Analysis of current economy's impact on consumers' purchase intention of new energy vehicles

Chen Ang

Limkokwing University, Jalan Technokrat, Cyberjaya, 63000, Malaysia

Abstract: New energy vehicles are becoming more and more popular these years and the relevant industry has gained an explosive growth for the past decades. Many factors are affecting consumers' intention to buy new energy vehicles, including product, cost, sale, brand, environment, etc. At the same time, the world's economy situation changes every day. Does the economy affect consumers' intention to buy new energy vehicles? This research tries to figure it out through questionnaire survey, literature analysis and model analysis methods, to understand the residents' attention and purchase psychology of new energy vehicle, discuss on the factors affecting their decision on the purchase of new energy vehicles, especially the factors which have the most significant impact on the purchase intention, and try to find out relationship between economy situation and purchase intention of new energy vehicles. The purpose of this article to enlighten enterprises so that they can be clearer about what is affecting the psychology of consumers, so as to develop a more suitable marketing strategy for new energy vehicles, and better promote the development of new energy vehicles.

Keywords: new energy vehicle, economy, product, price, cost

1. Introduction

New energy vehicles are usually known as electric vehicles (for research purpose we exclude cars using energies other than electricity, such as hydrogen vehicle). New energy vehicles were invented about 150 years ago, even earlier than the fuel vehicle coming into product. Since then, new energy vehicles had not been put into massive product until about 10 years ago when they finally have many more advantages over traditional fuel cars such as environment protection, cost saving, energy saving, less noise, easy to maintain and fix, faster speed, etc. Even though the advantages of new energy vehicles are obvious, they are still outnumbered by traditional fuel cars in the market today because they have some key weaknesses like limited driving distance and long charging time.

2. Problem statement

New energy car is becoming more and more popular these years. However, its users are still a minority group comparing with traditional fuel car users. The number of new energy car buyers is slowly growing year by year. At the same time, a pandemic burst out since the beginning of year 2020 throughout the world. The pandemic is striking the world economy and starting to make people focus more on environmental protection issues. The downward of economy and the importance of environmental protection may change potential fuel car buyer's attention to new energy cars.

3. Research objectives

This paper aims at the research on the current new energy car market situation, trying to find out the relationship between new energy car and the pandemic, hoping to give enlightenment on how the pandemic changes car buyer's thought and affects their purchase intention.

4. Literature Review

Tian Yuan, Zhuo Huijuan (2014) concluded that the maximum speed and range, convenience of charging mode, charging duration and vehicle safety have significant effects on the purchase decision of electric vehicles. Factors influencing the purchase decision of electric vehicles. [1]

Zhao Huiqing, Yu Hang, Wang Jingwen, Cheng Jinzhuang, Xu Jingjie (2018) concluded that At the present stage, consumers' understanding of new energy vehicles is not high, and the relevant information is mainly obtained from media publicity. [2]

Li Wenjuan, Wu Tingting (2018) concluded that consumers' environmental cognition has a positive impact on the purchase intention of new energy vehicles is that the higher the consumers' environmental cognition, the stronger the purchase intention of new energy vehicles.[3]

Liu Yafei, Xin Xiaoshan, Zhang Cui, Xu Yan (2015) concluded that the automobile market has network effect, and it shows strong indirect network effect. [4]

Zhang Zhe, Gan Hongcheng (2017) concluded that The main reason for Shanghai citizens to buy electric vehicles is to license them for free, which is quite different from the reasons for consumers in other second and third tier cities to buy electric vehicles. At the same time, the using cost, purchase information, convenience, charging, driving range, battery life and price are the main factors.[5]

5. Research Methodology

5.1 Data collection and respondents

This research uses a questionnaire with Likert 5 scale as the interview tools. Because new energy cars are still not widely known by people as the traditional fuel cars and not all people happen to want to buy a car at the time of research, we went to car dealers in China around Beijing and directly distributed the questionnaires to potential car buyers for the purpose of getting a more reliable results. The total number of questionnaires issued is 100 and all of them are recovered, of which 99 is effective, giving an effective recovery rate of 99%. Considering the new energy car buyers are still a minority group, the number of 100 sample questionnaires and the 99% recovery rate can be considered as relatively satisfactory.

5.2 Sample characteristics

The interviewees are all coming from Beijing, one of the most leading and developed cities in China. Of the 99 recovered questionnaires, 41 interviewees are female, accounting for 41.41%; 58 are male, accounting for 58.59%. For the purchasing plan, 92 of them have the plan to purchase a car in the near future, accounting for 92.93%, leaving 7 without recent purchasing plan, accounting for 7.07%. For the educational background, 81 of them are undergraduate or below, accounting for 81.82%; 16 of them have master's degree, accounting for 16.16%; 2 of them have doctor's degree, accounting for 2.02%. For the age structure, 4 of them are between age 10 to 20, accounting for 4.04%; 33 of them are between age 20 to 30, accounting for 33.33; 56 of them are between age 30 to 40, accounting for 56.57%; 6 of them are between age 40 to 50, accounting for 6.06%. The above result shows that the characteristic of potential new energy car consumers are going toward a younger and higher education direction.

5.3 Variables design

This research uses purchase intention as the dependent variable and influencing factors to purchase intention as the independent variables. The 4 independent variables, also called main factors, are cost factor, product factor, sale & brand factor and environmental protection factor. These main factors each is divided into 5 sub-factors, resulting in 20 sub-factors. In the questionnaire, the independent sub-factors are studied by asking interviewees whether they are important or not. The importance has five levels: very important, relatively important, general, less important and completely unimportant, from 5 to 1. The dependent variable is also divided into 5 sub-factors, by asking interviewees questions whether they agree or not. Their replies are divided into five levels: strongly agree, agree, neither agree nor oppose, disagree, strongly disagree, from 5 to 1. The variables are listed down below:

Independent Variables (main factors)	Sub-factors
1. Cost factor	1.1 vehicle price
	1.2 government subsidy
	1.3 fuel cost
	1.4 maintaining cost
	1.5 accessory price

2. Product factor	2.1 quality
	2.2 travel mileage
	2.3 speed and maneuverability
	2.4 inner space and outer design
	2.5 safety
3. Sale and brand factor	3.1 product promotion
	3.2 brand effect
	3.3 salesperson's attitude
	3.4 store environment
	3.5 after-sale service
4.Environmental protection factor	4.1 automobile exhaust pollution
	4.2 global warming
	4.3 nonrenewable energy saving
	4.4 environmental damage incurring disease
	4.5 balance of nature
Dependent variable	Sub-factors
5. New energy car purchase intention	5.1 New energy car represents leading technology. 5.2 New energy car is a type of more advanced product comparing with traditional fuel car. 5.3 New energy car is better for environment. 5.4 The comprehensive costs of new energy car are lower. 5.5 I prefer new energy car and I will surely choose it instead of traditional fuel car.

6. Research Result

This research uses SmartPLS 3.0[6] as the data analysis tool. The research results are listed below.

6.1 Coefficient analysis

Table 1 Coefficient table

Impact factor (independent variables)	Impact on purchase intention (dependent variable)
1. Cost factor	0.272
2. Product factor	0.287
3. Sale and brand factor	0.248
4. Environmental protection factor	0.114

Table 1 shows the impact of each factor on purchase intention. It is clear that product and cost have more impact on purchase intention, while the impact sale, brand, and environment have less impact on purchase intention. It means consumers are more concerned with product itself and relating cost. Considering product itself has always been the most concerned issue of a consumer, it can be removed from the impact table, leaving cost factor becoming the most important factor. This probably means during the economy downward caused by the pandemic, consumers are becoming more concerned with total cost of buying a car.

6.2 Reliability and validity analysis

In this session every main factor is divided into four sub-factors and they are checked for reliability and validity. After reexamine and reconstruct reliability and validity, sub-factors with weak impact on purchase intention are removed, leaving only those with strong impact. The result is shown in the table 2:

Table 2 Reliability and validity table

Main factors	Sub-factors	Composite reliability	Average variance extracted
1. Cost factor	1.1 vehicle price	0.631	0.226
	1.2 government subsidy	0.604	
	1.3 fuel cost	0.506	
2. Product factor	2.2 travel mileage	0.612	0.244
	2.3 speed and maneuverability	0.385	
	2.4 inner space and outer design	0.469	
	2.5 safety	0.402	
3. Sale and brand factor	3.5 after-sale service	0.650	0.241
4.Environmental protection factor	4.5 balance of nature	0.567	0.209
5. New energy car purchase intention	5.1 New energy car represents leading technology.	0.767	0.252
	5.3 New energy car is better for environment.	0.718	

The result clearly shows the product factor is still the most important main factor influencing purchase intention. After removing the weak impact one it now has four sub-factors left with strong impact. For a merchandise, this investigation result is quite natural, because there is no doubt when people want to buy something they would mostly focus on the goods itself. The only sub-factor removed is quality, which is not as important as the other four, probably because the total structure of electric car is relatively simple and comprehensive fault rate is low comparing with fuel cars using complex engines and gearboxes.

Following the product factor, the cost factor has the second strong impact on purchase intention. It has three sub-factors left: vehicle price, government subsidy and fuel cost. These are the main costs when purchasing and using a new energy car. Apart from product factor which is definitely the most important one, the rising importance of cost factors probably proves that during the economy downward people are looking for cars with lower costs. The two sub-factors not included here are maintaining cost and accessory cost. Again, it is probably due to simple structure of electric car that caused maintaining cost and accessory price low, which makes these costs not of consumers' major concern anymore.

There are one sub-factor left for sale & brand and environment each. It means these two main factors do not impact purchase intention as much as product and cost do, but the two sub-factors left are still of some importance, especially the after-sale service. Cars are not ordinary merchandise with a short life. It may accompany consumers or the following second hand users for several or many years, even one or two decades or more, and the after-sale service can only be done by professional car makers. As a result, sellers and makers' ability to provide after-sale service is quite important for the car continues to be a merchandise throughout its lifecycle.

For the dependent variable, two sub-factors are more important, which shows people consider new energy car representing leading technology (probably affected by hi-tech companies like Tesla) and better for environment with no doubt. What may be interesting here is people do not consider new energy car as a type of more advanced product comparing with traditional fuel car. Perhaps they think even though traditional fuel car has fallen behind in technology, but it is after all a type of more delicate product which holds complex craftwork in parts like engine and gearbox and new energy car is just a simplified form of car product itself. Perhaps they think new energy car is a high technology product, easy to use and maintain and less costly, but not high class enough, just like digital watch and mechanical watch.

Another interesting result is that sub-factors 5.5 is removed because its impact is weak. This means even though people know new energy car has many advantages over traditional fuel car and they have a good impression upon new energy car, they still cannot be sure they will definitely choose new energy car instead of traditional fuel car. In another word, the advantage of product and good impression of people do not necessarily transfer into actual purchase power. The reason may be complex. Problems such as limited travel mileage, shortage of charging pile, safety of lithium battery, etc. may prevent consumers to finally make up their mind to purchase a new energy car. Further development and improvement is needed for the new energy car industry. But fortunately, people have gradually realized

new energy car is a better product with lots of merits, especially the low cost and green emission.

7. Conclusion and Recommendation

7.1 Conclusion

Through the coefficient analysis, we can see that product factor and cost factor affect new energy car purchasers' intention more than sale, brand and environment factors. Next, through the reliability and validity analysis, we can see among the 20 sub-factors of independent variables, the following 9 have the most significant impact on purchasers' intention: vehicle price, government subsidy, fuel cost, travel mileage, speed and maneuverability, inner space and outer design, safety, after-sale service, balance of nature. 4 of these 9 sub-factors belong to product factor and 3 belong to cost factor, which also proves cost factor has a strong impact on purchasers' intention second only to product factor. While as commodity, product factor should have been the most important impact factor at any time, which makes cost factor actually the most important factor when consider buying a new energy car. The result shows that during the economic downturn, car consumers are more concerned on cost and they are more willing to buy new energy car mainly because its total costs of buying and using are lower comparing with traditional fuel car.

Another finding is that even though new energy car has obvious advantages over traditional fuel car such as low cost and green emission, and consumers are beginning to have a good impression on this product, many of them have not make up their mind to purchase one. They are still choosing. The weaknesses of this product are as obvious as its advantages, like limited travel mileage, shortage of charging pile, safety of lithium battery, etc. It still has a long way to go to replace traditional fuel car.

7.2 Recommendation

First, car makers should try to reduce their own cost in the whole producing and selling procedure. Nowadays car consumers are more concerned with price because of economic downturn. High price would very likely affect market and sales. Just like Tesla and Elon Musk who give us a hint: lower your cost, lower your price, sell more cars and become a car maker with world's largest market value.

Second, it is a pity that many consumers finally give up on buying a new energy car just because they do not have a place to charge their car, not because they do not like this product. It is very necessary to strengthen the construction of charging piles and supporting facilities to eliminate the main concerns of consumers about purchasing pure electric vehicles.

Third, car makers need to continue to develop new technologies, constantly improve the travel mileage and driving performance of new energy vehicles, and enhance consumer recognition. As a car, its travel range should not be limited within the city.

Fourth, car makers need to put more effort on battery research and development to increase battery safety. Also, it is necessary to increase the publicity on the safety and protection of new energy vehicles, and minimize the consumers' concerns about the safety and protection of new energy vehicles as far as possible.

References

[1] Tian Yuan, Zhuo Huijuan(2014).A practical study on the influencing factors of electric vehicle consumers' purchase decision.,, Business marketing, no.11,pp37-40.
[2] Zhao Huiqing, Yu Hang, Wang Jingwen, Cheng Jinzhuang, Xu Jingjie(2018).Research on Influencing Factors of purchase intention of new energy vehicles.Journal of Tianjin University of Commerce, Vol. 38,no.3,pp20-24.
[3] Li Wenjuan, Wu Tingting(2018).Research on Influencing Factors of consumers' purchase intention in new energy vehicle market.Market Weekly.no.11,pp112-114.
[4] Liu Yafei, Xin Xiaoshan, Zhang Cui, Xu Yan(2015).Research on purchase intention of new energy vehicles in Beijing from the perspective of network effect.Exploration Zone,no.1,pp233-235.
[5] Zhang Zhe, Gan Hongcheng(2017).The exploration of the influencing factors of Shanghai residents' willingness to buy electric vehicles.Science Technology and Industry, no.03.pp69-72.
[6] Ringle, C. M., Wende, S., and Becker, J.-M. 2015. "SmartPLS 3." Boenningstedt: SmartPLS GmbH, http://www.smartpls.com.