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Push-Pull-Mooring 모델을 이용한 전기자동차로의 사용자 전환의도에 관한 연구

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A Study on User Conversion Intention to Electric Vehicle Using Push-Pull-Mooring Model

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Abstract

This research will study the conversion intention of the users in China from fuel vehicle to new energy vehicles through the empirical methods. To this end, a questionnaire survey was conducted with car users as the object, combined with the theory of user migration and the PPM model to analyze the impact of fuel vehicle users' conversion intention to new-energy vehicles factor. The results showed that purchase experience contains the moderating effect, in which perceived risk and switching costs had a greater impact on the groups without purchase experience, whereas social identity, perceived value, personal attitude, and willingness to switch had a greater impact on groups with the purchase experience. Among all five factors, perceived risk had no discernible impact on the switching intention, but social identity, perceived value, attitude toward switching, and switching costs all had discernible impact on the switching intention. This study expects to come out with sustainable advises for the future growth of new energy vehicles from the study of car users' switching intention and the collective difference test of purchasing experience.

Keywords: Electric Vehicle, Switching Intention, Push-Pull-Mooring, Moderator Variable, Purchasing Experience
JEL Classifications: M10, M31

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Ⅰ. Introduction

An increasing number of countries are using new energy as one of their national development strategies due to problems such as environmental pollution, depletion of petroleum resources, and resource overexploitation. Studies have shown that HC (Hydrocarbons), NOx (Nitrogen Oxides), SOx (Sulfur Oxides), CO (Carbon Monoxide), and Pb (Lead) produced by automobile exhaust are not only harmful to the environment but also affect human health (Su. J, 2022). This phenomenon has forced countries around the world to speed up their plans to ban gasoline vehicles and propose an ICE ban. According to the plan, Norway will ban the sale of petrol cars as early as 2025 (ICCT, 2021). In China, Hainan Province will be the first city to pilot a total halt to the sale of gasoline cars and plan to complete the prohibition before 2030 (The People's Government of Hainan Provincial, 2022).

With the continuous improvement of people's living standards and technology, the family of new energy vehicles continues to grow, and there are as many as 8 types of products, including pure battery electric vehicles, hybrid electric vehicle, fuel cell electric vehicle, hydrogen powered vehicle, extended range electric vehicle, methanol vehicles, airpowerd vehiele, and other new energy vehicles (e.g., supercapacitor, flywheel energy storage). On January 6, 2017, the "Regulations on the Administration of New Energy Vehicle Manufacturers and Products Access" clarified that new energy vehicles refer to vehicles that use new power systems and rely entirely or mainly on new energy sources, including plug-in hybrid (Including extended-range) vehicles, pure electric vehicles and fuel cell vehicles, etc (Ministry of Industry and Information Technology of the People's Republic of China, 2017).

Since 2016, the domestic new energy market has performed brilliantly. Statistics showed show that the current number of new energy vehicles in China has exceeded 10 million, accounting for 59% of the global share of new energy vehicles. As of June 2022, the number of motor vehicles in China will reach 406 million, 310 million cars, and 10.01 million new energy vehicles. New energy vehicles accounted for 3.23% of all vehicles. Among them, there are 8.1 million pure electric vehicles, accounting for 80.93% of all new energy vehicles (Central People's Government of the People's Republic of China, 2022).

For now, there is a sharp increase in the global penetration rate of new-energy vehicles, which is expected to reach 10% in 2022. Among them, Chinese new energy vehicle penetration rate will reach 22%, Germany will reach 22%, Norway will reach 71%, the United States has only 7%, and Japan has only 2%. So it is very clear that the global development of new energy is out of balance. New energy automobiles will enter a totally new era of rapid growth as the United States increases the penetration rate. Therefore, we believe that it is important to carry out a in-depth research on the willingness of Chinese new energy vehicle users to switch. This is not only because China is the country with the fastest growth rate of new energy vehicle users, but also mining the willingness of new energy vehicle users to switch is conducive to promoting the ICE ban, which has profound implications.

Ⅱ. Theoretical Background

At present, most of the researches on new

Table 1. Penetration Rate of New-Energy Cars Around the World

Penetration Rate		2016	2017	2018	2019	2020	2021	2022 Q1	2022 Q2	Grand Total
China Summary		1%	3%	4%	5%	5%	13%	19%	25%	22%
Europe	Germany	1%	1%	2%	3%	13%	23%	22%	23%	22%
	France	1%	2%	2%	2%	9%	14%	16%	16%	16%
	Norway	22%	29%	38%	42%	58%	70%	73%	70%	71%
	Europe Other	1%	1%	1%	2%	4%	7%	6%	8%	7%
	Sweden	3%	4%	7%	10%	27%	39%	47%	43%	45%
	Italy	0%	0%	0%	1%	3%	10%	10%	10%	10%
	England	1%	2%	2%	3%	9%	16%	21%	18%	19%
European Summary		1%	1%	2%	3%	8%	14%	14%	15%	14%
North America	North America Other	0%	0%	1%	1%	1%	2%	2%	3%	2%
	America	1%	1%	2%	2%	2%	4%	6%	7%	7%
North America Summary		1%	1%	2%	2%	2%	4%	6%	6%	6%
Asia	Korea	0%	1%	2%	2%	3%	6%	8%	10%	9%
	Japan	0%	1%	1%	1%	1%	1%	2%	2%	2%
	Asia Other	0%	0%	0%	0%	0%	0%	0%	0%	0%
Asia Other Summary		0%	0%	0%	0%	0%	1%	1%	2%	1%
Southern Hemisphere Summary		0%	0%	0%	0%	0%	0%	1%	0%	0%
Total		1%	1%	2%	2%	4%	8%	10%	12%	11%

Source: wallstreetcn, 2022

energy vehicles were based on the perceived risk theory (Shu, T. et al., 2022)), planned behavior theory (Wang, Z. et al., 2017; Du, H. et al., 2018) and technology acceptance model (Wang, Z. et al., 2017; Wang, R. et al., 2021; Li, J. et al., 2020), all focusing on the Influential elements of new energy vehicle's purpose of purchasing and behavior. Few researchers have studied the conversion willingness of new energy vehicle users. This study complements the research on users' conversion willingness in this field and combines the PPM theory with the social identity theory to provide new ideas and concepts for new energy vehicle research.

The full name of PPM is Push-Pull-Mooring, which indicates the effective factors from the migration behavior of people moving from one area to another area can be explained in three aspects (Push, Pull, and Mooring-effect). This model was firstly mentioned in the study of population movement. Subsequently, Bansal (2005) applied the PPM-model to explain the user's alternated actions, and obtained the determinants of the user's switching willingness: Push effect which indicates the factors of the user tend to move away from the original channel; Pull effect which means the positive factors that pull users in new channels; Mooring effect which

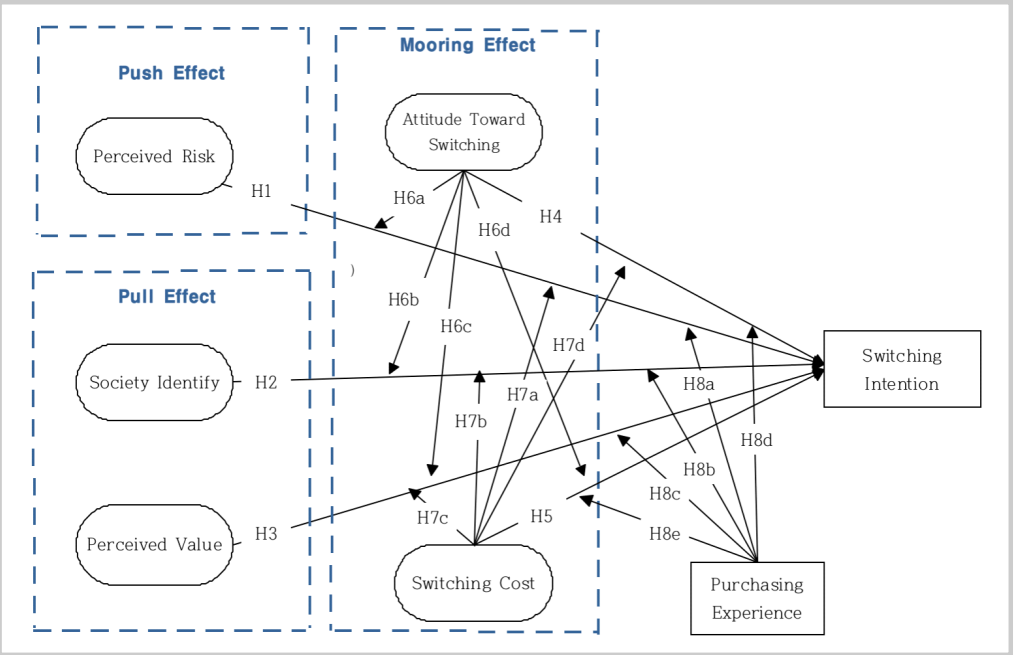
points out the factors that hinder users from switching. Nowadays, more and more scholars chose the PPM model within the field of marketing and information behavior (Hsieh, J., et al., 2012; Lai, J.-Y., et al., 2012).

Several scientific sectors have used the PPM model such as human-computer interaction (Lin, X., Chien, S., Hung, C., Chen, S, 2021; Chen, Y. H., & Keng, C. J, 2018; Cheng, S., Lee, S. J., & Choi, B, 2019; Chang, I. C., Liu, C. C., & Chen, K, 2014; Liao, Y. W., Huang, Y. M., Huang, S. H., Chen, H. C., & Wei, C. W, 2019), cloud computing service(Lee, S. H., & Jeong, S. C, 2021; Yoon, C and D. Lim, 2021), consumer research(Ghazali, E. M., et al., 2020, Yaqing, Zhang., Hee-Kyun, Oh., Chung Hun, Lee, 2021) and e-commerce (Chang, H., Wong, K., & Li. S, 2017). Scholars Liu and Lee (2020) studied the Chinese mobile gaming players' intentions to switch, taking factors such as "perceived challenge", "Bridging Social Capital" and "Continuance Commitment" as important influencing factors. Their findings showed that most of the variables in the PPM-frameworks have a substantial influence on the desire to switch, and they also have a moderating effect on each other.

Social identity theory originated in Europe and occupies a major position in social psychology. It was proposed and perfected by Tajfel in the 1970s and 1980s (Turner, J. C and Reynolds, K. J, 2010). The theory distinguishes between individual identity and social identity. It is an important part of an individual's self-conceptualization, which in turn affects the social attitudes and behavior of the group. This concept also serves as a way to explain intergroup behavior, providing new ideas for explaining intergroup behavior (Tajfel, H and Turner, J. C, 1979). Social identity theory is considered to consist of three basic processes of social identity, which are classification, comparison and positive distinctiveness. Classification refers to the classification of events, people, and objects into a certain community; Comparison refers to the advantages and disadvantages, status, rights, and reputations of the group identified by the party compared with other groups; Positive distinctiveness means that after comparing the status, power and reputation of the identified group with that of other groups, if the party concerned is not satified the current condition will distance themselves from the group or seek ways to achieve positive distinctiveness, such as comparing with the group with lower social status, so as to improve self-esteem. And social identity theory holds that an organization can change an individual's behavior as long as it can change their own identity or part of their self-concept generated by their knowledge and emotional attachment to the group (Tajfel, H and Turner, J. C, 1979).

Social identity theory is widely used in various studies. For example, the research results from Awaluddin, I and Hamid, W (2019) showed that consumers will be influenced by social identity and national identity. Grimmer, M (2011) believed that when consumers use cars, they will consciously reflect their social identities. Individuals will choose and buy cars with symbolic meanings that are consistent with their own image, so as to help them position themselves in society and achieve the purpose of improving self-esteem. Zhou, Lin and Deng (2021) Among the pull factors, social identity has the strongest effect on transfer intention (0.48), which has a significant positive effect. On this basis, this study adopts PPM model combined with social identity theory to learn and confirm the

Fig. 1. Research Model



switching purpose of car users.

Ⅲ. Research Model and Hypothesis

1. Research Model

The PPM-model framework used in this case is shown below (Fig. 1).

2. Hypothesis

(1) Push Effect (Perceived Risk)

Perceived risk was developed in psychology by Bauer (1960) at Harvard University. According to Bauer (1960), it is not possible to know the certainty of whether the expected result is accurate, no matter what purchasing action is taken. Uncertainty about the outcome is underlying consumer purchasing decisions, and this uncertainty can be viewed as the initial concept of perceived risk. Cox (1967) followed the study from Bauer (1960) to redefine the concept of risk sensing. Cox (1967) argued that perceived risk acts as a risk of detecting disadvantages that may occur when the result does not meet expectations after the purchase has occurred. However, Kotler (1997) argued that when consumers feel risky, they are more likely to change or postpone or cancel their decisions. Research from Chou, S.-Y. et al., (2016) confirmed that cross-channel free-riding intent is significantly and directly affected by the risk perception associated with online retailers. Also, Chiu, H.-C. et al., (2011) concluded that The appeal of rivals' offline retailers is positively impacted by the perceived risk of online purchases (λ = .17, t = 3.30). Whereas

customer's willingness to embrace EVs is adversely impacted by perceived risk (Wang, S. et al., 2018). This could lead to the following theory being proposed:

H1: Perceived risk will negatively affect switching intention.

(2) Pull Effect (Society Identify)

A social psychology theory called social identity theory conceptualizes self-analysis (Tajfel. H and Turner. J, 1979). Scholars Deaux and his colleagues (1999) found that social identity has seven functions, including improving self-perception, intergroup comparison, cohesion, collective self-esteem, inter-individual comparison, social interaction opportunities, and love relationships. Moreover, Abdulrazak, S and Quoquab, F (2018) believed that social identity is the specific social benefit realized by consumers' perceived behavior in the consumption process, and the realized specific social benefit strengthens the consumer's social self-concept. Also, research from Awaluddin, I and Hamid, W (2019) indicated that consumers' purchasing decisions are heavily influenced by social identity, whereas domestic purchase intentions are significantly influenced by national identification. Jiang and other scholars (2022) also verified the important role of social identity which indicated by social identity is directly related to sustainable consumption behavior, whereas all three functional, emotional, and social values indirectly affect consumers' sustainable consumption behavior through social identity. Therefore, the following hypothesis could be made:

H2: Society identify will positively affect switching intention.

(3) Pull Effect (Perceived Value)

The customer's impression and appraisal of any attribute of a product such as its performance, and the effects of product usage that help achieve goals and intentions in specific circumstances are referred to as perceived value (Flint, D. J. et al., 1997). Perceived value is the main competitive advantage (Michael Porter, 1985; Gale, 1994; Murali, 2016), and also the balance between perceived benefits and cost relationships (Hsu & Lin, 2015). Positively triggering changes in customers' perceived values, values, and value judgments, helping to strengthen relationships with customers (Flint, D. J. et al., 1997). Perceived value has an impact on switching intention (Chang, H. H., et al., (2017); Chen, K. et al., (2019). The related discovery confirmed that three dimensions of perceived value (price, functional value, service quality) have different effects on the purpose of purchasing, and perceived value positively affects EV adoption intention (Kim, M.-K. et al., 2018). So that, the following possibility could be listed:

H3: Perceived Value will positively affect switching intention.

(4) Mooring Effect (Attitude Toward Switching)

The rational action theory asserts that people are rational and they consider the meaning and consequences of their actions by synthesizing various information before taking any action. Fishbein and Ajzen (1980) analyzed how individual attitudes significantly affect individual behavior according to the definition, and focused on the attitude formation process based on

cognitive information. Attitude is a factor of cognition and is seen as a direct determinant of consumer behavior willingness. It is said that consumers' emotions can affect their cognitive state (attitude), which in turn affects the user's response to new energy vehicles. Brown and Stayman (1992) and Andrade (2005) proved the emotional-attitude response sequence, whereas M. S. Morgan and C. S. Dev (1994) believed that attitude towards conversion is a determining factor in users' willingness to convert. Simon, Nimako and Benjamin A. Ntim (2013) also verified the influence of switching attitudes on switching intention in their research. Furthermore, Wang, S. et al., (2018) and Higueras-Castillo, E. et al., (2019) showed that the readiness of consumers to accept electric vehicles is positively connected with their sentiments regarding to them. As a result, this investigation supported the following hypothesis:

H4: Attitude toward switching will positively affect switching intention.

(5) Mooring Effect (Switching Cost)

The majority of researchers took switching costs as an important mooring effect and conducted studies to validate them (Chang, H. H. et al., 2017; Nimako, S. et al., 2013; Yoon, C. et al., 2021; Liu, J. et al., 2020; Xu. et al., 2021; Lin CL. et al., 2021; Lin. X. et al., 2021). The expenses a customer incurs while switching from one supplier's goods to another are known as switching costs (Zhou, 2001). Scholar Burnham and his colleagues (2003) separated switching costs into the following sub-types (program switching costs, financial switching costs, and relational switching costs). Scholar Jones and his teammates (2007) validated the effect of various switching costs(procedural, social, and benefit loss) on interpersonal outcomes, both positively and negatively; furthermore, the results showed that social switching cost and benefit loss cost increase emotional commitment, which positively impact relationship outcomes. The improvement of emotional commitment will increase users' optimistic feelings and desires to repurchase, thereby reducing negative WOM (word of mouth). On the other hand, program switching costs support computing commitments and negatively affect relationship outcomes, even though in some cases it will increase users' willingness to repurchase, but it will also bring unfavorable feelings and negative WOM. In product or service sales, when users feel that the switching cost is high, even if they are not satisfied with the existing service or product, the users tend to remain with the same product suppliers which also means they are invisibly locked in the existing product (Bansal, H. S., et al., 2005). Based on that, this research supported the hypothesis below:

H5: Switching cost will negatively affect switching intention.

(6) Mooring Effect Moderator Effect

Previous studies had found that the mooring effect also moderates switching intention (Suite, M., & Karahanna, E. 2006; Seo, S., Kim, K., & Jang. J, 2018; Chen, Y. H. & Keng, C. J, 2018; Chang, I. C., Liu, C. C., & Chen. K, 2014; Chang, H. H. et al., 2017; Liu, J. & Lee. J, 2020; Chen, Y. H., & Keng, C. J, 2018) found the mooring effect significantly moderates the connections within the pull and push effect from a study exploring user intent to transfer from the

off-line to online English-learning live streaming class. Researcher Chang and other scholars (2014) studied social networking sites (SNSs) and confirmed a strong moderator between pull and mooring factors, and this moderating effect helps solve the confusion of why switching may not always happen when a push component is present. Moreover, Chang, H. H. et al., (2017) validated the partial moderating connection using the M-shopping's self-efficacy and switching cost of the mooring effect as moderators. Also, the study by Liu, J and Lee, J (2020) confirmed that the increasing frequency of playing existing mobile games among Chinese mobile game users will moderate the connection between the appeal of competing for mobile games and their switching intention. Based on this, the following hypothesis might be put forth:

H6-a: Attitude toward switching moderates the connection in between perceived risk and switching intention.

H6-b: Attitude toward switching moderates the connection in between society identify and switching intention.

H6-c: Attitude toward switching moderates the connection in between perceived value and switching intention.

H6-d: Attitude toward switching moderates the connection in between switching cost and switching intention.

H7-a: Switching cost moderates the connection in between perceived risk and switching intention.

H7-b: Switching cost moderates the connection in between society identify and switching intention.

H7-c: Switching cost moderates the connection in between perceived value and switching intention.

H7-d: Switching cost moderates the connection in between attitude toward switching and switching intention.

(7) Moderating Effect from Purchase Experience

The moderating impact of purchase experience has been confirmed and involved in the different research domains. For instance, social live streaming services (Song, Y. J., & Lee. Y, 2020), online store attributes (Byoungho, Jin and Jin Yong. Park, 2006), E-commerce (Hernández, B. et al., 2010), multichannel shopping (Campo, K and E. Breugelmans, 2015), online shopping sites (Han, S. J., & Kang. S, 2016) and social shopping (Sung Haengnam; Kim, Wonjong and Jae-Ik Shin, 2016). Hernández, B. et al., (2010) explored customer behavior in e-commerce by comparing potential and experienced e-customers, which further discovered that the e-customers with purchasing experience are less likely to abandon the buying process due to the interactions with complex websites. Perceived ease of usage has very little effect on potential electronics customers. Campo, K. and E. Breugelmans (2015) found that there were differences in the experience effect of different consumer groups. Research from Song, Y. J and Y. Lee (2020) demonstrated that the connection between cognitive communion and responsiveness/playfulness was significantly moderated by the SLSS purchasing experience. The research from Han, S. J and Kang, S (2016) also confirmed that purchase experience has a strong moderating impact. With the increasing purchase experience,

Table 2. Measurement Items

Construct		Item	Related Studies
Perceived Risk	1	I am concerned about the technology of new energy vehicle products is immature, there are still defects or flaws.	Wu, K.; Vassileva, J.; Zhao, Y. (2017). Bauer, R.A. (1960). Jacob, J. & Leon, B. K. (1972). Peter, J. P., et al., (1975)
	2	I am concerned about the performance of the new energy vehicle is not inconsistency to the propaganda from the merchants.	
	3	I am concerned about the financial losses due to inadequate facilities such as charging, maintenance, and repair facilities.	
	4	I am worried that there are potential battery safety problems in new energy vehicles and I did not find them in time when I purchased them.	
	5	I am worried that the performance of new energy vehicles will not meet my expectations.	
Social Identify	1	Using new energy vehicles provides me with the perception of affiliation.	Chiu, C. M., et al., (2006) Jiang S, Jotikasthira N, Pu R. (2022)
	2	Using new energy vehicles provides me with a sense of intimacy.	
	3	Being a part of the new energy vehicle family makes me proud.	
Perceived Value	1	All things considered, new energy vehicles are a good deal.	Sweeney, J. C., et al., (2001). Cocosila, M., et al., (2016). Simon, Nimako. and Benjamin A. Ntim., (2013)
	2	I believe new energy cars are incredibly cost-effective and economical.	
	3	In general, using new energy cars gives me more value for my money.	
	4	I do think that I get more benefits than the value I spent on new energy vehicles.	
Attitude Toward Switching	1	I think new energy cars are satisfactory.	Nimako, et al,. (2013) Bansal, et al,.2005) M. S. Morgan and C. S. Dev.(1994)
	2	I am interested in new energy cars.	
	3	I think new energy cars are very good.	
	4	In general, I have an optimistic attitude toward new energy vehicles.	
	5	For me, it was a good decision to switch from gasoline vehicles to new energy vehicles.	
Switching Cost	1	To learn about, purchase, and operate new energy vehicles, I'll need so much time, effort, and money.	Blut et al. (2014). Chang, et al., (2017).Burnham, et al,. (2003) Xu H., et al., (2021)
	2	To move from my existing gasoline-powered automobiles to new energy vehicles, I will invest tons of time, effort, and money.	
	3	I believe switching to another new energy vehicle would be expensive.	
	4	In general, if I transition from a gasoline automobile to a new energy vehicle, I will lose the advantages of long-distance traveling.	
Switching Intention	1	Do you plan to move to a better new energy car in the upcoming year?	Chang, et al., (2014). Hsieh, et al., (2012). Chang, et al., (2017). Mehmet Cem Bölen. (2020)
	2	In the next two years, how probable is it that you' ll move from a fuel-powered car to an energy-powered one?	
	3	To satisfy my consumption requirements, I' ll move from fuel-powered to new-energy automobiles.	
	4	To satisfy my future transportation needs, I intend to move from fuel-powered vehicles to new energy ones.	
	5	I plan to primarily use energy vehicle soon.	
	6	I will try to use energy vehicles as much as possible.	

Notes: This questionnaire used the seven-point Likert scale.

preventive consumers will have higher trust in online shopping websites than promotional consumers. Based on that, the following hypothesis could be made from this paper:

H8-a: Purchase experience moderates the connection in between perceived risk and switching intention.

H8-b: Purchase experience moderates the connection in between society identify and switching intention.

H8-c: Purchase experience moderates the connection in between perceived value and switching intention.

H8-d: Purchase experience moderates the connection in between attitude toward switching and switching intention.

H8-e: Purchase experience moderates the connection in between switching cost and switching intention.

Ⅳ. Empirical Analysis

CB-SEM (covariance based structural equation modeling) and PLS-SEM (partial least squares structural equation modeling) both are frequently used in PPM model validation, such as in the respective studies from Zhang, Y. et al., (2021), Yoon, C. et al., (2021), Nguyen, T. H. N. et al., (2022), Kang. K., et al., (2021). In those researches, partial least square SEM (PLS-SEM) was used for research demonstration, whereas Xu, H. et al., (2021), Liu, J. et al., (2020), Lin. X. et al., (2021), Ghazali, E. M. et al., (2020), and Zhang, K. Z. K. et al., (2012) used covariance-based SEM (CB-SEM) for research and demonstration. In this study, CB-SEM was used for research analysis and demonstration for the following two reasons:

Nimako, S and B. Ntim (2013) suggested that researchers could evaluate a formatively specified model of push-pull-mooring by using the CB-SEM method, following the systematic approach used in the empirical description. research Dash and Paul (2021) believed that CB-SEM and PLS-SEM have different requirements in term of the data: CB-SEM has higher data requirements, while PLS-SEM has more relaxed data requirements, although these two analytical methods ultimately provided nearly similar results. Dash, G and J. Paul (2021) suggested that for factor-based models, CB-SEM is more appropriate, and for the composite-based models, PLS-SEM should be chosen. Therefore, based on the above considerations, this study adopts CB-SEM for research analysis and demonstration.

1. Research Data

The questionnaire from this research adopted the seven levels of the Likert scale, and it was released through the online platform credamo (www.credamo.com), and the data collection was carried out after one week on June 6, 2022. In total, 320 responses were gathered. After excluding 27 invalid responses and 293 copies left, the effective rate is 91.56%.

This study conducted a survey of adults over 18-year-old (family unit) in China. The results showed that among all 293 valid responses, 40.6% were men and 59.4% were women. Only 2.7% were aged between 18-20, 50.2% were aged between 21-30, 36.2% were aged between 31-40, 6.5% were aged between 41-50, and 4.4% were aged over 51. In terms of the question about the number of car possession within the family, 59.4% of the respondents own one fuel vehicle in the family, 10.6% have one new energy vehicle and 4.4% have two fuel vehicles. Moreover, families with one fuel car and a new energy vehicle accounted for 25.3% of the total, while those with neither of the above accounted for only 0.3%.

Table 3. Demographic Characteristics

Variable	Category	Frequency(N=293)	Ratio(%)
Gender	Male	119	40.6%
	Female	174	59.4%
Age	18~20	8	2.7%
	21~30	147	50.2%
	31~40	106	36.2%
	41~50	19	6.5%
	over 51	13	4.4%
Occupation	Student	26	8.9%
	Civil Servant	21	7.2%
	Self-Employed	18	6.1%
	Company Employee	209	71.3%
	Other	19	6.5%
Assumptions Average Annual Gross Revenue	RMB 100,000 and below	39	13.3%
	RMB 110,000~200,000	113	38.6%
	RMB 210,000~300,000	89	30.4%
	RMB 310,000~500,000	44	15.0%
	RMB 510,000 and above	8	2.7%
Highest Education	High school or below	19	6.5%
	3-year college	33	11.3%
	4-year college	203	69.3%
	Master	37	12.6%
	Doctor	1	0.3%
Address	First-tier city	59	20.1%
	second-tier city	119	40.6%
	3rd-tier city	73	24.9%
	4th-tier city	29	9.9%
	5th-tier city	13	4.4%
Average Monthly Mileage	1000km and below	115	39.2%
	1001km~2000km	133	45.4%
	2001km~3000km	38	13.0%
	3001km and above	7	2.4%
Total number of household cars	None	0	0.0%
	1 fuel car	174	59.4%
	1 energy car	31	10.6%
	2 fuel car	13	4.4%
	1 fuel car, 1 energy car	74	25.3%
	None of the above	1	0.3%

Table 4. Reliability Statistics

Cronbach' s Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.775	0.815	27

Table 5. Correlation Analysis

	M	SD	PR	ID	PV	ATT	SC	SI
PR	4.063	1.500	1					
ID	5.101	1.212	−.345**	1				
PV	5.598	0.961	−.205**	.491**	1			
ATT	5.646	0.930	−.239**	.423**	.464**	1		
SC	3.738	1.414	.425**	−.282**	−.261**	−.294**	1	
SI	5.433	1.196	−.373**	.669**	.584**	.568**	−.434**	1

Notes: The correlation is significant (two-tailed) at the 0.01 level.
*** P<0.001; ** P<0.01; * P<0.05

2. Reliability Analysis

Reliability is a gauge of a scale's reliability or consistency, also known as a reliability or consistency test. In this text, the internal consistency reliability was conducted by using Cronbach's Alpha coefficient. The SPSS 25.0 data processing results revealed that Cronbach's Alpha number of the questionnaire from this case is 0.775. According to the standard Cronbach's Alpha coefficient (>0.7) of NUNALLY (1994), it can be judged that the scale has great reliability.

3. Correlation Coefficient Between Variables

The correlation output is shown as following Table 5. All factors were significantly correlated with the willingness to switch. There was a notable inverse connection between perceived risk, switching cost, and switching intention among them. Whereas significantly positive correlations were shown between social identity, perceived value, attitude toward switching, and switching intention.

4. Validity Analysis

Validity describes what extent to a scale can accurately express its intended meaning, and is mainly used to measure the validity of the index. The KMO-value from the sample data within the research was 0.922, also the Bartlett sphericity test was significant at the level of p=0.000, that revealed the data was suitable for the factor analysis. Furthermore, ehe principal component analysis method was used to perform factor rotation, which converged in 6 iterations. In total, 6 factors with eigenvalues higher than 1 were extracted, and the cumulative explained variance was 74.95%, and each item's factor loading under its factor was more than 0.5. The cross-loadings were all less than 0.5, which points out that the scale has great validity (Kaiser, 1974).

To confirm the scale's reliability even further, this study calculated the standard

Table 6. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.922
Bartlett' s Test of Sphericity	Approx. Chi-Square	5708.743
	df	351
	Sig.	0.000

Table 7. Convergent Validity Analysis

Constructs	Items	Loading	AVE	CR
Perceived Risk	PR1	0.865	0.6865	0.9161
	PR2	0.759		
	PR3	0.868		
	PR4	0.835		
	PR5	0.811		
Society Identify	ID1	0.89	0.7289	0.8896
	ID2	0.843		
	ID3	0.827		
Perceived Value	PV1	0.757	0.6009	0.8575
	PV2	0.765		
	PV3	0.781		
	PV4	0.797		
Attitude Toward Switching	ATT1	0.821	0.607	0.885
	ATT2	0.695		
	ATT3	0.782		
	ATT4	0.774		
	ATT5	0.817		
Switching Cost	SC1	0.844	0.7036	0.9041
	SC2	0.901		
	SC3	0.876		
	SC4	0.723		
Switching Intention	SI1	0.73	0.682	0.9277
	SI2	0.828		
	SI3	0.863		
	SI4	0.807		
	SI5	0.856		
	SI6	0.863		

loading of each factor, the average variance extracted (AVE), the composite reliability (CR), and the correlation coefficient within all factors. The CR-values of each factor were all higher than 0.7, which indicates this scale has high internal consistency (Chin, 1998). The AVE-value from every single factor is more than 0.5, which means this scale has great convergent validity (Bagozzi, 1998). The square root of the AVE value from all factors are all greater than the correlation coefficient within the factors, that means the discriminant validity of the scale can be considered as good (Fornell, 1981).

Cenfetelli and Bassellie (2009) believed that a good formative variable has a low

Table 8. Discriminant Validity Analysis

	PR	ID	PV	ATT	SC	SI	VIF
PR	0.829						1.415
ID	−0.676***	0.854					1.518
PV	−0.32***	0.625***	0.775				1.322
ATT	−0.354***	0.52***	0.472***	0.779			1.497
SC	0.745***	−0.411***	−0.331***	−0.374***	0.839		1.306
SI	−0.742***	1.111***	0.792***	0.755***	−0.732***	0.826	

Notes: Square root of AVE value. *** P〈0.001; ** P〈0.01; * P〈0.05

Table 9. Model Fit

Fitting Index	Recommended Value	Fitting Result
CMIN	−	576.826
DF	−	309
CMIN/DF	〈3	1.867
RMSEA	〈0.08	0.054
GFI	〉0.80	0.870
AGFI	〉0.80	0.841
PGFI	〉0.05	0.712
NFI	〉0.90	0.902
RFI	〉0.80	0.889
IFI	〉0.90	0.952
TLI	〉0.90	0.945
CFI	〉0.90	0.952

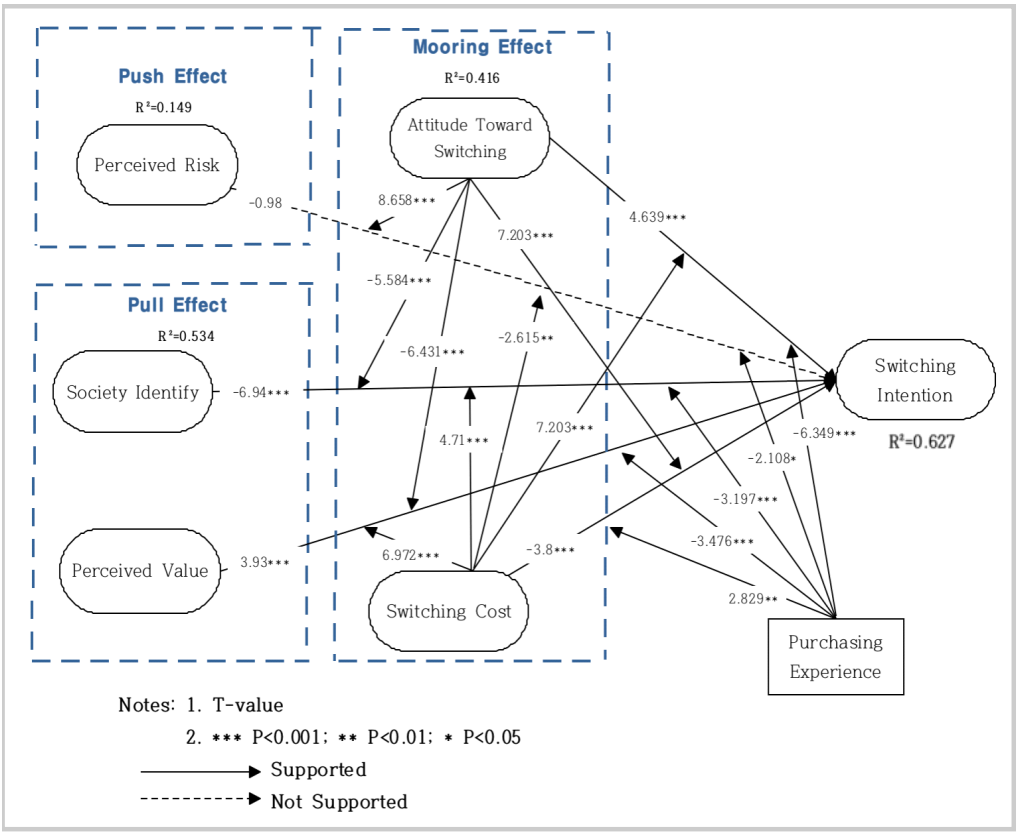
correlation between measures and no multicollinearity. Moreover, according to the suggestion from Hair and other scholars (2009), the ideal variance inflation factor (VIF) is less than 10. To prevent the increase in standard error due to multicollinearity, this study used smartPLS 3.3.9 for analysis, with the willingness to switch as the outcome variable. The outputs pointed out that the VIF values were entirely lower than 10, and no significant multicollinearity was detected.

5. Hypothesis Testing and Model Fitting

The model fit is shown in Table 9. RMSEA is least affected by sample size (Hu et al., 1995). RMSEA values fall between 0.0 and 0.05 indicating a very tight fit, then a reasonable fit will be a value less than 0.08, whereas a value higher than 0.08 is a poor fit (Browne and Cudeck, 1993). In this study RMSEA index value is 0.054, which fell into the reasonable range of fitting. The fitting indices of the models are all up to the standard, and the models fit well.

In this study, AMOS 21.0 and PROCESS v3.3 were used to test this study's hypothesis. The outputs of the model are shown below (Fig 2). The outcomes of the test revealed that, among all the hypotheses, only hypothesis H1 was not supported, the

Fig. 2. Hypotheses Test Results



p-value was higher than 0.05, and the rest were supported with a level of P less than 0.05. In addition, the explained variance of switching willingness is 62.7%, and the explained variance is relatively high, indicating that this model is appropriate to reflect the whole process of user switching willingness.

The hypothesis testing within this research is shown in Table 10. Except for H1, the other hypotheses were all supported. The specific analysis results were as follows:

In the push effect, Perceived risk negatively impacted switching intention (standardized coefficient=-0.046, P=0.328〉0.05), which did not reach statistical significance. Therefore, H1 is rejected. This is inconsistent with previous findings (Zhang, Y., et al., 2021), which means that perceived risk does not affect users' willingness to switch. These phenomena might be the result of a long time of new energy vehicle development. and the unprecedented breakthroughs in type, technology, and market share all reduced users' perceived risk perception. Also, various new energy vehicle brands such as Updates and iterations have sprung up, which leads to much more options for customers. Within the Top 20 worldwide new-energy brand sales for 2021, there were 8 from China, 4 from Germany, 3 from Europe, 2 from America, 2 from Korea, and

1 from Japan (CleanTechnica, 2021). We can see that Chinese brands account for 40% of the total which indicated that Chinese people have more and wider choices among the existing domestic car brands. Kircova, I and Esen, E (2018) argue that corporate reputation has a positive impact on both customer intentions and outcomes. According to incomplete statistics, since 2020, Tesla has had five brake failure scandals in China. In 2022, the US National Highway Traffic Safety Administration (NHTSA) launched an investigation into Tesla's "ghost brake" incident (CNBC, 2022). However, the scandal and investigation did not cause any impact or fluctuation on Tesla's sales. In 2021, Tesla's cumulative deliveries in China will be approximately 321,000 vehicles, an increase of approximately 133% compared to approximately 137,000 vehicles in 2020. %. The total sales in the first eleven months of 2022 will be 554,000 vehicles, a year-on-year increase of 72.5% (CPCA, 2022). This result confirms that even if the company's scandals lead to perceived danger, it will still not affect the willingness of Chinese users to switch.

In the pull effect, the greatest influence to switch intention was social identity (T-Value=6.944), and social identity positively affected switching intention (standardized coefficient=0.408, P=0.000). This is consistent with previous discoveries (Zhou, T., et al., 2021). The greater the user's social identity, the higher the willingness to convert. As Grimmer, M (2011) mentioned above, the car can represent the individual's image. Buying cars can help consumers position themselves in society and improve their self-esteem, which greatly affects their behavioral decisions. This proves that accurate car brand positioning, regular contact and continuous use of cars can help consumers establish a sense of identity and connection with the vehicle, and generate a sense of belonging. New energy vehicle brands can enhance users' sense of belonging and intimacy by establishing car clubs, organizing car fan meetings, or encouraging like-minded users to communicate and share information online or offline. Establish social identity and social positioning faster, so as to improve their self-esteem and achieve the purpose of decision-making. The research discovers that perceived value considerably increased (+) the likelihood of switching intention (standardized coefficient=0.229, P=0.000). Therefore, the greater the user's perception, the higher the switching intention. This is consistent with the discover from Ghazali, E. M., et al., (2020). This meant that high perceived value can effectively increase users' switching intention. With social progress and development, automobiles have become one of the daily necessities. In 2021, global automobile sales were 82.6848 million units, increasing 4.96% over the previous year (OICA, 2022). The demand for automobiles has increased significantly, followed by the depletion of oil resources and the global warming situation as well as the problem of rising oil prices has caused miserable users of oil vehicles. New energy vehicles offer more intuitive benefits than fuel vehicle (Egbue, O and Long, S, 2012). For example, carbon emission reduction and the promotion of renewable energy (Lopes, M. M., et al., 2014). Strengthening public awareness is also one of the main advantages of new energy vehicles, such as expanding the publicity of environmental protection, energy saving, air pollution reduction, cost reduction, carbon emission reduction, renewable energy promotion and so on.

Relevant government departments and automobile enterprises jointly promote online and offline through multi-channels such as multimedia, electronic platforms, urban LED advertising screens, so as to enhance users' value perception, increase users' willingness to switch, and accelerate the process of the era from fuel vehicles to new energy vehicles.

Within the mooring effect, attitude toward switching positively affected switching intention (standardized coefficient=0.248, P=0.000). As the attitude toward switching goes more positive, the switching intention will be greater. Conversely, when the attitude toward switching is more negative, the switching intention gets lower. This is also consistent with the discovery from Hussain, S., et al., (2022). The attitude toward switching and switching intentions significantly affect each other (Ajzen., et al., 2018). This means that actively promoting the conversion attitude of users is conducive to increasing the conversion intention, and how to improve the conversion attitude and avoid negative attitudes is very important. Relevant auto brand owners should avoid large-scale accidents that damage corporate reputation and operations, and maintain a good brand image. Instead they can use active donation to international large-scale events, actively rescue public events, etc. to improve social favorability, and change inherent stereotypes from all aspects of product quality, product features, corporate image, social image, and marketing methods, to improve conversion attitudes and reduce the generation of negative attitudes. Last but not the least, switching cost negatively affected switching intention (standardized coefficient=-0.180, P=0.000). This is congruent with what was found in earlier findings (Lin CL., et al., 2021; Cheng, S., et al., 2019; Chen, Y. H., et al., 2018). This result is also consistent with the idea from Liao, Y. W., et al., (2019) which is high switching costs hinder the switching intention. When the perceived switching cost of users is greater, the switching intention will be less. Conversely, the less cost to switch will lead to switching intention be greater. In this regard, the government can introduce corresponding subsidy policies, such as vehicle purchasing subsidies, vehicle maintenance subsidies and household charging station construction subsidies, etc. Optimizing the existing policies and regulations and expanding the coverage of charging stations. In addition, new energy vehicle developers can reduce the drawbacks of existing new energy vehicles by increasing the range of existing products, adding intelligent/humanized functions, improving the charging speed, reducing the charging loss, and developing corresponding remedies when there is little or no power, to reduce the switching cost of users and enhance their willingness to switch.

The moderating influence from the mooring effect has been verified (Chang, H. H., et al., 2017; Liu, J., & Lee. J, 2020). In this study, P values were all less than the significance level (0.05), which indicated statistically significant. Therefore, the research hypothesis was supported. Switching attitudes and switching costs moderated the connection within the push/pull effect and switching intention, which was supported by previous research discoveries (Chen, Y. H., et al., 2018; Chang, I. C., et al., 2014; Chang, H. H., et al., 2017). This means that the more negative the switching attitude, the higher the switching cost, and the more negative the link between the push-pull effect and switching intention.

Table 10. Results of Hypotheses Testing

SD-SEM Path Analysis (Main Effect)

Path				Estimate	Std.Est	S.E.	C.R.	P	Result
H1	SI	<-	PR	-0.04	-0.046	0.044	-0.98	0.328	Not Supported
H2	SI	<-	ID	0.439	0.408	0.063	6.944	***	Supported
H3	SI	<-	PV	0.314	0.229	0.08	3.939	***	Supported
H4	SI	<-	ATT	0.347	0.248	0.075	4.639	***	Supported
H5	SI	<-	SC	-0.19	-0.180	0.049	-3.802	***	Supported

Mooring Effect Moderator Effect (Attitude Toward Switching)

Path				β	SE	T	P	95% CI		Result
								Lower	Upper	
H6a	SI	<-	PR	0.3092	0.0357	8.6581	0.000	0.2389	0.3794	Supported
H6b	SI	<-	ID	-0.1816	0.0325	-5.5848	0.000	-0.2456	-0.1176	Supported
H6c	SI	<-	PV	-0.2723	0.0423	-6.4315	0.000	-0.3556	-0.1890	Supported
H6d	SI	<-	SC	0.2464	0.0342	7.2032	0.000	0.1790	0.3137	Supported

Mooring Effect Moderator Effect (Switching Cost)

Path				β	SE	T	P	95% CI		Result
								Lower	Upper	
H7a	SI	<-	PR	-0.0715	0.0274	-2.6154	0.009	-0.1254	-0.0177	Supported
H7b	SI	<-	ID	0.1159	0.0246	4.7180	0.000	0.0676	0.1643	Supported
H7c	SI	<-	PV	0.2269	0.0325	6.9742	0.000	0.1629	0.2910	Supported
H7d	SI	<-	ATT	0.2464	0.0342	7.2032	0.000	0.1790	0.3137	Supported

Dummy Variables Moderator Effect (Purchasing Experience)

Path				β	SE	T	P	95% CI		Result
								Lower	Upper	
H8a	SI	<-	PR	0.1982	0.0940	2.1087	0.0358	0.0132	0.0383	Supported
H8b	SI	<-	ID	-0.3358	0.1050	-3.1973	0.0015	-0.5425	-0.1291	Supported
H8c	SI	<-	PV	-0.4450	0.1280	-3.4766	0.0006	-0.6969	-0.1931	Supported
H8d	SI	<-	ATT	-0.7816	0.1231	-6.3498	0.000	-1.0239	-0.5393	Supported
H8e	SI	<-	SC	0.2691	0.0951	2.8296	0.0050	0.0819	0.4563	Supported

Notes: Subordination variable: Switching Intention; Bootstrapping = 5000
*** P<0.001; ** P<0.01; * P<0.05

On the contrary when the switching attitude is more positive, the switching cost is lower, and the connection between the push-pull effect and switching intention is stronger.

This study also found the purchase experience had a significant moderating influence. This is well-supported by the findings from previous research (Song, Y. J., & Lee, Y, 2020; Byoungho, Jin. and Jin Yong, Park, 2006; Hernández, B., et al., 2010; Campo, K and E. Breugelmans, 2015; Han, S. J., & Kang. S, 2016; Sung Haengnam, Kim, Wonjong and Jae-Ik Shin, 2016). P values were all 0.00 less than 0.05 (significance level), which reveals the remarkable variations existed between the various groups The difference test is shown in Table 11. As we can see from the average value of each group, the influence of perceived risk and switching cost is significantly greater than

Table 11. T Testing

Item	None (N=187)	Have (N=106)	T	P	F	95% CI	
						Lower	Upper
PR	4.4321±1.45921	3.4113±1.34627	5.915	0.00	0.528	0.6811	1.36043
ID	4.8253±1.27859	5.5881±0.90097	−5.956	0.00	15.862	−1.01484	−0.51064
PV	5.4305±0.99419	5.8939±0.82372	−4.286	0.00	5.556	−0.67629	−0.25049
ATT	5.5037±0.9491	5.8981±0.84188	−3.677	0.00	7.704	−0.60565	−0.18309
SC	3.9906±1.44067	3.2925±1.25189	4.340	0.00	6.70	0.38129	1.01509
SI	5.1105±1.33746	6.0016±0.54457	−8.014	0.00	75.287	−1.10997	−0.67214

that of the group with purchase experience, while the group with purchase experience is significantly more affected by social identity, perceived value, attitude toward switching and switching intention than the group without purchase experience. According to the research results, new energy vehicle brand owners formulate corresponding brand development strategies for groups with and without purchase experience. Start with group differences to avoid wasting unnecessary time and energy, and penetrate the market faster. Develop relevant measures based on perceived risk and switching costs for groups with no purchasing experience, and formulate market development strategies for groups with purchasing experience based on social identity, perceived value, switching attitude, and willingness to switch.

Ⅴ. Conclusion

This study was performed based on the PPM-model, focusing on car users in China, analyzing the influence of perceived risk, social identity, perceived value, switching attitude, and switching cost on car users' willingness to switch. The results showed that in addition to perceived risk and switching cost, social identity, perceived value and switching attitude all have positive and significant influences on users' willingness to switch, and that users' purchasing experience has significant differences. Different from previous studies on the influence of new energy vehicle purchase behavior based on perceived risk theory (Shu, T. et al., 2022), planned behavior theory (Wang, Z. et al., 2017; Du, H. et al., 2018), and technology acceptance model (Wang, Z. et al., 2017; Wang, R. et al., 2021; Li, J. et al., 2020). The theoretical significance of this question lies in combining the application of the PPM model. Its practical significance is providing feasible suggestions for the new energy automobile industry to meet users' expectations, playing a guiding and reference role for the subsequent development of new energy vehicles, and promoting the ban of the sale of gasoline vehicles and the sustainable development of new energy vehicles.

Even though this study produced certain research findings, there are still limitations that require more advancement and studied in the follow-up study. The first limitation is the research object only included Chinese users, due to the data was only gathered within China. Therefore, that is necessary to conduct global surveys and comparative studies in the future, which can further

validate and strengthen the research findings. Secondly, according to the sample structure, female users (59.4% of all respondents) and company employees (71.3% of all respondents) were more open to taking part in the research, which also leads to the over-representation of female and company employees in the sample. Therefore, efforts should be made to alleviate this difficulty and reduce the problem of imbalanced user ratios throughout the data collection phase of future surveys. The model also needs to be expanded further. Based on the PPM-model, this research started from the PPM-model, proposed relevant factors, and studied the switching intention for the car users. However, the factors proposed in this research model were limited. In subsequent research, we can enrich the PPM model by adding independent and dependent variables such as subjective norm, mental inertia, switching behavior, etc. and adding adjustment factors such as gender and age.

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