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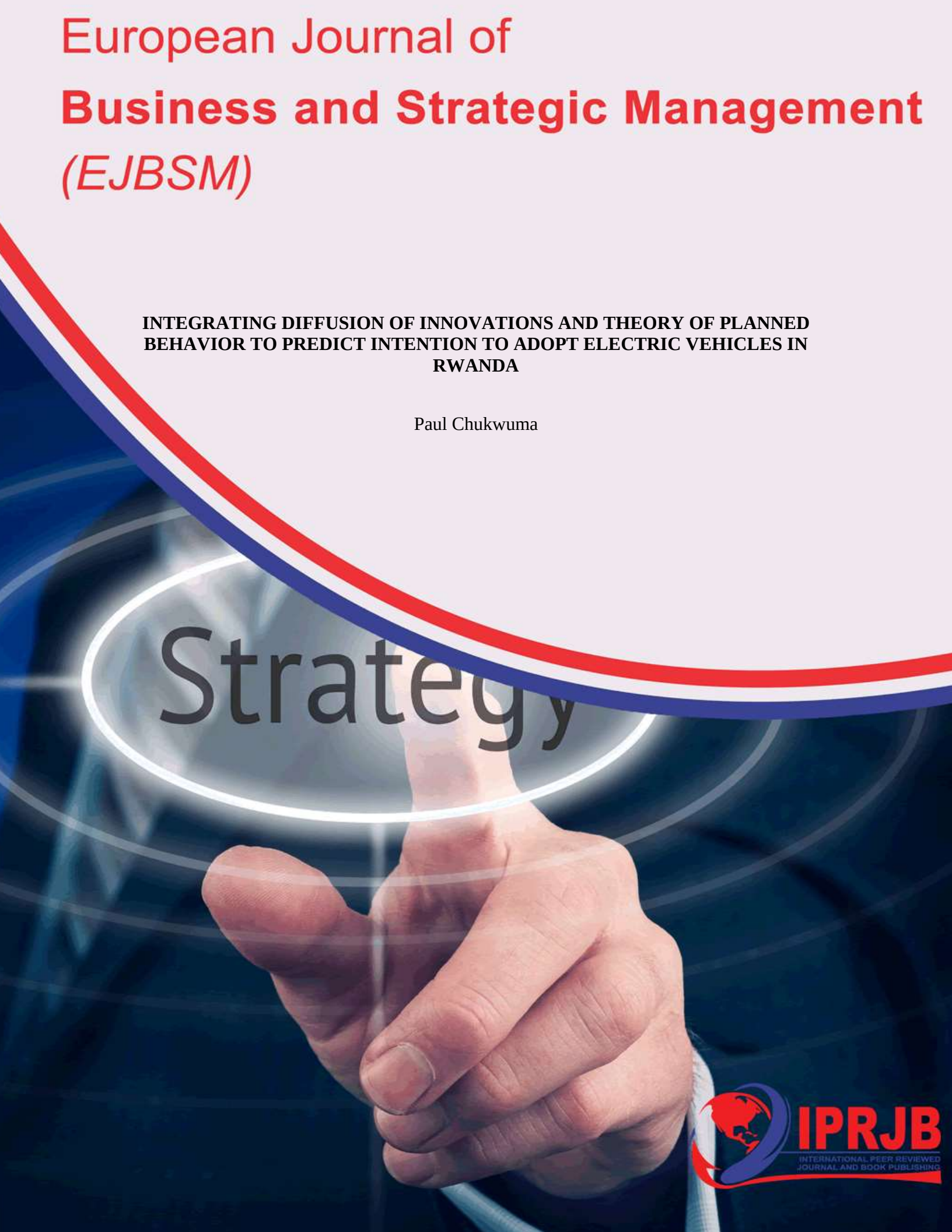

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Integrating Diffusion of Innovations and Theory of Planned Behavior to Predict Intention to Adopt Electric Vehicles in Rwanda

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Abstract

Purpose: Integration of the theory of planned behaviour and the Diffusion of innovations (DOI) theory to examine EVs low adoption intention in Rwanda.

Methodology: The research model involved the integration of the Theory of planned behaviour and the Diffusion of innovation. To build the conceptual framework, over 50 articles were collected from Google scholar and summarised using meta-analysis. Two hundred and twenty participants were surveyed in person using a questionnaire, with each construct having at least three questions to run the Partial least squares (PLS) Structural Equation Modelling (SEM). Data were analysed using SmartPLS 4.0.

Findings: The study found that two factors of the Theory of planned behaviour TPB- attitudes and perceived behavioural control- positively impact EVs adoption intention while subjective norm does not. Three factors of diffusion of innovation (DOI)- trialability, compatibility, and observability- positively impact attitude towards EV adoption.

Unique Contribution to Theory, Practice and Policy: Findings from the research explain the low adoption of electric vehicles in Rwanda. They can serve as an objective basis for policymakers to upscale EV uptake in Rwanda and brings to perspective the context of Rwanda on factors of EV adoption.

Keywords: *Theory of Planned Behaviour, Diffusion of Innovation, Electric Vehicles, Adoption Intention, Perceived Innovation Characteristics*

INTRODUCTION

Globally, over 1.3 billion automobiles on the road use 79 quadrillions of BTU energy, primarily from gasoline and diesel fuels. These automobiles produce over 5.7 gigatonnes of Co2. As a result, they account for over 25% of global emissions and are projected to hit 50% by 2050 (Ellen, 2021; McCollum et al., 2018, & Singh et al., 2020). Co2 and other automobile pollutants account for almost 200,000 annual premature deaths of over 800,000 caused by air pollution (Wahab & Jiang, 2018). These emissions and premature deaths will likely intensify if current transport systems are not transformed (Li et al., 2017).

Along with the changing climate, this looming future has stimulated actions to mitigate emissions in the transport sector, even in the least developed countries like Rwanda. Road transport accounts for more than 13% of Rwanda's greenhouse gas emissions and more than 50% of Rwanda's atmospheric pollution (Sudmant et al., 2020; Ministry of Infrastructure, 2021). Emissions from road transportation is a significant cause of lung cancer and strokes and cost Rwanda an estimated 50,000 disability-adjusted life year (DALY) per year. Considering the negative impact of fossil fuel-based road transportation, electric vehicles are becoming a better alternative (Gnann et al., 2018). According to the Ministry of Infrastructure (2021), a transition to electric vehicles in Rwanda can save the government 22 million dollars annually and reduce oil product imports by 15%, gasoline by 21%, and diesel by 9%. Despite the potential benefits of electric vehicles, the number of electric vehicles on the Rwandan road is miniature, as electric vehicles still make up less than 2% of the total vehicle fleets in Rwanda. (Ministry of Infrastructure, 2021 & Ampersand, 2022). Despite these, research has yet to be done to understand the reasons behind the slow adoption of electric vehicles in Rwanda. Research globally shows that several factors, such as premium price, perceived behavioural control, environmental concerns etc., affect electric vehicle adoption intention, which is a metric used for adoption behaviour (Kumar et al., 2021; Ewelina & Grysa, 2021). However, most of these studies failed to address the evaluation of EVs from the customer's perspective, which is a crucial factor in adoption, and such studies have yet to be carried out in Rwanda (Jung Moon, 2020). As a result, this study proposes the integration of the theory of planned behaviour (TPB) (Ajzen, 1991) and the Diffusion of innovations (DOI) theory (Rogers, 2003) to examine EVs low adoption intention in Rwanda.

Research Questions

1. Do the factors of the Theory of planned behaviour - subjective norm, attitude, perceived behavioural control - affect the intention adoption of electric vehicles in Rwanda?
2. Do the factors of diffusion of innovation - relative advantage, complexity, compatibility, observability, trialability - affect attitude towards EVs adoption Intention?

LITERATURE REVIEW

Researchers in other countries have used the integral model in their context. As a result, this study contains a review of these studies to strengthen its conceptual framework.

Theory of Planned Behaviour

The theory of planned behaviour outlines three dominant components - perceived behavioural control, social norms, and attitudes - as strong predictors of intentions and Consumers' behavioural

tendencies and purchasing patterns (Ansab & Kumar, 2020; Mohiuddin et al., 2018; Yeğin & Ikram, 2022; Adnan, 2017). It is a development of Fishbein and Ajzen's 1975 Theory of Reasoned Action (TRA), which forecasts a person's behavioural intention (Jung Moon, 2020). Several studies have shown that some or all of the factors of TPB can be used to predict purchase or adoption intention (Chen et al., 2019; Rezvani et al., 2017; Shankar & Kumari, 2019; Gnann et al., 2018 & Alzahrani et al., 2017)

Attitude

Attitude is the first element described in the Theory of planned behaviour and refers to the evaluation of the behavioural intention towards adopting a product (Shalender & Sharma, 2020). Several studies have shown that a person is more likely to buy a product if they have a good attitude toward it (Yeğin & Ikram, 2022; Asadi et al., 2022 & Abou-Zeid & Ben-Akiva, 2012). Also, Individuals with positive attitudes towards electric vehicles are more likely to compare individuals with negative attitudes to purchasing them (Egbue & Long, 2012). As a result, attitude strongly determines customers' EV purchase intentions (Hsu et al., 2017; Singh et al., 2020). Thuy & Hong (2019) also found that the intention to adopt electric two-wheelers is determined by attitude but positioned it as a less important factor than the subjective norm. However, this contradicts Shalender & Sharma's (2020) findings which positioned attitudes as the most influential factor and subjective norm as the least when compared to the other three factors of the TPB. Green purchasing intention is significantly and positively influenced by attitude; however, the relationship between attitude and purchase intention is geographically dependent (Wu et al., 2020). Previous studies have shown that attitude is essential, but this might be geographically dependent. As a result, it is essential to evaluate attitude in the context of Rwanda. Consequently, the relationship between attitude and adoption intention is hypothesised as follows:

H_1: Attitude toward EV adoption positively relates to intention to adopt electric vehicles in Rwanda.

Subjective Norm (SN)

It is defined in terms of the pressure a person feels from society to act in a socially acceptable manner (Ajzen 1991). Adnan (2017) also defined SN as a person's sense of what significant referents, such as family or friends, anticipate that person will do. Similarly, Yeğin & Ikram (2022) said SN means that individuals care about the environment's expectations before performing their behaviours, which creates social pressure on them. Wang et al. (2014) found that SN affects hybrid plug-in electric vehicles (HEV) purchase intentions of individuals in China. Several studies have found a positive correlation between feeling social pressure and performing the appropriate behaviour (Gulzari et al., 2022; Ackaah et al., 2021; Vafaei-Zadeh et al., 2022; & Wu et al., 2021; Rezvani et al., 2017). As a result, subjective norm is widely recognised as a factor of adoption intention (Moon, 2020). Some other studies have compared the relevance of the factors of TPB with each other. Thuy & Hong (2019) found subjective norms to be the most vital determinant of customers' intention towards two-wheelers among the three factors of TPB. However, some studies suggest that subjective norm is negligible in EVs adoption intention. The studies by Han et al. (2016) and Chen & Hung (2016) suggest no relationship between the adoption intention of electric vehicles and SN. These divergent findings make it relevant to evaluate the relationship between

subjective norms and the adoption intention of electric vehicles in Rwanda. Therefore the relationship between adoption intention and the subjective norm is hypothesised as follows:

H_2: Subjective norm is positively related to the intention to adopt electric vehicles in Rwanda.

Perceived Behavioural Control (PCB)

The PBC, the third variable of the TPB theory, defines the ease or difficulty with which a person may exhibit a specific type of behaviour (Ajzen, 1991). PBC is also the perception of how easy or difficult it is to perform a behaviour (Dutta & Hwang, 2021; Yeğin & Ikram, 2022). Some studies have outlined PBC as an essential determinant of adoption intention, even for electric vehicles. Mohamed et al. (2016) study with a large sample size of 3505 people found that perceived behavioural control significantly impacted purchasing willingness. Also, green purchasing intention significantly and positively influenced perceived behavioural control; however, this might vary from geographical location to another (Wang et al., 2020). There are divergent findings from studies that evaluate the strongest determinant of adoption intention amongst the factors of TPB. Shalender & Yadav (2017) found PBC the most substantial factor in measuring battery electric vehicle (BEV) purchase intentions in Norway. In contrast, Kaplan et al. (2016) found PBC to be the least essential determinant compared to attitudes and perceived subjective norms. Also, Moons & De Pelsmackers (2015) suggested that PBC was a negligible factor in determining adoption intention. Considering the divergent findings and geographical dependency of the relationship between PBC and the adoption intentions of Evs, it is essential to evaluate this relationship in Rwanda's context. As a result, the relationship between adoption intention and the subjective norm is outlined as follows:

H_3: Perceived behavioural control is positively related to the adoption intention of EVs in Rwanda.

Diffusion of Innovation (DOI)

The diffusion of innovation is the spread or adoption of technology within a social context (Vargo et al., 2020). The diffusion theory by Rogers in 2003 establishes the relationship between Perceived innovation attributes (PIC) and adoption. It suggests that there are five stages of innovation-decision, five categories of adopters, and five characteristics of technology that influence adoption five characteristics of technology influence acceptance. Knowledge, persuasion, decision, implementation, and confirmation are the five innovation decision stages. While five categories of adopters are: innovators, early adopters, early majority, late majority, and laggards (Kasilingam, 2020). Roger (2003) referred to the characteristics of technology or PIC - relative advantage, compatibility, complexity, trialability, and observability - as attributes of products or ideas. DOI theory is one of the most influential theories that have helped improve understanding of the process involved in adopting innovation in a population (Jamshidi et al., 2015). As a result of the DOI theory, its possible to understand how the process of innovation starts and ends, and it has been widely used to predict and explain customers' behaviour related to innovation adoption (Chou et al., 2012). Various studies have deployed the attributes of technology considered in DOI differently. While Ezeh (2018) added religiosity, profit and loss sharing, consumer awareness, uncertainty, and information quality to the DOI framework, Yahaya et al. (2014) only used four of the five traits listed. However, this study will consider all five traits of a technology proposed by Roger (2003).

- Relative advantage refers to the benefits of innovation over old products and technology. Furthermore, its added value innovation as compared to other products.
- Compatibility is the match of the new technology or consumer product experience with previous experience
- Complexity refers to the difficulty in understanding and using innovation
- Trialability refers to the consumers' opportunities to experience or test the effects of innovation through a trial, to improve their purchase or acceptance willingness
- Observability is the possibility of observing the innovation after usage, which contributes to the spread of innovation

Some studies reveal that the factors of PICs best influence adoption intention indirectly when mediated through attitude. Moon's (2020) and Chou et al. (2012) findings suggest that PICs are psychological markers of innovation adoption attitudes; as a result, they influence adoption intention when mediated through attitudes. Similarly, Mukhlis (2014) found that relative advantage, compatibility, and trialability all positively impacted consumer attitudes. However, Felix et al. (2010) found that compatibility and trialability positively influence attitudes about utilising technology, whereas relative advantage, complexity, and observability have a negative impact. Also, Min et al. (2018) outline that social influence, comparative advantage, compatibility, complexity, and observability significantly impact perceived usefulness and perceived ease of use as factors that affect consumer attitudes and adoption intentions. There are divergences in the findings from previous studies. As a result, there is a need to evaluate the correlation between PIC attributes and attitudes towards EVs in Rwanda. Therefore the relationship between PICs and attitudes is outlined below:

H_4: Relative advantage is positively correlated with attitude towards Evs in Rwanda.

H_5: Compactibility is positively correlated with attitude towards Evs in Rwanda.

H_6: Complexity is negatively correlated with attitude towards Evs in Rwanda.

H_7: Observability is positively correlated with attitude towards Evs in Rwanda.

H_8: Triability is positively correlated with attitude towards Evs in Rwanda.

Conceptual Framework

Considering the nature of the study and the hypotheses formulated, the study's conceptual framework is visualised below.

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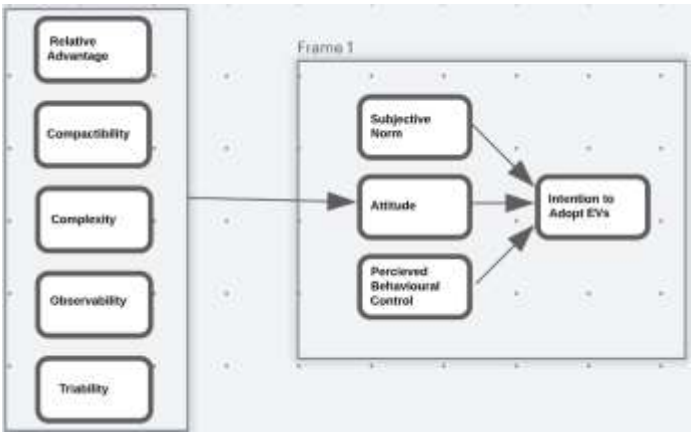

Figure 1.0: Conceptual Framework of the Research

METHODOLOGY

This study polled potential EV buyers over 20 years who lived in Kigali, Rwanda. The poll questionnaire responses were physically collected from willing respondents using a Google survey form. The questionnaire was constructed emulating the designs of Moon (2021), Ajzen (2019) and Yadav et al. (2019). As a result, the questionnaire survey was measured on a 5-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (5). The Theory of planned behaviour had three dimensions and was measured by three items each. While Perceived innovation characteristic had five dimensions, each measured by three items, except for observability which was measured by four items and finally, three items measured adoption intention. The 10-times rule was deployed in determining the sample size for the study. It specifies that the sample size should be greater than the maximum number of structural routes directed at a variable multiplied by 10 (Hair et al., 2017). A total of 220 respondents were surveyed between November 1 and November 30, 2022. Data was analysed through Partial least squares (PLS) Structural Equation Modelling (SEM), considered preferable when a model is intricate with numerous variables and a small sample size. SmartPLS 4.0, using its algorithm, bootstrapping, PLSpredict, was used to run the study's SEM and evaluate the validity and reliability, collinearity, and significance test of the proposed model. Findings from the analysis were presented using tables and model diagrams from SmartPLS 4.0.

RESULT

Demographic Profile of Sample

Two demographic variables are considered age and income. 30.7% of the respondents are between the age of 21-30, 67.9% are between the age of 31-40, and 1.4% are between the age of 41-50. Furthermore, 0.9% earn between 50,000 - 69,000 FRW, 24.1% earn 70,000 - 89,000 FRW, 55.6% earn 90,000 - 109,000 FRW, 13.4% earn 110,000 FRW -129,000 FRW, 4.6% earn 130,000-149,000 FRW, and 1.4% earn 150,000 - 169,000 FRW.

Model Reliability, Validity, Significance and P-value

The reliability, validity, collinearity, and significance path coefficient are presented below to elucidate the model's strength.

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Table1: Results for Collinearity Analysis

Construct	Path coefficients	Collinearity
Attitude	0.517	2.779
Complexity	0.093	1.224
Compactibility	-0.138	1.162
Observability	-0.316	1.229
Perceived Behavioural Control	0.268	5.985
Relative Advantage	0.103	1.118
Subjective Norm	0.083	4.799
Trialability	0.213	1.252

Table 2: Reliability and Validity Measurements

Construct	Cronbach's alpha	Average variance extracted (AVE)
ATT	0.901	0.835
COMP	0.804	0.83
COMPAC	0.887	0.898
INT	0.91	0.847
OBV	0.975	0.976
PBC	0.851	0.771
RA	0.943	0.897
SN	0.914	0.854
TRA	0.959	0.924

Table 3: Significance Testing Results of Path Coefficients

Construct	Path coefficients	P-value	Significance
ATT -> INT	0.517	0	Yes
COMP -> ATT	0.093	0.176	No
COMPAC -> ATT	-0.138	0.031	Yes
OBV -> ATT	-0.316	0	Yes
PBC -> INT	0.268	0.021	Yes
RA -> ATT	0.103	0.105	No
SN -> INT	0.083	0.407	No
TRA -> ATT	0.213	0.001	Yes

N/B: A Construct is Significant when it has a P-Value Less Than 0.05

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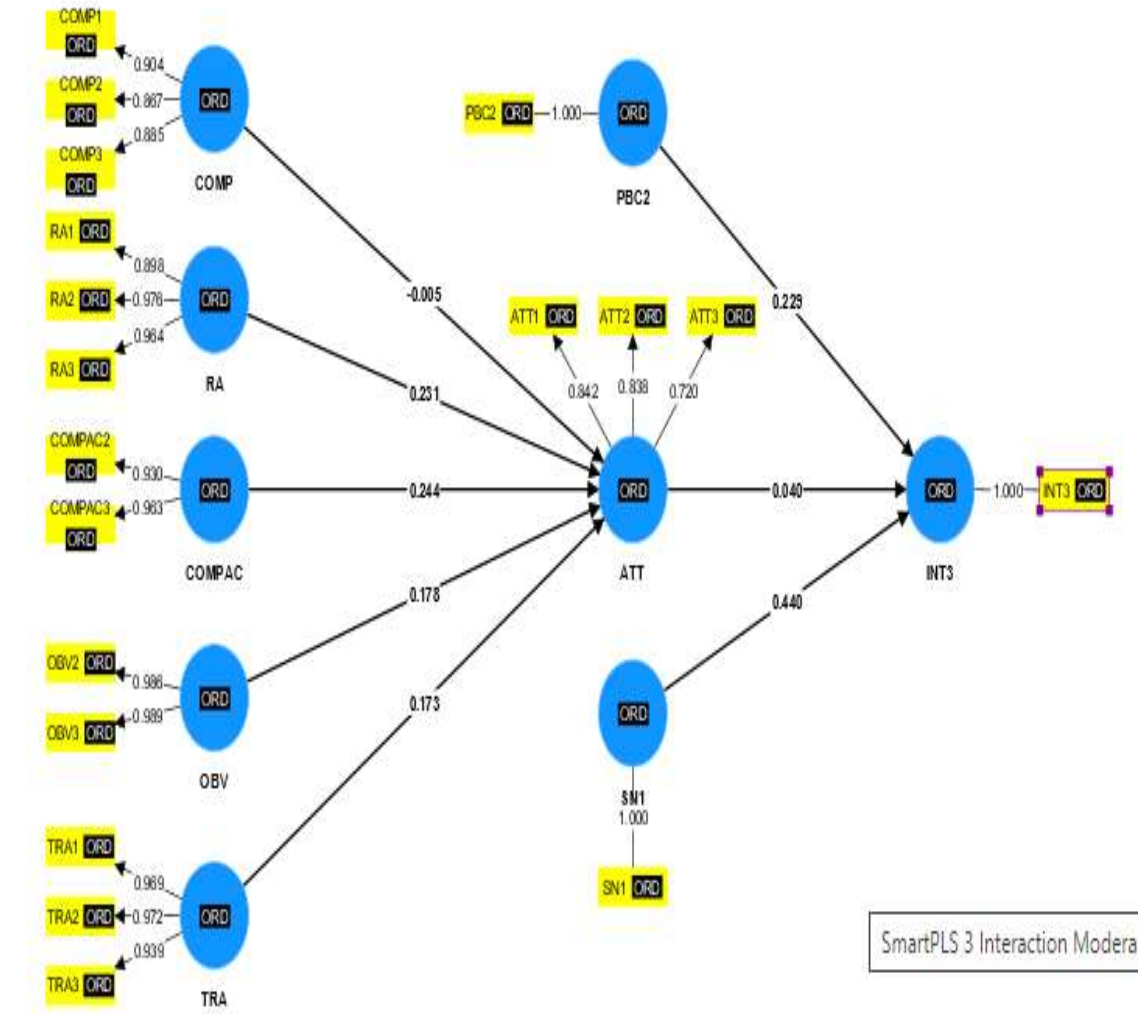

Fig 1.1 The collinearity test of the model presented in table one shows all constructs have a VIF value less than five except for perceived behavioural control (PBC) which signifies a possible collinearity problem with PCB. The reliability and validity results are presented in table 2. For all constructs, Cronbach's alpha values were higher than 0.7, and the AVE values were greater than 0.64, which signifies the model is reliable and valid (Moon, 2021). However, some items for observability, compatibility, perceived behavioural control, subjective norm, and intention to adopt were dropped due to validity and reliability issues. The SEM and test of hypotheses are presented in table 3. The coefficient of determination for EV adoption is 0.669, signifying a reasonably explanatory solid power (cohen, 1988). The significance of the path coefficient is evaluated using the p-values. This showed that trialability, compatibility, and observability positively impact attitude in decreasing order as they have p-values less than 0.05. Therefore **H_5, H_7, and H_8** are accepted. Attitude and perceived behavioural control (PCB) positively impact Ev's intention adoption in decreasing order, while subjective norms do not, as its p-value is greater than 0.05. As a result, **H_1 and H_3** were accepted, while **H_2** was rejected. The collinearity, validity, and reliability tests were obtained using the PLS-SEM algorithm, while the significance test was done using the SmartPLS bootstrapping process.

Table 4: F-Square Value

Construct	F2 value
ATT	0.29
COMP	0.009
COMPAC	0.021
OBV	0.105
PBC	0.036
RA	0.012
SN	0.036
TRA	0.047

Table 5: R-Square Value

Construct	R-square	R-square adjusted
ATT	0.227	0.223
INT	0.669	0.668

Table 6: Q2 value indicating the predictive relevance

Construct	Q^2predict
ATT	0.19
INT	0.498

The F, Q, and R square values elucidates the strength of the research findings. The F-square values in table 4 show that Compactibility, relative advantage, observability and complexity have a minimal impact on the R-squared value as their f-square value was less than 0.15. At the same

time, trialability significantly impacted the R-squared value as it has an F-square value greater than 0.35 (cohen, 1988). Subjective norm and perceived behavioural control had F-square values greater than 0.35, which significantly impacted the R-square value for adoption intention. In contrast, the attitude has a medium effect as it has an R-squared value greater than 0.15 but less than 0.35 (Cohen, 1998). The predictive relevance of both dependent variables in the model - attitude and EVs adoption intention - are medium and firm, respectively. Hair (2013) outlined that a Q-squared value greater than 0.15 indicated moderate predictive relevance, and a value greater than 0.35 indicated strong predictive relevance. The R-square values are presented in table 5 and suggest that the explanatory power for attitude (0.223) was weak and that for intention adoption (0.669) was substantial (Cohen, 1998).

Discussion

The study explores factors that influence EVs adoption intention in Rwanda by integrating the theory of planned behaviour and the diffusion of innovation. The integral model, which is gradually diffusing into space, has been used by different authors in different contexts except Rwanda (Moon, 2021; Roger, 2003). The study will provide a solid basis to improve the adoption of electric vehicles in Rwanda. Results suggest that two of the Theory of Planned Behaviour (TPB) variables - attitude and perceived behavioural control- positively impact Ev's adoption intention. While 3 of 5 DOI variables - trialability, compatibility and observability- positively impact attitudes. The findings from the study on attitudes agree with previous studies (Yeğin & Ikram, 2022; Asadi et al., 2022 & Abou-Zeid & Ben-Akiva, 2012; Mohamed et al., 2016). Also, the finding on subjective norm as an essential factor of Ev adoption intention agrees with Thuy & Hong (2019). Still, it is antagonistic to the findings by Kaplan et al. (2016) and Moons & De Pelsmackers (2015). However, the findings on subjective norms as a negligible factor oppose several findings from previous studies (Vafaei-Zadeh et al., 2022; Wu et al., 2021; Rezvani et al., 2017). Other DOI variables' findings suggest that relative advantage affects attitude (Chou et al., 2012; Mukhlis, 2014; Moon, 2021). This is contrary to the findings of this paper, which found that relative advantage does not positively correlate with attitude. However, considering the validity and reliability of the findings from this paper, there is a strong argument that actions to accelerate the adoption of Evs in Rwanda should prioritise attitude and perceived behavioural control. While to improve attitudes, trialability, compatibility, and observability should be prioritised in decreasing order.

The Limitation of the Study

The study proposes significant findings that can provide an objective basis for actions that can accelerate EV adoption in Rwanda however has a few drawbacks. There is an observed high collinearity issue in the SEM model used. The VIF value for PBC was more than 5.5, which can reduce the model's significance. Also, the sample size and geographical representation could have impacted the findings as samples were conveniently collected in Kigali. Finally, the R-squared value for attitude was less than 0.3. As a result, the study did not include variables that could explain over 70% of attitudes.

Conclusion

The proposed model deployed to explore the low adoption rate for Evs is reliable and valid. It provides the first academic contribution from Rwanda on the integral model for explaining Electric

vehicles (Evs) adoption intention. Findings from this paper can guide actions to improve electric vehicle adoption in Rwanda. Although the endogenous variables adequately explained the adoption intention in the model, attitude was not explained by the variables used in the model construct. As a result, further research can focus on incorporating possible exogenous variables such as the total cost of ownership and environmental concerns to explain attitude.

REFERENCE

Abou-Zeid, M., & Ben-Akiva, M. (2012). Well-being and activity-based models. Transportation, 39(6), 1189–1207. https://doi.org/10.1007/s11116-012-9387-8

Ackaah, W., Leslie, V. L., & Osei, K. K. (2021). Perception of autonomous vehicles – a Ghanaian perspective. Transportation Research Interdisciplinary Perspectives, 11, 100437. https://doi.org/10.1016/j.trip.2021.100437

Adnan, N., Nordin, S. M., Rahman, I., & Amini, M. H. (2017). A market modeling review study on predicting Malaysian consumer behavior towards widespread adoption of PHEV/EV. Environmental Science and Pollution Research, 24(22), 17955–17975. https://doi.org/10.1007/s11356-017-9153-8

Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179-211. https://doi.org/10.1016/0749-5978(91)90020-T

Ajzen, I. (2019). Constructing a Theory of Planned Behavior Questionnaire. Retrieved from https://www.researchgate.net/publication/235913732_Constructing_a_Theory_of_Planned_Behavior_Quest ionnaire

Alzahrani, K., Hall-Phillips, A., & Zeng, A. Z. (2017). Applying the theory of reasoned action to understanding consumers' intention to adopt hybrid electric vehicles in Saudi Arabia. Transportation, 46(1), 199–215. https://doi.org/10.1007/s11116-017-9801-3

Ampersand. (2022). Home. AMPERSAND. Retrieved December 15, 2022, from https://www.ampersand.solar/

Ansab, K. V., & Kumar, S. P. (2020). The Factors Influencing Electric Car Adoption among consumers in an Emerging Market Context. Society for Marketing Advances Proceedings, 182–187.

Asadi, S., Nilashi, M., Iranmanesh, M., Ghobakhloo, M., Samad, S., Alghamdi, A., Almulihi, A., & Mohd, S. (2022). Drivers and barriers of electric vehicle usage in Malaysia: A DEMATEL approach. Resources, Conservation and Recycling, 177, 105965. https://doi.org/10.1016/j.resconrec.2021.105965

Chen, K., Ren, C., Gu, R., & Zhang, P. (2019). Exploring purchase intentions of New Energy Vehicles: From the perspective of frugality and the concept of "Mianzi." Journal of Cleaner Production, 230, 700–708. https://doi.org/10.1016/j.jclepro.2019.05.135

Chen, S.-C., & Hung, C.-W. (2016). Elucidating the factors influencing the acceptance of green products: An extension of theory of planned behavior. Technological Forecasting and Social Change, 112, 155–163. https://doi.org/10.1016/j.techfore.2016.08.022

Chou, C. J., Chen, K. S., & Wang, Y. Y. (2012). Green practices in the restaurant industry from an innovation adoption perspective: Evidence from Taiwan. International Journal of Hospitality Management, 31(3), 703-711. https://doi.org/10.1016/j.ijhm.2011.09.006

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillside, NJ: Lawrence Erlbaum Associates.

Dutta, B., & Hwang, H.-G. (2021). Consumers purchase intentions of Green Electric Vehicles: The influence of consumers technological and environmental considerations. Sustainability, 13(21), 12025. https://doi.org/10.3390/su132112025

Egbue, O., & Long, S. (2012). Barriers to widespread adoption of electric vehicles: An analysis of consumer attitudes and perceptions. Energy Policy, 48, 717–729. https://doi.org/10.1016/j.enpol.2012.06.009

Ellen, H., Sim, S., & Rachael, B. (2021). Causes of climate change [Ebook]. Retrieved from https://climatescience.org/advanced-greenhouse-effect/

Ezeh, P.C. and Nkamnebe, A.D. (2018), "A conceptual framework for the adoption of Islamic banking in a pluralistic-secular nation: Nigerian perspective", Journal of Islamic Marketing, Vol. 9 No. 4, pp. 951-964.

Felix , A., Rebecca , O., & Folorunso, O. (2010). Diffusion of Innovation in Social Networking Sites among University Students. Retrieved December 8, 2022, from https://www.researchgate.net/publication/46093467_Diffusion_of_Innovation_in_Social_Networking_Sites_among_University_Students

Gulzari, A., Wang, Y., & Prybutok, V. (2022). A green experience with eco-friendly cars: A Young Consumer Electric Vehicle Rental Behavioral Model. Journal of Retailing and Consumer Services, 65, 102877. https://doi.org/10.1016/j.jretconser.2021.102877

Hair Jr, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2017). A primer on partial least squares structural equation modeling (2nd ed.). Sage publications, LA. https://doi.org/10.15358/9783800653614

Han, H., jae, M., & Hwang, J. (2016). Cruise travelers' environmentally responsible decision-making: An integrative framework of goal-directed behavior and Norm Activation process. International Journal of Hospitality Management, 53, 94–105. https://doi.org/10.1016/j.ijhm.2015.12.005

Hsu, C.-L., Chen, Y.-C., Yang, T.-N., & Lin, W.-K. (2017). Do website features matter in an online gamification context? focusing on the mediating roles of user experience and attitude. Telematics and Informatics, 34(4), 196–205. https://doi.org/10.1016/j.tele.2017.01.009

Jamshidi, D., Hussin, N. and Lai Wan, H. (2015), "Islamic banking services adoption as a new banking restructure: examining its adoption from the perspective of DOI theory and trust in Malaysia", Humanomics, Vol. 31 No. 2, pp. 214-223.

Jung Moon, S. (2020). Integrating diffusion of innovations and theory of planned behavior to predict intention to adopt electric vehicles. International Journal of Business and Management, 15(11), 88. https://doi.org/10.5539/ijbm.v15n11p88

Kaplan, S., Gruber, J., Reinthaler, M., & Klauenberg, J. (2016). Intentions to introduce electric vehicles in the commercial sector: A model based on the theory of planned behaviour. Research in Transportation Economics, 55, 12–19. https://doi.org/10.1016/j.retrec.2016.04.006

Kasilingam, D. L. (2020). Understanding the attitude and intention to use smartphone chatbots for shopping. Technology in Society, 62, 101280. https://doi.org/10.1016/j.techsoc.2020.101280

Li, W., Long, R., Chen, H., & Geng, J. (2017). A review of factors influencing consumer intentions to adopt Battery Electric Vehicles. Renewable and Sustainable Energy Reviews, 78, 318–328. https://doi.org/10.1016/j.rser.2017.04.076

McCollum, D. L., Wilson, C., Bevione, M., Carrara, S., Edelenbosch, O. Y., Emmerling, J., Guivarch, C., Karkatsoulis, P., Keppo, I., Krey, V., Lin, Z., Broin, E. Ó., Paroussos, L., Pettifor, H., Ramea, K., Riahi, K., Sano, F., Rodriguez, B. S., & van Vuuren, D. P. (2018). Interaction of consumer preferences and climate policies in the global transition to low-carbon vehicles. Nature Energy, 3(8), 664–673. https://doi.org/10.1038/s41560-018-0195-z

Min, S., So, K. K., & Jeong, M. (2018). Consumer adoption of the uber mobile application: Insights from diffusion of innovation theory and technology acceptance model. Journal of Travel & Tourism Marketing, 36(7), 770–783. https://doi.org/10.1080/10548408.2018.1507866

Ministry of Infrastructure. (2021). Rwanda is Building Climate Resilient Transport Systems. MININFRA. Retrieved October 17, 2022, from https://www.mininfra.gov.rw/updates/news-details/rwanda-is-building-climate-resilient-transport-systems

Mohamed, M., Higgins, C., Ferguson, M., & Kanaroglou, P. (2016). Identifying and characterizing potential electric vehicle adopters in Canada: A two-stage modelling approach. Transport Policy, 52, 100–112. https://doi.org/10.1016/j.tranpol.2016.07.006

Mohiuddin, M., Al Mamun, A., Syed, F. A., Mehedi Masud, M., & Su, Z. (2018). Environmental Knowledge, Awareness, and Business School Students' Intentions to Purchase Green Vehicles in Emerging Countries. Sustainability, 10(5), 1534.

Moons, I., & De Pelsmacker, P. (2015). An extended decomposed theory of planned behaviour to predict the usage intention of the electric car: a multi-group comparison. Sustainability, 7(5), 6212–6245. https://doi.org/10.3390/su7056212

Moons, I., & De Pelsmacker, P. (2015). An extended decomposed theory of planned behaviour to predict the usage intention of the electric car: a multi-group comparison. Sustainability, 7(5), 6212–6245. https://doi.org/10.3390/su7056212

Mukhlis , Y. (2014). Diffusion of Innovation, Consumer Attitudes and Intentions to use Mobile Banking. Information and Knowledge Management , 4(10). https://doi.org/https://core.ac.uk/display/234671813?utm_source=pdf&utm_medium=banner&utm_campaign=pdf-decoration-v1

Rezvani, Z., Jansson, J., & Bengtsson, M. (2017). Cause I'll feel good! an investigation into the effects of anticipated emotions and personal moral norms on consumer pro-environmental behavior. Journal of Promotion Management, 23(1), 163–183. https://doi.org/10.1080/10496491.2016.1267681

Rogers, E. M. (2003). Diffusion of Innovations (5th ed.). The Free Press, NY, pp. 15-17.

Shalender, K., & Yadav, R. K. (2020). Promoting e-mobility in India: Challenges, framework, and future roadmap. Environment, Development and Sustainability, 20(6), 2587–2607. https://doi.org/10.1007/s10668-017-0006-x

Shankar, A., & Kumari, P. (2019). Exploring the enablers and inhibitors of electric vehicle adoption intention from sellers' perspective in India: A view of the dual-factor model. International Journal of Nonprofit and Voluntary Sector Marketing, 24(4). https://doi.org/10.1002/nvsm.1662

Singh, V., Singh, V., & Vaibhav, S. (2020). A review and simple meta-analysis of factors influencing adoption of electric vehicles. Transportation Research Part D: Transport and Environment, 86, 102436. https://doi.org/10.1016/j.trd.2020.102436

Sudmant, A., Kalisa, E., & Bower, J. (2020). Ideas for growth The impact of scaling up electric motorbikes in Rwanda.

Thuy, T. T., & Hong, P. T. (2019). Attitude to and Usage Intention of High School Students Toward Electric Two-Wheeled Vehicles in Hanoi City. VNU Journal of Science: Economics and Business, 35(2), Article 2. https://doi.org/10.25073/2588-1108/vnueab.4224https://doi.org/10.25073/2588-1108/ vnueab.4224

Vafaei-Zadeh, A., Wong, T.-K., Hanifah, H., Teoh, A. P., & Nawaser, K. (2022). Modelling Electric Vehicle Purchase intention among generation Y consumers in Malaysia. Research in Transportation Business & Management, 43, 100784. https://doi.org/10.1016/j.rtbm.2022.100784

Wahab, L., & Jiang, H. (2019). Factors influencing the adoption of electric vehicle: The case of electric motorcycle in northern Ghana. INTERNATIONAL JOURNAL FOR TRAFFIC AND TRANSPORT ENGINEERING, 9(1), 22–37. https://doi.org/10.7708/ijtte.2019.9(1).03

Wang, S., Fan, J., Zhao, D., Yang, S., & Fu, Y. (2014). Predicting consumers' intention to adopt hybrid electric vehicles: Using an extended version of the theory of planned behavior model. Transportation, 43(1), 123–143. https://doi.org/10.1007/s11116-014-9567-9

Wu, J., Liao, H., & Wang, J.-W. (2020). Analysis of consumer attitudes towards autonomous, connected, and electric vehicles: A survey in China. Research in Transportation Economics, 80, 100828. https://doi.org/10.1016/j.retrec.2020.100828

Yahaya, S., Yusoff, W.S.B.W., Idris, A.F.B. and Haji-Othman, Y. (2014), "Conceptual framework for adoption of Islamic banking in Nigeria: the role of customer involvement", European Journal of Business and Management, Vol. 6 No. 30, pp. 11-24.

Yeğin, T., & Ikram, M. (2022). Analysis of consumers' Electric Vehicle Purchase Intentions: An expansion of the theory of planned behavior. Sustainability, 14(19), 12091. https://doi.org/10.3390/su141912091