's transition towards sustainable mobility. Furthermore, while the global shift towards green transportation continues to accelerate, the specific socio-demographic factors influencing EV adoption among older adults in the region remain substantially under-researched.

Purpose of the article: This study aims to investigate the determinants of EV adoption intentions among older adults in sub-Saharan Africa, where EV uptake remains limited despite increasing environmental concerns and government support.

Methods: Drawing on the Theory of Planned Behaviour, the study analyses empirical data collected from a sample of 312 registered vehicle owners aged 55 years and older. By examining this specific cohort across three major metropolitan areas in Ghana, the study provides detailed demographic and behavioural insights into a population segment whose perspectives are important for understanding the region's transition towards green mobility. The research hypotheses were tested using confirmatory factor analysis and covariance-based structural equation modelling. The data were analysed using IBM SPSS Amos.

Findings & Value added: The findings identify four key factors that significantly and positively influence behavioural intentions to purchase environmentally friendly vehicles: attitudes and beliefs towards EVs, financial incentives, environmental concern, and uncertainty avoidance. Furthermore, uncertainty avoidance was found to positively moderate the relationships between these factors and behavioural intention, thereby strengthening the effects of attitudes, financial incentives, and environmental concern on purchase decisions. The study highlights the need for targeted and multifaceted strategies to encourage EV adoption among older consumers. Practical implications include fostering positive attitudes towards EVs, designing effective financial incentive programmes, promoting environmental awareness, and developing communication strategies that address risk-related concerns. By focusing on an under-researched demographic in a developing African context, the study provides valuable insights for policymakers and marketers seeking to advance sustainable transportation and reduce the environmental impacts of conventional vehicles in the region.

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INTRODUCTION

Over the past few decades, researchers and policymakers have increasingly focused on the environmental impacts of transport activities, driven by growing concerns about climate change and the challenges associated with dependence on fossil fuels (Ojeda-Diaz et al., 2025; van Wee et al., 2012). The transport sector, which remains heavily reliant on petroleum-based fuels, is a major contributor to environmental pollution. Approximately one quarter (25%) of global carbon dioxide emissions originate from this sector, and this share is projected to reach 50% by 2035 (McCollum et al., 2018). Light-duty vehicles, including passenger cars and small trucks, are among the principal sources of these emissions. A similar trend is evident in sub-Saharan Africa, where transport-related emissions are increasing by approximately 7% annually despite considerably lower vehicle ownership rates than in developed economies (Ayetor et al., 2021).

In Ghana, carbon emissions are increasing by approximately 11.1% annually (Ayetor et al., 2021), compared with a growth rate of only 0.12% in the United Kingdom (Brown et al., 2020). Decarbonising the transport sector is therefore essential to mitigate the adverse environmental effects of fossil-fuel combustion. Electric vehicles (EVs) represent a promising decarbonisation solution and have the potential to substantially reduce CO_2 emissions (Agrawal et al., 2026; de Rubens et al., 2018). However, despite government initiatives to encourage EV adoption, uptake remains below established targets (Singh et al., 2020).

According to the Electric Vehicle Outlook (Bloomberg, 2025), achieving net-zero emissions by 2050 will require EVs to account for 60% of all new vehicle sales worldwide by 2030. Nevertheless, even affluent countries such as the United States and Australia continue to lag in EV adoption (Philip et al., 2023). Sub-Saharan Africa, and Ghana in particular, records some of the lowest levels of electric mobility globally, with South Africa and Kenya only marginally ahead of other countries in the region (Sakyi et al., 2025). In Ghana, the EV market remains at an early stage but offers considerable potential if existing adoption barriers are addressed. Accordingly, the practical research problem concerns the factors influencing older adults' intentions to purchase environmentally friendly vehicles in sub-Saharan Africa. The region faces substantial environmental challenges, including air pollution and climate change, both of which could be mitigated through greater adoption of green vehicles (Eccarius & Chen, 2024; Adu-Gyamfi et al., 2024). However, older adults—an often-overlooked demographic in environmental research—represent a growing population segment whose perceptions of and barriers to green purchasing may differ from those of younger consumers.

Understanding the factors influencing individual EV adoption is essential because of its potential to promote more sustainable mobility behaviour. In sub-Saharan Africa, where EV uptake remains minimal, identifying and addressing barriers to adoption is particularly important (Okoh et al., 2024). Despite government efforts, the integration of green vehicles into the transport sector, especially in Ghana, remains at an early stage (Zhang & Yao, 2015). This study therefore empirically examines the factors influencing older adults' intentions to purchase environmentally friendly vehicles in a developing-country context, focusing on psychological factors, financial incentives, environmental concern, and the moderating role of uncertainty avoidance. The research also aligns with the Green Elders Mobility Program, which emphasises awareness campaigns, financial incentives, and community engagement to promote green vehicle adoption among older adults and improve access to healthcare. By addressing the gap in green vehicle adoption, the study contributes to environmental sustainability and provides a foundation for a cleaner and more sustainable transport future in Africa.

Although research on green purchasing behaviour and EV adoption has expanded globally, the existing literature remains affected by substantial geographical and demographic biases. Most studies of EV adoption that apply frameworks such as the Theory of Planned Behaviour (TPB) have been conducted in high-income or rapidly developing economies in Europe, North America, and East Asia. Consequently, existing empirical models often fail to account for the specific structural, infrastructural, and economic conditions of sub-Saharan Africa, including underdeveloped electricity grids and evolving policy frameworks, where EV uptake remains critically low despite increasing environmental concerns. Moreover, research on sustainable consumer behaviour frequently treats consumers as a homogeneous group or focuses predominantly on younger, technologically proficient populations. Older adults aged 55 years and above are routinely overlooked in the green mobility literature, despite often possessing the financial resources required for vehicle acquisition in developing economies such as Ghana.

This study addresses these intersecting gaps by providing a highly localised and demographically focused analysis. Its novelty lies in its dual level of specificity: it integrates micro-level consumer psychology, based on the TPB, with a clearly defined and under-researched demographic group—older urban vehicle owners—in an under-represented regional context, namely sub-Saharan Africa and Ghana. By applying covariance-based structural equation modelling (CB-SEM) to a sample of 312 older drivers across three major Ghanaian cities, the study provides some of the first empirical evidence on how age-specific perceptions and developing-country conditions jointly shape the transition towards sustainable transport.

THEORETICAL BACKGROUND

The Theory of Planned Behaviour (TPB) provides the theoretical foundation for this study. According to the TPB, behavioural intention is primarily determined by attitudes towards the behaviour, subjective norms, and perceived behavioural control (Malik et al., 2026; Kashif et al., 2018). By applying the TPB to older adults' green purchasing intentions, the study provides insight into the psychological processes underlying their decisions to purchase environmentally friendly vehicles. Environmental sustainability and the need to adopt more environmentally responsible behaviours have become increasingly urgent, particularly in the context of rising consumerism (Lorincova et al., 2026). Green purchasing, which involves selecting products and services with lower environmental impacts, represents an important area of inquiry. In the automotive sector, the adoption of environmentally friendly vehicles, including electric and hybrid models, has increased globally (Husain et al., 2021). Nevertheless, relatively little is known about the factors influencing green purchase intentions among specific demographic groups, particularly older adults. Guided by the TPB, this study therefore investigates the determinants of older adults' intentions to purchase environmentally friendly vehicles in an economy characterised by a relatively low level of digitalisation.

Attitudes, defined as favourable or unfavourable evaluations of a behaviour, significantly influence older adults' intentions to purchase environmentally friendly vehicles. Positive attitudes towards green vehicles, shaped by perceived cost savings, anticipated benefits, and environmental concerns, are likely to strengthen purchase intentions. Subjective norms, which reflect perceived social pressure from influential individuals or groups, also play an important role in determining green purchasing intentions among older adults in Ghana. Social influence and perceptions of approval or disapproval may affect an individual's intention to purchase environmentally friendly products. Perceived behavioural control, which refers to individuals' perceptions of their ability to afford, access, and use green vehicles, further shapes their intentions to engage in green purchasing.

The TPB provides a comprehensive framework for understanding the objectives of the present study. By examining attitudes and beliefs, financial incentives, environmental concern, and uncertainty avoidance, the framework offers insight into the decision-making processes associated with green vehicle purchases among older adults (Ackaah et al., 2022). Previous studies have applied the TPB to investigate factors influencing green purchase intentions among older populations, emphasising the importance of understanding and promoting environmentally sustainable consumer behaviour within this demographic group (Qiao et al., 2025). Ultimately, the study seeks to generate evidence that can inform targeted interventions and policies designed to encourage environmentally responsible consumer behaviour among older adults, thereby contributing to a more sustainable and environmentally friendly future.

Behavioural Intentions

Behavioural intentions reflect an individual's readiness or inclination to engage in a specific behaviour and are therefore central to understanding consumer decision-making processes, including those related to electric vehicle (EV) adoption (Ajzen, 1991; Hunik, 2024). According to the Theory of Planned Behaviour, behavioural intentions are determined by three principal factors: subjective norms, attitudes, and perceived behavioural control. Recent studies have extended this framework by incorporating additional predictors relevant to EV adoption, including moral norms and environmental concerns (Nurhayati et al., 2027). For example, Nurhayati et al. (2027) found that attitudes, subjective norms, perceived behavioural control, moral norms, and environmental concerns significantly influence German consumers' intentions to purchase EVs.

Many studies have used structured questionnaires to collect data on consumers' attitudes, perceptions, and intentions regarding EV purchases. For instance, a study conducted in Norway employed an online survey of 280 participants to identify factors influencing behavioural intentions (Lai et al., 2015). The results showed that environmental awareness and concern were positively associated with purchase intentions. However, much of the existing research has focused on specific geographical contexts, such as the United States, Europe, Norway, and Germany, thereby limiting the generalisability of the findings. Further research is therefore needed to examine behavioural intentions towards EVs in diverse cultural contexts, including developing countries (Lai et al., 2015).

The enjoyment and pleasure associated with using EVs may also positively influence adoption intentions. Curtale et al. (2022), for example, identified hedonic motivation as a significant factor enhancing acceptance of autonomous electric car-sharing services. Similarly, Shanmugavel and Balakrishnan (2023) examined the influence of pro-environmental behaviour on EV adoption intentions in India and found that personal norms and environmental knowledge significantly shape positive intentions towards EVs.

These findings collectively underscore the multifaceted nature of behavioural intentions towards EV adoption, which are influenced by environmental concerns, social norms, individual attitudes, and driving experiences. Addressing these factors through targeted strategies and awareness campaigns is essential for promoting widespread EV adoption and fostering sustainable transport practices. Xu et al. (2020) further found that positive EV driving experiences enhance adoption intentions by improving perceptions of relative advantage and ease of use. However, perceived risks associated with EVs may create barriers to adoption, highlighting the need for effective risk-mitigation strategies. By synthesising evidence from diverse studies, this research contributes to a more comprehensive understanding of the determinants of behavioural intentions towards EV adoption and offers relevant insights for policymakers and marketers seeking to encourage sustainable mobility behaviour.

Psychological Factors

The adoption of electric vehicles is increasingly recognised as a critical component of sustainable transportation and environmental protection. Understanding consumer attitudes towards EVs is therefore essential for promoting adoption and addressing barriers to widespread use. One of the principal drivers of positive attitudes towards EVs is growing awareness of environmental issues. Xue (2023) reported that 72% of Americans considering EVs identified environmental benefits as a major reason for their interest. This finding is consistent with Guido et al. (2022), who emphasise that environmental attitudes significantly influence consumers' willingness to adopt EVs.

Lai et al. (2015) found that financial incentives, including tax credits and rebates, positively affect consumers' perceptions of EVs, making them more attractive than conventional vehicles. Social norms and peer influence are also important in shaping attitudes towards EV adoption. Research indicates that individuals are more likely to develop positive attitudes when they perceive support for EV adoption within their social networks. This social dimension is reflected in the findings of Shanmugavel and Balakrishnan (2023), who highlight the importance of community acceptance in fostering favourable attitudes.

Xue (2023) conducted a survey in California examining EV adoption, with particular attention to price incentives and consumer attitudes. However, further studies are needed to examine attitudes towards EVs in diverse cultural settings, including developing countries (Farinloye et al., 2024). Although existing theories have contributed to understanding EV-related attitudes, additional factors—such as technological developments and consumers' direct experiences with EVs—should also be incorporated to provide a more comprehensive explanation (Xue, 2023). Based on the reviewed literature, the following hypothesis is proposed:

- H1a: There is a positive relationship between attitudes towards EVs and behavioural intentions to adopt EVs.

EV adoption is influenced by a complex interaction of attitudes, perceptions, and motivations. Recent empirical literature has identified several key factors that shape consumer beliefs across different geographical contexts. Ashby et al. (2025) conducted a comprehensive literature review highlighting the diverse determinants of EV adoption worldwide. Their work emphasises the importance of environmental concerns, technological development, economic incentives, and policy initiatives in shaping consumer beliefs regarding EVs.

Pathak et al. (2021) examined consumer perceptions in China and found that functionality and reliability are critical determinants of EV adoption. Their study suggests that consumers prioritise these attributes when evaluating EV alternatives, reflecting broader patterns of technology acceptance. Xue (2023) investigated the effects of price incentives and consumer attitudes on EV adoption in California and found that financial incentives significantly increase consumers' willingness to adopt EVs, underscoring the role of government policy in supporting market development. Farinloye et al. (2024) explored the potential for EV adoption in Nigeria and identified market-specific factors influencing consumer intentions. Their findings highlight the need to adapt EV adoption strategies to local conditions.

Based on the reviewed literature, the following hypothesis is formulated:

- H1b: There is a positive relationship between beliefs about EVs and behavioural intentions to adopt EVs.

Financial Incentives

Financial incentives play a pivotal role in shaping individuals' intentions to adopt electric vehicles. A growing body of empirical research highlights the effectiveness of financial mechanisms, including subsidies, tax rebates, and purchase incentives, in promoting EV adoption.

Gautam and Bolia (2024) examined the effectiveness of subsidies in increasing EV adoption rates. Their analysis indicates that direct purchase rebates significantly increase the probability of consumers registering battery electric vehicles, with registrations rising by approximately 8% for every USD 1,000 of financial incentives offered. This finding underscores the critical role of financial incentives in reducing the high upfront costs associated with EV purchases.

Tzeng et al. (2026) explored how economic factors, particularly cost savings and financial incentives, influence individuals' intentions to adopt EVs. Their findings emphasise that incentives are essential for overcoming initial cost barriers and increasing the attractiveness of EVs relative to conventional vehicles. Xie (2025) analysed how individuals evaluate the cost–benefit balance of EV ownership in the presence of financial incentives. The results indicate that access to incentives increases the perceived economic viability of EV ownership and positively influences intentions to transition to electric mobility.

Chen et al. (2025) evaluated the effects of EV rebate programmes on consumer purchase intentions. Their findings reveal that such programmes improve perceptions of affordability and increase the attractiveness of EVs compared with conventional vehicles. The study further demonstrates that well-designed rebate programmes can substantially increase consumer interest and willingness to adopt EVs.

Sierzchula et al. (2014) examined the influence of policy stability on EV adoption intentions, particularly in relation to financial incentives. They found that uncertainty surrounding incentive programmes can reduce consumer confidence in the long-term affordability and feasibility of EV ownership, thereby negatively affecting adoption rates. Based on the reviewed literature, the following hypothesis is proposed:

- H2: There is a positive relationship between financial incentives and behavioural intentions to adopt EVs.

Ecological Care

Ecological care encompasses a multifaceted approach to environmental stewardship, including awareness, concern, and action aimed at protecting ecosystems, natural resources, and the overall health of the planet (World Commission on Environment and Development, 1987). In the context of EV adoption, environmental consciousness plays a central role in shaping consumer attitudes and behaviour.

Studies by Laksmawati et al. (2024) and Pawar et al. (2020) identify environmental concern as a key driver of EV adoption, reflecting growing awareness of the environmental impacts of conventional fossil-fuel vehicles. This awareness also extends to the potential environmental benefits of EVs. Hawkins et al. (2013), for example, emphasise the contribution of EVs to reducing life-cycle emissions.

Policy frameworks also play an important role in reducing emissions and promoting EV adoption, thereby illustrating the significance of regulatory and societal support in strengthening environmental awareness (Alsaleh & Farooq, 2026). Technological advances continue to improve the environmental performance of EVs and contribute to their acceptance and adoption (Alsaleh & Farooq, 2026). Awareness of climate change further increases recognition of the potential role of EVs in mitigating environmental damage (Raza et al., 2025).

Laksmawati et al. (2024) and Pawar et al. (2020) demonstrate that environmental consciousness, particularly concern about climate change, influences preferences for environmentally friendly vehicles and shapes adoption decisions. Effective communication strategies are also important for raising awareness of the environmental benefits of EVs and their potential contribution to climate-change mitigation (Romero et al., 2024).

Policy interventions (Sierzchula et al., 2014) and advances in battery management (Raza et al., 2025) may further reduce the carbon emissions associated with EV use. Personal commitment to sustainable practices also emerges as a key determinant of EV adoption intentions (Laksmawati et al., 2024; Pawar et al., 2020). Romero et al. (2024) emphasise the importance of personal commitment in resisting social pressures and maintaining pro-environmental behaviour, including the decision to choose an EV.

Overall, ecological care—expressed through environmental awareness, concern about climate change, and personal commitment to sustainability—underpins individuals' intentions to adopt EVs and engage in sustainable transportation practices. This interconnected perspective highlights the combined importance of societal awareness, policy support, technological innovation, and individual values in facilitating the transition towards environmentally responsible mobility. Based on the reviewed literature, the following hypothesis is proposed:

- H3: There is a positive relationship between ecological care and behavioural intentions to adopt EVs.

Understanding Uncertainty Avoidance and EV Adoption Intentions

Uncertainty avoidance is a cultural dimension reflecting the extent to which individuals feel comfortable with ambiguity and uncertain situations. It can play an important role in shaping intentions to adopt EVs. This section reviews recent studies examining the relationship between uncertainty avoidance and EV adoption intentions.

Zhang et al. (2026) examined how cultural dimensions, including uncertainty avoidance, affect intentions to adopt EVs. Their findings suggest that individuals from cultures characterised by high uncertainty avoidance tend to report lower EV adoption intentions because of concerns about technological uncertainty and range anxiety. Li and Wang (2022) further investigated how perceived risks associated with EV ownership influence adoption intentions. They found that individuals with high uncertainty avoidance may perceive EVs as riskier because of unfamiliar technologies and insufficient charging infrastructure, resulting in weaker adoption intentions.

Li et al. (2022) examined the effect of policy stability on confidence in EV adoption and proposed that stable and supportive policy environments can alleviate concerns associated with uncertainty avoidance. By providing credible commitments to long-term incentives and infrastructure development, such policies may strengthen intentions to adopt EVs.

Kaur and Kumar (2026) analysed the effectiveness of communication strategies in addressing uncertainty avoidance related to EVs. They advocate the clear and transparent dissemination of information concerning EV technology, charging infrastructure, and government support. Such communication may reduce perceived uncertainty and strengthen adoption intentions.

Overall, the reviewed evidence highlights the important influence of uncertainty avoidance on EV adoption intentions. Based on the literature, the following hypotheses are proposed:

- H4a: Uncertainty avoidance positively moderates the relationship between psychological factors—attitudes and beliefs—and behavioural intentions to adopt EVs.
- H4b: Uncertainty avoidance positively moderates the relationship between financial incentives and behavioural intentions to adopt EVs.
- H4c: Uncertainty avoidance positively moderates the relationship between ecological care and behavioural intentions to adopt EVs.

AIM, METHODOLOGY, AND DATA

The aim of the article is to identify key educational and The objective of this study is to investigate the determinants of EV adoption intention among older adults in Sub-Saharan Africa, a region where EV uptake remains notably low despite growing environmental concerns and governmental promotion.

Research design

The study used a cross-sectional research design in which data were gathered from a sample of elderly Ghanaian citizens who are over 55 years of age. The positivist paradigm guided the study's quantitative methods for collecting and analysing data. These were deemed suitable since the study's conceptual model for testing was developed primarily using a priori theories and constructs. The study's background, the reasons Ghana was chosen for the research, and the creation of the research tool are all covered in detail in the sections that follow. This also goes over the methods utilised for data collection and analysis in the study.

Ghana, a developing country in sub-Saharan Africa, presents a compelling context for studying green purchasing intention among the elderly for several reasons. Ghana has experienced rapid urbanisation in recent decades, leading to increased energy consumption, waste generation, and environmental degradation (Ansu-Mensah, 2021). Studying green purchasing intention provides insights into how the elderly can contribute to sustainable consumption and environmental protection. Like many developing countries, Ghana is experiencing population ageing. The proportion of the population aged 60 years and above increased as expected. Understanding the green purchasing intention of the elderly is crucial for designing targeted interventions and policies to promote sustainable consumption among this growing demographic group. The green product market in Ghana is still in its infancy, with limited awareness and availability of green products (Chan et al., 2018). Studying the determinants of green purchasing intention among the elderly can help identify barriers and facilitators to the adoption of green vehicles, which can inform marketing strategies and policy interventions to stimulate the green market.

Consequently, while several studies have investigated green purchasing behaviour in Ghana, most have focused on the general population or specific age groups (Syed et al., 2024). There is a paucity of research on the green purchasing intention of the elderly in Ghana and other sub-Saharan African countries. Filling this research gap can contribute to the understanding of sustainable consumption among the elderly in developing country contexts. Promoting green purchasing intention among the elderly in Ghana can have significant environmental and social benefits. The elderly often have more disposable income and influence over household purchasing decisions (Uzir et al., 2023). Encouraging green vehicle adoption among this group can contribute to reducing greenhouse gas emissions, improving air quality, and promoting sustainable mobility in urban areas.

Development of research instrument and data collection

This methodological approach is intended to give a comprehensive investigation, providing insightful information about the variables influencing older people's intentions to adopt green vehicles within the socio-cultural context of Ghana. The data collection instrument utilised in this study was a structured questionnaire, chosen primarily due to the availability of established measurement items for the proposed constructs within the research model (Keelson et al., 2025). The questionnaire was organised into two distinct sections. The first section gathered demographic information, including age, gender, work experience, and educational level. The second section focused on the Theory of Planned Behaviour (TPB) explanatory constructs, incorporating statements primarily sourced from existing literature and slightly adapted to align with the objectives of this study. The constructs assessed included Behavioural Intention, ecological care, attitudes, beliefs, financial incentives, and Uncertainty Avoidance, all measured using a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). In this framework, ecological care (Rahayu et al., 2025; Dahlberg et al., 2016), attitudes and beliefs (Jensen et al., 2014 Beck et al., 2017], financial incentives (Sierzchula et al., 2014; Hardman et al., 2017) were treated as the independent variable, uncertainty avoidance as moderator, while behavioral intention served as the dependent variable (Higueras-Castilloé et al., 2024).

Since the study is quantitative, the researchers selected the preferred respondents for the data collection using a snowball methodological approach to achieve the study's objectives. The snowball sampling provided critical access to a relatively niche and hard-to-reach population—specifically, car owners aged 55 and above within major Ghanaian urban centers. Because a centralized, accessible registry of older vehicle owners does not readily exist, leveraging the social and professional networks of initial participants allowed the sample to expand organically and precisely within the target criteria. Also, this method significantly enhanced data quality by establishing immediate interpersonal trust. In the regional context of Sub-Saharan Africa, potential respondents are often hesitant to engage with unfamiliar researchers or cold-contact surveys; however, receiving an invitation from a trusted peer effectively mitigated skepticism, minimized non-response bias, and yielded a high completion rate. Finally, this chain-referral strategy proved to be highly cost- and time-efficient, allowing for the successful gathering of 312 high-quality responses across three major cities without the prohibitive resource expenditure required by city-wide screening.

Compared to other sampling techniques, this one requires less planning and fewer workers, and it enables the researchers to reach populations that are challenging to sample. The study targeted car owners (elderly whose ages are above 55 years). This survey is an essential instrument for gathering a variety of viewpoints and ideas regarding the elderly population's adoption of green automobiles. The study targeted elderly car owners for the survey across three major cities in Ghana (i.e. Accra, Kumasi, and Takoradi). These cities were selected for the study because they are major cities as far as automobiles are concerned (Ansu-Mensah, 2021). Both online and offline approaches to data collection were deployed.

Prior to the main data collection phase, face validity, and content validity checks were conducted to ensure the relevance and comprehensibility of the items derived from existing literature (Jibril et al., 2024). Additionally, a pretest was carried out with 35 respondents in Takoradi to enhance the quality of the items, leading to the removal of irrelevant statements that could compromise the predictive relevance of the model. The study specifically targeted elderly car owners aged 55 and above, recognizing them as a unique and influential demographic. This group is particularly relevant due to their financial capability and heightened environmental awareness, making them ideal candidates for exploring green purchasing intentions toward vehicles in sub-Saharan Africa. Their insights are crucial for understanding how to encourage sustainable vehicle choices within this significant segment of the population. The data collection process yielded a total of 375 respondents, of which 312 surveys were validly completed, resulting in a response rate of 83.2%. The remaining 63 questionnaires were deemed unusable and excluded from the analysis due to partial completion, as including them could potentially compromise the integrity of the data.

Statistical methods and software

A descriptive analysis was conducted on the data collected from elderly car owners. This analysis included calculating the mean scores, standard deviations, skewness, and kurtosis to assess the normality of the data distribution before proceeding with further statistical tests. To evaluate the measurement model and determine how well it fits the dataset, the researchers employed Confirmatory Factor Analysis (CFA) using AMOS 22 software. CFA is a suitable technique for assessing the goodness-of-fit of the measurement model, as it provides relevant fit indices. CB-SEM was chosen because it is a robust technique for testing and estimating causal relationships between observed and latent variables. This method is particularly suitable for studies that aim to confirm a theoretical model, as it allows for the simultaneous assessment of multiple relationships and the examination of complex theoretical constructs (Hair et al., 2019).

CB-SEM is advantageous in this context because the study explores the determinants of green purchasing intentions, which involve multiple latent constructs such as environmental awareness, perceived benefits, and social influences. These constructs are not directly observable and require a sophisticated method like CB-SEM to validate the measurement model and assess the structural relationships among them (Gefen et al., 2011). Moreover, CB-SEM provides a comprehensive assessment of model fit, allowing researchers to evaluate how well the proposed model fits the empirical data, which is critical for testing theoretical hypotheses in behavioral studies (Rigdon, 2016).

The choice of CB-SEM over alternative methods, such as Partial Least Squares SEM (PLS-SEM), is justified when the research goal is to test a well-established theory and when the data meet the assumptions required by CB-SEM, such as multivariate normality and sufficient sample size (Gefen et al., 2011). In this study, CB-SEM allows for rigorous hypothesis testing and contributes to the development of a deeper understanding of the factors influencing green purchasing intentions among the elderly in Sub-Saharan Africa.

Structure of respondents

The results indicate that a higher proportion of male respondents participated in the study, accounting for 75.0% of the total, compared to 25.0% of female participants. Regarding age distribution, 19.0% of the respondents were aged between 55 and 57 years, while the majority, 67.7%, fell within the 58 to 60-year age range. Additionally, 11.0% of the respondents were aged between 61 and 63 years, and 2.3% were over 64 years old. This indicates that the majority of the respondents were between 55-57. This indicates that the 55-57 age range is often approaching retirement. This transition period leads to increased interest in sustainable practices, including green purchasing, as they may have more time to consider their lifestyle choices and their impact on the environment. This demographic is likely to be more reflective of their consumption patterns, especially regarding significant purchases like vehicles. Also, respondents in this age group (55-57) typically possess greater financial stability compared to younger cohorts. Many of them have accumulated savings or assets over their working years, enabling them to make substantial purchases, such as green vehicles. This financial capability, combined with a growing awareness of environmental issues, makes them more inclined to consider eco-friendly options. Additionally, older adults often have significant influence over household purchasing decisions, making their perspectives critical for understanding green purchasing intentions.

The analysis of the educational levels of respondents, where 10% had no formal education, 15% had basic education, 12% had secondary education, 25% had tertiary education, and 38% had post-tertiary education, reflects typical trends observed among the elderly in developing countries. The educational distribution among the elderly in developing countries is characterized by a significant proportion with low or no formal education, reflecting historical, socioeconomic, and systemic educational barriers. This analysis underscores the importance of addressing educational inequalities to improve the quality of education for older adults in these regions.

RESULTS

The issue of non-response bias is checked by comparing early and late response groups (Armstrong & Overton, 1977). The responses obtained in the first two months of the data collection or early responses (n1= 156) are compared with responses obtained in the last two months or late responses (n2 = 156) using the t-test and Levene's test. In all, the sample size used in this study was 312 as well as the data collection took four months from November 2023 to February 2024. The results showed

Table 1: Verification of validity and reliability of items

Constructs	Items	Mean	SD	Skewness	Kurtosis	Loadings	CA	CR	AVE
Attitude	A6	3.96	0.832	-0.903	1.630	0.762	0.898	0.898	0.595
	A5	4.07	0.752	-0.535	0.303	0.731			
	A4	4.13	0.768	-0.439	-0.560	0.769			
	A3	4.16	0.751	-0.647	0.389	0.783			
	A2	4.13	0.768	-0.654	0.380	0.803			
	A1	4.11	0.774	-0.901	1.627	0.778			
Belief	B3	4.12	0.790	-0.537	-0.151	0.809	0.818	0.822	0.600
	B2	4.10	0.785	-0.494	-0.159	0.758			
	B1	3.99	0.833	-0.420	-0.348	0.755			
Financial Incentives	FI4	4.09	0.805	-0.645	0.376	0.808	0.889	0.890	0.668
	FI3	4.02	0.825	-0.481	-0.045	0.786			
	FI2	4.06	0.766	-0.364	-0.284	0.829			
	FI1	4.07	0.773	-0.339	-0.680	0.846			
Ecological Care	EC3	3.89	0.867	-0.587	0.102	0.863	0.795	0.798	0.665
	EC2	3.93	0.861	-0.573	0.223	0.764			
Uncertainty Avoidance	UA5	3.92	0.831	-0.499	-0.044	0.848	0.921	0.921	0.701
	UA4	3.93	0.828	-0.382	-0.279	0.831			
	UA3	3.93	0.861	-0.603	0.141	0.852			
	UA2	3.98	0.827	-0.412	-0.481	0.837			
	UA1	3.93	0.886	-0.499	-0.203	0.818			
Behavioral Intention	BI3	3.91	0.877	-0.666	0.578	0.776	0.878	0.881	0.712
	BI2	3.93	0.818	-0.728	0.859	0.884			
	BI1	4.03	0.787	-0.486	0.225	0.867			

Note: CA = Cronbach's alpha; CR = composite reliability; AVE = average variance extracted, SD = Standard deviation. Sources: authors' process from AMOS software

no significant difference in the mean and variance between the two response groups, allowing us to disregard the issue of non-response bias in our data.

Next, the researchers adopted procedural and statistical countermeasures recommended by Podsakoff et al. (2009) to prevent the potential common method bias issue due to using a single respondent (firm representative). About the survey design, the independent variables are time-ordered at the beginning and the dependent variables at the latter part. Further, Harman's one-factor test is conducted using all variables to verify the issue of common method variance (CMV). The results showed 5 factors with eigenvalues>1, with 64.88% of the total variance explained and the largest factor accounting for 32.23% of the variance, negating the CMV issue (Hair et al.,2019).

Finally, the researchers verified the reliability and validity of the constructs used in the study. Considering that all the study constructs are adapted from established literature, researchers conducted confirmatory factor analysis (CFA) to verify their one-dimensionality and convergence validity. Table 1 shows the results of measurement model validation. First, the Cronbach's α and composite reliability (CR) values for all constructs were >0.7, showing an acceptable internal consistency of theoretical constructs (Hair et al., 2019). Next, the standardised loadings of individual items on their respective constructs ranged from 0.731 to 0.884 (acceptable limit of >0.5, Hair et al. (2019) except for two items (one item each of the ecological care EC1 and behavioural intention BI4 constructs). Overall, these results confirmed an acceptable convergence validity of constructs.

The researchers also adopted the Fornell and Larcker criterion for establishing the construct's divergent validity. Following the Fornell & Larcker (1981), the square roots of each construct's AVEs (√AVE) are compared with its

Table 2: The Fornell-Lacker criterion

Constructs	1	2	3	4	5	6
Attitude	0.771					
Belief	0.680***	0.774				
Financial Incentives	0.687***	0.533***	0.818			
Ecological Care	0.619***	0.693***	0.674***	0.815		
Uncertainty Avoidance	0.612***	0.717***	0.686***	.606***	0.837	
Behavioral Intention	0.631***	0.672***	0.616***	0.614***	0.624***	0.844

Source: authors' process from AMOS software

Table 3: Structural models with dependent variable – behavioral intention

Main Effect	1	2	3	4
Attitude (Att)	.275***	.917***		
Belief (BI)	1.63**			
Financial Incentives (FI)	0.123		1.125***	
Ecological Care (EC)	0.037			.346*
Uncertainty Avoidance (UA)	.248***	.928***	1.210***	.718***
Interaction Effect				
Att*UA		.136**		
FI*UA			.208***	
EC*UA				.064*
Model Summary				
R-squared	0.442	0.4253	0.4155	0.337
F-stats	15.188***	75.745***	72.473***	52.061***

Note: *** p < 0.01, ** p < 0.05, * p < 0.100. Source: authors' process from AMOS software

correlation (φ) for other constructs. confirms an acceptable discriminant validity (Table 2). Further, the model fit indices for the constructs are (χ2 /Df = 2.069; NFI = 0.919; RFI = 0.905; IFI = 0.947; TLI = 0.949; CFI = 0.956; RMSEA = 0.059) and are found to meet the thresholds [59].

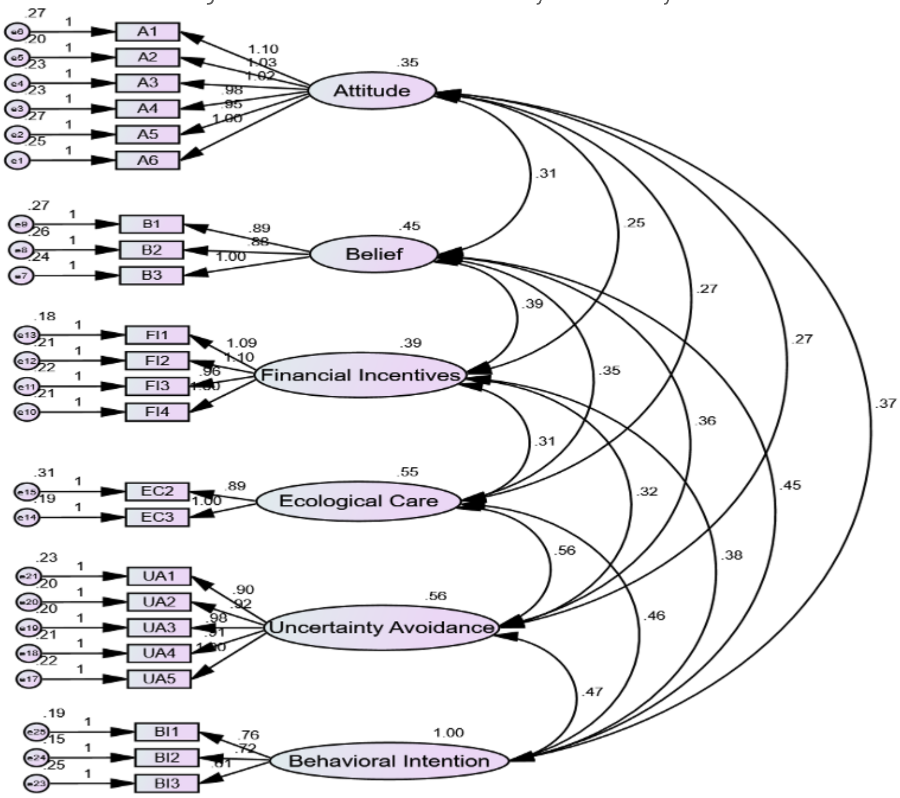
As stated earlier, the study employs a combination of SPSS and AMOS 26, and Hayes' Process 4.2 macro for SPSS to estimate the structural model and test the moderated effects. Table 3 presents the estimates obtained using the moderated regression model.

The model accurately accounts for 44.0% of the variance in the behavioural intention to purchase green EVs. The F-statistics also confirm that the model is significant. Also, the results show that attitude and belief, financial incentives, and ecological care all have a positive correlation on behavioral intention (β = 0.275, p < 0.01; β = 0.711, p < 0.01; β = 1.125, p < 0.01; β = 0.346, p < 0.10) confirming H1a, H1b suggesting that a unit increase in attitude, belief, financial incentives and ecological care is associated with increase in behavioral intention to purchase green EVs. Also, uncertainty avoidance is significantly and positively related to behavioural intention to purchase green EVs (β = 0.248, p < 0.01), providing support for H2 and H3, indicating that higher uncertainty avoidance determines buyers' intention to purchase green EVs. In terms of moderation analysis, attitude, financial incentives, and ecological care combined with uncertainty avoidance affect behavioural intention to purchase green EVs (β = 0.136, p < 0.05; β = 0.208, p < 0.01; β = 0.064, p < 0.10), confirming H4a, H4b, and H4c.

Moderating graphs (Figures 1) further clarify that the link between attitude and belief, financial incentives, and behavioural intention to purchase green vehicles is positive and stronger for buyers with high uncertainty avoidance (i.e., one standard deviation above the average level of uncertainty avoidance).

However, the link between ecological care and behavioural intention is rather strong (see figure 1) for buyers with

Figure 1: Results from confirmatory factor analysis



Source: authors' process from AMOS software

low uncertainty avoidance (i.e., one standard deviation below the average level of uncertainty avoidance).

DISCUSSION AND IMPLICATIONS

International Comparison

The transport sector and its reliance on fossil-fuel-powered vehicles are widely recognised as major contributors to CO_2 emissions. These emissions are expected to continue increasing atmospheric greenhouse gas concentrations beyond 2030. However, replacing conventional vehicles with environmentally friendly alternatives such as electric vehicles (EVs) remains challenging (Reddy et al., 2024). Governments have therefore implemented various initiatives to increase the acceptance and use of EVs as part of broader efforts to achieve net-zero CO_2 emissions.

A key objective is to support the adoption of EVs powered by renewable energy, thereby improving supply chain sustainability worldwide. Supply chain sustainability aims to optimise operations and reduce their environmental impacts, including those associated with transport and logistics, which remain heavily dependent on road vehicles. EVs offer a cleaner alternative to conventional fossil-fuel-powered vehicles and can contribute to more sustainable supply chains by reducing carbon emissions and air pollution. Their adoption may also encourage vehicle manufacturers to reduce emissions across their activities, including production, transportation, and reverse logistics. Successful EV adoption, however, requires a clear empirical understanding of the barriers that may hinder uptake, particularly in sub-Saharan Africa, where EV adoption remains among the lowest globally.

The findings show that attitudes and beliefs (H1a and H1b), financial incentives (H2), and ecological care (H3) are all positively associated with behavioural intentions to purchase environmentally friendly vehicles. These findings are supported by a growing body of research across different national contexts, including studies conducted in Vietnam, China (Wang et al., 2022), Malaysia (Yong et al., 2017), and Saudi Arabia (Batawi, 2016). Collectively, these studies suggest that favourable attitudes and beliefs concerning environmental protection, perceptions of financial incentives associated with green vehicles, and concern for ecological well-being jointly shape behavioural intentions to adopt environmentally friendly vehicles.

The positive influence of attitudes and beliefs on behavioural intentions is consistent with the Theory of Planned Behaviour (Ajzen, 1991), which identifies attitudes and subjective norms as key predictors of behavioural intention. Individuals who hold favourable attitudes towards environmental protection and believe in the importance of sustainable practices are more likely to intend to adopt green vehicles (e.g., Wang et al., 2022).

Financial incentives, including tax credits, rebates, and subsidies, can reduce the perceived economic barriers associated with green vehicle adoption, making such vehicles more attractive and accessible to consumers (Yong et al., 2017). These findings are also consistent with the Theory of Reasoned Action and related behavioural frameworks, according to which perceived affordability and control over financial resources can shape behavioural intentions.

Ecological care, defined as concern for the environment and a desire to minimise one's ecological footprint, is rooted in environmental values and norms (Yang et al., 2024; Jagers et al., 2016). Consumers with high levels of ecological concern are more likely to exhibit pro-environmental intentions, including intentions to purchase green vehicles as a means of contributing to environmental sustainability (Wang et al., 2022). These findings highlight the importance of addressing not only financial barriers but also attitudes, beliefs, and ecological awareness through educational campaigns, promotional activities, and policy interventions designed to facilitate widespread green vehicle adoption.

The study also found that uncertainty avoidance significantly strengthens buyers' behavioural intentions to purchase green vehicles. Uncertainty avoidance is a cultural dimension reflecting the extent to which individuals within a society feel threatened by ambiguous or uncertain situations (Yi, 2021). It has been identified as an important factor in environmentally conscious decision-making (e.g., Patterson et al., 2023). Individuals with high levels of uncertainty avoidance tend to prefer structured and predictable situations and are more likely to avoid ambiguity and risk (Arshad & Ibrahim, 2019).

In the context of green vehicle adoption, purchasing an EV may be perceived as a relatively novel and uncertain decision because of concerns regarding emerging technologies, resale value, and charging infrastructure (Rezvani et al., 2015). The present findings suggest that uncertainty avoidance can strengthen favourable behavioural intentions when green vehicles are perceived as reliable, predictable, and capable of reducing long-term environmental and economic risks.

These results are also consistent with the theoretical assumptions of the TPB (Ajzen, 1991), according to which behavioural intentions are shaped by attitudes, subjective norms, and perceived behavioural control. Uncertainty avoidance may influence attitudes towards green vehicles by affecting perceptions of reliability, safety, and environmental benefits, thereby increasing the attractiveness of such vehicles (Ray & Sahney, 2022). Moreover, individuals with high uncertainty avoidance may perceive stronger social pressure to comply with established sustainability norms, thus reinforcing the effects of subjective norms on behavioural intentions (Yong et al., 2017).

These findings have important implications for policymakers and marketers seeking to promote green vehicle adoption. Communication strategies that emphasise reliability, predictability, technological safety, infrastructure availability, and risk mitigation may be particularly effective among individuals characterised by high uncertainty avoidance.

The results further provide clear evidence that uncertainty avoidance positively moderates the relationships between attitudes and beliefs (H4a), financial incentives (H4b), ecological care (H4c), and behavioural intentions to purchase green EVs. These findings are consistent with previous research suggesting that individuals in high uncertainty avoidance cultures rely more strongly on established attitudes and beliefs to reduce ambiguity and perceived risk (Bao, 2019). Consequently, positive attitudes and beliefs concerning green EVs are likely to exert a stronger influence on purchase intentions in cultures characterised by higher levels of uncertainty avoidance.

The positive moderating effect of uncertainty avoidance on the relationship between financial incentives and behavioural intention may be explained by the tendency of individuals in high uncertainty avoidance cultures to prioritise financial security and minimise potential financial risks (Hofstede & Minkov, 2010). Financial incentives, including tax credits, rebates, and lower operating costs, may therefore play a particularly important role in motivating green EV purchases by reducing the financial uncertainty associated with adoption.

Similarly, the finding that uncertainty avoidance positively moderates the relationship between ecological care and behavioural intention is consistent with evidence that individuals in high uncertainty avoidance cultures may perceive environmental problems as sources of uncertainty and risk (Jiang & Kassoh, 2022). Individuals with strong ecological concern may therefore be more inclined to purchase green EVs as a means of mitigating perceived environmental threats, resulting in a stronger association between ecological care and behavioural intention in cultures characterised by high uncertainty avoidance.

Theoretical Implications

The theoretical implications of this study extend to supply chain management, particularly last-mile delivery. Last-mile delivery is a critical component of supply chains and has gained increasing prominence since the COVID-19 pandemic, as individuals have become more involved in using personal vehicles for delivery activities. EVs represent a suitable solution for last-mile logistics because of their efficiency in urban areas, lower CO_2 emissions, and quieter operation compared with fossil-fuel-powered vehicles. Their reduced noise levels are particularly advantageous in residential areas.

Cost savings represent another potential benefit of EV adoption in supply chains, especially in last-mile delivery. Although EVs generally involve higher initial acquisition costs, they offer lower operating and maintenance costs than petrol- or diesel-powered vehicles. Relatively stable electricity prices may also generate long-term savings in supply chain operations.

The theoretical implications of this study align with sustainability objectives in two main respects. First, identifying the factors that influence EV adoption can inform stakeholders, particularly vehicle manufacturers, about the need to prioritise emission-reduction practices. Second, the adoption of EVs in last-mile delivery can reduce reliance on fossil-fuel-powered vehicles and lower operational costs. The study is distinct in recognising the growing role of individuals in last-mile delivery activities, particularly in the post-pandemic period.

Furthermore, the study addresses a significant gap in the literature by examining the green purchase intentions of older adults in a developing region such as sub-Saharan Africa. Previous studies have frequently focused on younger consumers or populations in developed countries, leaving limited evidence regarding the attitudes and behaviours of older adults in emerging markets. By examining this under-represented demographic and regional context, the study contributes to a more comprehensive understanding of global green purchasing behaviour and provides evidence that may help adapt strategies to comparable settings.

In addition to its academic contributions, the study offers practical implications for policymakers and marketers. For policymakers, the findings may inform the development of interventions that address the specific needs and concerns of older adults when promoting green vehicles (Crayton & Meier, 2017). Such interventions may include financial incentives, educational programmes, and infrastructure development designed to reduce the barriers to green purchasing among older consumers.

For marketers, the study provides insights into how green vehicles can be communicated and positioned more effectively for older consumers. By emphasising benefits that may be particularly relevant to this demographic, including environmental protection, reliability, safety, and long-term cost savings, marketers may improve the appeal of green vehicles to older consumers (Guido et al., 2022).

By addressing these issues, the study advances the academic understanding of green purchasing behaviour among older adults in sub-Saharan Africa and provides actionable insights for supporting the adoption of environmentally friendly technologies in the region. Its focus on last-mile logistics also enables the study to contribute not only to the literature on older consumers' intentions to adopt green vehicles, but also to research on a contemporary and strategically important aspect of supply chain management.

Practical Implications

The study contributes to addressing a critical environmental and social issue by identifying the factors influencing older adults' intentions to purchase green vehicles. The older population in sub-Saharan Africa is growing, yet its specific needs and attitudes towards environmentally friendly technologies have received limited attention in existing research. By focusing on this demographic, the study highlights the importance of understanding the distinct determinants of green purchasing behaviour among older adults, including environmental awareness, perceived benefits, financial considerations, and social influences. These insights are important for developing tailored strategies capable of encouraging green purchasing within this population group.

The adoption of environmentally friendly vehicles, particularly EVs, also has important implications for sustainable ageing. Efforts to reduce carbon emissions and environmental degradation are consistent with the objective of creating living environments that support long-term ecological and public health. Older adults, as key stakeholders in this study, can contribute to a more sustainable and healthier environment through their transport choices.

Accelerating the use of environmentally friendly vehicles may not only address environmental concerns but also improve access to healthcare among older populations. Sustainable transportation options such as EVs can contribute to improved air quality and better environmental conditions, thereby positively affecting the health and well-being of older adults. Reductions in air pollution may help lower the incidence of respiratory and cardiovascular diseases and support healthier ageing.

The implementation of awareness campaigns, financial incentives, and community engagement initiatives, such as the Green Elders Mobility Program, can encourage sustainable transport choices while also fostering social connections among older adults. Social engagement is an important component of sustainable ageing because it supports mental well-being and strengthens a sense of community belonging.

The transition from fossil-fuel-powered vehicles to EVs, particularly in last-mile delivery services, can reduce dependence on non-renewable energy sources and promote cleaner and more sustainable energy use. This shift may contribute to a more resilient and sustainable future for older generations.

Understanding the determinants of EV adoption among older adults can also inform manufacturers, policymakers, and other stakeholders about the specific preferences and needs of this demographic. Such evidence may support the development of age-friendly and sustainable transport solutions, create more supportive environments for ageing populations, and contribute to broader efforts to mitigate climate change and environmental degradation.

CONCLUSION

This study investigated the determinants of older adults' intentions to purchase green vehicles in Ghana. The findings confirmed that attitudes and beliefs, financial incentives, and ecological care are positively associated with behavioural intentions to purchase environmentally friendly vehicles. In addition, uncertainty avoidance was found to significantly strengthen buyers' behavioural intentions to purchase green vehicles.

The results further provide clear evidence that uncertainty avoidance positively moderates the relationships between attitudes and beliefs, financial incentives, ecological care, and behavioural intentions to purchase green

EVs. The study therefore highlights the importance of fostering positive attitudes and beliefs, providing financial incentives, promoting ecological awareness, and addressing uncertainty-related concerns to encourage green vehicle adoption among older adults in Ghana.

These findings offer relevant insights for policymakers, vehicle manufacturers, marketers, and environmental organisations seeking to promote sustainable transport and reduce carbon emissions through wider adoption of green vehicles.

Despite its contributions, the study has several limitations. First, it focuses exclusively on older vehicle owners in Ghana, which limits the generalisability of the findings to other age groups, cultural contexts, and geographical regions. Future research should therefore examine the determinants of green vehicle adoption among more diverse demographic groups and across different national settings.

Second, the study employs a cross-sectional research design, which limits the ability to establish causal relationships or observe changes over time. Longitudinal research could provide a more comprehensive understanding of the evolving nature of consumer attitudes, beliefs, and behavioural intentions concerning green vehicle adoption.

Third, the study focuses on a specific set of determinants. Future research could examine additional factors, including subjective norms, perceived behavioural control, technological readiness, charging infrastructure, environmental regulation, and prior experience with EVs, to provide a more comprehensive explanation of green vehicle adoption intentions.

AUTHOR CONTRIBUTIONS STATEMENT

Conceptualization, J.A.P. and R.Y.; methodology, H.M. and R.Y.; software, H.M.; validation, R.Y.; formal analysis, J.A.P.; investigation, H.M. and R.Y.; resources, H.M.; data curation, H.M.; writing – original draft preparation, H.M. and R.Y.; writing – review and editing, J.A.P.; visualization, H.M.; supervision, J.A.P. All authors have read and agreed to the published version of the manuscript.

DATA AVAILABILITY STATEMENT

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

AI DISCLOSURE

During the preparation of this work, the authors used an AI tool (DeepSeek) to enhance the manuscript's language, readability, and stylistic consistency. Following its use, the authors thoroughly reviewed and edited the content and take full responsibility for the final publication.

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