EV CAR consumption trend among people in Phra Nakhon Si Ayutthaya province

1 Theerasak Supprasert, 2 Jantana Sansook, 3 Adisai Watanaputi
1,2,3 Business Administration and Information Technology, Rajamangala University of Technology Suvarnabrumi, Thailand
1 theerasak.research@gmail.com, 2 jantana_tuk@hotmail.com, 3 Kapaosapay2@gmail.com

Abstract- This research aims to 1 (study social values, quality of life awareness, environmental responsibility, value added consideration, price acceptance and EV CAR consumption trend among people in Phra Nakhon Si Ayutthaya province and 2 (study the influence of social values, quality of life awareness, environmental responsibility, value added considerations, price acceptance and EV CAR consumption trend among people in Phra Nakhon Si Ayutthaya province. Data were collected from 400 people in Phra Nakhon Si Ayutthaya Province. Data were analyzed by statistics, frequency, percentage, mean, standard deviation and multiple regression analysis.

The research results showed that consumers had a high level of opinion on social value factors, quality of life awareness, and environmental responsibility, value added considerations, and price acceptance affecting the EV CAR consumption trend. The results of the hypothesis analysis revealed that social values, quality of life awareness, and value added considerations influenced on the EV CAR consumption trend. On the other hand, environmental responsibility and price acceptance had no influence on EV CAR consumption trends.

Keywords— consumption trends, social values, quality of life, added-value

I. INTRODUCTION

People all throughout the world are at risk from air pollution, particularly those who live in large cities, where there are many health-threatening polluting activities. Likewise, Thailand has been experiencing air pollution problems for many years and it is becoming more and more severe. This is a condition in which contaminants are present in amounts above normal for long enough to be harmful to living organisms. Air pollution can occur naturally, such as particulate matter from wind storms, forest fires, natural gas, or earthquakes, or it can be caused by human action, especially pollution from automobile exhaust in transportation, which is an air pollution problem that more severe than natural occurrence and are toxic substances that are vented into the atmosphere, such as carbon monoxide, nitrogen oxides, hydrocarbon compounds, dust smaller than 10 microns, lead and sulfur dioxide [1] that is extremely harmful to health. Thailand has a cumulative number of registered vehicles of 41,471,345, including motorcycles, passenger cars, trucks, and buses [2] (Department of Land Transport, 2021), which is a ratio of 1,000 people per 548 vehicles and is ranked 3rd in ASEAN. With the high consumption of cars, the fuel consumption increases and results in the oil price situation rising as well [3]. This also puts consumers at the expense of high fuel consumption costs. At the same time, the heavy use of automobiles affects the environment causing life-threatening air pollution. For this reason, cities around the world are trying to find solutions to the air pollution caused by the burning of car fuel that is threatening the health of the world today.
Therefore, the automotive industry innovates modern technology by producing electric vehicles (EV CARs) to reduce fuel consumption and reduce emissions into the air since electric cars are near zero emission vehicles. [4], which will be of great benefit to the world. However, even though the government has a policy to encourage the use of EV CARs to increase to 1.2 million vehicles by 2036 [5], [6], there is still quite a growth slowly despite the fact that EV CARs will reduce fuel consumption and be environmentally friendly. Promoting the reliance on electric vehicles can reduce greenhouse gas emissions equivalent to reduction in 6.13 million tons of carbon dioxide [7], and Thailand is one of the region's leading eco-friendly vehicle markets [8]. Therefore, the researcher is interested in studying the trend of EV CAR consumption of people in Phra Nakhon Si Ayutthaya Province by focusing on social values (SOV), awareness of the quality of life (AQL), environmental responsibility (ENR), considering the added value (CAV), and price acceptance (PRI) that influences the EV CAR consumption trend of the people in Ayutthaya province to apply the study results to the industry and businesses related to EV CAR and as a guideline for development to meet more demands of consumers, which will have a real positive effect on the global environment.

II. RESEARCH OBJECTIVES

1. To study social values (SOV), awareness of the quality of life (AQL), environmental responsibility (ENR), considering the added value (CAV), price acceptance (PRI), and trends in EV CAR consumption of people in Phra Nakhon Si Ayutthaya Province.

2. To study the influence of social values (SOV), awareness of the quality of life (AQL), environmental responsibility (ENR), considering the added value (CAV), price acceptance (PRI) that affect EV CAR consumption trends of the people in Phra Nakhon Si Ayutthaya Province.

III. LITERATURE REVIEW

EV CAR is a vehicle that uses accumulative electricity stored in a battery or other form of electrical storage device and uses the electricity obtained from the battery storage to drive the motor when it is used instead of fuel. At present, EV cars can be divided into 4 types according to technology: [5] 1) Hybrid electric vehicle (HEV) is a vehicle that uses a combination of conventional fuel and battery electricity. This type of vehicle has a lower fuel consumption than the engine only because when the brakes are applied some of the energy is stored in the battery and later used to drive the electric motor along with the operation of a fuel-powered engine. 2) Plug-in hybrid electric vehicle (PHEV) This type of vehicle has the same fuel and electrical system as a hybrid vehicle, but can be plugged into an external charger, so that when plugged in, the car...
can travel longer distances than an old hybrid system. The used battery can also be recharged to store its charge as needed. When the battery runs out, the car behaves similarly to a hybrid (HEV) system. 3) Battery electric vehicle (BEV) is a vehicle that uses an electric motor to drive alone, so it has a larger battery than other electric vehicles. Automakers may install a small engine to generate electricity to charge the battery to increase the range, hence the term range extender battery electric vehicle. 4) Fuel cell electric vehicle (FCEV) is a vehicle that uses a motor as the main power for propulsion, like a battery electric vehicle, but the source of electricity is different. This type of car stores energy in the form of hydrogen gas and does not cause air pollution because when a car is powered it only releases water into the atmosphere. This type of vehicle is in the research stage and has not been commercially produced [9].

**EV CAR consumption trend** refers to the opportunity or probability that most consumers will see the benefits and worthiness that will cause a willingness to switch to EV CAR and would like to recommend it to people who know how to use it as well. Consumers’ decision to choose EV CAR, which are new and unfamiliar innovations, may cause concerns, coupled with the high car prices, thus requiring a greater process of consideration. There may be a number of factors that drive consumers to choose EV CAR, including social values (SOV), awareness of the quality of life (AQL), environmental responsibility (ENR), considering the added value (CAV), and price acceptance (PRI).

**Social values (SOV)** refers to the beliefs of individuals in a society that adhere to a common practice in using electric vehicles that are technologically advanced and do not pollute the environment. Social values (SOV) is one of the factors that will stimulate the trend in buying electric cars because consumers believe that they will be appreciated by people around them as well, thereby making them more likely to consume cars [10], as hypothesis 1, social values (SOV) have a positive influence on the trend of EV CAR consumption.

**Awareness of the quality of life (AQL)** refers to how individuals prioritize their well-being and lifestyle with the expectation and desire to be healthy, live well, and more comfortably [11]. Consumers who value quality of life must be aware of good physical and mental health, convenience, comfort in life [12], or have a better life in terms of utilities, transportation, including the environment and fresh air, etc. This is in line with Maslow's theory of needs, which shows that human beings want to improve their lives in the order of five stages: they want to survive safely, need a warm family, and secure work to lead stability of life, especially in matters of good health, free from disease [13]. Hence, using EV CAR is one of the choices that consumers are interested in because using electric cars will improve the quality of life. Therefore, awareness of the quality of life (AQL) affected the trend of consumption [14], as hypothesis 2, awareness of the quality of life (AQL) has a positive influence on EV CAR consumption trends.

**Environmental responsibility (ENR)**

Environmental responsibility (ENR) refers to the willingness and care to make efforts to reduce pollution by changing behavior to make the environment better by using electric cars that help reduce dust pollution and improve the weather. If consumers pay more attention to the environment by switching to electric cars, the air pollution will be reduced, which is considered to be the responsibility of everyone. Therefore, if a person is attentive to environmental responsibility
(ENR), it will affect the trend of EV CAR consumption more [15], as hypothesis 3 environmental responsibility (ENR) has a positive influence on EV CAR consumption trends.

**Considering the added value (CAV)**

Considering the added value (CAV) refers to consumers' belief in and acceptance of innovative and valuable EV CARs with special features to help them significantly save fuel. The fact that EV CARs are characterized by innovative, modern designs and cost-effective fuel consumption has led consumers to pay attention to the increasing value of EV CARs. This results in a tendency for consumers to decide to buy an EV CAR to use more and more [16], as the hypothesis 4 considering the added value (CAV) has influenced the trend of EV CAR consumption.

**Price acceptance (PRI)**

Price acceptance (PRI) means that consumers believe that EV CAR prices and maintenance are reasonable compared to current and future quality and value, thus being willing to pay willingly. When consumers are interested in buying a car, it is important to consider the cost-effectiveness of EV CAR as an attractive alternative, even if the price is high, but compared to the lower costs later, it is acceptable for consumers as this type of car uses electric power instead of the expensive fuel. As well as lower maintenance costs because there is no engine and no oil change, it makes maintenance easier and makes consumers more inclined to use EV CARs [17], as hypothesis 5, price acceptance (PRI) has a positive influence on the trend of EV CAR consumption.

**IV. RESEARCH METHODS**

This research is quantitative. Data was collected from 400 people in Phra Nakhon Si Ayutthaya Province. The researcher determined the sample by using the formula for calculating the sample size of the unknown population at the 95% confidence level, the error was 5%, and data were collected using a nonprobability sampling as per convenience sampling.

**The instrument used for this data collection**

The instrument used for this data collection was a questionnaire created from the study of the doctoral data. Materials, books, theories, and related research by creating tools in accordance with the subject matter and research scope are divided into 3 parts as follows.

Part 1 was the respondents’ general information, including gender, age, occupation, income, and status, which was characterized as a closed-ended Multiple Choices Question of 5 items.

Part 2 was three questions about social values (SOV), three items of awareness of the quality of life (AQL), five items of environmental responsibility (ENR), three considering the added value (CAV), three price acceptance (PRI), and three EV CAR consumption trends, which were closed-ended questions and were characterized by a rating scale. Each question had 5 answers to choose from: Highest, High, Medium, Low, and Least levels.

Part 3 was opinions and suggestions which were open-ended questionnaires for the sample group to have the opportunity to express their opinions.
The researchers examined the tool quality by checking the content validity from 3 experts. It was found that the IOC (Index of Item – Objective Congruence) value was between 0.67 – 1.00, which met the criteria. Reliability is checked by finding the Alpha - Coefficient according to Cronbach's method, which found that the alpha coefficient was between 0.737 - 0.865 which was greater than 0.7 and the questionnaire was considered to have a high level of confidence [18].

V. RESEARCH RESULTS

The results of the data analysis revealed that the majority of the 400 respondents were female, aged 21-30 years, student or student occupation, income 10,001 - 20,000 baht, and were single.

Analysis of opinion level social values (SOV), awareness of the quality of life (AQL), environmental responsibility (ENR), considering the added value (CAV), price acceptance (PRI), and EV CAR consumption trends as in Table 1.

### Table 1. Mean and standard deviation, social values (SOV), awareness of the quality of life (AQL), environmental responsibility, considering the added value (CAV), price acceptance (PRI), and EV CAR consumption trends

<table>
<thead>
<tr>
<th>Factors</th>
<th>𝜇</th>
<th>S.D.</th>
<th>Review Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social values (SOV)</td>
<td>3.80</td>
<td>0.572</td>
<td>High</td>
</tr>
<tr>
<td>Awareness of the quality of life (AQL)</td>
<td>3.47</td>
<td>0.726</td>
<td>High</td>
</tr>
<tr>
<td>Environmental responsibility (ENR)</td>
<td>3.84</td>
<td>0.487</td>
<td>High</td>
</tr>
<tr>
<td>Considering the added value (CAV)</td>
<td>3.86</td>
<td>0.623</td>
<td>High</td>
</tr>
<tr>
<td>Price acceptance (PRI)</td>
<td>3.96</td>
<td>0.765</td>
<td>High</td>
</tr>
<tr>
<td>EV CAR consumption trends</td>
<td>3.47</td>
<td>0.785</td>
<td>High</td>
</tr>
</tbody>
</table>

From Table 1, opinion levels on social values (SOV), awareness of the quality of life (AQL), environmental responsibility, considering the added value (CAV), price acceptance (PRI), and EV CAR consumption trends found that all factors were averaged at a high level. The price acceptance (PRI) factor was the highest average (\( \bar{x} = 3.96, \text{S.D.} = 0.765 \)). It was followed by considering the added value (CAV) (\( \bar{x} = 3.86, \text{S.D.} = 0.362 \)), environmental responsibility (ENR) (\( \bar{x} = 3.84, \text{S.D.} = 0.487 \)), social values (SOV) (\( \bar{x} = 3.80, \text{S.D.} = 0.572 \)), awareness of the quality of life (AQL) (\( \bar{x} = 3.74, \text{S.D.} = 0.726 \)), and EV CAR consumption EV CAR trends (\( \bar{x} = 3.47, \text{S.D.} = 0.785 \)), respectively.

Analysis of social values (SOV), awareness of the quality of life (AQL), environmental responsibility (ENR), considering the added value (CAV), price acceptance (PRI) influence on EV CAR consumption trend of People in Phra Nakhon Si Ayutthaya Province.

In hypothesis testing, the properties of the variables were checked to see if the data were suitable for multiple regression analysis by using Pearson's Correlation Coefficient to avoid correlation problems between the independent variables that were too high that may cause problems Multicollinearity as in Table 2.
Table 2 The correlation coefficients, social values (SOV), awareness of the quality of life (AQL), environmental responsibility, considering the added value (CAV), price acceptance (PRI), and EV CAR consumption trends.

<table>
<thead>
<tr>
<th>Variables</th>
<th>SOV</th>
<th>AQL</th>
<th>ENR</th>
<th>CAV</th>
<th>PRI</th>
<th>EV CAR consumption trends</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
<td>3.80</td>
<td>3.74</td>
<td>3.84</td>
<td>3.75</td>
<td>3.96</td>
<td>3.41</td>
</tr>
<tr>
<td>S.D</td>
<td>0.37</td>
<td>0.72</td>
<td>0.49</td>
<td>0.82</td>
<td>0.77</td>
<td>0.78</td>
</tr>
<tr>
<td>Social value (SOV)</td>
<td>-</td>
<td>0.211**</td>
<td>0.849**</td>
<td>181.07**</td>
<td>0.0310</td>
<td>196.07**</td>
</tr>
<tr>
<td>Awareness of the quality of life (AQL)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.093**</td>
</tr>
<tr>
<td>Environmental responsibility (ENR)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.105**</td>
</tr>
<tr>
<td>Considering the added value (CAV)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.137**</td>
</tr>
<tr>
<td>Price acceptance (PRI)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.110</td>
</tr>
<tr>
<td>EV CAR consumption trends</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.073</td>
</tr>
</tbody>
</table>

* Sig. p < 0.05, ** sig. p < 0.01

From Table 2, it was found that the correlation coefficients among independent variables, social values (SOV), awareness of the quality of life (AQL), environmental responsibility (ENR), considering the added value (CAV), price acceptance (PRI) had the value between 0.021 – 0.349, which did not exceed 0.8. The determination of the VIF value found that the VIF value was 1.091-1.298, which was not more than 10, indicating that the relationship of the independent variables did not cause multicollinearity problems. Therefore, it can be tested by Multiple Regression Analysis as in Table 3.

Table 3: Results of analysis of social values (SOV), awareness of the quality of life (AQL), environmental responsibility (ENR), considering the added value (CAV), and price acceptance (PRI) influencing the EV CAR consumption trends of the people in Phra Nakhon Si Ayutthaya Province.

<table>
<thead>
<tr>
<th>Factors</th>
<th>EV CAR consumption trend among people in Phra Nakhon Si Ayutthaya Province</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Regression coefficient ($)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.013E+03</td>
</tr>
<tr>
<td>Social value (SOV)</td>
<td>0.227</td>
</tr>
<tr>
<td>Awareness of the quality of life (AQL)</td>
<td>0.290</td>
</tr>
<tr>
<td>Environmental responsibility (ENR)</td>
<td>-0.007</td>
</tr>
<tr>
<td>Considering the added value (CAV)</td>
<td>0.203</td>
</tr>
<tr>
<td>Price acceptance (PRI)</td>
<td>-0.014</td>
</tr>
<tr>
<td>Adjusted R Square</td>
<td>0.174</td>
</tr>
</tbody>
</table>

* Sig. p < 0.05, ** sig. p < 0.01

From Table 3, it was found that independent variables can predict dependent variables at 17.40% based on the Adjusted R Square value of 0.174. When considering each factor, it was found that social values (SOV), awareness of the quality of life (AQL), considering the added value (CAV) had a significant positive influence on the EV CAR consumption trend of people in Ayutthaya province at the 0.01 level (β = 0.227, β = 0.209, β = 0.203, respectively), which was the acceptance of hypothesis 1, hypothesis 2, and hypothesis 4. The environmental responsibility (ENR) and price acceptance (PRI) factors did not affect the EV car consumption trend of people in Ayutthaya province (β = -0.007, β = -0.014, respectively), which rejects hypothesis 3 and hypothesis 5.

VI. CONCLUSION AND DISCUSSION

An analysis of the public opinion level in Ayutthaya province revealed that social values (SOV), awareness of the quality of life (AQL), environmental responsibility (ENR), considering the added value (CAV), price acceptance (PRI) and the EV CAR consumption trends, had a high level of opinion. It also found that social values (SOV), awareness of the quality of life (AQL),
and considering the added value (CAV) influenced the EV CAR consumption trends. Considering the added value (CAV) and price acceptance has no influence on the EV CAR consumption trends. The results can be discussed as follows.

Social values (SOV) influenced the EV CAR consumption trends of people in Phra Nakhon Si Ayutthaya Province because EV CARs were a new production model. The use of modern technology created novelty and awakened the people who were highly interested in the advancement of the automotive industry. Most people believe that having the opportunity to use electric cars will affect their image in terms of being a technology leader, being environmentally friendly, and possibly driving other people's demand for electric cars as well. This was consistent with research [10] which found that overall image and product purchase behavior were in the same direction. The findings were consistent with research conducted [19] found that attitudes towards technology use influence on consumers' purchase decision for battery electric vehicles in Bangkok and vicinities.

Awareness of the quality of life (AQL) has influenced the trend of EV CAR consumption among people in Phra Nakhon Si Ayutthaya Province because people understand that if everyone turns to EV CAR, it will improve the weather and affect health. In addition, some EV CAR companies will produce smaller cars, making travel easier, faster, less congestion, and easier to find parking spots, which affects the mental state and quality of life. This was consistent with the research [14] which found that the factors of good health attitudes were positively correlated with the behavior of intention to consume significantly. The findings were consistent with the research [20] indicating that this is an important factor for consumers who use travel to facilitate their daily commute.

Environmental responsibility (ENR) had no influence on the EV CAR consumption trend of people in Phra Nakhon Si Ayutthaya province. Even if a person has environmental responsibility (ENR), it may not make it possible to choose an electric vehicle as most of them still have concerns and uncertainties about their quality. With the unfamiliarity, they may not believe that they can save the environment. Although EV CARs can help reduce dust, most of the power generation still requires oil to produce, which is a natural resource use. In addition, Phra Nakhon Si Ayutthaya Province had up to 5 industrial estates, which was one of the factors that caused environmental pollution. This was consistent with the research [15] which found that environmental marketing factors in terms of environmental label perception and quality of environmentally friendly products did not influence the incidence of purchasing behaviors of products that were eco-friendly for consumers.

Considering the added value (CAV) influenced the trend of electric vehicle consumption for people in Phra Nakhon Si Ayutthaya province. Due to the current situation, the price of fuel was quite high, affecting the cost of living in all aspects. Choosing an electric vehicle can help them save more on fuel costs and save on maintenance. EV CARs were more cost-effective when looking at long-term costs, in line with the research [16] who found that the price characteristics were appropriate for the quality. The findings were consistent with research [21], indicating that brand image affects consumers’ purchase decision for hybrid cars in Thailand.

Price acceptance (PRI) had no influence on the electric vehicle consumption trend of people in Ayutthaya province. Although EV CARs were attractive to consumers, the current global
and domestic economy was sluggish and the epidemic was the main reason for consumers to decide to slow down their EV CAR purchases first until the situation improves. Electric vehicle prices must be flexible according to economic conditions, resulting in price acceptance (PRI) for people. This was consistent with research [17], which found that price had no influence on purchasing decisions, which was inconsistent [22] [23] who found that price variables had influence on battery electric vehicle purchase decision.

**Recommendations**

In the EV CAR consumption trend of people in Phra Nakhon Si Ayutthaya Province, the researcher gave suggestions from research and recommendations for future research as follows.

1. **Recommendations obtained from research**

1.1 From the research results, it was found that social values (SOV) influenced the trend of choosing innovative EV CARs. Therefore, government agencies or related persons should be involved in supporting consumers to be aware of the good image of using EV CARs, such as being praised as a model in terms of energy saving to convince consumers for increasing the interest in electric vehicles and entrepreneurs should accelerate to create awareness among consumers about the value and use of electric vehicles through more channels.

1.2 There should be proactive public relations to make consumers aware of the importance of a better quality of life by educating consumers about the benefits of switching to electric vehicles instead of using fuel that is good for everyone's health.

1.3 There should be a clear understanding with consumers about how good electric vehicles are for the environment and how fuel-powered cars will affect the environment for consumers to have environmental responsibility (ENR) by providing knowledge through various media.

1.4 Entrepreneurs must communicate and publicize the differences between electric vehicles and fuel-fuelled vehicles, what advantages, advantages, and special features that electric vehicles, but fuel vehicles do not have.

1.5 Due to the current global and domestic economic conditions, there is a stagnation causing consumers to slow down in purchasing electric cars. Entrepreneurs should promote more marketing by organizing marketing activities such as giving gold necklaces, giving electrical appliances to create more attractiveness for consumers to be interested in electric cars.

2. **Suggestions for future research**

2.1 There should be a satisfaction study of customers who have used an EV CAR, to compare how the value received is different from a fuel-powered vehicle, including the services of an after-sales service center for entrepreneurs to be able to plan their business further.

2.2 There should be an in-depth study with qualitative research by interviewing entrepreneurs and people who have already used EV CARs to study information, methods of use, value, and benefits to gain valuable insights and further benefits to consumers.

**REFERENCES**
1. Department of Environmental Quality Promotion, “Air pollution”, Retrieved on 30th January 2021, from https://datacenter.deqp.go.th/knowledge/%E0%B8%AD%E0%B8%B2%E0%B8%81%E0%B8%B2%E0%B8%A8%E0%B8%A1%E0%B8%A5%E0%B8%9E-%E0%B8%A9%E0%B8%97%E0%B8%B2%E0%B8%87%E0%B8%AD%E0%B8%B2%E0%B8%81%E0%B8%B2%E0%B8%A8/


23. J. Yachompoo, “Factors affecting the decision to buy a car up to 1,500 cc.”, (Independent research, Master of Business Administration program), Bangkok : Thammasat University, 2016.
25. J. Yachompoo, “Factors affecting the decision to buy a car up to 1,500 cc.”, (Independent research, Master of Business Administration program), Bangkok : Thammasat University, 2016.