

The Effect of Social Influence on Consumers' Hybrid Electric Vehicles Adoption in Korea and China

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Abstract— Hybrid electric vehicles (HEVs) are alternatives to conventional vehicles, and have a critical role in migrating climate change and saving oil resources. Even though supported by government with several incentives, HEVs are still less accepted by consumers. Previous studies stated it mainly due to innovative perceived risks, such as perceived economic loss and psychology concern, but without considering the moderation effect of geographical culture and economic environment. Besides, the effect of social influence was argued important to HEVs market penetration, but with little experimental research. Hence, this study tries to identify the effect of social (altruism, image, subjective norm) influences on adoption intention, and estimate moderation effect of different culture and economic situation. Hypotheses are developed from literatures, and tested using questionnaires. Social influence, such as altruism and image motivations, are found to be significant in increasing consumers' purchase intention in both Korea and China, whereas different culture and economic background also have an significant effect on consumer intention, and particularly reflected by the difference of consumers' perceived financial and psychology risk. The findings from these two countries provide managerial insights for politicians and manufactures into potential consumers' behaviour of HEVs.

Keywords— Hybrid electric vehicles, altruism, image, subjective norm, perceived risk

I. INTRODUCTION

In response to global challenges such as climate change and the depletion of nature oil resource, automobile manufactures offered a diverse set of alternative fuelled vehicles with low ecological pollution. Among these alternatives, hybrid electric vehicles (HEVs) are considered as the most practicable and

promising strategies nowadays because of the superior compatibility with traditional internal combustion engine. However, private consumers' acceptance of HEVs is still absent[1].

Previous researchers[3] found that the resistance was mainly due to innovation related perceived risks. Even though perceived risks were demonstrated as an inhibitor for plenty of innovative products and services[2], such as internet banking and online shopping[4, 5], little studies considered the different culture and economic development level effects on consumers perceived risk perception, and particular for the automobile industry with frequently global tractions. To effectively make the global business models, it is important to understand consumers' risk perceptions explicitly with different culture and economic development environment. For current study, Korea is regarded as the developed country, whereas China represents the developing country because of Korean's GDP per capital is much higher than China according to the data of World Bank.

In addition, social influence is suggested as an effective approach to enhance consumers' adoption of high visible, innovative and green category products, such as smart phone and organic food[6, 7]. However, research of social influence on consumers' preference for adopting alternative vehicles are still limited[8].

Hence, the aim of present study is to begin filling these research gaps by a) examining whether HEVs related social factors have a significantly influence on potential HEV consumers' purchase perception or not and b) comparing the difference between Korean and China consumers' HEVs purchase intention.

II. THEORETICAL BACKGROUND

A. HEV and its diffusion in global market

Hybrid electric vehicles are alternatives to conventional vehicles that could achieve almost twofold fuel economy and half CO₂ emission by combining the internal combustion engine with a rechargeable battery[9]. The global wide government all have a long-termed target of disengagement from fossil fuels and employment of a significant amount of alternative technologies, especially for HEVs. Although the end consumer demand for HEVs has increased in China, Korea and global market, the HEVs market still represents a niche market with little turnover[3].

B. Role of social factors influence on HEVs diffusion.

Based on green, innovative and high visible category products' features, such as alternative vehicles, there are three primary social motivations for consumers to adopt HEVs, altruism (adopting HEVs is transcending selfish for promoting the green life environment for others)[10, 11], image benefits (adopting HEV is expressing innovative or green personality and social status to others)[12], subjective norm (performance innovatively and pro-environmentally to comply with others wishes)[13].

These factors have been evidenced significantly affect consumers' adoption behaviour for various products. Image benefits is believed to be a particular strong determinant of intention and behaviour for products and services that are symbolic and consumed in public setting, such as vehicles, IT and green products[7, 13, 14]. Raats, Shepherd, and Sparks found that perceived altruism had an effect on intention and independently predicted from attitudes particularly for pro-environmental product, such as transports and food choice[15]. The subjective norm is a central component of Theory of reasoned behaviour and has been included in numerous studies across a large number of studies[12, 13].

Therefore, comparing these social factors influence on HEV consumers' purchase intention, and enhance the most significant factor could be an efficient way to increase HEVs market penetration.

C. Cross-cultural and development level market segmentation

Culture and economic development also has an influence on consumer behaviour[16], greater understanding of how these factors drive consumers product choice is important. Chinese and Korean differ in terms of the attributes and benefits they seek in products and situations because of economic environment and culture background. Korea is a relative developed country comparing to China, in addition, Korean is collectivist and Chinese seems to be more individualistic[17]. Members of individualistic cultures tend to individual's uniqueness, whereas collectivist cultures tend to social connectedness, such as with the family and peer groups.

Current study proposes that Korean (developing country individual) is much more sensitivity to psychology risk in the consumption of product, whereas Chinese (developed country individual) is more sensitivity to financial risk. Because of very few studies examined consumers' intention toward

specific alternative vehicles, especially for HEVs, across different markets, hence, this study attempts to identify this issue through an exploration of the China and Korean HEV markets. Therefore, current studies considered the relative strong perceived risk factors (financial risk and psychological risk) and social influences (altruism, image, subjective norm) to capture the culture influence. This finding leads to the following proposition:

P1. Social influences and perceived risks differently contribute to potential HEVs consumers' intention between Korean consumers and Chinese consumers.

III. CONCEPTUAL MODEL

Conceptual model are showed in Fig.1, independent variables contains perceived risks and social influences two parts, and dependent variable is purchase intention of HEVs' potential consumers. While social influences consist of altruism, image, and subjective norm, Perceived risk consist of financial and psychology risk.

A. Altruism

Altruistic is referred to perceptions and values motivate people to transcend selfish concerns and promote the welfare of others, such as values representing benevolence and a wider concern for people and the environment which is social-altruistic in nature[11]. According to Heffner[18] and Ozaki[19]'s research, consumers' environment protection and resource saving for community and nation have a kind of incentive for consumers to purchase HEV. Hence, altruistic also considered as one of the social elements in current research.

H1. The higher the altruism perceived by a consumer, the higher is the intention to purchase an HEV.

B. Image

Image refers to the degree to which adoption or usage of the innovation is perceived to enhance one's image or status in one's social system. According to relevant vehicle use and purchase motives research [6, 18, 20], non-utilitarian functions such as sociability, status, personality, fashion are very prominent motivations for vehicle purchase. With these conceptions, image benefit regarded as a main social influence

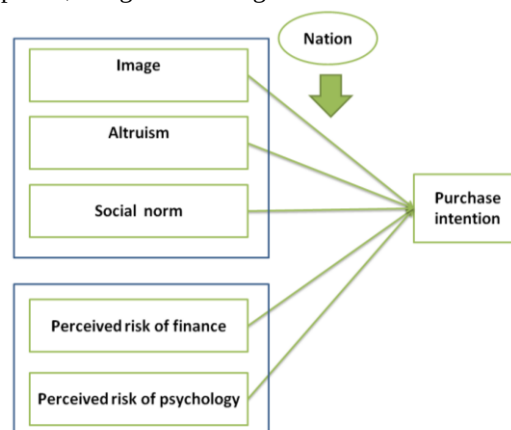


Figure 1. The conceptual model.

factor in HEV diffusion in current study.

H2: The higher the image benefit perceived by a consumer, the higher is the intention to purchase an HEV.

C. Subjective Norm

The concept of subjective norm pertains to a combination of peoples' perceptions that important others think they should or should not perform the behaviour in their motivation to comply with other's [21]. Although it have proven to be an important determinant of intention to use various technologies and services [7, 12, 13], the results as regard alternative vehicle sector is still limited. Considering society and government pays more attention to the environmental (climate change) and energy (oil crisis) issues[3], hence, peoples' intention to perform environmentally is more and more affected by subjective norm, therefore, subjective norms are also regarded as a main social influence factor in HEV diffusion in current study.

H3: The higher the subjective norm perceived by a consumer, the higher is the intention to purchase an HEV.

D. Perceived Risks

Perceived risk is commonly thought of 'the expectation of losses associated with purchase and acts as an inhibitor to purchase behaviour'[5]. Previous studies proved that perceived risk is the main reason for various products, such as

e-service and alternative vehicles, and divided it to several primary dimensions[3]. while Klaus's study of alternative vehicles indicate that the financial risk and psychological risk have relative high affect comparing with other risks; hence, current research included this two dimension perceived risk to measure the effect caused by culture and economic environment. In this context, Korean consumers are regarded as developed economic individual, whereas Chinese consumers are considered as developing economic individual.

H4: The higher economic developed by a country, the higher psychology risk perceived by the consumer to resist purchasing an HEV.

H5: The higher economic developed by a country, the lower financial risk perceived by the consumer to resist purchasing an HEV.

IV.METHOD

A self-completion questionnaire with scales developed from the literature was distributed both in on line and hard copy form, and all items used a seven-point Likert scale (1=strongly disagree; 7= strongly agree). The questionnaire was sent to students in China universities and distributed in several public areas; 62 completed questionnaires were returned. In Korea, a translated and back translated questionnaire was sent to undergraduate, graduate, and MBA students at a major Korean university and several public areas, 42 completed responses were obtained.

The target population was HEVs potential consumers in

TABLE 1. EVALUATION OF THE MEASUREMENT MODEL OF KOREA AND CHINA

Factor	Cronbachs Alpha		Factor loading		t value		Composite Reliability		AVE	
	Korea	China	Korea	China	Korea	China	Korea	China	Korea	China
Independent variable										
Altruism	0.88	0.70					0.94	0.87	0.89	0.89
AL1			0.93	0.89	17.47	12.93				
AL2			0.96	0.87	72.13	10.96				
Image	0.88	0.83					0.92	0.88	0.74	0.74
I1			0.90	0.83	15.72	7.43				
I2			0.90	0.90	20.91	23.87				
I3			0.88	0.86	11.95	13.82				
I4			0.75	0.61	7.38	3.08				
Perceived risk of finance	0.67	0.60					0.86	0.82	0.75	0.75
PRF1			0.88	0.88	4.28	3.56				
PRF2			0.86	0.86	4.46	5.29				
Perceived risk of psychology	0.80	0.90					0.87	0.91	0.69	0.69
PRP1			0.87	0.87	8.20	3.10				
PRP2			0.92	0.92	9.11	2.75				
PRP3			0.68	0.68	2.57	2.76				
Subjective norm	0.77	0.85					0.87	0.93	0.77	0.77
SN1			0.98	0.98	3.24	14.35				
SN2			0.76	0.76	2.49	41.45				
Dependent variable										
Intention	0.92	0.85					0.96	0.93	0.93	0.93
IN1			0.96	0.94	89.49	34.30				
IN2			0.96	0.93	79.27	43.01				

the China and Korea. These two countries were selected because they have significant different levels economic development level, and Chinese and Korean also differ in their cultural heritage, with the Korea sample being representative of an economic developed country and collectivist culture and China sample being represent an economic developing country and individualistic culture. Partial Least Squares (PLS) approach was used to analyse the effect of the behavioural and normative components on intentions to adopt HEVs.

V. RESULTS

The six independent variables were tested against a depended variable (purchase intention of HEV). For all factors, the results show sufficiently high factor loadings with 0.61 as the smallest loading. The average variance extracted (AVE) and the reliability test reveal satisfactory results, as shown in table1. Table 3 shows that altruism and image influence were significant in both samples, whereas perceived risk of finance was significant in China only and perceived risk of psychology was significant in Korea only.

Hypothesis H1 argues that the more potential consumers' altruism, the higher purchase intention of HEV. The results indicate a strong association between the altruism perception through adopting HEV and purchasing intention in both samples. H1 is thus supported. This result confirms the finding of that altruism is important to consumers' intention[10]. While Korean consumers' are slightly higher altruism than Chinese on purchase intention, it reflects the collectivist culture influence of Korea.

Hypothesis H2 argues that the greater the perceived image benefit of HEVs, the greater purchase intention. This hypothesis is supported in both sample, consist with previous research personal and social identity as the key factor in consumers' adoption with vehicles [7]. In the china sample, image benefit effect is more significant than Korea, and reflects the individualistic culture of China with more caring of self superior images than others.

Hypothesis H3 argues that the greater sense of subjective norm to HEV, the greater purchase intention. The questionnaire results support the association between subjective norm and purchase intention in China market only, which conflicts with previous research. Although HEVs penetration in both Korea and China is low, HEVs' superiority perception seems to be widely recognized among Chinese consumers, and it is not significant to Korea consumers.

Hypothesis H4 argues that the higher economic developed by a country, the higher psychology risk and lower financial perceived by the consumer to purchase HEVs. Perceived risk of finance of HEVs adoption is significant in China market only, and perceived risk of psychology is significant in Korea market. Hence, H5 is supported, and it indicated that Chinese is more sensitive to higher purchase price, whereas Korean is not. Besides, the psychology risk seems the main barrier to Korean potential consumers to adopt a HEV, whereas it shows little influence to China market. This result also opposite to previous studies that perceived risk of finance has a significant

effect in potential consumers' resistance of alternative vehicles adoption with no differentiation cross the nations[3].

Construct	Korea		China	
	Original Sample	t value	Original Sample	t value
Altruism →intention	0.44	2.96	0.32	2.59
Image →intention	0.25	2.02	0.36	3.68
Subjective norm →intention	0.12	0.70	0.23	1.95
Perceived risk of finance →intention	0	0.03	-0.23	2.40
Perceived risk of psychology→intention	-0.33	2.90	0	0

TABLE 2. REGRESSION RESULTS: FACTORS AFFECTING THE PURCHASE INTENTION OF HEV

VI. DISCUSSION

With the needs of consumers becoming much more important to the success of new technological products, this study is to examine potential consumers' perceived social influences and risk perceptions on HEVs purchase intention ,with different economic and culture background. The overall conclusion is that both social and culture factors have an effect on potential consumers' HEV purchase intention, and the effect is different for these two countries. Five key factors (Altruism, Image, Perceived risk of finance, Perceived risk of psychology, Subjective norm) were tested against purchase intention of HEVs. The findings indicate that purchase intention is mainly associated with altruism, image and perceived risk of finance in China, with altruism, image and perceived risk of psychology in Korea. The results demonstrate the importance of altruism and image effect in both samples, thus supporting the finding of other researchers. However, subjective norm was weak significant in Korea case only, although the earlier study found the opposite result which indicate that the social pressure is still not enough to these two markets. In addition, the finding that financial factors of HEVs are determinant of consumer purchase intention in China is supported in this study, and the results also do support the importance of psychology risk of purchasing in Korea.

In this context, the finding is useful for manufactures and politicians to attract a larger number of consumers to HEVs. The HEV market is growing steadily in the Korea automobile market, although it's overall user share remains small. In this study the social influence was significant, therefore, enhancing information and organized institutional support for the conversion of HEVs seems an effective way for consumers' to switch vehicles.

The result may also reflect a cultural element. The developed country (Korea) with higher level of income consumers shows a significant psychology risk perception to alternative vehicles purchase, whereas the developing country (China) consumers are more sensitive to financial risks to

alternative vehicle purchase. Hence, the reduction of financial risk can bring to the user more prefer purchase HEVs in China market. From a financial perspective, various policy instruments (e.g. tax rebates) as well as economic indicators (e.g. payback periods or resale values) are possible measures to overcome existing financial adoption barriers for Chinese consumers. In addition, the reduction of psychology risk could bring to the user more prefer purchase HEVs in Korea market. Awareness campaigns or consumer workshops in collaboration with car dealers could be a direction in Korea market, and the explanation of HEVs inherent environmental and innovative advantages maybe an effective way to reduce perceived psychology risk.

Although the context is HEVs market, this study also provides insight to the further development of eco-innovative product with high visible and durable characters products for Korea and China, such as IPTV and knowledge management system in organization. The finding on the chief factors indicates strongly influence of consumers purchase intention in both countries. Importantly, the finding that national differences influence the balance of importance of perceived risk perception. A universal business model may not be appropriate for all cultures, with some perception and beliefs of products taking on more importance in certain countries than in others. This conclusion supports the assertion of Varnali and Toker [22] that more research is required across culture borders.

There are, however, limitations to this study that further research could address. The students sample may not represent the Korean and China population as a whole, and it could be removed in future work by using a larger and more representative sample to permit more powerful statistical tests to be conducted. Future, information on personal, lifestyle, and behavioral characteristics not covered by this study could also be closely examined in relation to the finding of the current study. Finally, this study involved only two countries, the Korea and China, although previous research makes some suggestions that why differences between national markets occur, hence, more in-depth research is required to fully understand how national environmental factors influence the adoption of new technology.

REFERENCES

- [1] Dijk, M. and M. Yarime, The emergence of hybrid-electric cars: Innovation path creation through co-evolution of supply and demand. *Technological Forecasting and Social Change*, 2010. 77(8): p. 1371-1390.
- [2] Wiedmann, K.-P., et al., Adoption barriers and resistance to sustainable solutions in the automotive sector. *Journal of Business Research*, 2011. 64(11): p. 1201-1206.
- [3] Tsai, C.-H., et al., The effect of reducing risk and improving personal motivation on the adoption of knowledge repository system. *Technological Forecasting and Social Change*, 2010. 77(6): p. 840-856.
- [4] Featherman, M., Predicting e-services adoption: a perceived risk facets perspective. *International Journal of Human-Computer Studies*, 2003. 59(4): p. 451-474.
- [5] Steg, L., Car use: lust and must. Instrumental, symbolic and affective motives for car use. *Transportation Research Part A: Policy and Practice*, 2005. 39(2-3): p. 147-162.
- [6] Thorbjørnsen, H., P.E. Pedersen, and H. Nysveen, "This is who i am": Identity expressiveness and the theory of planned behavior. *Psychology and Marketing*, 2007. 24(9): p. 763-785.
- [7] Peters, A., H. Gutscher, and R.W. Scholz, Psychological determinants of fuel consumption of purchased new cars. *Transportation Research Part F: Traffic Psychology and Behaviour*, 2011. 14(3): p. 229-239.
- [8] Huang, K.D., et al., Integration mechanism for a parallel hybrid vehicle system. *Applied Energy*, 2005. 82(2): p. 133-147.
- [9] Collins, C.M., Psychological and Situational Influences on Commuter-Transport-Mode Choice. *Environment and Behavior*, 2005. 37(5): p. 640-661.
- [10] Charng, J.A.P.H.W., ALTRUISM A Review of Recent. *Annual Review of Sociology*, 1990. 16: p. 27-65.
- [11] Shepherd, P.S.a.R., self-identity and the theory of planned behavior assessing the role of identification with green consumerism. *Social Psychology Quarterly*, 1992. 55: p. 388-399.
- [12] Elena Karahanna, D.W.S., Information Technology Adoption Across Time: a cross-sectional comparison of pre-adoption and post-adoption beliefs. *MIS Quarterly*, 1999. 23: p. 183-213.
- [13] Chang, E.-C. and Y.-F. Tseng, Research note: E-store image, perceived value and perceived risk. *Journal of Business Research*, 2011, 27, p. 27-65.
- [14] Armitage, M.C.a.C.J., Extending the Theory of Planned, Behavior: *Organizational Behavior and Human Decision Processes*, 1991. 50: p. pp179-211.
- [15] A Review and Avenues for Further Research. *Journal of Applied Social Psychology*, 1998. 28(15): p. pp.1429-1464.
- [16] Ray, S. and P. Kanta Ray, Product innovation for the people's car in an emerging economy. *Technovation*, 2011. 31(5-6): p. 216-227.
- [17] Lee, J.-H., et al., Expressive versus instrumental functions on technology attractiveness in the UK and Korea. *Journal of Business Research*, 2011.
- [18] Heffner, R.R., <Effects of Vehicle Image in Gasoline-Hybrid Electric Vehicles.pdf>. *Institute of Transportation Studies*, 2005: p. 13.
- [19] Ozaki, R. and K. Sevastyanova, Going hybrid: An analysis of consumer purchase motivations. *Energy Policy*, 2011. 39(5): p. 2217-2227.
- [20] Lois, D. and M. López-Sáez, The relationship between instrumental, symbolic and affective factors as predictors of car use: A structural equation modeling approach. *Transportation Research Part A: Policy and Practice*, 2009. 43(9-10): p. 790-799.
- [21] Ajzen, I., The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, 1991. 50: p. pp179-211.
- [22] Varnali, K. and A. Toker, Mobile marketing research: The-state-of-the-art. *International Journal of Information Management*, 2010. 30(2): p. 144