Research Model on Factors Affecting Consumer Behavior toward Two-Wheeler Electric Vehicles in Vietnam

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Abstract: This paper presents the research model on factors affecting usage of electric two-wheel vehicles in Vietnam's urban. The research applies theory of planned behavior (TPB) to the study of Vietnam's situation and adjusts the theory model TPB in accordance with actual situation of Vietnam. The research model has been proposed with five factor groups, including attitude, subjective norm, perceived control, attraction of alternative (motorcycle), and consumer's characteristics affect to consumer behavior toward intention of using electric two-wheeler vehicle in Vietnam.

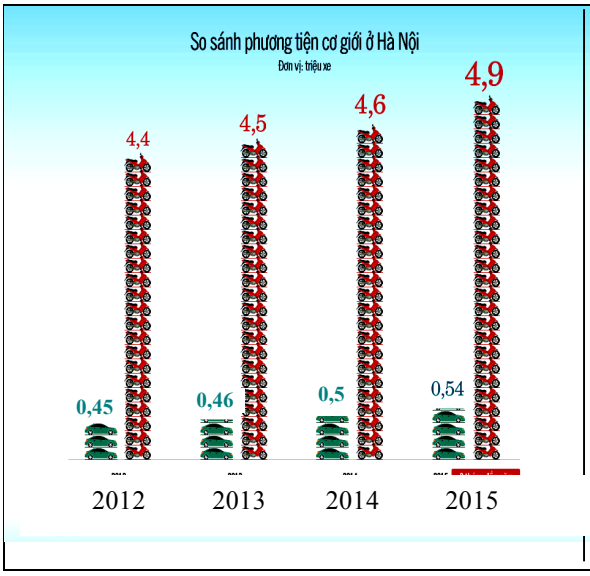
Keywords: Two-Wheeler Vehicle, Electric Vehicle, Consumer Behavior, Theory of Planed Behavior

1. INTRODUCTION

Although the growth rate of Vietnam in recent years has been lower than previous years, Vietnam still achieved the GDP growth rate of 5.6% in 2015 and the income per capita was around US$ 2,300 by the end of 2015 (GSO, 2016). Along with the population of more than 90 million, Vietnam has moved from the low-income country to average income country and continue to reform its economic policies during the global integration process.

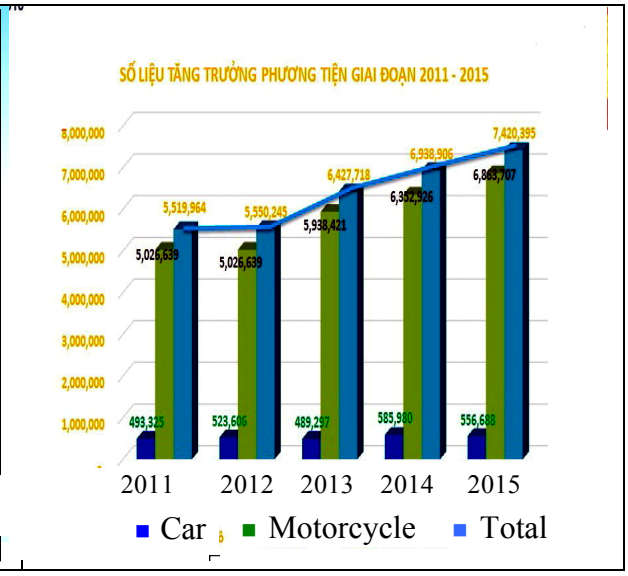
In accordance with the economic development, the demand for travel and private vehicle ownership increases rapidly. Currently, there are about 1.5 million private cars and 40 million motorcycles regularly operated in the whole country (VOA, 2016). As the public transportation currently meets only 10 percent of total travel needs of people in Hanoi and Hochiminh city - the two biggest cities of Vietnam, personal vehicles are still more common for people in urban areas. By 2020, private vehicles are estimated to account for 75 – 80 percent of total travel needs, in comparison with 20 – 25 percent of public transportation (Tramoc, 2016). The average growth rate of private cars and motorcycles used per year are 17 percent and 11 percent respectively, 1.5 to 2 times higher than economic growth rate in Hanoi (Vo Hai, 2016), while the average growth rate of private vehicles in Hochiminh city is 10 - 15 percent (VOH, 2016). The number of vehicles has exceeded the planning by the year of 2020 (Decision No.365 of Prime Minister, 2013). Thus, two-wheel personal vehicles will still be dominant means used primarily by consumers in the near future.

In recent years, along with an increase of dominant motorcycles, the emergence of electric two-wheel vehicle (e-vehicle or electric motor bike and electric bicycle) as a new personal vehicle has attracted many people to use widely in crowded cities of Vietnam. In the year of 2015, 2 million electric vehicles were in use (Doan Loan, 2015), in which nearly 70 percent of those were electric motorcycles, and 30 percent of those were electric bicycles (National Traffic Safety Commission, 2015).



Source: Tien Thanh and Ba Do, 2015.

Figure 1. Number of private ownership car and motorcycle in Hanoi city.



Source: Transportation Department of Hochiminh city, 2016.

Figure 2. Number of private ownership car and motorcycle in Hochiminh city.

Along with the rapid increase in the use of electric two-wheel vehicles, the number of electric vehicle manufacturers has grow up as well. Currently, there are about 70 electric vehicle manufacturers including both e-motorcycle and e-bike in the whole country. Up to now, the quantity of supply is estimated about 400,000 units per year, and the number of e-bike accounts for approximately 30 percent (Ba Do, 2015). Most of manufacturers locate in the Northern Vietnam. The number of electric two-wheel vehicles increases rapidly in both supply and demand side.

In the present trend, consumer behaviors are always concerns of production, business and the whole society. Currently, modern economics tends to consider consumers as the basis for the development of production, business and society. The main purpose of this research paper is to develop the model of factors affecting consumer behavior toward electric two-wheel vehicles (e-motorcycle and e-bike) in urban areas of Vietnam. Based on the background, research context and research model and some hypothesis are established.

The success of this research is promised to help fill in the knowledge gap to understand the consumer behavior or individuals toward the electric two-wheel vehicles in Vietnam, which are prominent traveling vehicle in Vietnam's urban areas. The success of this research will be an interest of enterprises and governments and the whole society.

2. LITERATURE REVIEW

The increase in electric two-wheel vehicle usage in Vietnam is similar to situation in some other Asian countries such as China, Taiwan, India, etc. in the same period. The study of Christopher R. Cherry (2007) on the e-bike use in China indicated that, the rapid growth of e-bike use in China resulted from the economic growth in terms of income per capita, technology advances of battery and engine, petrol prices, the ban of motorcycle use, overloading of public transportation.

The qualitative study by Nguyen Ngoc Quang (2008) showed four groups of factors affecting consumer behavior toward motorcycle in Vietnam: (i) external stimulus, (ii)

environment factors, (iii) consumer features, and (iv) relevant variables to consumers. This research was based on the 'Stimulus – Intervention – Response' decision-making model with in-depth interview, observation and group interview. The research by Dang thi Ngoc Dung (2012) has indicated five factors affecting the behavioral intention of using metro in Hochiminh city: (i) perception of Metro's usefulness, (ii) perception of environment, (iii) subjective norm, (iv) attraction of mean.

The qualitative study from Ronald Mani, Debasis Tripathy (2011), based on the theory of decision making process by Phillip Kotler, showed that cultural factors, social factors, personal factors and psychological factors affected bicycle purchasing behaviors in India. This qualitative research provided data on consumers and market segments for bicycle in India.

Similarly, the study from Sheetal Soni, Abhishek Soni (2012) on two-wheel bicycle in some provinces of India indicated factors that affected consumer's purchasing behavior: (i) bicycle characteristics (price, speed, guarantee, feature, safety, longevity); (ii) subjective norm; (iii) brand name; (iv) communication media. This qualitative study only concentrated on external factors of consumer's purchasing behavior, and made the market segment based on survey results.

The research by Pranav Ranjan, Yuvraj Bhatnagar, Razia Shedev (2013) pointed out 5 factors that impacted on Indian consumers' purchasing behavior toward electric motorcycle: (i) trend and fashion, (ii) feature and brand, (iii) quantity, (iv) engine power, (v) advertisement.

Different attributes from vehicles will affect various consumer groups differently. Technological innovation of electric motorcycle has greatly affected the consumers' choice (Chiu and Tzeng's, 1999; Luke R. Jones a, Christopher R. Cherry, Tuan A. Vu, Quang N. Nguyen, 2013), along with that of electric bicycle in China (Robin Cherry, 2007; Jonathan Xavier Weinert, 2007). These authors have applied the multi-regression to analyze the relationship between variables (independent and dependent variables).

Luke R. Jones a, Christopher R. Cherry, Tuan A. Vu, Quang N. Nguyen (2013) provided empirical evidence on the potential adoption of electric motorcycles as a clearner alternative to gasoline-powered motorcycles in Hanoi, Vietnam. They used experimental choice model to estimate the market share for scenarios involving different levels of electric two wheeler technology, gasoline prices, and sales tax rates. Results indicate that technological improvements and economic incentives, particularly sales taxes, have significant effects on adoption. Technological improvements are critical for adoption of electric motorcycle and sales tax has a powerful effect on the purchasing decision and can be used as a tool to stimulate e-scooter demand. Therefore, a change in sales tax has a stronger effect on vehicle choice than an equivalent change in purchase price.

Ning Wang, Yafei Liu (2015) studied the key factors influence influencing consumers' willingness to purchase electric vehicles in China. The factors are the Demographics, Personality Characteristics, Perceived Risks, Performance Attributes, Financial Benefits, Marketing Effectiveness, Charging Infrastructure, Government Policies and Social Influence. The research paper applied the chi-square test and a binary logistic regression model based on the questionnaires of 1,057 Chinese online consumers. The research results showed that, the groups who are willing to adopt EV are high income, interests in new technology and environmental sensitivity and buy EV as second vehicle. Consumers, who perceive less risks such as short driving range and long charging time, social values likely tended to purchase EV.

Kristinka Wilmink (2015) studied the adoption of hybrid and electric vehicles in Netherland based on six factors: purchase price difference, annual cost savings, range, charging time, fast charging time and detour time. Price is the most important factor, then range and annually cost saving. Charging time and detour time is not significant in EV model.

The results of Yew-Ngin Sang, Hussain Ali Bekhet (2015) revealed that Environmental

Concern, Consumer Knowledge, Psychological Benefits and Demographics are key predictors and have positive effects of electric vehicle Usage Intention in Malaysia. Psychological benefits are identified as a reward or benefits arises compared to usual alternatives and 'feeling better' which enhance status and reputation arises by choosing a certain product (Yew-Ngin Sang & et.al, 2015). Infrastructure Readiness was not significant in this study. Because electric vehicles is mainly for city and short distance use, charging was not the main issue in Malaysia as the travel distance per single charge is still within the urban mobility range.

The study of Eleonora Sottile, Benedetta Sanjust di Teulada, Italo Meloni, Elisabetta Cherchi (2017), which were conducted in Cagliari, Italy with public employee indicated the three factors affecting to the use of bicycle in Italy 1) perception of the bicycle as a means of transport (in terms of travel time, travel cost, comfort, health, *etc*. and societal level such as environment, quality of life, quality of living); 2) perception of bike ability (in terms of usefulness and safety) and 3) perception of the bike infrastructure (extensive network of dedicated bike lanes, presence of racks and secure parking for bicycles and extension of restricted traffic zones or pedestrian zones). In which, the perception of the context and the perception of the bicycle as a means of transport strongly affect the propensity to cycle. In addition, the individual characteristics also affects use of bicycle.

The increase in use of electric vehicles recently has raised some questions to the producers, authorities and policy makers: why do people use the electric two-wheel vehicles and what factors affect their use as well as their attitude toward the e-vehicles; should e-vehicles be encouraged to use in order to reduce and limit the number of personal motorcycles, which use petrol fuel and lead to the serious environment pollution, in Vietnam's urban in the near future. Therefore, the study on "Factors affecting the use of private electric two-wheel vehicles in the urban areas of Vietnam: the case study of Hanoi city" is extremely useful and beneficial.

In the present trend, consumer behaviors are always concerns of production, business and the whole society. Currently, modern economics tends to consider consumers as the basis for the development of production, business and society. Therefore, the success of this research is promised to help fill in the knowledge gap to understand the consumer behavior or individuals toward the electric two-wheel vehicles in Vietnam, which are prominent traveling vehicle in Vietnam's urban areas.

3. METHODOLOGY AND DATA COLLECTION

In order to develop research model and testing hypotheses, the research was conducted by two-step methodology: (i) Step 1 - Primary research, which applies the desk research method; and (ii) Step 2 - Exploratory research, which will be implemented to have a better understanding about the research areas. The exploratory research applies the qualitative research method.

***Desk research*:** synthesizing theories and literatures relevant to consumer behavior in general and traveling mode choices in particular, make an assessment of social - economic development in Vietnam and Hanoi, infrastructural conditions, travel needs, the situation of electric two-wheel vehicle market in Vietnam, reviewing regulations, learn experience lessons from other countries was conducted. Desk research helps the author have better understanding about the forces that promote and constrain the electric vehicle market in Vietnam by using the force field analysis methodology.

Desk research was useful in gathering secondary data from various sources: internet, documents, domestic and foreign studies, statistic offices, literatures from workshops, specialized magazines, international organizations, etc. This facilitated the authors to develop research model to test the relationship between the factors and decision making of two-wheel electricity vehicle users.

***Exploratory research*:** exploratory research was implemented with the qualitative research method. Data collection was gathered by in-depth interview and focused group interview techniques.

Exploratory research was conducted initially to collect fundamental information along with the qualitative research method to identify factors most relevant to the context studied, and to better understand the potential influence of these factors on consumer behavior to use electric two-wheel vehicles. In addition, it helps confirming the use intention as the key response variable to be researched in the second stage survey.

Exploratory research used in-depth interview and focused group interview techniques to collect data. This data collection technique will help to have insights into the relevant factors and their relationships to the consumer response variables (Mark Saunders, Philip Lewis, Adrian Thornhill, 2007).

***In depth interview**:* In this research stage, the psychological characteristics of consumers may internally drive consumer responses to the electric two-wheel vehicles. Electric vehicle consumers have not been considered as the appropriate source of the data required because they are unlikely to be familiar with this complicated information, and in turn are unlikely to be able to give accurate opinions on this subject (Atasit, 2005). Therefore, in spite of gathering information from electric vehicle consumers, these interviews were conducted with key knowledgeable people who have been directly responsible for collecting and analyzing information regarding electric vehicle market, consumer tastes and needs, brand names of various electric vehicles, government policies and regulations relevant to electric vehicles. These key knowledgeable people have frequently used this information in analyzing market, design changes, and production plan.

The interviews were conducted by semi – structural questionnaire survey, which assists gaining insights of specific information and close discussion.

Focused group interview: the interview was conducted before a large scale interview. Data was gathered from a group of electric vehicle users in Hanoi city. The group interview is useful in better understanding of perception, attitude and the utility of consumers, which has assisted identifying more accurate research issues.

4. RESEARCH MODEL AND HYPOTHESIS

4.1 Research model

Consumer behavior has been affected by different factors, including external factors and internal factors. According to theory of utility, consumers always make a rational decision suitable with consumer's benefit in purchasing or using goods or service (Atasit Lorterapong, 2005; Luke R. Jones, Christopher R. Cherry, Tuan A. Vu, Quang N. Nguyen, 2013). Decision-making process of Stimulus – Intervention – Response model (S-I-R), a psychological behavior theory, describes how consumer's perception converted into behavioral responses in accordance with the actual environment (Nieschlag et al., 1997; Nguyen Ngoc Quang, 2008; Nguyen Luu Nhu Thuy, 2012; Pranav Ranjan, Yuvraj Bhatnagar, Razia Shedev, 2013; Chu Tien Dat, 2014). Based on the background of theory and actual situation of Vietnam, general S-I-R model of consumer behavior toward electric-two wheel vehicles in Vietnam has been described in Figure 3.

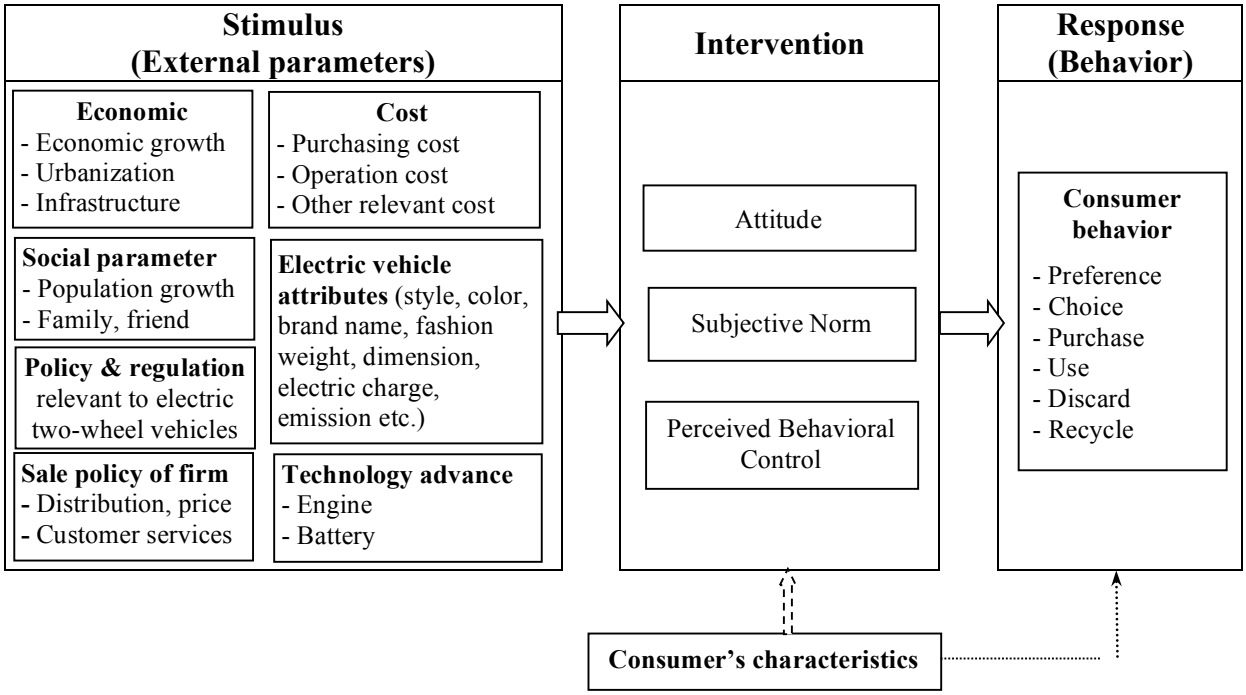


Figure 3. Consumer behavior chain to use electric two-wheel vehicles in Vietnam (based on the S-I-R model from Kroeber – Riel and Weinberg, 2003 (Hanna, 2011)

The theory of planned behavior (TPB) has been used as the basis of a number of consumer behavior studies in an attempt to understand issues such as identifying the factors affecting consumer behaviors and their impacts, and the relationship between different factors in various fields such as: marketing (Atasis, 2005; Tu thi Hai Yen, 2015), agricultural product option (Ahmed Yangui, 2014), communication service (Nguyen Hai Ninh, 2012; Chu Tien Dat, 2014; Ha Ngoc Thang, 2015), transportation (Bamberg, Ajzen & Schmidt 2003; Long, Choocharukul và Nakatsuji, 2010; Ching & Wei 2011; Dang thi Ngoc Dung, 2012; Rattanaporn, Wichuda, Sittha và Thaned, 2015; Le Quan Hoang, Toshiyuki Okamura, 2015), traffic safety (Khuat Viet Hung, Le Thu Huyen 2010), psychology and health (Ajzen, 2011), purchase electric vehicle (Ning Wang, Yafei Liu, 2015), etc.

According to the theory of Planned Behavior (TPB), behavior is the manifest, observable response in a given situation with respect to a given target. Single behavioral observations can be aggregated across contexts and times to produce a more broadly representative measure of behavior. In the TPB, behavior is a function of compatible intentions and perceptions of behavioral control. Conceptually, perceived behavioral control is expected to moderate the effect of intention on behavior, such that a favorable intention produces the behavior only when perceived behavioral control is strong. In practice, intentions and perceptions of behavioral control are often found to have main effects on behavior, but no significant interaction (Ajzen, 2005).

Intention is an indication of a person's readiness to perform a given behavior, and it is considered to be the immediate antecedent of behavior. The intention is based on attitude toward the behavior, subjective norm, and perceived behavioral control, with each predictor weighted for its importance in relation to the behavior and population of interest (Ajzen, 2005).

Attitude toward a behavior is the degree to which performance of the behavior is positively or negatively valued. According to the expectancy value model, attitude toward a behavior is determined by the total set of accessible behavioral beliefs linking the behavior to various outcomes and other attributes (Ajzen, 2005).

Subjective norm is the perceived social pressure to engage or not to engage in a behavior. Drawing an analogy to the expectancy-value model of attitude (see attitude toward the behavior), it is assumed that subjective norm is determined by the total set of accessible normative beliefs concerning the expectations of important referents (Ajzen, 2005).

Normative beliefs refer to the perceived behavioral expectations of such important referent individuals or groups as the person's spouse, family, friends, and depending on the population and behavior studied - - teacher, doctor, supervisor, and coworkers. It is assumed that these normative beliefs -- in combination with the person's motivation to comply with the different referents -- determine the prevailing subjective norm. Specifically, the motivation to comply with each referent contributes to the subjective norm in direct proportion to the person's subjective probability that the referent thinks the person should perform the behavior in question

Perceived behavioral control refers to people's perceptions of their ability to perform a given behavior. Drawing an analogy to the expectancy- value model of attitude (see attitude toward the behavior), it is assumed that perceived behavioral control is determined by the total set of accessible control beliefs, i.e., beliefs about the presence of factors that may facilitate or impede performance of the behavior (Ajzen, 2005).

According to the Theory of Planned Behavior (TPB), a behavioral intention is based on attitude toward the behavior, subjective norm and perceived behavioral control (Ajzen, 1991, 2005). A behavioral intention is defined as an important antecedent of future behavior. The strength of intention indicates how much people attempt to conduct the behavior. Therefore, understanding behavioral intention results in valuable prediction about a given behavior (Le Quan Hoang, Toshiyuki Okamura, 2015). The application of TPB has been conducted in previous studies on travel behavior, focusing on behavioral intentions toward public transportation (Dang thi Ngoc Dung, 2012; Rattanaporn, Wichuda, Sittha and Thaned, 2015; Le Quan Hoang, Toshiyuki Okamura, 2015). The theory of planned behavior from intentions to actions has been applied to study the relationship among beliefs, attitudes, behavioral intentions and actual behavior in various fields including transportation mode choices, and in particular consumer behavior to use vehicles (Ching and Wen 2011; Dang thi Ngoc Dung 2012; Ning Wang, Yafei Liu, 2015). However, such a study of intention to use two-wheeler electric vehicles has not been conducted in Vietnam.

The theory of planned behavior suggests that behavioral beliefs and attitudes towards behavior are related, normative beliefs have influence over subject norms, perceived behavioral control is determined by the total set of accessible control beliefs, and behavior is a compatible intention of perception of behavioral control and actual behavioral control (Figure 4).

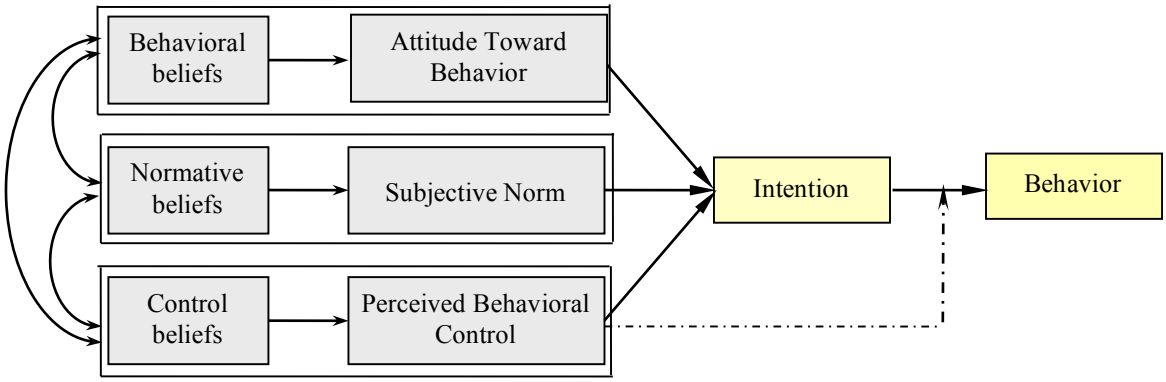


Figure 4. Theory of planned behavior (Icek Ajzen, 1991, 2005)

By applying TPB theory to context study of Vietnam and adjusting the model in accordance with the actual situation of Vietnam, the specific research model has been proposed to explore

factors affecting consumer behavior toward electric-two wheel vehicles in Vietnam (Figure 5). The hypotheses are briefly introduced and figures provide a visualization of the conceptual relationships that will be tested in a further study.

4.2 Key terms

Electric vehicle definition

According to the National technical standardized regulations for electric bikes by the Ministry of Transport (Circular No.30/2013/TT-BGTVT dated November 1, 2013), electric bicycle is a two-wheel bicycle operated by a direct current motor or by pedal structure with the assistance from a direct current motor, having the largest motor power of no greater than 250W and maximum designed speed of no more than 25 km/h. The weight itself (including the battery) is no greater than 40 kg. Any two-wheel electric vehicles that do not meet one of the above criteria are classified as electric motor or electric motorcycles. The electric motor has maximum speed greater than 50 km/h or maximum engine power greater than 4kW and the vehicle normally weights greater than 118 kg. Electric motorcycles are required to have maximum speed of no greater than 50 km/h, maximum engine capacity of no greater than 4kW, and vehicle weight of up to 118kg.

The difference between electric bicycle, electric motorcycle and electric motor is distinguished by speed, weight and motor power. The distinguishing between e-bikes and electric motorcycles should be based on the following criteria: motor, vehicle speed and pedal (with or without pedal).

Table 1. Distinguishing between electric bicycle, electric motorcycle and electric motor

Criteria	Electric bicycle	Electric motorcycle	Electric motor
Highest speed (km/h)	< 25	≤ 50	> 50
Weight (kg)	< 40	≤ 118	> 118
Motor power (kW)	< 0.025	≤ 4	> 4

Source: MOT, 2013. Circular No.39/2013/TT-BGTVT of the Ministry of Transport dated 11 January 2013: Promulgate national technical regulations on electric bicycles QCVN number 68: 2013/BGTVT, effective from 01 January 2014.

According to the theory, human behavior is guided by three kinds of considerations: beliefs about the likely consequences or other attributes of the behavior (behavioral beliefs), beliefs about the normative expectations of other people (normative beliefs), and beliefs about the presence of factors that may further or hinder performance of the behavior (control beliefs). In their respective aggregates, behavioral beliefs produce a favorable or unfavorable *attitude toward the behavior;* normative beliefs result in perceived social pressure or *subjective norm;* and control beliefs give rise to *perceived behavioral control,* the perceived ease or difficulty of performing the behavior. In combination, attitude toward the behavior, subjective norm, and perception of behavioral control lead to the formation of a behavioral *intention.* Finally, given a sufficient degree of *actual* control over the behavior, people are expected to carry out their intentions when the opportunity arises. Intention is thus assumed to be the immediate antecedent of behavior (Ajzen, 2005).

Attraction of alternatives is attributes of a motorcycle - one most popular use in Vietnam, that users prefer to substitute for an electric vehicle in performing their behavior.

Economic benefit is related to attributes of products, that measure in economic term of saving operating cost in comparison with an alternative.

Convenience refers to comfortable features of product, that users have experience in term of flexibility, mobility, fuel recharge, replacement of components and parts.

Fashion refers to apparent features of vehicle that affect to the taste of users.

The environmental concern has a direct strong impact on people's behavior in specific environmentally related domains like recycling, energy saving, buying environmentally friendly products or travel mode choice (Sebastian Bamberg, 2003). Environment concern refers to the whole range of environmentally related perceptions, emotions, knowledge, attitudes, values and behaviors. *Environment perception* view the perception of environmental pollution, environmental knowledge and energy saving of user's behavior.

Safety is considered as the result of user's experience in term of perception of speed safety and road safety.

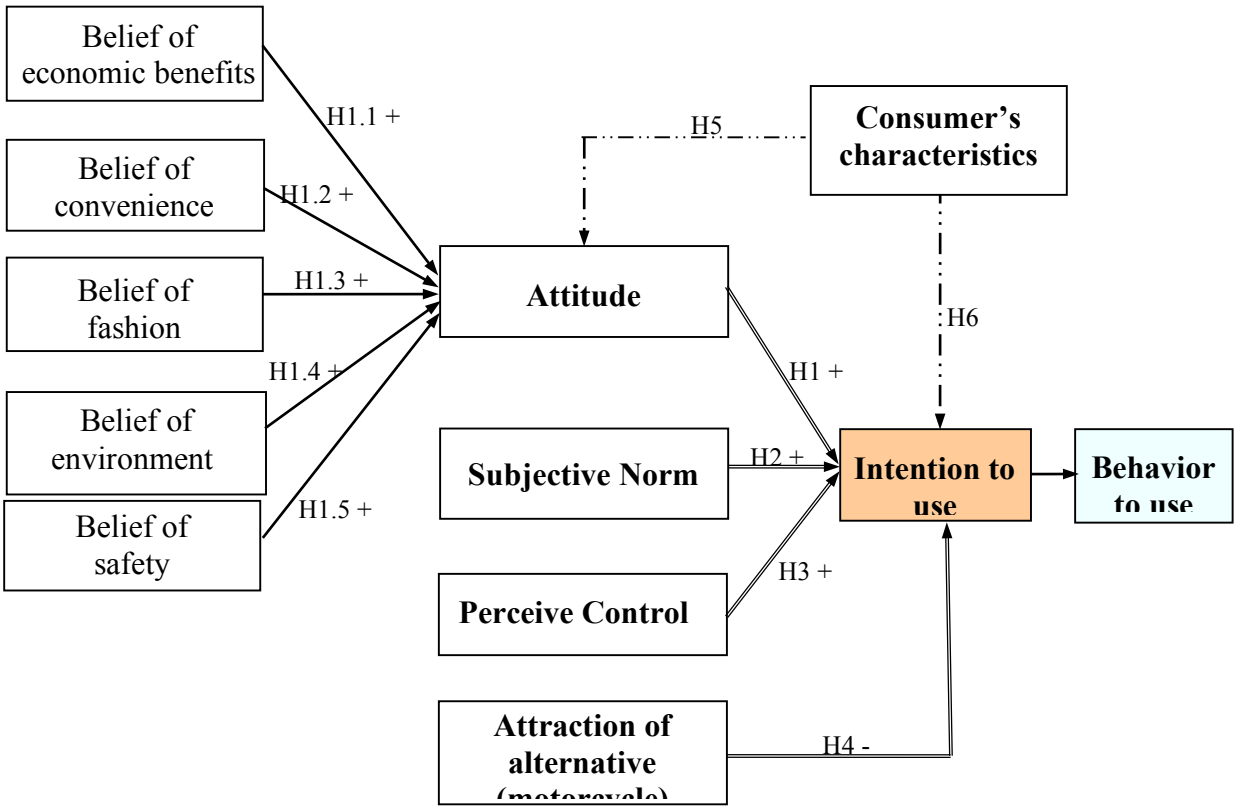


Figure 5. Proposed research model based on the theory of utility and TPB model

4.3 Research Hypotheses

Hypothesis 1: The greater attitude towards behavior, the greater intention of using electric two-wheel vehicles.

Hypothesis 1.1: Belief of economic benefits positively influences the attitude towards the intention of using electric two-wheel vehicles.

Hypothesis 1.2: Belief of convenience positively influences the attitude towards the intention of using electric two-wheel vehicles.

Hypothesis 1.3: The greater belief of fashion, the greater attitude towards the intention of using electric two-wheel vehicles.

Hypothesis 1.4: The better belief of environmental awareness, the better attitude towards the intention of using electric two-wheel vehicles.

Hypothesis 1.5: The belief of safety positively influences the attitude towards the intention of using electric two-wheel vehicles.

Hypothesis 2: Subjective norm positively influences the intention of using electric two-wheel vehicles.

Hypothesis 3: Perceived control positively influences the intention of using electric two-wheel vehicles.

Hypothesis 4: The greater attraction of alternative motorcycle, the less intention of using electric two-wheel vehicles

Hypothesis 5: Consumers with different profiles have different levels of attitude toward intention of using electric two-wheel vehicles.

Hypothesis 6: Consumers with different profiles have different levels of intention of using electric two-wheel vehicles.

5. CONCLUSION

The paper has presented the research model on factor influencing consumer behavior toward electric two-wheel vehicles in urban of Vietnam. To determine how these factors have an impact on consumer behavior of using electric two-wheel vehicles in Vietnam, a further survey should be conducted for a next quantitative research in some urban areas of Vietnam. Data collected from further questionnaire survey will allow the researcher to collect a large amount of information used to test the hypotheses. This research model and a further quantitative research will help to have more comprehensive understanding about consumer attitude and consumer behavior toward electric two-wheel vehicles in Vietnam, as well as draw some implications for manufacturers, policy makers and local authorities in the production, management and control the effective and sustainable use of electric two-wheel vehicles in urban areas of Vietnam.

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