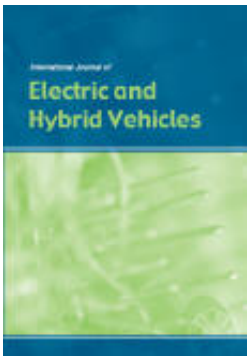

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Nagarajan Shanmugavel, Chidambaram Alagappan

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An exploration on electric vehicle purchase intention

Nagarajan Shanmugavel* and
Chidambaram Alagappan

Alagappa Institute of Management,
Alagappa University,
Karaikudi, India
Email: nagarajanps@alagappauniversity.ac.in
Email: chidambaramalc@gmail.com
*Corresponding author

Abstract: The crucial objective of this research is to explore the effect of environmental product knowledge, environmental concern, perceived behavioural control and perceived innovativeness on electric vehicles' purchase intention and to explore the direct and indirect effect of these variables on customer's purchase intention of electric vehicle. This study employed selective variables from two different theories namely the TBP and UTAUT to explore the impact accumulated by the variables on the purchase intention of electric vehicle. The uniqueness of this study is to consider perceived innovativeness along with these environmental constructs to explore the purchase intention of electric vehicles from a sample of 322 members of the public. The final outcome of this research signifies that environmental product knowledge has a substantial effect on EV purchase intention, perceived innovativeness has positive significant effect on EV purchase intention and environmental product knowledge on electric vehicle purchase intention is positively moderated by age.

Keywords: electric vehicle purchase intention; environmental product knowledge; environmental concern; perceived behavioural control; perceived innovativeness.

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Biographical notes: Nagarajan Shanmugavel has specialised in digital marketing, environmental marketing and stress management and has been into teaching management courses since 2000. He has received funds from institutions like ICSSR, UGC-MHRD and DST to undergo research projects, conduct conferences and workshops. He has published research papers in various national and international repute journals.

Chidambaram Alagappan is a research scholar in the Alagappa Institute of Management, Alagappa University and has specialised in entrepreneurship development. He has published research papers in various Scopus indexed journals in management.

1 Introduction

Withering environmental continuum is one of the egregious problems faced by the humans, flora and fauna (Haytko and Matulich, 2008). In the meantime, several scientists determined the climate change as induced by humans (Cook et al., 2013). Consequently, the effective usage of energy consumption was encouraged by consumers' vast environmental awareness (Kasulis et al., 1981). Inter alia, Paul et al. (2016) stated that consumers in developing countries have lesser environment concerns against the developed countries. Similarly, green energy consumers have greater concern towards the environment than the general population (Clark et al., 2003; Hansla et al., 2008). In addition, Ritter et al. (2015) opined that the environmental impact could be alleviated by the consumption of environmentally friendly products (Ritter et al., 2015). Environmental issues, global warming and health concerns are the significant factors that influence consumers to purchase green products (Do Paco and Raposo, 2009; Barber, 2010). Environmental concern is stated as the awareness about the environment and the willingness to fix environmental issues (Alibeli and Johnson, 2009). Effects of climate change were ameliorating, that are directly related by emission impact of the transportation sector (Noori et al., 2015). In future the ubiquitous and economical fuel for transportation is electricity (Connolly et al., 2014). Environmental pollution like CO_2 emission and consumption of fossil fuel cause adverse impact to climate change; human immune system and sustainable living the measure for immunity and aegis for future premises of humankind is perceived as electric vehicle (Neumann et al., 2010). The most environmentally friendly and highly potential transport technology presumed in the contemporary context is electric vehicle as compared to other fuel technology (Mathiesen and Lund, 2009) and electric vehicles stirred the global interest too (Noori et al., 2015). For the conservation of rare non-renewable energy sources and to reduce environmental impacts, electric vehicle are an amiable solution (Liu et al., 2019). India imports eighty per cent of its crude oil from various countries and emits cumbersome quantity of CO_2 through road transportation (Kumar et al., 2015). The demand for petroleum products is increasing year by year and also plays a significant role in environmental emission impact, all governments were positioned to take crucial arrangement over it. Global mobility summit had made a significant decision, to transform all public transport vehicles as electric by 2030 (Preetha and Poornachandran, 2019). The drive to assuage the environmental adversities by the government is phenomenal in recent times at the outset of present global scenario, inter alia electric vehicles marks as an irresistible solution. From various research studies, the ideal mindset of the government does not corroborate with the attitude and intentions of the people in the environmental pollution context because of various reasons. People in Asian countries like India have product sensitivity in nature (Anholt, 2000) in order to explore purchase intentions of customers towards electric vehicle, employment of the theory of planned behaviour (TBP) (Ajzen, 1991) as explains human behaviours and intentions (Hamzah and Tanwir, 2021) have been used in this study. The constructs like environmental product knowledge (Maichum et al., 2016), environmental concern (He et al., 2018; Maichum et al., 2016; Hartmann and Apaolaza-Ibáñez, 2012), perceived innovativeness (Shin and Hancer, 2016) and perceived behavioural control (Maichum et al., 2016; Hamzah and Tanwir, 2021) were employed to explain the purchase intention of electric vehicles individually. Similarly, few studies have focused on green purchase intention, consumer attributes and perception over electric vehicle. However, no studies have holistically considered perceived

innovativeness along with these environmental constructs to explore the purchase intention of electric vehicles. Further, the current research attempts to find the direct and indirect effects of perceived innovativeness on purchase intention of electric vehicles and adopted constructs from UTAUT as propounded by (Venkatesh et al., 2012) and TPB validated by Ajzen (1991) and their importance to the behavioural and purchase intention towards electric vehicle.

2 Review of literature

2.1 EV product knowledge

Awareness attainment and collecting information about the product concerned by the consumers is defined as product knowledge (Brucks, 1985). Regarding purchase behaviour of consumers, one of the most inevitable and consistent influencing factors is the product knowledge (Burton et al., 2009). Product knowledge depends upon awareness about the product by the consumers or confidence of the consumer about the product and concludes that product knowledge of the consumers has a significant influence on purchase decision (Lin and Zhen, 2005). Previous research states that green product knowledge is observed as direct predictor of purchase intention of green products (Wang et al., 2019) and influence adaptation and evaluation of new product by the customer (Moreau et al., 2000). A positive interrelation of consumer's behavioural attitude and intention with environmental knowledge (Arcury, 1990) and also environmental knowledge had a positive relation with environmental attitude of the consumers (Bang et al., 2000), similarly product knowledge also has a positive relationship with consumers intention to purchase environmentally friendly electric vehicles. As consumers are concerned more about their health, they show interest towards the environment (Howarth and Norgaard, 1995). Environmental concern consumers were seemingly less knowledgeable (Bang et al., 2000). Environmental concern has a weak impact on environmental knowledge; thus, this study attempts to explore the significance between EV product knowledge and environmental concern. In the TBP, perceived behavioural control is termed as one of the three main factors that predict behavioural intention and its influence on purchase intention of eco-friendly house (Wijayaningtyas et al., 2019). Thus, green product knowledge is explored as a predictor of eco-friendly products' purchase intention, hence we attempted to explore the relationship between EV product knowledge and perceived behavioural control.

Hypothesis 1 EV product knowledge has a positive significant relationship with EV purchase intention.

Hypothesis 2 EV product knowledge has a significant relationship with environmental concern.

Hypothesis 3 EV product knowledge has a significant relationship with perceived behavioural control.

2.2 Environmental concern

An affective attribute that comprises' environmental considerations and worries of the consumers about the environment is termed as environmental concern (Yeung, 2004). However, Alibeli and Johnson (2009) stated as individuals' awareness and willingness to solve environmental issues. In consumer decision-making process, environmental concern is an important factor (Diamantopoulos et al., 2003). New vehicle technologies are very likely to be chosen by the consumers who have higher awareness about the environment that includes hybrid vehicles (Hackbarth and Madlener, 2016; Krupa et al., 2014) and also more likely to adopt EVs (Sinnappan and Rahman, 2011). Several researches stated that environmental concern had a strong positive influence on consumer purchase intention (He et al., 2018; Hamzah and Tanwir, 2021; Ahmed et al., 2021; Hartmann and Apaolaza-Ibáñez, 2012), thus environment concern has a positive influence on the purchase intention of electric vehicle. Prior study demonstrated positive influence of perceived behavioural control on purchase intention of the customers (Shin and Hancer, 2016), thereby we attempted to explore the relationship between environmental concern and perceived behavioural control.

Hypothesis 4 Environment concern has a significant relationship with EV purchase intention.

Hypothesis 5 Environment concern has a significant relationship with perceived behavioural control.

2.3 Perceived behavioural control

Perceived behavioural control is defined as the opinion of people that concerns to the degree of comfort or complexity in executing their behaviour of interest (Ajzen, 1991). Prior studies state that behavioural intention and actual behaviour are found to be influenced by perceived behavioural control (Schifter and Ajzen, 1985). Similarly, prior studies highlighted the positive effect of perceived behavioural control on purchase intention of consumers in purchasing hybrid vehicles (Wang et al., 2016) and significant impact of perceived behaviour control on green purchase intention (Hamzah and Tanwir, 2021). The silent predictor and significant influencer of consumer's intention to purchase hybrid cars is perceived behavioural control (Huang and Ge, 2019; Simsekoglu and Nayum, 2019; Tanwir and Hamzah, 2020). In line with the prior researchers, we intend to explore the relationship between perceived behaviour control and purchase intention of electric vehicle in Indian context.

Hypothesis 6 Perceived behavioural control has a significant relationship with EV purchase intention.

2.4 Perceived innovativeness

New technology adaptation researchers employed perceived innovativeness as a significant factor (Fu and Elliott, 2013; Johnson et al., 2001; Kaplan, 2009). Perceived innovativeness is defined as an expectant to which the individuals suppose that the product possesses newness and uniqueness which is termed as the significant characteristic of innovation (Watchravesringkan et al., 2010). The product reflects the

uniqueness of the technology as indicated by Perceived innovativeness (Kleinschmidt and Cooper, 1991). People having high personal innovativeness prefers new products, technology and to seek new experience (Midgley and Dowling, 1978). Personal innovativeness was employed to explore its influences on online purchase intention and discerns the positive influence between the variables (Boyle and Ruppel, 2006) and was also determined as a strong predictor of omni channel purchase intention (Juaneda-Ayensa et al., 2016). Prior research shows the positive influence of perceived behavioural control on purchase intention of the customers (Shin and Hancer, 2016), green product knowledge influences adaptation and evaluation of new product by the customer. Perse, perceived innovativeness also has a significant impact on purchase intention, from this perspective the current research attempts to explore the significance between perceived innovativeness and perceived behavioural control, and perceived innovativeness claims to be a strong influencing variable on purchase intention of electric vehicles.

Hypothesis 7 Perceived innovativeness has a significant relationship with EV purchase intention.

Hypothesis 8 Perceived innovativeness has a significant relationship with perceived behavioural control.

Hypothesis 9 Perceived innovativeness has a significant relationship with EV product knowledge.

2.5 Moderating variable: age

Analysis of individuals and their labeling in modern social science research considered age as a significant variable (Aapola, 2002). Control variable of entrepreneurial intention is coined as age and gender (Puni et al., 2018). Age employed as a moderating variable in order to find out the relationship between viral marketing and purchase intention of the consumers (Sawaftah et al., 2020). Thus, we attempted to find the impact of age on the relationship between electric vehicle purchase intention and the following hypothesis is framed.

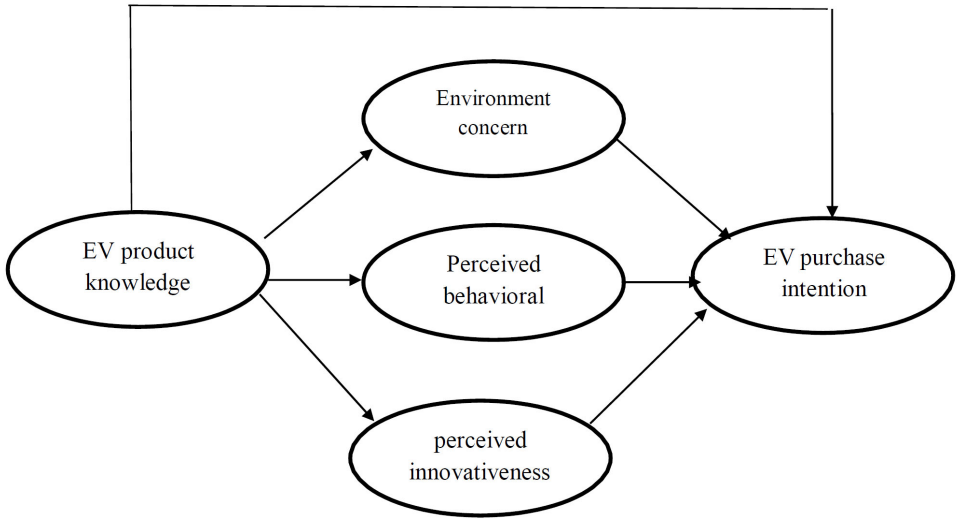
Hypothesis 10 The impact of EV purchase intention is positively moderated by age.

3 Theoretical consideration and conceptual framework

Research design is the formal framework that guides the researcher to accumulate information and analyse the obtained data to interpret for the practical implications. The crucial objective of this research is to explore the effect of environmental product knowledge, environmental concern, perceived behavioural control and perceived innovativeness on electric vehicles' purchase intention and to explore the direct and indirect effect of these variables on customer's purchase intention of electric vehicle. TPB expounds individuals' intention to perform ameticulous behaviour, proposed by Ajzen. TBP was verily employed to explore the effort, willingness to try and performance accumulated by an individual to practice a meticulous behaviour (Ajzen and Driver, 1992). Unified theory of acceptance and use of technology (UTAUT) also has been employed to investigate the behavioural intention (Attuquayefio and Addo, 2014). It is

also a lens to inspect the technology adoption of an individual (Slade et al., 2014). In this study perceived innovativeness was employed as a mediating variable to explore the relationship with the purchase intention of electric vehicles. Similarly, consumers' motivation to product acquirement and use are enhanced by perceived innovativeness (Lafferty and Goldsmith, 2004). Previous studies also have stated the positive influence of perceived behavioural control on purchase intention of the customers (Shin and Hancer, 2016). In the same way the current research employed several variables form two different theory namely the TBP and UTAUT to explore the impact accumulated by the variables on purchase intention of electric vehicle.

Figure 1 Conceptual framework



4 Methodology

As the supreme objective of this research centrally focuses on the impact of EV product knowledge, environment concern, perceived behavioural control and perceived innovativeness on purchase intention of electric vehicle, an explanatory research design has been adopted. The secondary objective of this research is to discern the direct and indirect effects between these variables on purchase intention. Convenient sampling method was adopted in this study. This research has initially targeted 370 respondents and only 322 general public were taken as the study cases, subsequently instructed about the study purpose, there by several units were discarded because of the lack of knowledge about electric vehicles and the other sample cases were asked to fill up the structured questionnaire made with close ended questions.

4.1 Questionnaire and measures

The research questionnaire consists of two parts; the first part has been framed to explore the demographic details of the respondents and the second part aims to investigate the purchase intention of electric vehicle of the respondent. In order to explore EV purchase

intention five constructs were formulated with nineteen items that devise the sequel of purchase intention of electric vehicle. In this research, the constructs used to study the purchase intention of electric vehicles were adopted from prior researches, such as; EV product knowledge (Park and Lessig, 1981), environment concern (Fransson and Gärling, 1999, Le Hebel et al., 2014), perceived behavioural control (Paul et al., 2016) and perceived innovativeness (Yang et al., 2012) and purchase intention (Barbarossa et al., 2015). At the same time minimal words were rephrased in order to befit to the present study. Seven-point Likert scale was adopted to compute the items that ranges between 7 – 'strongly agree' to 1 – 'strongly disagree'.

4.2 Data analysis

Statistical Package for the Social Sciences (SPSS), AMOS and Microsoft Excel were utilised for analysing and interpreting the obtained data for the research. In order to explore the relationship between exogenous and endogenous factors and testing hypothetical model, structural equation model has been used (MacCallum and Austin, 2000). Similarly, with the use of structural equation modelling (SEM) and AMOS mediation and moderation analysis were done.

5 Results

5.1 Demographical profile

A sample of 322 members of the public was used in this research. Gender, age, domicile and years of experience are taken as socio-demographic details. In this study 58.1% of the respondents are male and 41.9 % are female. 33.9% of the respondents are age between 29–39 years, 21.4% are 18–28 years of age. 38.8% of the respondents are having 6–10 years of vehicle experience, 32.6%of respondents having 1–5 years of experience. 46.0% of the respondents' hail from rural areas and the remaining 54.0% are urban dwellers.

5.2 Measurement model

Initially confirmatory factor analysis (CFA) was used and subsequently the discriminate validity and reliability test were examined. Table 2 shows the loadings of the factors, all the loadings of the items score are above 0.76, the average variance extracted (AVE) scores are above 0.68, from these measures the discriminate validity threshold levels are clear as the maximum shared variance (MSV) and average shared variance (ASV) are lower than average variance extracted (AVE). The value of CR for all variables is higher than 0.88 which is also adequate. The Cronbach's alpha critical level value is 0.80 and stated as good. Unidimensionality and lessened measuring bias are guided by goodness of fit suggested by Leung et al. (2012). The fit indices calculated from the measurement model are as follows, CMIN/DF = 2.191; GFI = 0.910; CFI = 0.961 and RMSEA = 0.61, these are within the recommended level (Leung et al., 2012). Similarly, the discriminate validity is ensured as the square root of AVEs is equal to the diagonal values in the correlation matrix and the diagonal value greater than the inter correlation scores.

Thereby, our study ensures a good level of discriminate validity which is depicted in Table 3.

Table 1 Demographical profile

Characteristics	*Category*	*Frequency*	*Percentage%*
Gender	Male	187	58.1%
	Female	135	41.9%
Domicile	Rural	148	46.0%
	Urban	174	54.0%
Age	18–28 yrs	69	21.4%
	29–39 yrs	109	33.9%
	40–50 yrs	61	18.9%
	51–60 yrs	54	16.8%
	< 60 yrs	29	9.0%
Years of experience	> 1 yr.	20	6.2%
	1–5 yrs.	105	32.6%
	6–10 yrs.	125	38.8%
	10–15 yrs.	58	18.1%
	< 15 yrs.	14	4.3%
Total		322	100%

Table 2 Measurement model results

Construct	*Items*	*Mean (SD)*	*Loadings*	*AVE, MSV and ASV*	*Composite reliability*
EV product knowledge	EVK 1	4.31 (1.65)	.853***	0.721, 0.479 and 0.228	0.912
	EVK 2	4.42 (1.48)	.846***		
	EVK 3	4.32 (1.42)	.876***		
	EVK 4	4.49 (1.47)	.820***		
Environmental concern	EC 1	4.70 (1.34)	.769***	0.682, 0.185 and 0.084	0.915
	EC 2	4.63 (1.38)	.854***		
	EC 3	4.63 (1.27)	.827***		
	EC4	4.61 (1.35)	.840***		
	EC5	4.65 (1.37)	.836***		
Perceived behavioural control	PBC 1	4.31 (1.44)	.842***	0.694, 0.434 and 0.191	0.901
	PBC 2	4.19 (1.38)	.859***		
	PBC 3	4.24 (1.31)	.818***		
	PBC 4	4.03 (1.27)	.812***		
Personal innovativeness	PI 1	4.82 (1.29)	.837***	0.709, 0.177 and 0.063	0.880
	PI 2	4.62 (1.41)	.840***		
	PI 3	4.59 (1.36)	.849***		
EV purchase intention	EVPI 1	4.64 (1.22)	.812***	0.724, 0.479 and 0.319	0.887
	EVPI 2	4.28 (1.24)	.874***		
	EVPI 3	4.29 (1.27)	.866***		

Note: ***significant at 99% confidence level.

Table 3 Inter-correlation and √AVE values

Constructs	*Cronbach's α*	*PBC*	*EVK*	*EC*	*PI*	*EVPI*
PBC	0.902	0.833				
EVK	0.860	0.523	0.849			
EC	0.834	0.161	0.345	0.826		
PI	0.926	0.171	0.203	0.077	0.842	
EVPI	0.874	0.659	0.692	0.430	0.421	0.851

Notes: The diagonal values represent the √AVE.
PBC – perceived behavioural control; EVK – electric vehicle product knowledge; EC – environmental concern; PI – personal innovativeness; EVPI – electric vehicle purchase intention.

5.3 Common method bias

In order to ensure the study measures whether free from common method bias, exploratory factor analysis was performed and the first factor gains 37.7% which is lesser than threshold value 50%and confirms the study free from common method bias (CMB) issues (Wilson et al., 2016).

5.4 Structural model evaluation

Fit indices from the SEM analysis are CMIN/DF = 2.176 (ideal value < 3.00); NFI = 0.931 (ideal value > 0.90); AGFI = 0.881 (ideal value > 0.90); CFI = 0.961 (ideal value > 0.90); GFI = 0.903 (ideal value > 0.90); and RMSEA = 0.061 (ideal value < 0.08), fit indices values that are obtained from this research are corroborate with the results of Hair et al. (2014). Table 4 presents the path co-efficient analysis of the proposed hypothetical model. Environmental product knowledge has a substantial effect on EV purchase intention ($\beta = 0.356$; $p < 0.001$) thus H1 was supported. The significance between environmental product knowledge and environment concern was positively indicated ($\beta = 0.345$; $p < 0.001$) thus H2 got supported. The significance between electric vehicle product knowledge and perceived behaviour control was positively indicated ($\beta = 0.517$; $p < 0.001$) thus H3 was supported and there is a positive significance between environment concern and EV purchase intention ($\beta = 0.224$; $p < 0.001$) thus H4 got accepted. The significance between environment concern and perceived behaviour control was found to be positively significant ($\beta = 0.230$; $p < 0.001$) thus H5 got supported and there was a positive significance between perceived behaviour control and EV purchase intention ($\beta = 0.392$; $p < 0.001$) thus H6 got supported. Perceived innovativeness has positive significant effect on EV purchase intention ($\beta = 0.265$; $p < 0.001$) and a positive significant effect on perceived behaviour control ($\beta = 0.670$; $p < 0.001$) thus H7 and H8 got accepted. Further, significance between perceived innovativeness and electric vehicle product knowledge was found ($\beta = 0.203$; $p < 0.001$) thereby, H9 got accepted.

Table 4 Results of hypotheses testing

Endogenous constructs	*Exogenous constructs*	*Standardised estimates*	*R2*
EC	EVK	.345***	.119
PI	EVK	.203***	0.41
PBC	EVK	.517***	.279
PBC	EC	.230***	
PBC	PI	.067***	
EVPI	EVK	.356***	.712
EVPI	EC	.224***	
EVPI	PI	.265***	
EVPI	PBC	.392***	

Note: *** denotes $p < 0.001$; ** denotes $p < 0.005$; ns denotes values not significant.

5.5 Analysing the direct and indirect effects

This research study attempts to find out the direct and indirect effect of perceived usefulness and hedonic motivation on entrepreneurial intention by using structural equation model with bootstrapped samples of 3,000 at 95 % significance level suggested by Richter et al. (2016). From the testing the direct and indirect effect of electric vehicle product knowledge on perceived behaviour control and perceived innovativeness towards electric vehicle purchase intention, results states that perceived behaviour control and purchase intention has a positive direct effect and did not have positive indirect effect through electric vehicle product knowledge. The another finding shows the effects between perceived innovativeness and purchase intention through electric vehicle product knowledge and mentions a positive impact direct and indirect effect on purchase intention. However, this research found that perceived behaviour control did not have indirect effect on the purchase intention of electric vehicles, rather perceived innovativeness positively influences electric vehicles' purchase intention through electric vehicle product knowledge.

Figure 2 Direct and indirect effect

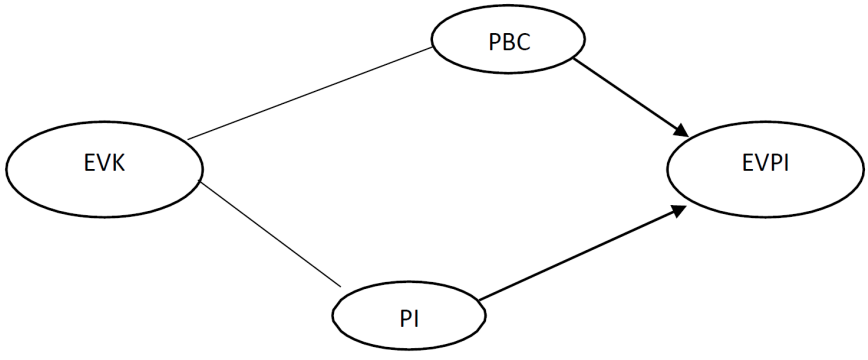


Table 5 Results of mediation analysis

	Effects	*Effects of PBC on EVPI mediated*	*Effects of PI on EVPI*
Environmental product knowledge	Total effects (std. error, lower bound, upper bound)	0.273*** (0.086, 0.410, 0.083)	0.428*** (0.072, 0.546, 0.245)
	Direct effect (std. error, lower bound, upper bound)	0.057** (0.087, 0.398, 0.059)	0.372*** (0.076, 0.523, 0.213)
	Indirect effect (std. error, lower bound, upper bound)	0.012^{ns} (0.016, 0.076, –0.003)	0.036** (0.03, 0.086, 0.002)

Notes: *** denotes significant at 99% confidence level and ** denotes significant at 95% confidence level; n = 400; bootstrap iterations = 3,000.
PBC – perceived behavioural control; EVK – EV product knowledge;
PI – Personal innovativeness; EVPI – EV purchase intention

5.6 Analysing the moderating influence of age

This research study attempts to identify moderating influence of age. Adapting electric vehicle product knowledge as independent variable, electric vehicle purchase intention as dependent variable and the moderating variable as age. Figure 3 represents that age as moderator of electric vehicle product knowledge and electric vehicle purchase intention, from the research findings it is found that age positively strengthens the relation between environmental product knowledge and electric vehicle purchase intention (β= 0.432; $p < 0.001$). Thus, the impact of environmental product knowledge on electric vehicle purchase intention is positively moderated by age, whereby the H10 was supported.

Figure 3 Moderating influence of age

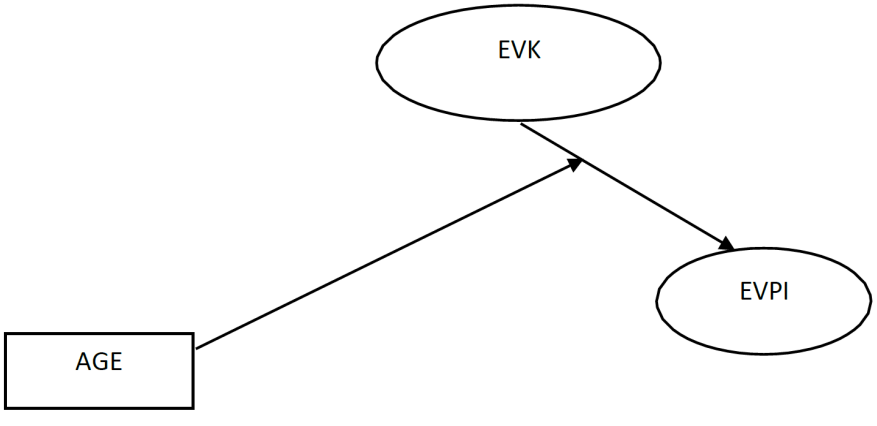
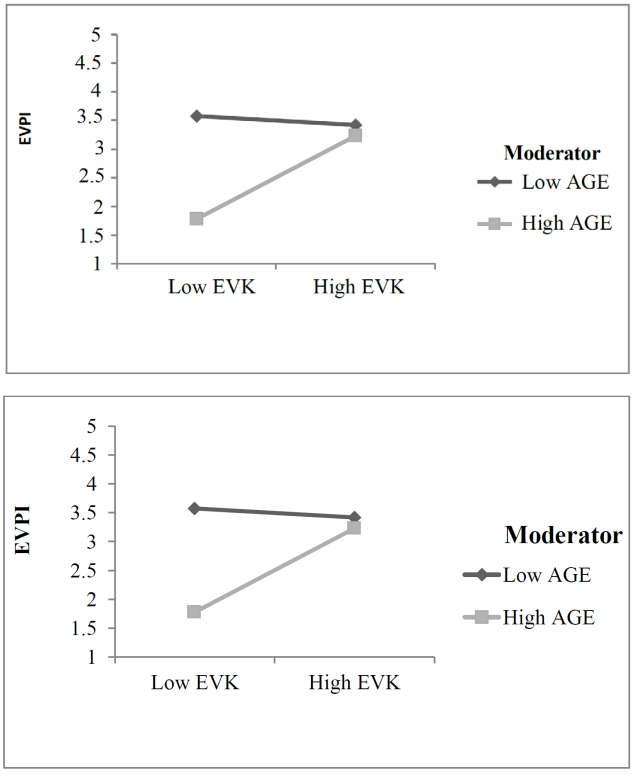


Figure 4 Moderation effect of age



6 Discussion

Main objective of this research is focused on the effect of electric vehicle product knowledge, environmental concern, perceived behavioural control and perceived innovativeness on electric vehicles purchase intention and to explore the direct and indirect effect of these variables on customer's purchase intention of electric vehicle. From the findings electric vehicle product knowledge has a substantial effect on EV purchase intention and supports the results of the prior research (e.g., Lin and Zhen, 2005; Wang et al., 2019). Electric vehicle product knowledge showed a positive effect on perceived behavioural control and also demonstrated a significant impact on environment concern that further supports the findings of prior research (Bang et al., 2000). Perceived behavioural control also showed a significant relationship with environmental concern and a positive significant relationship was witnessed between perceived behavioural control and EV purchase intention and contradicts the results of He et al. (2018) and Hamzah and Tanwir (2021). Further, the perceived innovativeness has positive significant effect on EV purchase intention (Boyle and Ruppel, 2006; Juaneda-Ayensa et al., 2016) and positive significant effect on perceived behavioural control and electric vehicle product knowledge. Finally, the study showed a positive moderating influence of age on electric vehicle product knowledge to explain the electric vehicle purchase intention.

6.1 Theoretical contribution

This empirical paper inherited two different theories and their importance to the behavioural and purchase intention towards electric vehicle. Numerous researches had explored the theory of planned behaviour, however this research makes a contribution to the theory by exploring the factors like electric vehicle product knowledge, environmental concern and perceived behavioural control on the purchase intention of electric vehicles. From unified theory of acceptance and use of technology, perceived innovativeness was taken for this research and shows a positive impact on the purchase intention of the consumers towards electric vehicle. The major theoretical contribution of this research is the exploration of the significance of perceived innovativeness along with the environmental constructs, to explain the purchase intention of electric vehicles and grouping of these major theories and their significance between the variables that contribute significantly to the purchase intention of electric vehicles.

6.2 Limitation and future scope

In order to attain better results similar with the opinion of the prior researchers the sample size would have been taken more with an outreach of different varieties of study cases from different geographical locations. The other limitation that this study points out is the exclusion of the demographic factor like; family's economic status of the study cases, as it is supposed by the researcher that it would offer precise results. Limited variables taken from TBP and UTAUT theory would further lead future researchers to study the better prediction effect of the purchase intention of electric vehicles.

7 Conclusions

Humankind is the cause and sufferer of environmental problems. As the needs and requirements of humans increase due to numerous modern sophistication and requirements, consequences of modern requirements, modern environmental hazards have emerged as an inevitable problem to the humankind. To suspend this environmental imbalance, innovation is the key element for sustainable growth to green environment. Emission of fossil fuels turns to be major factor in global climatical change and also expensive commodity in various under developing countries, to resolve the hazards caused by fossil fuel emission, electric vehicle is the ideal solution. In the current context the global economy needs technology that not only satisfies the needs of the consumer, it needs to protect the environment and enrich the natural resources. For a sustainable green environment individuals have to pay for their madness that highly affects peaceful environment. Environment is in the verge of losing its normality and is verily in the hands of government and the people to protect it. This study exposes the purchase intention of electric vehicle in view of the behavioural aspects and the results of this study explores the respondents' mindset and effect of various factors like electric vehicle product knowledge, environmental concern, perceived behavioural control and perceived innovativeness on the electric vehicles' purchase intention. The findings contribute significantly the behavioural aspects that directly impact in the consumers approaching towards new innovative products and purchase intention towards electric vehicle. Uniqueness of this research is that combination of two different theories sails towards the

purchase intention, explores the direct and indirect effect of these variables on customer's purchase intention of electric vehicle, moderating influence of age substantiating the results of previous research in the domain of consumers attribute towards electric vehicle.

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References

Aapola, S. (2002) 'Exploring dimensions of age in young people's lives: a discourse analytical approach', *Time & Society*, Vol. 11, No. 2, pp.295–314.

Ahmed, N., Li, C., Khan, A., Qalati, S.A., Naz, S. and Rana, F. (2021) 'Purchase intention toward organic food among young consumers using theory of planned behavior: role of environmental concerns and environmental awareness', *Journal of Environmental Planning and Management*, Vol. 64, No. 5, pp.796–822.

Ajzen, I. (1991) 'The theory of planned behavior', *Organizational Behavior and Human Decision Processes*, Vol. 50, No. 2, pp.179–211.

Ajzen, I. and Driver, B.L. (1992) 'Application of the theory of planned behavior to leisure choice', *Journal of Leisure Research*, Vol. 24, No. 3, pp.207–224.

Alibeli, M.A. and Johnson, C. (2009) 'Environmental concern: a cross national analysis', *Journal of International and Cross-Cultural Studies*, Vol. 3, No. 1, pp.1–10.

Anholt, S. (2000) 'The nation as brand', *Across the Board*, Vol. 37, No. 10, pp.22–28.

Arcury, T.A. (1990) 'Environmental attitude and environmental knowledge', *Human Organization*, Vol. 49, No. 4, pp.300–304.

Attuquayefio, S. and Addo, H. (2014) 'Review of studies with UTAUT as conceptual framework', *European Scientific Journal*, Vol. 10, No. 8, pp.249–258.

Bang, H.K., Ellinger, A.E., Hadjimarcou, J. and Traichal, P.A. (2000) 'Consumer concern, knowledge, belief, and attitude toward renewable energy: An application of the reasoned action theory', *Psychology & Marketing*, Vol. 17, No. 6, pp.449–468.

Barbarossa, C., Beckmann, S.C., De Pelsmacker, P., Moons, I. and Gwozdz, W. (2015) 'A self-identity based model of electric car adoption intention: a cross- cultural comparative study', *Journal of Environmental Psychology*, Vol. 42, No. 1, pp.149–160.

Barber, N. (2010) ''Green' wine packaging: targeting environmental consumers', *International Journal of Wine Business Research*, Vol. 22, No. 4, pp.423–444.

Boyle, R.J. and Ruppel, C.P. (2006) 'The effects of personal innovativeness, perceived risk, and computer self-efficacy on online purchasing intent', *Journal of International Technology and Information Management*, Vol. 15, No. 2, p.5.

Brucks, M. (1985) 'The effects of product class knowledge on information search behavior', *Journal of Consumer Research*, Vol. 12, No. 1, pp.1–16.

Burton, S., Howlett, E. and Tangari, A.H. (2009) 'Food for thought: how will the nutrition labeling of quick service restaurant menu items influence consumers' product evaluations, purchase intentions, and choices?', *Journal of Retailing*, Vol. 85, No. 3, pp.258–273.

Clark, C.F., Kotchen, M.J. and Moore, M.R. (2003) 'Internal and external influences on pro-environmental behavior: participation in a green electricity program', *Journal of Environmental Psychology*, Vol. 23, No. 3, pp.237–246.

Connolly, D., Mathiesen, B.V. and Ridjan, I. (2014) 'A comparison between renewable transport fuels that can supplement or replace biofuels in a 100% renewable energy system', *Energy*, Vol. 73, pp.110–125.

Cook, J., Nuccitelli, D., Green, S.A., Richardson, M., Winkler, B., Painting, R. and Skuce, A. (2013) 'Quantifying the consensus on anthropogenic global warming in the scientific literature', *Environmental Research Letters*, Vol. 8, No. 2, p.024024.

Diamantopoulos, A., Schlegelmilch, B.B., Sinkovics, R.R. and Bohlen, G.M. (2003) 'Can socio-demographics still play a role in profiling green consumers? A review of the evidence and an empirical investigation', *Journal of Business Research*, Vol. 56, No. 6, pp.465–480.

Do Paco, A. and Raposo, M. (2009) ''Green' segmentation: an application to the Portuguese consumer market', *Marketing Intelligence & Planning*, Vol. 27, No. 3, pp.364–379.

Etikan, I., Musa, S.A. and Alkassim, R.S. (2016) 'Comparison of convenience sampling and purposive sampling', *American journal of Theoretical and Applied Statistics*, Vol. 5, No. 1, pp.1–4.

Fransson, N. and Gärling, T. (1999) 'Environmental concern: conceptual definitions, measurement methods, and research findings', *Journal of Environmental Psychology*, Vol. 19, No. 4, pp.369–382.

Fu, F.Q. and Elliott, M.T. (2013) 'The moderating effect of perceived product innovativeness and product knowledge on new product adoption: an integrated model', *Journal of Marketing Theory and Practice*, Vol. 21, No. 3, pp.257–272.

Hackbarth, A. and Madlener, R. (2016) 'Willingness-to-pay for alternative fuel vehicle characteristics: a stated choice study for Germany', *Transportation Research Part A: Policy and Practice*, Vol. 85, No. 1, pp.89–111.

Hair, J.F., Gabriel, M. and Patel, V. (2014) 'AMOS covariance-based structural equation modeling (CB-SEM): guidelines on its application as a marketing research tool', *Brazilian Journal of Marketing*, Vol. 13, No. 2, pp.1–12.

Hamzah, M.I. and Tanwir, N.S. (2021) 'Do pro-environmental factors lead to purchaseintention of hybrid vehicles? The moderating effects of environmental knowledge', *Journal of Cleaner Production*, Vol. 279, p.123643.

Hansla, A., Gamble, A., Juliusson, A. and Gärling, T. (2008) 'The relationships between awareness of consequences, environmental concern, and value orientations', *Journal of Environmental Psychology*, Vol. 28, No. 1, pp.1–9.

Hartmann, P. and Apaolaza-Ibáñez, V. (2012) 'Consumer attitude and purchase intention toward green energy brands: The roles of psychological benefits and environmental concern', *Journal of Business Research*, Vol. 65, No. 9, pp.1254–1263.

Hartmann, P. and Apaolaza-Ibáñez, V. (2012) 'Consumer attitude and purchase intention toward green energy brands: the roles of psychological benefits and environmental concern', *Journal of business Research*, Vol. 65, No. 9, pp.1254–1263.

Haytko, D.L. and Matulich, E. (2008) 'Green advertising and environmentally responsible consumer behaviors: linkages examined', *Journal of Management and Marketing Research*, Vol. 1, No. 1, pp.1–11.

He, X., Zhan, W. and Hu, Y. (2018) 'Consumer purchase intention of electric vehicles in China: The roles of perception and personality', *Journal of Cleaner Production*, Vol. 204, No. 10, pp.1060–1069.

Howarth, R.B. and Norgaard, R.B. (1995) 'Intergenerational choices under global environmental change', *Handbook of Environmental Economics*, pp.111–138.

Huang, X. and Ge, J. (2019) 'Electric vehicle development in Beijing: an analysis of consumer purchase intention', *Journal of Cleaner Production*, Vol. 216, No. 2, pp.361–372.

Johnson, J.D., Donohue, W.A., Atkin, C.K. and Johnson, S. (2001) 'Communication, involvement, and perceived innovativeness: tests of a model with two contrasting innovations', *Group & Organization Management*, Vol. 26, No. 1, pp.24–52.

Juaneda-Ayensa, E., Mosquera, A. and Sierra Murillo, Y. (2016) 'Omnichannel customer behavior: key drivers of technology acceptance and use and their effects on purchase intention', *Frontiers in Psychology*, Vol. 7, No. 1, p.1117.

Kaplan, M.D. (2009) 'The relationship between perceived innovativeness and emotionalproduct responses: a brand oriented approach', *Innovative Marketing*, Vol. 5, No. 1, pp.39–47.

Kasulis, J.J., Huettner, D.A. and Dikeman, N.J. (1981) 'The feasibility of changing electricity consumption patterns', *Journal of Consumer Research*, Vol. 8, No. 3, pp.279–290.

Kleinschmidt, E.J. and Cooper, R.G. (1991) 'The impact of product innovativeness on performance', *Journal of Product Innovation Management*, Vol. 8, No. 4, pp.240–251.

Krupa, J.S., Rizzo, D.M., Eppstein, M.J., Lanute, D.B., Gaalema, D.E., Lakkaraju, K. and Warrender, C.E. (2014) 'Analysis of a consumer survey on plug-in hybrid electric vehicles', *Transportation Research Part A: Policy and Practice*, Vol. 64, No. 2, pp.14–31.

Kumar, A.G., Anmol, M. and Akhil, V.S. (2015) 'A strategy to enhance electric vehicle penetration level in India', *Procedia Technology*, Vol. 21, No. 2, pp.552–559.

Lafferty, B.A. and Goldsmith, R.E. (2004) 'How influential are corporate credibility and endorser attractiveness when innovators react to advertisements for a new high- technology product', *Corporate Reputation Review*, Vol. 7, No. 1, pp.24–36.

Le Hebel, F., Montpied, P. and Fontanieu, V. (2014) 'What can influence students' environmental attitudes? Results from a study of 15-year-old students in France', *International Journal of Environmental and Science Education*, Vol. 9, No. 3, pp.329–345.

Leung, C., Lo, S.K. and Leung, S.S. (2012) 'Validation of a questionnaire on behaviour academic competence among Chinese preschool children', *Research in Developmental Disabilities*, Vol. 33, No. 5, pp.1581–1593.

Lin, L.Y. and Zhen, J.H. (2005) 'Extrinsic product performance signaling, product knowledge and customer satisfaction: an integrated analysis–an example of notebook consumer behavior in Taipei City', *Fu Jen Management Review*, Vol. 12, No. 1, pp.65–91.

Liu, Y., Ouyang, Z. and Cheng, P. (2019) 'Predicting consumers' adoption of electric vehicles during the city smog crisis: an application of the protective action decision model', *Journal of Environmental Psychology*, Vol. 64, No. 3, pp.30–38.

MacCallum, R.C. and Austin, J.T. (2000) 'Applications of structural equation modeling in psychological research', *Annual Review of Psychology*, Vol. 51, No. 1, pp.201–226.

Maichum, K., Parichatnon, S. and Peng, K.C. (2016) 'Application of the extended theory of planned behavior model to investigate purchase intention of green products among Thai consumers', *Sustainability*, Vol. 8, No. 10, p.1077.

Mathiesen, B.V. and Lund, H. (2009) 'Comparative analyses of seven technologies to facilitate the integration of fluctuating renewable energy sources', *IET Renewable Power Generation*, Vol. 3, No. 2, pp.190–204

Midgley, D.F. and Dowling, G.R. (1978) 'Innovativeness: the concept and its measurement', *Journal of Consumer Research*, Vol. 4, No. 4, pp.229–242.

Moreau, T.,Confavreux, C., Vukusic, S. and Adeleine, P. (2000) 'Relapses and progression of disability in multiple sclerosis', *New England Journal of Medicine*, Vol. 343, No. 20, pp.1430–1438.

Neumann, I., Cocron, P., Franke, T. and Krems, J.F. (2010) 'Electric vehicles as a solution for green driving in the future? A field study examining the user acceptance of electric vehicles', *Proceedings of the European Conference on Human Interface Designfor Intelligent Transport Systems*, April, Berlin, Germany, Vol. 1, pp.445–453.

Noori, M., Gardner, S. and Tatari, O. (2015) 'Electric vehicle cost, emissions, and water footprint in the United States: development of a regional optimization model', *Energy*, Vol. 89, No. 1, pp.610–625.

Park, C.W. and Lessig, V.P. (1981) 'Familiarity and its impact on consumer decision biases and heuristics', *Journal of Consumer Research*, Vol. 8, No. 2, pp.223–230.

Paul, J., Modi, A. and Patel, J. (2016) 'Predicting green product consumption using theory of planned behavior and reasoned action', *Journal of Retailing and Consumer Services*, Vol. 29, No. 1, pp.123–134.

Preetha, P.K. and Poornachandran, P. (2019) 'Electric vehicle scenario in India: roadmap, challenges and opportunities', *2019 IEEE International Conference on Electrical, Computer and Communication Technologies*, February, Vol. 36, pp.1–7.

Puni, A., Anlesinya, A. and Korsorku, P.D.A. (2018) 'Entrepreneurial education, self-efficacy and intentions in Sub-Saharan Africa', *African Journal of Economic and Management Studies*, Vol. 9, No. 4, pp.492–511.

Richter, N.F., Sinkovics, R.R., Ringle, C.M. and Schlägel, C. (2016) 'A critical look at the use of SEM in international business research', *International Marketing Review*, Vol. 4, No. 8, pp.261–282.

Ritter, Á.M., Borchardt, M., Vaccaro, G.L., Pereira, G.M. and Almeida, F. (2015) 'Motivations for promoting the consumption of green products in an emerging country: exploring attitudes of Brazilian consumers', *Journal of Cleaner Production*, Vol. 106, No. 2, pp.507–520.

Sawaftah, D., Calıcıoglu, C. and Awadallah, R. (2020) 'The relationship between viral marketing and consumer purchase intention, the moderator role of brand image and age: evidence from smartphone users in North Cyprus', *Management Science Letters*, Vol. 10, No. 6, pp.1307–1320.

Schifter, D.E. and Ajzen, I. (1985) 'Intention, perceived control, and weight loss: an application of the theory of planned behavior', *Journal of Personality and Social Psychology*, Vol. 49, No. 3, p.843.

Shin, Y.H. and Hancer, M. (2016) 'The role of attitude, subjective norm, perceived behavioral control, and moral norm in the intention to purchase local food products', *Journal of Foodservice Business Research*, Vol. 19, No. 4, pp.338–351.

Simsekoglu, Ö. and Nayum, A. (2019) 'Predictors of intention to buy a battery electric vehicle among conventional car drivers', *Transportation Research Part F: Traffic Psychology and Behaviour*, Vol. 60, No. 2, pp.1–10.

Sinnappan, P. and Rahman, A.A. (2011) 'Antecedents of green purchasing behavior among Malaysian consumers', *International Business Management*, Vol. 5, No. 3, pp.129–139.

Slade, E.L., Williams, M.D. and Dwivedi, Y.K. (2014) 'Devising a research model toexamine adoption of mobile payments: an extension of UTAUT2', *The Marketing Review*, Vol. 14, No. 3, pp.310–335.

Tanwir, N.S. and Hamzah, M.I. (2020) 'Predicting purchase intention of hybrid electric vehicles: evidence from an emerging economy', *World Electric Vehicle Journal*, Vol. 11, No. 2, p.35.

Venkatesh, V., Thong, J.Y. and Xu, X. (2012) 'Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology', *MIS Quarterly*, Vol. 36, No. 1, pp.157–178.

Wang, H., Ma, B. and Bai, R. (2019) 'How does green product knowledge effectivelypromote green purchase intention?', *Sustainability*, Vol. 11, No. 4, p.1193.

Wang, S., Fan, J., Zhao, D., Yang, S. and Fu, Y. (2016) 'Predicting consumers' intention to adopt hybrid electric vehicles: using an extended version of the theory of planned behavior model', *Transportation*, Vol. 43, No. 1, pp.123–143.

Watchravesringkan, K., Hodges, N.N. and Kim, Y.H. (2010) 'Exploring consumers' adoption of highly technological fashion products', *Journal of Fashion Marketing andManagement: An International Journal*, Vol. 14, No. 2, pp.263–281.

Wijayaningtyas, M., Handoko, F. and Hidayat, S. (2019) 'The millennials' perceived behavioural control on an eco-friendly house purchase intention', *Journal of Physics: Conference Series*, November, Vol. 1375, No. 1, p.012060, IOP Publishing.

Wilson, D., Charidimou, A., Ambler, G., Fox, Z.V., Gregoire, S., Rayson, P., Imaizumi, T., Fluri, F., Naka, H., Horstmann, S. and Veltkamp, R. (2016) 'Recurrent stroke risk and cerebral microbleed burden in ischemic stroke and TIA: a meta-analysis', *Neurology*, Vol. 87, No. 14, pp.1501–1510.

Yang, S., Lu, Y., Gupta, S., Cao, Y. and Zhang, R. (2012) 'Mobile payment services adoption across time: an empirical study of the effects of behavioral beliefs, social influences, and personal traits', *Computers in Human Behavior*, Vol. 28, No. 1, pp.129–142.

Yeung, S.P.M. (2004) 'Teaching approaches in geography and students' environmental attitudes', *Environmentalist*, Vol. 24, No. 2, pp.101–117.