

Original Article

Empirical Study Assessing the Factors that Influence Consumer Purchase Intentions for Eco-friendly Vehicles in the Colombo District of Sri Lanka

Ranatunga D.¹, Gunawardan A.,²

*^{1,2} Department of Logistics and Transportation, Faculty of Management, Humanities and Social Sciences, CINEC Campus, Malabe, 10115, Sri Lanka;
dilaksharanatunga@gmail.com*

Abstract

This study explores the factors influencing consumer purchase intentions for eco-friendly vehicles in the Colombo district of Sri Lanka. The conceptual framework was structured primarily based on the Theory of Planned Behavior and 28 potential influential factors were explored in this study. This study mainly focuses on determining the influence of attitudes, subjective norms, perceived behavioral control, personal moral norms and also demographics of the consumers in purchasing eco-friendly vehicles. 262 responses were taken by using snowball sampling by distribution of the questionnaire survey and 210 useable responses were considered in the research. The author has found that personal moral norm and supplementary factors influence the intention to adopt eco-friendly vehicles while attitudinal, perceived behavioral control and subjective norms have become insignificant.

Keywords: *Consumer Buying Behavior, Eco-Friendly Vehicles, Green Consumerism, Purchase Intention, Theory of Planned Behavior*

Introduction

This study explores the factors influencing consumer purchase intentions for eco-friendly vehicles in the Colombo district of Sri Lanka.

The conceptual framework was structured primarily based on the Theory of Planned

Behavior and 28 potential influential factors were explored in this study. This study mainly focuses on determining the influence of attitudes, subjective norms, perceived behavioral control, personal moral norms and also demographics of the consumers in purchasing eco-friendly vehicles. 262 responses were taken by using snowball sampling by distribution of the questionnaire survey and 210 useable responses were considered in the research. The author has found that personal moral norm and supplementary factors influence the intention to adopt eco-friendly vehicles while attitudinal, perceived behavioral control and subjective norms have become insignificant.

One of the most common ways of fulfilling the generation of energy which is required for these vehicles is by burning fossil fuels. This emits enormous amount of gases to the environment. Carbon dioxide, which is one of the major contributors to the Green House Effect, is emitted extensively during this combustion. Thiel, et al., (2012) states that the emission of CO₂ from road transportation has increased significantly during the recent past. As of 2016, global transport sector had contributed 7,866.0 million of tonnes of CO₂ of which 5,852.6 million of tonnes is by road transportation (IEA,

2018). Sri Lanka had contributed 9.4 million of tonnes in 2016 of which 9.0 million of tonnes is by road transportation (IEA, 2018).

According to (International Energy Agency , 2021) CO₂ emissions from transport in Sri Lanka in 2018 was 8258 metric tons which is higher than 8078 metric tons in 2017. According to statistics of Department of Motor Traffic, (2018) one fifth of vehicles were unable to successfully pass the Gas Emission test in 2016. Passing rate of the Gas Emission test has increased during 2012 to 2015 period, but in 2016 there is a significant drop.

According to IEA, (2018) transportation sector has contributed 7.866 billion tonnes of CO₂ into the environment in 2016 of which 5.8526 billion tonnes is by road transportation at a global scale. Bekker, (2019) in his studies found that Car and Light Commercial Vehicle (LCV) sales in top 54 markets contracted by 0.5% in a global scale in 2018 compared to 2017. However, also found that there is a 3.3% increase in the sales of such mentioned vehicles in Asia-Pacific region in 2018 compared to 2017. It is evident that the CO₂ emissions also rises with the increase of vehicle population as fuel consumptions go up. Figure 1 shows the increase of vehicle population in Sri Lanka by year 2012 to 2018 and there is a significant increase in vehicle population. So the fuel consumption also goes up dramatically.

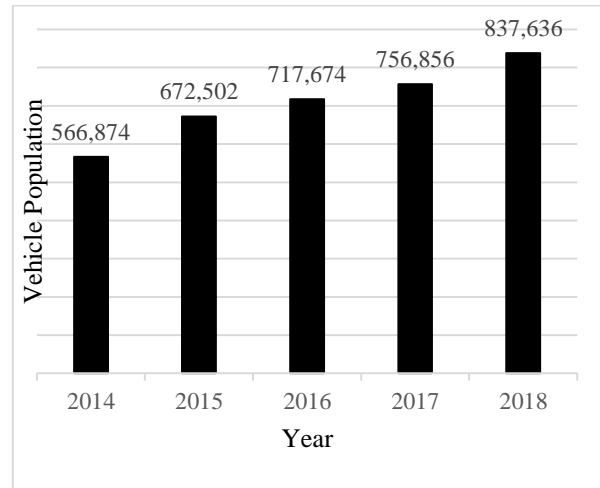


Fig. 1 Vehicle Population in Sri Lanka by Year (2012-2018)

Source - (Department of Motor Traffic, 2018)

It is very important to take actions in order to reduce pollution caused by emission of CO₂ from transportation and conserve the environmental systems in a sustainable manner. Sustainable environmental planning and management are few of the strategic challenges to overcome in the current circumstances. Today's world is going forward in terms of initiating green concepts and sustainability measures in transportation sector to reduce the amount of emission of CO₂ into the environment and minimize carbon footprint while Sri Lanka is yet to thrive. Yusof, et al., (2013) states that there is an increased awareness and concern of environmental issues throughout the population. It has initially begun with the concern on decrease of scarce natural resources and then it moved towards a concept called green consumerism where people started to consume environmentally friendly products. Laroche, et al., (2001) mentioned that consumers are willing to pay a higher price or premium for such green products.

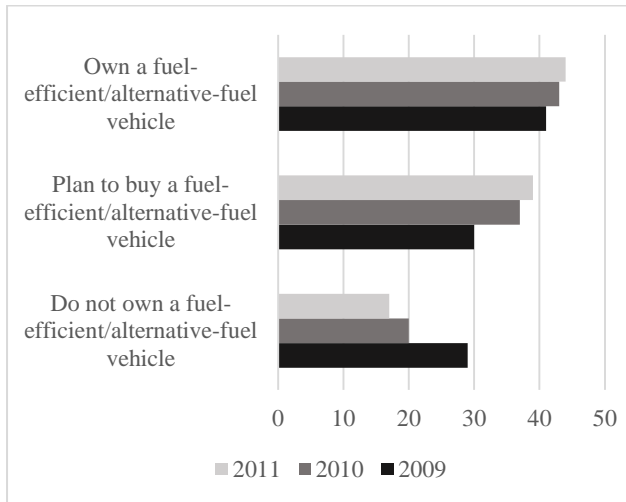


Fig. 2 Percentage increase in interest in Green Vehicles

Source - (Capgemini, 2011)

Environmentally friendly vehicles are said to be a solution to minimize the environmental impact in the current context. According to findings of Van Mierlo, et al., (2003), Electric vehicles causes the lowest environmental damage and the hybrid vehicles can be considered as 'clean'. Countries have taken measures to promote eco-friendly vehicles such as hybrid and electric vehicles for the consumers to reduce the emissions by road vehicles. There are different types of eco-friendly vehicles such as Hybrid cars, Electric cars, Bio diesel cars, Ethanol cars, Hydrogen powered cars. Hybrid cars can be categorised as Hybrid Electric Vehicles (HEVs) and Plug-In Hybrid Electric Vehicles (PHEVs) while Electric cars can be categorised as Battery Electric Vehicles (BEVs) and Fuel Cell Electric Vehicles (FCEVs).

Dijk, et al., (2013) uncovered that Toyota and Honda were the first to mass-produce low carbon emission vehicles with hybrid technology during 1997-2005 period. The success story was not smooth according to his studies. The Prius I with relatively lesser acceleration was launched to Japan market in 1997 and after capturing the market Prius II

with increased acceleration was introduced to California in 2000. With the rapid consumerism of the new technology in American market, Toyota started to roll out worldwide in 2004. Toyota and Honda launched their hybrid products as Prius and Insight in 1997 and 1998 respectively. Other car manufactures were reluctant to go for such technology at first, but after 2005 they started to invest for hybrid technology.

Bekker, (2019) states that the BEV sales increased drastically by a huge 74% in 2018 to 1.26 million of BEVs compared to 0.73 million of BEVs in 2017.

Karunanayake & Wanninayake, (2015) mentions that Sri Lankan vehicle market is introducing different varieties of eco-friendly vehicles ranging from mid-range Toyota hybrids to top-end luxuries like Porsche hybrids. Also states that Sri Lankans are "Risk Avers" people and are hesitating to embrace innovative technological products. But for vehicles with eco-friendly technology it was totally different and purchasers with high purchasing power as well as cost conscious purchasers lean towards purchasing eco-friendly vehicles.

In this regard, it is timely convenient to explore the factors influencing the intension of purchasing eco-friendly vehicles. These vehicles can be a significant solution for the increasing environmental impact due to conventional internal combustion vehicles. These vehicles emit zero or minimal amount of CO₂ to the environment and so that they play an important role in reducing the harmful emissions. As this sustainable, environmentally friendly technology can be very important to developing countries like Sri Lanka, the focus of this research is on understanding the factors influencing the consumer intention for

purchasing an eco-friendly vehicles among Sri Lankan consumers.

Colombo is the commercial capital and major economic centre in Sri Lanka. As most of the key activities take place around Colombo, it contributes a significantly high level of emissions to the atmosphere. So, it is timely convenient to study relating the solutions to mitigate this issue. Therefore, this study mainly concerns on the research problem of “what are the factors influencing consumer purchase intention for eco-friendly vehicles in Colombo district of Sri Lanka”.

As consumers always try to maximize their utility, there is a significant question whether they are more sensitive to cost or availability or any other attributes. Especially when it comes to Sri Lankan context, as there is only one publication in Sri Lanka regarding the same discipline as this study, there is not much empirical evidences to understand such determinants in Sri Lanka.

As mentioned by Karunanayake & Wanninayake, (2015) most of the previous researches were focused on environmental aspect and only itself is not sufficient enough to understand the behaviour of consumers towards purchasing eco-friendly vehicles. This study is realistic in nature as such area of knowledge is concerned when it comes to making a decision in purchasing a vehicle. Accordingly, this study is the only publication in Sri Lanka related to similar discipline and it has been done partly based on Theory of Reasoned Action (TRA). As the researcher has found that Theory of Planned Behaviour (TPB) was shown to be superior to the TRA for the prediction of target behaviour and TPB explains more variation in behavioural intention than the TRA regardless of the level of control (Madden, et al., 1992).

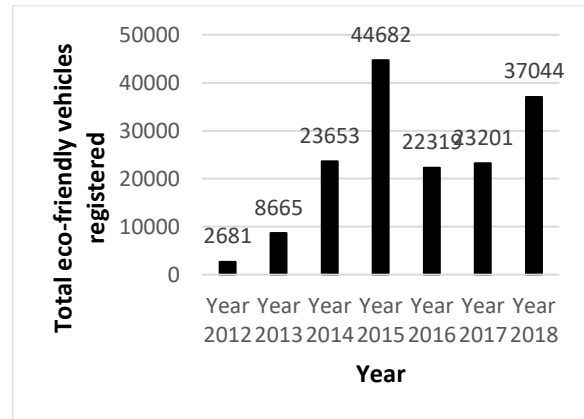


Fig. 3 Registration of Eco-Friendly Vehicles by Year (2012-2018)

Source - (Liyanage, 2019)

Fig. 3 shows the registration of eco-friendly vehicles in past seven years. The highest number of eco-friendly vehicle registrations can be seen in year 2015. Even though there is a massive growth between year 2012 and year 2015, an enormous decrease in registration of eco-friendly vehicles can be observed in year 2016. However, a significant increase in year 2018 is visible and so that there is an immense variation in the registration of eco-friendly vehicles. So that, it can be said that there is an empirical gap as well as a practical gap in the study area and researcher find it worthy to investigate.

This study endeavour to assess the factors influencing such discipline in the Sri Lankan context. This can be useful in encouraging people towards purchasing environmentally friendly vehicles replacing the conventional internal combustion vehicles. Consequently, these outcomes can be used in policy decision process towards the favour for the consumers such as tax concessions, dedicated parking and lane priorities etc. Understanding the consumer intention is important to policy decision makers as they are the responsible parties for long-term development of transportation sector as well as infrastructure. Also, it is influential for the car manufacturers to direct the industry towards a

more sustainable future. This study is significant to companies who market eco-friendly vehicles as well as the government and also it helps to encourage academics to further investigate on the same discipline.

The primary objectives of this paper is assessing the factors influencing the consumer purchase intention towards eco-friendly vehicles in Colombo district. Secondary Objectives are:

- Identifying how attitudes, influence the consumer purchase intention towards eco-friendly vehicles in Colombo district.
- Identifying how subjective norms, influence the consumer purchase intention towards eco-friendly vehicles in Colombo district.
- Identifying how perceived behavioural control, influence the consumer purchase intention towards eco-friendly vehicles in Colombo district.
- Identifying how personal moral norms, influence the consumer purchase intention towards eco-friendly vehicles in Colombo district.
- Identifying how demographics, influence the consumer purchase intention towards eco-friendly vehicles in Colombo district.

The following research questions are formulated to be answered through the study as means of achieving aforementioned objectives.

Question 01: What are the waste clearance approaches available for pharmaceutical industry in Sri Lanka?

Question 02: What are the positively and negatively correlated factors those will be affected to the waste disposal cost in pharmaceutical industry?

Explaining human behaviour is a complex and difficult task. As Kotler, (2000) mentioned, "Understanding consumer behaviour is never

simple, because customers may say one thing but do another". Consumer Purchasing Behaviour is considered to be a highly important research area. Many researches have been conducted to identify the factors influencing the consumer purchasing behaviour. Understanding such behaviour can be beneficial for successful marketers to study customers and uncover clues for developing new products, product features, prices, channels, messages and other marketing mix elements (Kotler, 2000). As described in stimulus response model, consumer's buying behaviour is influenced by cultural (culture, subculture, and social class), social (reference groups, family, and social roles and statuses), personal (age, stage in the life cycle, occupation, economic circumstances, lifestyle, personality, and self-concept), and psychological (motivation, perception, learning, beliefs, and attitudes) factors.

As per the writings of Kotler & Armstrong, (2014), buying behaviour differs greatly from product to product or service to service. There are types of Buying Decision Behaviour such as Complex buying behaviour, Dissonance-Reducing buying behaviour, Habitual buying behaviour, Variety seeking buying behaviour etc.

Prasad & Jha, (2014) has mentioned 10 models to help the marketers to understand various steps in the whole process of consumer decision making for final purchase of the products of their choices. Few of them are Andreason model, Nicosia model, Howard-Sheth model, Industrial buyer decision model etc and also has found that price, quality etc and attitude, perception, self-concept etc are taken into consideration during the processes.

The Theory of Reasoned Action (TRA) is a model which has been used extensively to predict the behavioural intentions and/or

behaviour (Madden, et al., 1992). The conceptual framework of research of Karunanayake & Wanninayake, (2015) has been developed partly based on this theoretical model.

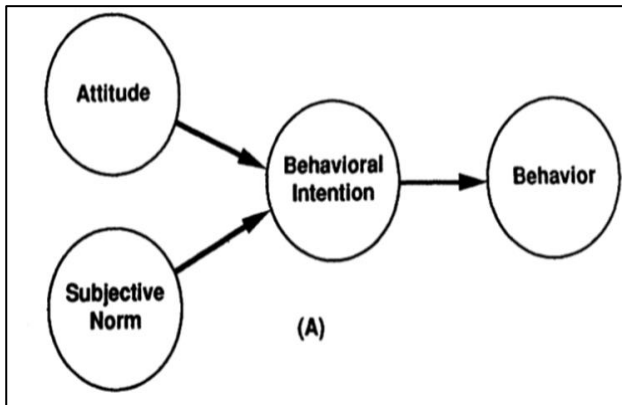


Fig. 4 Path model for Theory of Reasoned Action
Source - (Madden, et al., 1992)

Theory of Planned Behaviour (TPB) is one of the most commonly used theory in identifying the factors affecting purchase intention of the consumers. It is an extension of the “Theory of Reasoned Action” (TRA). According to TPB, it is a collective function of both intention and perceived behavioural control (Ajzen, 1991). Madden, et al., (1992) have concluded that TPB was shown to be superior to the TRA for the prediction of target behaviour and TPB explains more variation in behavioural intention than the TRA regardless of the level of control.

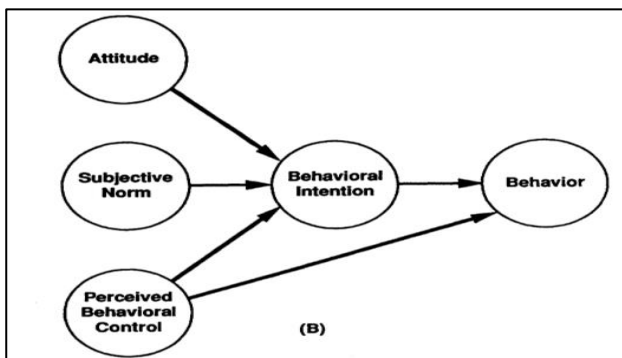


Fig. 5 Path model for Theory of Planned Behaviour
Source - (Madden, et al., 1992)

Selecting a vehicle is often a complex task with a high involvement process within it. TPB is a good model to understand the factors influencing the consumer purchase intention towards eco-friendly vehicles. Hong, et al., (2013) used decomposed TPB as a basis for investigating the factors influencing the adoption of eco-friendly vehicles. According to the study, the decomposed theory of planned behaviour acts as a good means of understanding factors influencing intention of a person to adopt innovative products such as attitude, subjective norm, and perceived behavioural control.

- **Attitude** - Attitude refers to the degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question (Ajzen, 1991). As of Henning & Karlsson, (2011), attitude generally describes ones like or dislike of a certain thing.
- **Subjective norm** - Ajzen, (1991) refers this as the perceived social pressure to perform or not to perform the behaviour. Hong, et al., (2013) states it is the “person’s perceptions that is people who are important to him think that he/she should or should not perform the behaviour in question”.
- **Perceived Behavioural Control** - Hong, et al., (2013) states this as factors that may impede the performance of the behaviour. It further describes that there are two aspects to this. The first one is individual’s self-confidence in his or her ability to perform a behaviour and the second one is facilitating conditions and it reflects the availability of resources needed to engage in the behaviour.
- **Personal moral norm** - Kaiser & Scheuthle, (2003) stated that the explanatory power, when determining intention of

individual to perform certain environmental-friendly behaviours, can be enhanced by personal feeling of moral responsibility or personal moral norm and also found that an individual's moral norm plays a significant role in predicting behavioural intention. In addition to the three primary elements in the TPB model, Wang, et al., (2016) has incorporated personal moral norm in order to develop and extended TPB model to predict the behavioural intention.

- Demographics and Intention to Adopt - Wu, et al., (2010) states that higher education, higher income and young consumers have a higher tendency to purchase hydrogen powered cars and Sanitthangkul, et al., (2012) mentions age, occupation and income significantly influence on decision to purchase eco-friendly cars

Karunanayake & Wanninayake, (2015) has conducted the first research on purchase intentions of Hybrid Vehicles in Sri Lanka and has considered variables such as consumers' environmental attitudes, price perception such as price of product and comparison of prices, perceived risks, social influence or subjective norms, and product knowledge.

Hong, et al., (2013) has used compatibility, pro-environmental, perceived behavioural control, demographics such as gender, income, education level, and age, attitudes and subjective norms in the study. Gupta, (2013) has found that influence of friends, family and relatives has a significant impact on the vehicle purchasing behaviour and also price of vehicle, fuel efficiency, powerful engines, brand image, re-sale value, after sales services also impacts the said behaviour. Performance, after sales services, safety are taken into consideration in the study of Aghdaie & Yousefi, (2011) for Iran market. Dongyan & Xuan, (2008) has taken performance, brand image, fuel consumption,

safety, re-sale value into consideration in the study for purchase behaviour in Beijing.

Knez, (2017) has considered that price of vehicle, maintenance/repair cost, warranty, fuel type, load space as factors affecting vehicle purchasing behaviour. Neizari, et al., (2017) and Krupa, et al., (2014) has also considered price of vehicle as a factor influencing the purchasing behaviour. Thiel, et al., (2012) state factors such as price of vehicle, safety features, performance, environmental considerations, automobile trends, recharge mileage and recharge time etc. influence the purchase behaviour. Wang, et al., (2017) has found that personal morals such as moral principle and responsibility towards environment are influenced in eco-vehicle purchasing behaviour.

Karunanayake & Wanninayake, (2015), Gupta, (2013), and Krupa, et al., (2014) have taken subjective norms such as influence of family, friends and colleagues as for the factors affecting the consumer purchase intention. Perceived behavioural factors such as tax incentives, sales incentives, and government fuel policies are taken into their studies by Hong, et al., (2013). And also factors such as automobile trends and tax incentives are taken by Thiel, et al., (2012) and Jayaraman, et al., (2015) respectively. Lai, et al., (2015) has taken variables such as cheap electricity and infrastructure readiness and Wang, et al., (2017) the cruising range for identifying purchase behaviour.

TABLE I
Summary of Supporting literatures

Factor	Supporting Literature Review
Price of vehicle	Karunanayake & Wanninayake (2015), Neizari, et al. (2017), Krupa, et al. (2014), Thiel, et al. (2012), Gupta (2013), Knez (2017)
Fuel Efficiency	Hong, et al. (2013), Krupa, et al. (2014), Gupta (2013), Hamamoto (2019)
After-Sales Services	Dongyan & Xuan (2008), Gupta (2013), Aghdaie & Yousefi (2011)
Maintenance/repair cost	Knez (2017)
Re-Sale Value	Hong, et al. (2013), Dongyan & Xuan (2008), Gupta (2013)
Brand Image	Karunanayake & Wanninayake (2015), Gupta (2013)
Safety Features	Thiel, et al. (2012), Dongyan & Xuan (2008), Knez (2017), Gupta (2013), Aghdaie & Yousefi (2011)
Design	Hamamoto (2019), Gupta (2013)
Performance	Krupa, et al. (2014), Thiel, et al. (2012), Gupta (2013), Knez (2017), Hamamoto (2019), Aghdaie & Yousefi (2011)
Environmental considerations	Karunanayake & Wanninayake (2015), Krupa, et al. (2014), Thiel, et al. (2012), Jayaraman, et al. (2015), Knez (2017)
Influence of family	Karunanayake & Wanninayake (2015), Krupa, et al. (2014), Gupta (2013)
Influence of friends	Karunanayake & Wanninayake (2015), Krupa, et al. (2014), Gupta (2013)
Influence of colleagues	Karunanayake & Wanninayake (2015), Krupa, et al. (2014), Gupta (2013)
Automobile trends	Thiel, et al. (2012)
Tax incentives	Hong, et al. (2013) Jayaraman, et al. (2015)
Sales incentives	Hong, et al. (2013)
Government Fuel Policies	Hong, et al. (2013)
Cheap electricity	Lai , et al. (2015)
Infrastructure readiness	Lai , et al. (2015)
Cruising range	Wang, et al. (2017)
Recharge mileage	Thiel, et al. (2012)
Recharge time	Thiel, et al. (2012)
Fuel type	Knez (2017)
Load space/Passenger capacity	Knez (2017)

Availability of Spare parts	Hong, et al. (2013)
Warranty	Knez (2017)
My moral principle	Wang, et al. (2016)
My responsibility towards environment	Wang, et al. (2016)

Research Methodology

This research takes the nature of a causal design which is also known as exploratory research. According to Dudovskiy, (2018) causal research is conducted in order to recognize the extent and nature of the cause-and-effect relationships. Causal researches are used for explanatory purposes and for prediction and testing of hypotheses which enables the researcher to forecast probable scenarios that would take place.

The main objective of the study is to assess the factors influencing consumer intention towards purchasing eco-friendly vehicles in Colombo district of Sri Lanka. Dependent variable of this

research is the intention to adopt eco-friendly vehicles while factors influencing the consumer intention towards purchasing such vehicles are considered as the independent variables of the study. Those independent variables are supported by research articles as mentioned above in table 1

The conceptual framework is developed based on the theory of planned behaviour as described by Ajzen, (1991). Further extensions are included according to the decomposed theory of planned behaviour of Hong, et al., (2013) and personal moral norm incorporated model of Wang, et al., (2016). The conceptual framework of is study is as shown in the Fig. 6 below

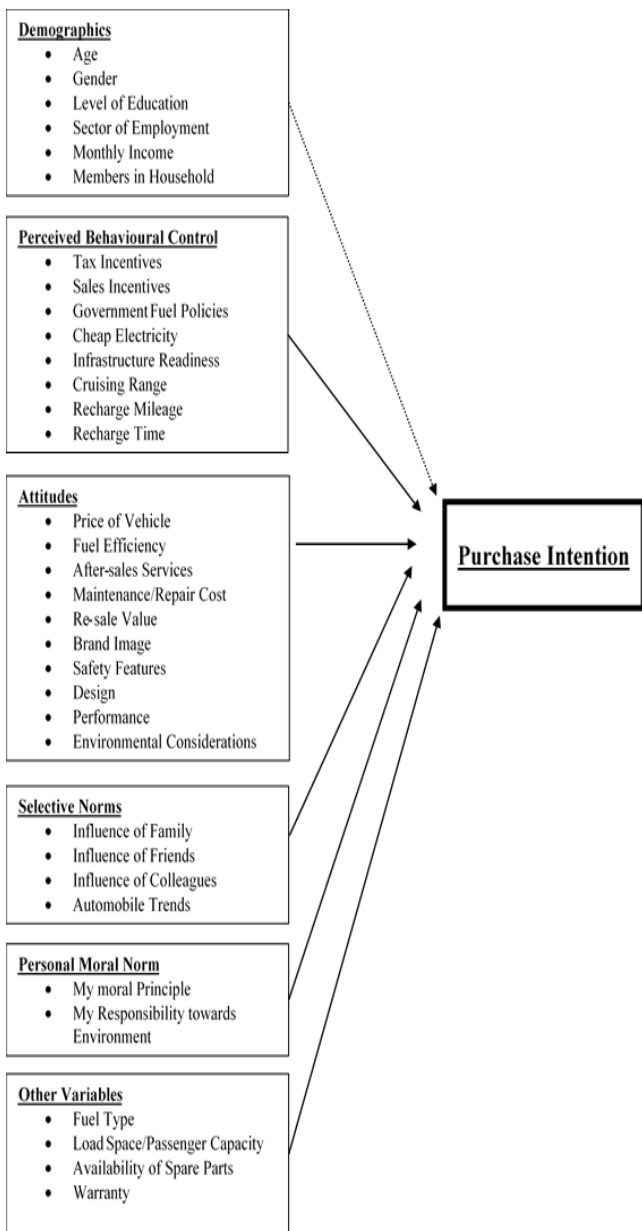


Fig. 6 Conceptual Framework

The primary data was collected through distribution of an online questionnaire. Questionnaire was distributed through Google Forms and hard copies were given out among random car purchasers. In order to test the validity and reliability, a pilot survey was conducted by distribution of the questionnaire survey to 100 respondents. The Cronbach's Alpha was calculated to find the reliability of data collected from the pilot survey to statistically verify the validity and reliability of the questionnaire and the alpha coefficient was in the excellently acceptable range which permitted the questionnaire to be used in the main survey.

Primary Data Set

The research is based on primary data collected through the questionnaire survey which was distributed among 262 respondents. Once the pilot survey confirmed the validation of the questionnaire, the final survey was initiated.

Secondary Data

Secondary data was mostly used for the conceptualization of the study and they were

gathered from sources such as journals, scholarly articles, peer reviewed various articles, credible publications, reports and web pages etc. These secondary data were also supportive in determining sample size, sampling methods, development of conceptual framework and questionnaire, scaling and analysing data as well.

Validity and Reliability

Cronbach's Alpha is used in statistics to measure the internal consistency/ reliability which is utmost commonly used to verify the reliability of the scale in a multiple Likert-Scale questionnaire. Higher rate of Alpha coefficient is measured as questionnaire being further reliable to collect the primary data related to the survey. Conventionally, it is recognized that Cronbach's alpha coefficient requires 0.70 or higher to be reliable. Following (01) is the equation for calculating total Cronbach's Alpha coefficient. The reliability test using Cronbach's Alpha coefficient has been carried out in this study to check the reliability of the pilot and main surveys.

$$\alpha = \frac{N * \bar{c}}{\bar{v} + (N-1) * \bar{c}} \dots\dots\dots (01)$$

- α = Cronbach's Alpha value
- N = Number of items
- \bar{c} = Average inter-item covariance between the items
- \bar{v} = Equal to average variance

Statistical Methods of Data Analysis

Data collected through the questionnaire survey were fed into SPSS 16.0 (a statistical software tool) in order to generate a broad analysis of the dissertation which is discussed below in next section. Following statistical data analysis methods were used in analysing the data set obtained.

Descriptive Analysis

Descriptive statistics are used in order to describe the fundamental features of the data in the study while providing summaries about the considered sample and the measures which were taken for the study and also it summarizes the distribution of the responses. Level or the nature of the collected data has been identified by using the descriptive statistics. This can be categorized into two parts as measures of central tendency such as mean, median, and mode and measures of variability such as standard deviation, variance, the minimum and maximum variables, and the kurtosis and skewness.

Cross Tabulation

Cross Tabulation is used to understand the patterns in different categorical variables in the study. It is also used to analyse the relationships within data which may not be readily evident. The Chi-Square is used to evaluate Tests of Independence when using a cross tabulation.

Factor Analysis

Factor analysis is a technique which is used to reduce the large number of variables in the study into lesser number of factors. It enables to group variables with similar characteristics together. This analysis is used to group the variables which is taken additionally to the theoretical model.

Correlation Analysis

Correlation analysis is a statistical evaluation method used to study the strength of relationship between two or more variables. The variables are said to be associated with each other when the movement of one variable is co-occur with the movement of another.

Regression Analysis

Regression analysis is done to describe the relationship between the independent variables

and the dependent variable. It produces a regression model where the coefficients represent the relationship between each variable and the dependent variable and also the predictions can be made using this model. Multiple Linear Regression Analysis is carried since there are more than one independent variable.

Results and Discussion

Cross Tabulation Analysis

According to the results of the Cross-Tabulation analysis gender biasness is not clearly visible towards intention to adopt eco-friendly vehicles while similar proportions from each age category have agreed to have the intention to adopt them. Respondents who are with bachelors and master’s degree have high tendency towards adopting eco-friendly vehicles.

Independent Sample t-test and One-Way ANOVA for Demographics

The level of education has found to be having an influence on the intention to adopt eco-friendly vehicles with ANOVA. According to the probabilities, A/L, degree, masters and doctorate qualifications are having insignificant P values. Therefore, they do not have any difference with regard to intention to adopt eco-friendly vehicles. Other educational qualifications, diploma and undergraduate are having significant differences. Descriptive statistics are applied to identify these differences. Wang, et al., (2016) also has discovered that the ones whose education level is high are more likely to adopt Hybrid Electric Vehicles and it supports the finding of the author. According to descriptive statistics, ones who hold bachelor’s and masters are having higher mean values for intention to adopt eco-friendly vehicles. Therefore, those who are

having such educational qualifications have higher intention to adopt eco-friendly vehicles

Factor Analysis

This study is based on a theoretical model and the author has taken few other variables into consideration. The factor analysis is done in order to group these additional variables into meaningful factors.

TABLE II
KMO and Bartlett’s Test Results

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.876
Bartlett's Test of Sphericity	Approx. Chi-Square	936.156
	df	6
	Sig.	.000

According to the Table 4.2, KMO value is 0.876 which is higher than the acceptable adequacy rate of 0.5. It indicates that the factor analysis can be useful with the data

The Bartlett’s test shows a highly significant value of 0.000 which is significant at alpha=0.001. Therefore, null hypothesis (H0) can be rejected. Correlation metrics is not an identity matrix and it can be concluded that there is a significant correlation between variables which has been used in factor analysis.

TABLE III
Communalities Test Results

	Initial	Extraction
Availability of Spare parts	1.000	.897
Fuel type	1.000	.865
Load space/passenger capacity	1.000	.904
Warranty period	1.000	.894

Extraction Method: Principal Component Analysis.

The output of the communalities test shows the proportion of variance in each variable that can be explained by the factors. All the variables have an extraction value above 50% and the highest extraction value is in the “load space/passenger capacity” which is 90.4%.

TABLE IV
Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.559	88.978	88.978	3.559	88.978	88.978
2	.182	4.546	93.524			
3	.137	3.426	96.946			
4	.122	3.054	100.000			

Extraction Method: Principal Component Analysis

The total variance table shows the eigenvalues, percentage of variance, and cumulative percentage of variance of each factor or component that can be extracted from the analysis. The analysis has extracted one component that explain 88.978% of the total variance.

TABLE V
Component Score Coefficient Matrix

	Component
	1
Availability of Spare parts	.266
Fuel type	.261
Load space/passenger capacity	.267
Warranty period	.266

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization
Component Scores.

Factor A (Supplementary)=(0.266×Availability of Spare parts)+(0.261×Fuel Type)+(0.267×Load space or passenger capacity)+(0.266×Warranty Period)

Reliability Analysis

TABLE III
Summary of results of Reliability Analysis

Factor	Cronbach's Alpha	No. of Items
Attitudes	.980	10
Perceived Behavioural Control	.980	09
Subjective Norm	.911	04
Personal Moral Norm	.943	02
Supplementary	.958	04

There is an excellent internal consistency as the Cronbach's Alpha values of all factors are more than 0.9. According to the reliability analysis, all the variables are having Cronbach's Alpha values more than 0.6 and it indicates that there is an internal consistency between the items. Therefore, variables can be created with respect to the corresponding items included in the questionnaire.

Descriptive Analysis

Using Mahalanobis Distance statistics researcher removed 11 outliers. According to CDF Chi-Square outliers have been detected and they have been removed. Mahalanobis probability less than 0.001 have been identified. After that objectives have been addressed.

TABLEVII Descriptive Statistics

	Attitude	Perceived Behavioural Control	Subjective Norms	Personal Moral Norm	Supplementary	Intension to adopt eco-friendly vehicle
N Valid	210	210	210	210	210	210
Missing	0	0	0	0	0	0
Mean	3.9360	3.8352	3.1536	3.7296	3.8568	4.07
Std. Deviation	1.15695	1.16899	1.00622	1.21981	1.18742	.883
Skewness	-1.855	-1.511	-.515	-1.204	-1.545	-1.435
Std. Error of Skewness	.168	.168	.168	.168	.168	.168
Kurtosis	2.041	1.261	-.437	.485	1.225	3.057
Std. Error of Kurtosis	.334	.334	.334	.334	.334	.334

According to descriptive Statistics, all the independent factors are in agree level. This is because mean values are closer to 4 in the Likert Scale and it indicates that these variables are in the agree level in the organization. Highest standard deviation belongs to Personal Moral Norm as the highest standard deviation is 1.21981. Minimum variance belongs to Subjective Norms as the minimum standard deviation is 1.00622. All the coefficients of skewness are between -3 and +3. This says that data are normally distributed **Invalid source specified..**

Correlation Analysis

The association between the dependent variable and the identified five factors is tested by the Pearson Correlation Analysis and the below hypotheses are tested.

H0: There is no association between intention to adopt EFV and ith factor

H1: There is an association between intention to adopt EFV and ith factor

$i = \{\text{Attitudes, Perceived Behavioural Control, Subjective Norms, Personal Moral Norm, Supplementary variables}\}$

TABLE VIII
Correlation Analysis Results

		Intension to adopt eco-friendly vehicle
Attitude	Pearson Correlation	.152*
	Sig. (2-tailed)	.027
	N	210
Perceived Behavioural Control	Pearson Correlation	.162*
	Sig. (2-tailed)	.019
	N	210
Subjective Norms	Pearson Correlation	.099
	Sig. (2-tailed)	.154
	N	210
Personal Moral Norm	Pearson Correlation	.186**
	Sig. (2-tailed)	.007
	N	210
Supplementary	Pearson Correlation	.103
	Sig. (2-tailed)	.137
	N	210

According to the correlation analysis, probability of the association between intention to adopt eco-friendly vehicles and Attitude factor is 0.027. Therefore, the result is highly significant at 5% and hence the null hypothesis (H₀) is rejected.

Coefficient of correlation is) is rejected. Coefficient of correlation is 0.152 and as the value is positive and between 0 and 0.5, it can be said that there is a significant weak positive association between intention to adopt eco-friendly vehicles and Attitude

Furthermore, probability of the association between intention to adopt eco-friendly vehicles and Perceived Behavioural Control factor is 0.019. Therefore, the result is highly significant at 5% and hence the null hypothesis (H₀) is rejected. Coefficient of correlation is 0.162 and as the value is positive and between 0 and 0.5, it can be said that there is a significant weak positive association between intention to adopt eco-friendly vehicles and Perceived Behavioural Control.

However, probability of the association between intention to adopt eco-friendly vehicles and Subjective Norms factor is 0.154. Therefore, the result is insignificant and hence the null hypothesis (H₀) can be retained. There is no significant association between intention to adopt eco-friendly vehicles and Subjective Norms.

Same time, probability of the association between intention to adopt eco-friendly vehicles and Personal Moral Norm factor is 0.007. Therefore, the result is highly significant at 1% and hence the null hypothesis (H₀) is rejected. Coefficient of correlation is 0.186 and as the value is positive and between 0 and 0.5, it can be said that there is a significant weak positive association between intention to adopt eco-friendly vehicles and Personal Moral Norm.

Finally, probability of the association between intention to adopt eco-friendly vehicles and Supplementary factor is 0.137. Therefore, the result is insignificant and hence the null

hypothesis (H0) can be retained. There is no significant association between intention to adopt eco-friendly vehicles and Supplementary factor.

Regression Analysis

TABLE IX
MODEL SUMMARY

According to the model summary multiple

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.268a	.072	.049	.861	1.782

a. Predictors: (Constant), Supplementary, Subjective Norms, Personal Moral Norm, Perceived Behavioural Control, Attitude

b. Dependent Variable: Intension to adopt eco-friendly vehicle

correlation is 0.268. This means that individual factors are having weak association jointly with intention to adopt eco-friendly vehicles. Durbin-Watson test statistics is 1.782 and it is between the expected standard values of 1.5 to 2.5 and therefore residuals are independent, and model is appropriate. Jointly effect of individual factors has been analysed by Regression ANOVA result is provided by Table 4.29 below.

Proportion of dependent variable is covered by regression model is explained by the R Square value. If the R Square value is equal or more

than 0.6, that model is nicely fitted. According to Table 4.28, the R Square value is 0.072. Even though this value is less than that of the required value, the regression model is valid as the ANOVA result is significant.

TABLE X
Regression ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	11.673	5	2.335	3.146	.009a
Residual	151.394	204	.742		
Total	163.067	209			

a. Predictors: (Constant), Supplementary, Subjective Norms, Personal Moral Norm, Perceived Behavioural Control, Attitude

b. Dependent Variable: Intension to adopt eco-friendly vehicle

In the regression ANOVA, probability of F-test statistics is 0.009. This is highly significant at 1% and it deems that individual factors jointly influence on intention to adopt eco-friendly vehicles. Individual effect has been analysed by individual Coefficient and result are given by Table 4.30.

Probability of F-test statistics of the regression ANOVA is highly significant, and it means that the model is jointly significant. Therefore independent factors jointly on intention to adopt eco-friendly vehicles.

TABLE XI
Table of Coefficient

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	3.582	.222		16.136	.000		
Attitude	.124	.139	.162	.889	.375	.136	7.329
Perceived Behavioural Control	.190	.122	.252	1.555	.121	.174	5.760
Subjective Norms	-.012	.087	-.013	-.135	.893	.460	2.175
Personal Moral Norm	.262	.111	.362	2.359	.019	.193	5.185
Supplementary	-.434	.158	-.584	-2.741	.007	.100	9.957

a. Dependent Variable: Intension to adopt eco-friendly vehicle

Probabilities of personal moral norm factor and supplementary factor are highly significant with positive beta value and negative beta value respectively. This says that the personal moral norm influences positively, and supplementary factor influence negatively on intention to adopt eco-friendly vehicles. Attitude factor, perceived behavioural control factor and subjective norms are individually insignificant as the P values are more than 5%. Hence, it can be deemed that they influence individually, but they influence jointly.

Following Linear Regression Model can be built based on the above table.

$$Y = 3.582 + 0.124X_1 + 0.190X_2 - 0.012X_3 + 0.262X_4 - 0.434X_5$$

Y = Intention to adopt eco-friendly vehicles

X1 = Attitude Factor

X2 = Perceived Behavioural Control Factor

X3 = Subjective Norms Factor

X4 = Personal Moral Norm Factor

X5 = Supplementary Factor

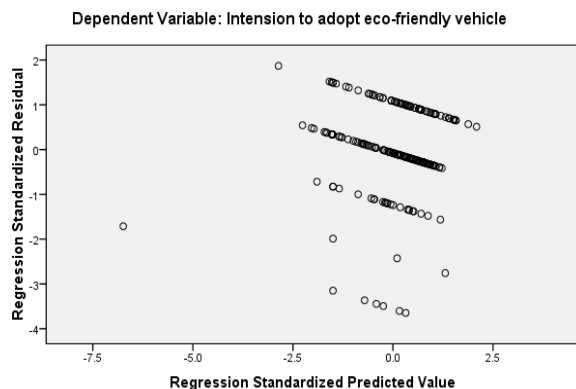
Researcher concludes that intention to adopt eco-friendly vehicles is expected to increase by 0.124, if the attitude increase by 1. Intention to adopt eco-friendly vehicles is expected to increase by 0.190, if the perceived behavioural control increase by 1. Intention to adopt eco-friendly vehicles is expected to decrease by 0.012, if the subjective norms increase by 1.

Intention to adopt eco-friendly vehicles is moral norm increase by 1. Intention to adopt eco-friendly vehicles is expected to decrease by 0.434, if the supplementary factor increase by 1.

Diagnostic tests for regression results

Residuals are tested as diagnostic test to decide the validity of regression results. In the model summary, Durbin-Watson test statistic is 1.782 and it is very close to 2 and in between 1.5 to 2.5. Therefore, residuals are independent, and model is valid. As all the Variation Inflation Factors (VIF) are less than 10, it indicates that independent factors are not highly correlated. Therefore, there is no multicollinearity problem in the regression model. Also, the Tolerance values in each factor are more than 0.1, it can be said that there is no multicollinearity problem in the model. So, it can be concluded that the regression model is highly valid.

TABLE IV
Scatterplot



In the scatterplot, standardized residuals are plotted against standardized predicted values. Residuals are distributed in a systematic pattern. This indicates that there is a pattern between the residuals and the dependent variable. That means there is a heteroscedasticity problem. So, the author has concluded that there are

expected to increase by 0.262, if the personal additional variables that has not been considered in the study.

Hypothesis Testing

Hypothesis testing is done for the five factors in order to check how the independent variables effect on the dependent variable of “intention to adopt eco-friendly vehicles”.

H0: There is no significant impact by ith factor on intention to adopt eco-friendly vehicles

H1: There is a significant impact by ith factor on intention to adopt eco-friendly vehicles

- Attitude

According to the table of coefficients of regression analysis, the significant value of attitudes is 0.375 which is higher than 0.05 ($P > 0.05$). Then the null hypothesis (H0) is not rejected. That means the attitude has no influence on the intention to adopt eco-friendly vehicles.

- Perceived Behavioural Control

According to the table of coefficients of regression analysis, the significant value of perceived behavioural control is 0.121 which is higher than 0.05 ($P > 0.05$). Then the null hypothesis (H0) is not rejected. That means the perceived behavioural control has no influence on the intention to adopt eco-friendly vehicles.

- Subjective Norms

According to the table of coefficients of regression analysis, the significant value of subjective norms is 0.460 which is higher than 0.05 ($P > 0.05$). Then the null hypothesis (H0) is not rejected. That means the subjective norms has no influence on the intention to adopt eco-friendly vehicles.

- Personal Moral Norms

According to the table of coefficients of regression analysis, the significant value of personal moral norms is 0.019 which is higher than 0.05 ($P < 0.05$). Then the alternative hypothesis (H1) is accepted and null hypothesis is rejected. That means the personal moral norm has an influence on the intention to adopt eco-friendly vehicles.

- Supplementary Factor

According to the table of coefficients of regression analysis, the significant value of supplementary factor is 0.007 which is higher than 0.05 ($P < 0.05$). Then the alternative hypothesis (H1) is accepted and null hypothesis is rejected. That means the supplementary factor has an influence on the intention to adopt eco-friendly vehicles.

Discussion and Conclusions

The researcher concludes that attitude, perceived behavioural control and subjective norms has no influence individually on the intention to adopt eco-friendly vehicles while personal moral norm and supplementary factor influences on the intention to adopt eco-friendly vehicles. It indicates that intention to adopt eco-friendly vehicles does not get influenced by attitude, perceived behavioural control and subjective norms.

TABLE V
Summary of Findings of the study

	P Value	Acceptance or Rejection
Attitude	0.375	Rejected
Perceived Behavioural Control	0.121	Rejected
Subjective Norms	0.460	Rejected
Personal Moral Norm	0.019	Accepted
Supplementary	0.007	Accepted

54% of the useable responses represents the male category while 46% represents female category. 18-25 age group represents 51% of the sample while the age category of 26-35 represents 45% of the sample. These age groups are very important for a more accurate result as the research also focuses on the ones who has the intention to adopt eco-friendly vehicles in near future. The other age group of 36-45 accounts for only 5% of the sample.

Furthermore, one of the key findings of this study is that Toyota, BMW and Honda are in the topmost preferred brand of vehicle in the Sri Lankan vehicle market. 63% of the sample use vehicle for the purpose of personal travel 36% of the considered sample use vehicle for both personal travel as well as for business purposes. Most of the people are price conscious rather than quality as Sri Lanka is still in the developing phase. 80.5% of the useable responses mentioned that price is either important or very important factor which

influence the consumer intention towards purchasing of eco-friendly vehicles.

The outcome of the study can be used as a basis to suggest ways to promote eco-friendly vehicles and to provide recommendations. The foremost recommendation is to reduce the taxes imposed or provide tax incentives on eco-friendly vehicle importation to Sri Lanka. The prices of these vehicles should be comparatively very low in order to encourage the people in purchasing such vehicles. So, with respect to that, the taxes should be reduced to maximum extent possible. Also, life cycle cost of these vehicles is very high due to high maintenance/repair cost which people consider that as a pessimistic factor to reject purchasing eco-friendly vehicles. Reduction of taxes can be identified as a solution for this also.

Current trend is for either necessities or luxuries irrespective of ecology. The awareness of importance among the people about the eco-concepts should be highly considered and they should be encouraged to use eco-friendly products like these eco-friendly vehicles. Also, the potential purchasers should be encouraged to purchase this kind of vehicles. Low interest vehicle loans, easy payment plans for eco-friendly vehicles can also be recommended. Benefits like priorities in parking, parking free of charge can also be provided to encourage eco-friendly vehicles.

The infrastructure support should be provided in order to increase the usage of eco-friendly vehicles. Increasing and improvements in charging infrastructure can be recommended. The number of charging stations in urban areas and especially in outstations should be expanded. Also, the maintenance facilities should be enhanced. Availability of spare parts is also another factor that influences the eco-friendly vehicles. So, the availability of them

should be increased and the parts should be readily available at affordable prices. Safety features should be increased, enhanced and improved.

Few modifications in the vehicle is also can be recommended. The efficiency of the vehicles has to be enhanced in order to attract more purchasers. Charging times of these vehicles are significantly high. Increasing battery capacity and embedding fast charging technologies can be identified as recommendations for this issue. The PHEVs should be improved further, and also eco-technologies can also be developed for heavy vehicles.

However, even though it is considered that the eco-friendly vehicles as a sustainable solution for the environmental crisis, there are few major concerns that should be taken care of. One of the major sources of generating electricity is by combustion of coal which is another a major environmental crisis. And also, the disposal of batteries is another major concerning area. Electricity generation and the disposal of batteries should be eco-friendly and properly managed. Usage of eco-friendly fuel can be taken as an alternative for power generation.

Declarations

Study Limitations

Data from a simple random sampling method will help to obtain a more accurate model. Lack of a proper database of the eco-friendly vehicle purchasers, restricted the researcher using random sampling techniques to collect primary data. As there is a limitation, researcher has chosen snowball sampling technique to gather data. There is a tendency to have more outliers in snowball sampling technique due to the nature of it. Also, the time frame for the data collection is inadequate as the sampling technique is snowball sampling. Dudovskiy,

(2018) has also mentioned that, oversampling a particular network of peers in snowball sampling, can lead to biasness. Hence, the data collection has been a difficult task and a proper and more accurate model is not constructed due to these limitations.

The study initially used 28 variables that might influence the consumer intention towards purchasing of eco-friendly vehicles with the support of literatures. However, there might be numerous more other factors which are not considered in the study, especially the factors which are more specific in Sri Lankan context. Future research can also focus on those particular factors.

Also, there is a pattern between the residuals and the dependent variable. That means there is a heteroscedastic problem. The author has concluded that there are additional variables that has not been considered in the study. That is a limitation to this study and the future research can take these additional variables into consideration and expand the study further.

Furthermore, the area of scope considered under the study is the Colombo district of Sri Lanka. However, the people resided in other districts might possess different factors that influence the consumer intention towards purchasing of eco-friendly vehicles. Hence, the future research can address and overcome these limitations in order to get more holistic picture of the study.

Acknowledgements

This note of acknowledgement is to convey my heartfelt thanks and deepest appreciation to all those who helped me in numerous ways throughout this time period. Firstly, I would also convey my gratitude to Mr. A.M.C.P. Atapattu and Ms. Rashika Mudunkotuwa for providing valuable advice and guidance.

Next, I extend my thanks to the Department of Logistics and Transport, CINEC Campus and all its academic staff members and non-academic staff members for the tremendous service rendered throughout.

Also, I must gratify to Ms. N.B.V.K. De Silva – English teacher at Sri Sumana Maha Vidyalaya, Ratnapura, Ms. Nadeera Karawita - Co-Founder at InnoLabs (Pvt) Ltd., Mr. A.T. Ranasinghearachchi – Management Assistant at Development Branch of Department of Motor Traffic, Mr. Jayasampath Liyanage – Senior Statistician at Statistical Branch of Department of Motor Traffic and staff of Department of Motor Traffic.

A special thanks goes to all the respondents for taking the time to assist me in my educational endeavours by completing the questionnaires with enthusiasm.

Last but not least, I would like to give my heartfelt thanks to my family members and friends for their support and guidance throughout the study.

References

- 1) Aghdaie, S. F. A. & Yousefi, E., 2011. The Comparative Analysis of Affecting Factors on Purchasing Domestic and Imported Cars in Iran Market - Using AHP Technique. *International Journal of Marketing Studies*, 3(2), pp. 142-150.
- 2) Ajzen, I., 1991. The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, Volume 50, pp. 179-211.
- 3) Capgemini, 2011. *Cars Online* 11/12, s.l.: Capgemini.
- 4) Department of Motor Traffic, 2018. Gas Emission Test. [Online] Available at: http://www.transport.gov.lk/web/index.php?option=com_content&view=article&id=26&Itemid

=146&lang=en#gas-emission-test [Accessed 10 June 2019].

5) Dongyan, L. & Xuan, B., 2008. Car Purchasing Behaviour in Beijing: An Empirical Investigation. Umeå School of Business and Economics, University of Umeå , p. 71.

6) Gupta, S., 2013. A Study of Buying Decision Influencers for Passenger Car Segment in New Delhi. *International Journal of Business and Management Invention* , 2(12), pp. 64-71.

7) Hamamoto, M., 2019. An empirical study on the behavior of hybrid-electric vehicle purchasers. *Energy Policy*, Volume 125, pp. 286-292.

8) Hong, Y. H., Khan, N. & Abdullah, M. M., 2013. The Determinants of Hybrid Vehicle Adoption: Malaysia Perspective. *Australian Journal of Basic and Applied Sciences*, 7(8), pp. 347-454.

9) IEA, 2018. CO₂ Emissions from Fuel Combustion Highlights, s.l.: IEA Publications.

10) International Energy Agency , 2021. Data and Statistics. [Online] Available at: <https://www.iea.org/data-and-statistics?country=WORLD&fuel=CO2%20emissions&indicator=CO2BySector>

[Accessed 14 03 2021].

11) Jayaraman, K., Yun, W. W., Seo, Y. W. & Joo, H. Y., 2015. Customers' reflections on the intention to purchase hybrid cars: an empirical study from Malaysia. *Problems and Perspectives in Management*, 13(2), pp. 304-312.

12) Karunanayake, R. T. & Wanninayake, W. B., 2015. Impact of Key Purchasing Determinants on Purchase Intention of Hybrid Vehicle Brands in Sri Lanka, an Empirical Study. *Journal of Marketing Management*, 3(1), pp. 40-52.

13) Knez, M., 2017. Sustainable transport, electric vehicle promotional policies, and factors influencing the purchasing decisions of

electric vehicles: A case of Slovenia. *Electric Vehicles: Prospects and Challenges*, pp. 207-244.

14) Krupa, J. S. et al., 2014. Analysis of a consumer survey on plug-in hybrid electric vehicles. *Transportation Research Part A*, Volume 64, pp. 14-31.

15) Lai , I. K. W. et al., 2015. Factors Influencing the Behavioural Intention towards Full Electric Vehicles: An Empirical Study in Macau. *Sustainability*, Volume 7, pp. 12564-12585

16) Liyanage, J., 2019. Senior Statistician at Statistical Branch of Department of Motor Traffic, Sri Lanka [Interview] (20 August 2019).

17) Madden, T. J., Ellen, P. S. & Ajzen, I., 1992. A Comparison of the Theory of Planned Behavior and the Theory of Reasoned Action. *Personality and Social Psychology Bulletin*, 18(01), pp. 3-9.

18) Neizari, M. M., Nikandish, A. & Samadi , B., 2017. A Study on Hybrid Car Purchasing Intention. *International Journal of Business and Social Science*, 8(12), pp. 46-56.

19) Thiel, C. et al., 2012. Attitude of European car drivers towards electric vehicles: a survey. *JRC Scientific and Policy Reports*, pp. 1-28.

20) Wang, S., Yang, S. & Fan, J., 2016. Predicting consumers' intention to adopt hybrid electric vehicles: using an extended version of the theory of planned behaviour model. *Transportation*, Volume 43, pp. 123-143.

21) Wang, Z., Zhao, . C., Yin, J. & Zhang, B., 2017. Purchasing intentions of Chinese citizens on new energy vehicles: How should one respond to current preferential policy?. *Journal of Cleaner Production*, Volume 161, pp. 1000-1010.