

LEVEL 7 ASSESSMENT SPECIFICATION

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PILOT STUDY IN PREDICTING THE INTENTION OF CONSUMERS TOWARDS ELECTRIC VEHICLES IN HONG KONG WITH THE EXTENDED THEORY OF PLANNED BEHAVIOR APPROACH

1. Introduction

The objective of this study is to examine the factors affecting the intention of consumers towards electric vehicles in Hong Kong. Environmental issues are now threatening the life of human, consumers' behavior has been influenced by the environmental concerns (Jang et al., 2015). As climate problems are critical importance issues, there is a perspective that electric vehicles will become the substitute for the conventional vehicles, however, are the customers willing to change over to the electric vehicle? Since electric vehicles produce less carbon emissions, people with higher concern about the environment will have more intention to buy electric vehicles (Kahn, 2007; Bockarjova and Steg, 2014). Environmental concern becomes significant in consumer behavior (Kang and Park, 2011). Nevertheless, the high cost of battery and inadequate charging facilities will lower the consumers' intention towards electric vehicles (Schuitema et al. 2013; Diamond, 2009; Hidrue et al. 2011). Some studies indicate that Hybrid electric vehicles would be a more favorable alternative than the full electric vehicles (Potoglou and Kanaroglou, 2007; Erdern et al. 2010; Achtnicht 2012).

The research questions of this pilot study are:

1. What are the factors affecting the consumers' intention towards electric vehicles?
2. What is the relationship between the factors?

There are various factors affecting consumers' purchasing behavior. A pilot study has been carried out in order to analyze the factors influencing consumer behavior. A number of researchers have employed the Theory of Planned Behavior (TPB) to investigate the consumers' behavior in electric vehicles (Wang et al., 2014; Moons and Pelsmacker, 2015; Zhang et al., 2018). In this study, a conceptual model and the questionnaire is to be developed based on the extended theory of planned behavior. Besides the basic elements (consumers' attitude, subjective norm, and perceived behavioral control), extended elements environmental concern and moral consciousness will be examined simultaneously. The constructs will be tested to see the degree of association among them. The outcome will show the significance of the association between the constructs.

2. Literature Review

2.1 *Extended Theory of Planned Behavior*

In order to understand the concept of consumer behavior, most researchers will use the Theory of Planned Behavior (TPB). There are three basic aspects that influence the consumer behavior, including the attitude towards the behavior, subjective norm, and perceived behavioral control. All of these lead to a Behavior Intention which may eventually turn out into a behavior change (Ajzen, 1991). The Theory of Planned Behavior is extensively used to study the behavioral intention and the behavior. For example, TPB has been used to analyze the environmental attitude and ecological behavior (Kaiser et al., 1999); explore consumers' behavioral intention to hybrid electric vehicles and the use of public transport (Bamberg et al. 2007; Wang et al. 2014; Moons and Pelsmacker 2015).

Besides, some studies indicate that the Technology Acceptance Model (TAM) is a suitable model when studying consumers' attitude towards electric vehicles. Since electric vehicle is a new kind of technology, TAM explores that consumers' behavioral intention to use a particular technology, which is determined by the attitude, which is consistence with the Theory of Planned Behavior (Davis, 1989). Venkatesh (2000) also claims that TAM is suitable in evaluating the intention towards electric vehicles. Technology Acceptance Model (TAM) explains the acceptance of this technology by consumers. There are two determinants from the TAM, perceived usefulness and perceived ease of use. Perceived usefulness indicates that people need to see that technology is useful and it can do what they need. People may have more intention to use the new technology if it is useful at the moment and in the future. Perceived ease of use is people's perception that consumers feel confident to use the kind of technology (Davis, 1989). In spite of this, Bagozzi (2007) argues that there is a limitation in using TAM. Social aspects are not involved in the TAM model which can have an extensive impact. According to the above limitation, this pilot study will perform mainly based on the Theory of Planned Behavior (TPB) while extended elements will be incorporated into the conceptual model.

2.1.1 *Attitude towards behavior (AT)*

In the TPB model, attitude represents a person's positive or negative thoughts concerning the performance of the behavior which is influenced by behavioral beliefs and the outcome evaluation. Attitude towards the behavior relates to how people generally think and feels about the behavior, whether it is a positive or negative contribution to their own behavior. While attitude is a factor that may affect the consumers' intention towards electric vehicles, various studies indicated that the attitude is significant in behavioral intention (Kang et al. 2006; Dickinger and Kleijnen 2008). A

research was conducted and the result shows that the more positive attitude consumers have a stronger intention to perform certain behavior (Beck and Ajzen, 1991).

2.1.2 Subjective Norm (SN)

Subjective norm is the degree to which the person feels social pressure to perform the behavior, which is predicted by normative beliefs and motivation to comply. Subjective norm mainly focuses on everything around the individual, see how's everyone is doing, such as the social network, cultural norm, group belief, and how the campaign is supported, especially if someone who is important to the individual, the degree of social pressure would be higher (Ajzen, 1991). Individuals may think that they should behave that same way as people around them. Previous researches provide evidence that there is a positive relationship between subjective norm and behavioral intention (Abou-Zeid and Ben-Akiva, 2011; Castanier et al., 2013).

2.1.3 Perceived Behavioral Control (BC)

Perceived behavior control expresses a person's belief on how easy or hard it is to perform certain behavior or to act in a certain way. (Ajzen, 1991; Pavlou and Fygenson, 2006) In the context of electric cars, various control factors are included, such as perceptions of price, vehicle ability, understanding of the technology, cost of use, and charging infrastructure (Axsen and Kurani, 2013, Moons and Pelsmacker, 2015).

2.1.4 Extended Element: Environmental Concerns (EC)

TPB can be applied to other relevant issues such as environmental concerns. Recent studies exhibit that the consumers' environmental attitude and the environmental friendly behavior are significantly related. Consumers with higher environmental concern will have more tendencies to purchase electric vehicles (Kahn 2007; Heffner et al. 2007). Some other studies show that the environmentalists would happy to pay more for the electric vehicles to protect the environment (Ziegler 2012; Daziano and Bolduc 2013). Literature also stated that people will tend to adopt electric vehicles if this could help to improve the environmental issues (Bockarjova and Steg, 2014). Therefore, it needs to be recognized that environmental concern should be incorporated into the conceptual model for analysis.

2.1.5 Extended Element: Moral Consciousness (MC)

Morality may affect consumers' behavior directly since the individual feels that there is an obligation to act in a certain way (Beck and Ajzen, 1991). Literature also indicates that social interface affecting the ethical consumption and the consumers will become more consciousness if

the members of the social network share the particular information (Cherrier, 2007). It has been concluded that an individual who has a higher level of moral consciousness is more likely to have a positive impact on the intention to adopt electric vehicles (McGregor, 2006; Achtnicht, 2012). Consequently, it is worth exploring moral consciousness is worth to take into account as an extended element in the conceptual model.

2.2 Hypotheses development

In order to analyze the consumer's intention towards electric vehicles in Hong Kong, hypotheses are developed with reference to the literature review in the previous section. According to the conceptual model presented in Figure 1, the key factors affecting consumers' behavioral intention towards electric vehicles are consumers' attitude towards electric vehicles, consumers' subjective norm, consumers' perceived behavioral control, and moral consciousness. The hypotheses are proposed:

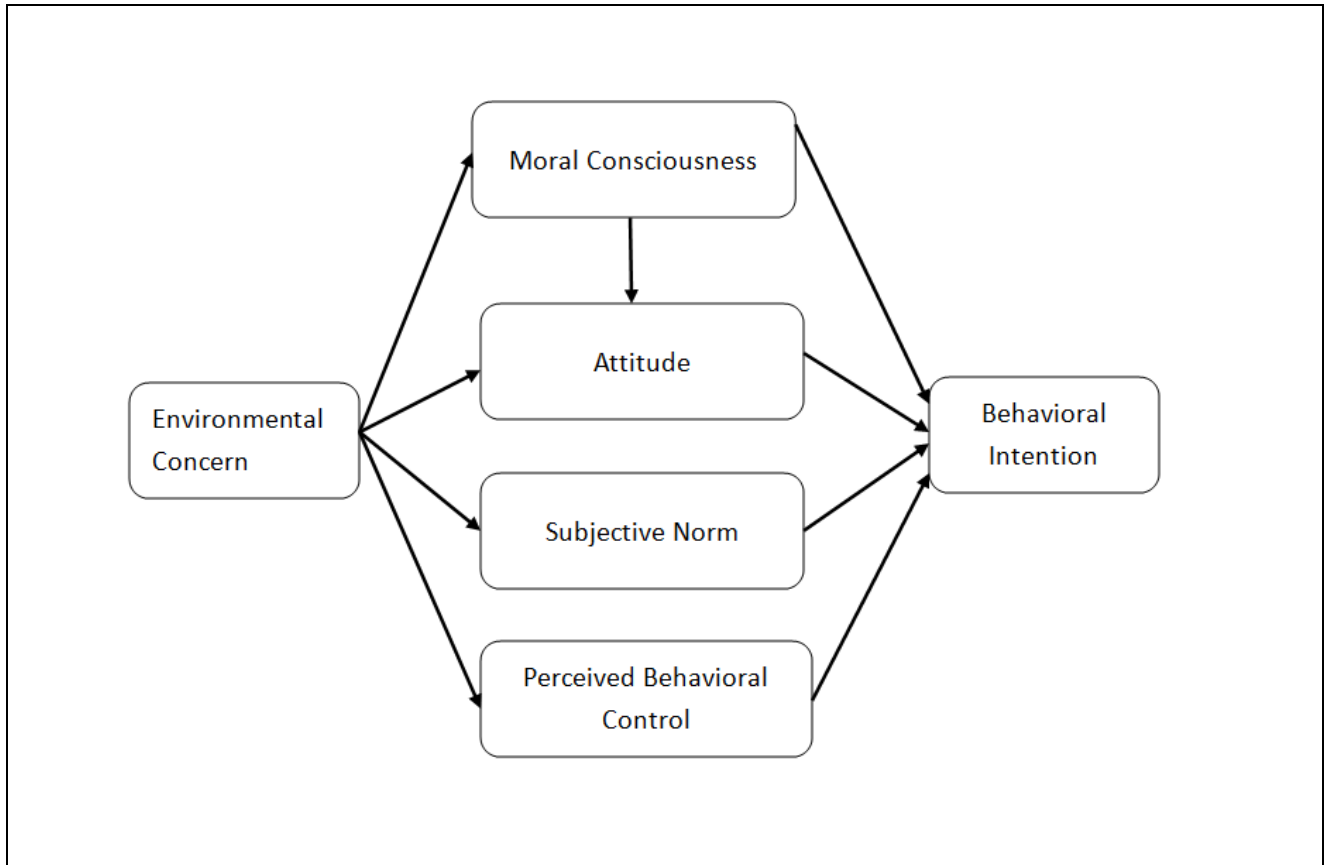
- H1: There is a positive relationship between consumers' attitude and their behavioral intention towards electric vehicles.
- H2: There is a positive relationship between consumers' subjective norm and their behavioral intention towards electric vehicles.
- H3: There is a positive relationship between consumers' perceived behavioral control and their behavioral intention towards electric vehicles.

Further analysis was conducted to test the extended elements of the conceptual model. It was mentioned that environmental concern affects an individual's behavior indirectly through attitude, subjective norm, perceived behavioral control, and moral consciousness (Ajzen and Fishbein, 1980; Bamberg, 2003). Moreover, it was being argued that there was an impact between the moral consciousness and attitude of the consumers (Cherrier, 2007). As a result, the hypotheses regarding the extended elements are proposed:

- H4: There is a positive relationship between consumers' environmental concern and their attitude towards electric vehicles.
- H5: There is a positive relationship between consumers' environmental concern and their subjective norm.
- H6: There is a positive relationship between consumers' environmental concern and their perceived behavioral control.
- H7: There is a positive relationship between consumers' environmental concern and their moral consciousness.

- H8: There is a positive relationship between moral consciousness and their attitude towards electric vehicles.
- H9: There is a positive relationship between moral consciousness and their perceived behavioral intention towards electric vehicles.

Figure 1. Conceptual Model



3. Methodology

3.1 Measurement/scale development

The measurement scales were adapted with reference from the previous studies (Wang, S. et al., 2014; Lai, I.K.W. et al., 2015; Moons, I. & Pelsmacker, P.D. 2015). A two-section questionnaire was designed based on the Theory of Planned Behavior. The first section is the general background of the respondents. The second section consists of 21 items for the five constructs, including 5 items for attitude, 4 items for subjective norm, 3 items for behavioral control, 3 items for behavioral intention, 4 items for environmental concern, and 2 items for moral consciousness. A 5-point Likert-Type scale was adopted, scaling from 1 (for strongly agree) to 5 (for strongly disagree).

The construct measurements were adapted from previous studies. The attitude towards electric vehicles was measured by 5-point scale items (Wang, S. et al., 2014; Moons& Pelsmacker, 2015; Yang, S. et al., 2018). The items used to measure environmental concern were validated in previous researches (Weigel, 1983; Ajzen, 1989; Gadenne et al, 2011), including individuals' concerned about environmental problems, about air pollution, the seriousness of the environmental problem and the contribution to improving the environment. The items used to measure subject norm were revised from research by Wang, S. et al. (2014). The items measuring behavioral control is based on the studies by Wang S. et al. (2014) and Yang, et al. (2018). The behavioral intention measured the possibility that an individual will purchase an electric vehicle in the future. The items used to measure behavioral intention were adapted from a previous study (Zeithaml et al., 1996). It was argued that the behavioral intention may be affected by the general background of and individual, including gender, age, and education level (O'Garra et al., 2005; Achtnicht, 2012), which were included in the first section of the questionnaire.

In order to pre-check the reliability of the scale, a test run was conducted before the launch of the survey with 40 valid questionnaires. The Cronbach's Alpha reaches 0.855, which indicates a high level of internal consistency for the scale with the test run sample. The questionnaire was delivered to the target group to collect data for further analysis. It is strongly recommended to use the correlation coefficient in research because it can provide objective findings accurately and is not affected by human factors (Reed, 1917). The valid data was then interpreted with SPSS.

3.2 Sampling

Due to the limited time, the researcher uses non-probability sampling for research. Purposive sampling, snowball sampling, and expert sampling is used. An online questionnaire survey was conducted to collect data. The target respondents were between 18 to 70 years old with a driver's licence. A total of 61 completed questionnaires were collected. However, only 53 of them were valid for further analysis. Subsequently, the data analysis was conducted using SPSS Statistics 26 to verify the reliability of the constructs and the correlation between the items.

The demographic data of the respondents are shown in Table 1. The participants include 67.9% males and 32.1% females. The average age was between 41-50 years old. The respondents are relatively high-educated, of which 54.7% have a master degree and 9.4% have a doctoral degree. Over half of the respondents (52.8%) own a vehicle.

4. Findings

The data analysis was conducted using SPSS 26. Before determining the association between the constructs, reliability had been tested. The reliability of the Likert-Typed scale of the questionnaire was measured by the Cronbach's alpha coefficient (α), which provided an overall reliability coefficient for a set of items. In this study, the Cronbach's alpha coefficient of the five constructs ranged from 0.735 to 0.946 (Table 2), which indicates a high level of internal consistency for the scale ($\alpha > 0.7$).

Table 1. Respondent's Demographic Profile

Demographics		Frequency	Percentage (%)
Gender	Male	36	67.9
	Female	17	32.1
Age Group	Below 30	2	3.8
	31-40	9	17.0
	41-50	26	49.1
	51-60	12	22.6
	61-70	3	5.7
	71-80	1	1.9
Education Level	High School	4	7.5
	Certificate/ Diploma/ Associate Degree	3	5.7
	Bachelor Degree	12	22.6
	Master Degree	29	54.7
	Doctoral Degree	5	9.4
Own Vehicle	Yes	28	52.8
	No	25	47.2
Total Number of Respondents:		53	

There was a very strong and positive correlation between environmental concern and moral consciousness ($r = 0.924$), environmental concern and perceived behavioral control ($r = 0.866$), environmental concern and attitude ($r = 0.785$), moral consciousness and attitude ($r = 0.771$), moral consciousness and perceived behavioral control ($r = 0.764$), attitude and behavioral intention ($r = 0.732$) and attitude and perceived behavioral control ($r = 0.710$). There was a substantial association between behavioral intention and perceived behavioral control ($r = 0.632$),

environmental concern, and behavioral intention ($r = 0.630$) and moral consciousness and behavioral intention ($r = 0.567$). All of these associations were statistically significant ($p < 0.05$). The correlation between subjective norm and behavioral intention ($r = 0.243$), and between subjective norm and attitude ($r = 0.202$) are low. The result indicated that there was a low negative correlation between subjective norm and behavioral control ($r = -0.135$). The correlation between environmental concern and subjective norm ($r = -0.024$), and subjective norm and moral consciousness ($r = -0.009$) are negligible.

Table 2. Reliability of the Constructs

Constructs	Mean	Standard Deviation	Cronbach's Alpha (α)
Attitude towards electric vehicles (AT)	2.438	0.827	0.910
AT1 I have a positive attitude in electric vehicles.	2.38	1.004	
AT2 I think using electric vehicles is desirable.	2.53	0.868	
AT3 I think the future trend is using electric vehicles.	2.47	1.120	
AT4 I think electric vehicles are useful and can satisfy what I need.	2.42	0.865	
AT5 I think electric vehicles are simple and confident to use.	2.40	0.947	
Subjective Norm (SN)	2.830	0.789	0.848
SN1 People who are important to me convince me to use electric vehicles.	2.87	0.962	
SN2 People who are important to me influenced me to use electric vehicles.	3.02	0.971	
SN3 The media gave me a positive image about electric vehicles.	2.68	0.872	
SN4 The media influenced me to use electric vehicles.	2.75	0.998	
Behavioral Control (BC)	1.987	1.256	0.945
BC1 The purchase price of electric vehicles is important to me.	2.15	1.246	
BC2 The maintenance costs of electric vehicles is important to me.	2.00	1.359	
BC3 The electric vehicles infrastructure is important to me.	1.81	1.360	

Behavioral Intention (BI)	2.409	0.914	0.826
BI1 I am happy to use electric vehicles in the future.	2.23	1.281	
BI2 I will buy electric vehicles in the future.	2.53	0.992	
BI3 I will recommend people to use electric vehicles.	2.47	0.868	
Environmental Concern (EC)	2.154	1.040	0.946
EC1 I am concerned about the environmental problems.	2.02	1.201	
EC2 I am concerned about air pollution.	2.00	1.209	
EC3 I think environmental problem is serious at the moment.	2.13	1.241	
EC4 I think environmental problems will become more serious.	2.13	1.272	
Moral Consciousness (MC)	2.321	0.936	0.735
MC1 I have to participate to protect the environment.	2.19	1.001	
MC2 Using electric vehicle is an obligation to the environment.	2.45	1.102	

Table 3. Associations Among Constructs

	Pearson Correlation Coefficient (r)					
	Attitude	Subjective Norm	Perceived Behavioral Control	Behavioral Intention	Environmental Concern	Moral Consciousness
Attitude	1					
Subjective Norm	0.202	1				
Perceived Behavioral Control	0.710	-0.135	1			
Behavioral Intention	0.732	0.243	0.632	1		
Environmental Concern	0.785	-0.024	0.866	0.630	1	
Moral Consciousness	0.771	-0.009	0.764	0.567	0.924	1

As the sample size is small (only 53 respondents), multiple regression was not applicable to this study. The Pearson correlation coefficient (r) becomes the major tool to analyse the strength of associations of the constructs. The Pearson's correlation result of this study is shown in Table 3. The correlations between constructs were found to be significant at a level lower than 0.05 from a statistical perspective. A positive attitude towards electric vehicles has a significantly positive correlation on the behavioral intention towards electric vehicles, that means an individual with a positive attitude will consequently show a stronger intention to adopt electric vehicles, H1 is supported. The effect of subjective norm on behavioral intention is low but positive, H2 is marginally supported. The perceived behavioral control has a substantial association with the behavioral intention towards electric vehicles, consumers are more likely to adopt electric vehicles if they have more perceived behavioral control, H3 is supported.

The study found that environmental concern has a significant positive impact on consumers' attitudes toward electric vehicles, perceived behavioral control, and moral awareness, that is H4, H6, and H7 are supported. Within these hypotheses, the very strong relationship between consumers' environmental concern and their moral consciousness shows that people have more concern about the environment will have stronger moral consciousness. Nevertheless, environmental concern and subjective norm has no significant effect, hence, H5 is not supported. Moral consciousness also has a strong association with attitude, and substantial relationship with behavioral intention, it turns out that both H8 and H9 are supported.

5. Conclusions & Limitations

This pilot study is focused on the factors influencing consumers' intention to adopt electric vehicles in Hong Kong. Based on the Theory of Planned Behavior, literature has been reviewed and an online questionnaire survey has been conducted. The data has been analysed to show their statistical significance. The result confirms that consumers' attitude and perceived behavioral control significantly correlated to the behavioral intention towards electric vehicles. Furthermore, in the extended theory of planned behavior model, the inclusion of environmental concern and moral consciousness provide a strong impact on the intention to adopt electric vehicles. The effects of environmental concern are positively related to consumer's attitude, perceived behavioral control, and moral consciousness. The model also confirmed that moral consciousness is a valuable aspect influencing the attitude towards electric vehicles, consequently, the behavioral intention towards electric vehicles. The only construct that is not significantly related is the subjective norm. The influence of subjective norm to the behavioral intention towards electric

vehicles is rather limited.

The result of this study suggests that the extended TPB model is appropriate in predicting the consumers' behavioral intention towards electric vehicles. While the environmental issues become more and more serious, it is a warning sign to the human society. The adoption of electric vehicles is one of the ways to reduce environmental pollution. For the automobile industry, this pilot study can help the industry to understand consumers' behavior and acceptance of electric vehicles. This can provide the industry with some directions on how to promote electric vehicles. For instance, the automobile industry should develop its product based on environmental concern, such as, environmentally friendly and cleanliness.

There are some limitations to this study. First, the sample size is small due to limited time and resources, the facts may not be reflected thoroughly. Second, some of them responded questionnaire is invalid. It is unavoidable the participants did not respond with their sincerity in the survey. Third, this study assumes respondents have substantial knowledge of electric vehicles, however, electric vehicles still in its growing phase, some respondents may not even have the basic knowledge in this area, and consequently, the information provided by these respondents may be influenced by the questionnaire. Lastly, due to the time constraint, this study examines only five constructs, factors such as ease of usage and perception of new technology should be investigated as well in further study.

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