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A Study of Relationships among Green Consumption Attitude, Perceived Risk, Perceived Value toward Hydrogen-Electric Motorcycle Purchase Intention

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Abstract

Taiwan has the Asia's highest density of motorcycle, which results in problems such as traffic jams and air pollution. To effectively reduce the motorcycle's impact to the ecosystem, in July 2009, Taiwanese government initiated the consumer and manufacturer encouragement project to promote electronic motorcycle industry. The purpose of this study is to discuss consumers' green consumption attitude, perceived risk and perceived value toward hydrogen-electric motorcycle purchase intention. Based on a structure equation modeling approach, it is concluded that: perceived risk and perceived value are significantly related to consumption attitude; consumption attitude is significantly related to hydrogen-electric motorcycle purchase intention; and perceived value is significantly related to purchase intention. However, perceived risk and hydrogen-electric motorcycle purchase intention has no relation. This research analyzes the key factors of consumer behaviors from customers' point of view and further discusses improvement solutions. The study can serve as a reference to government, cooperates and consumers in promoting, educating and marketing the green concepts.

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Keywords: green consumption attitude; perceived risk; perceived value; purchase intention; hydrogen-electric motorcycle

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1. Introduction

The excessive greenhouse gas causes the deterioration of climate changes which threaten all living beings on the planet. The crisis include rising of sea level, unbalanced ecosystem, reduced biological diversity and extreme weather. Ever since then, people become aware the unpredictable risks of climate changes. On top of the natural impacts, there is also a high rising oil prices due to the depletion of natural resources. Human's behavior starts to change in hoping to stop the deteriorating environment and to avoid the risk of climate change. Meanwhile, with the advent of green consumerism and growing concern over environmental issues, green consumption has become the main stream concept of environmental protection in the 21st century. Peng (2011) states that green consumption covers all aspects from manufacturing to consuming including recycling of the product material recycling, energy utilization efficiency and environmental/living beings protection. Chen (2012) points out that green consumption is a consumer behavior and decision when facing environmental and resource related matters. This behavior or decision not only serves as personal priority but also take social common wealth into account. Therefore, consumers start to change their usual ways of consumption and purchase green products which are less harmful to the environment.

According to a statistics of Ministry of Transportation & Communications (MOTC) in 2011, the number of motorcycles in Taiwan has reached over 15.174 million. That is, there is one motorcycle for every two person; the density is the highest in Asia. Such large number of motorcycles not only causes traffic jams but also creates air pollution and other negative impacts to the ecosystem. Transportation carton-dioxide exhaustion is second only to industrial exhaustion due to the fact that vehicles' main source of energy relies on petroleum. To reduce the pollution from motorcycles, Taiwanese government initiates an encouragement project in July 2009 to promote electric motorcycle industry. The objective of this project is to motivate consumers to purchase electric motorcycles and encourage manufacturers for production. The target is to reach 160 thousand domestic sales and 3.65 million export sales on removable Li-Ion battery motor vehicle. In contrary to petroleum or lead-acid battery, hydrogen fuel cell battery has several earth friendly and energy saving benefits such as zero-emission, high efficiency, low noise, low vibration, fast startup and long lasting. Therefore, hydrogen fuel cell technologies have grabbed the attention of green market and become the key development focus in United States, Japan and European countries. However, hydrogen fuel cell battery motorcycles are regarded as a new application and innovation; hence, they are not yet a main stream product. Although in the era of environmentalism and sustainability, not all green products are accepted by the consumers. That is, without thorough market research and evaluation, the green products may be eliminated due to impracticality or unreasonable pricing. Therefore, assessment before entering full production is crucial. There are several assessment guidelines, and consumer's purchase intention is one of them. Howard (1989) proposes a consumer decision model stating that product recognition may turn into product attitude and confidence, which in turn, influences consumer's purchase intention toward the product and eventually generate purchase action. Lin and Huang (2012) reveal that the consumers with high green consumption cognition are more supportive to green products and are more willing to choose green products.

All in all, this study takes the uniqueness of hydrogen-electric motorcycle into account and treats green consumption attitude, perceived risk and perceived value as the antecedent variables. This research attempts to reveal the influence of recognition on perceived risk and perceived value have on the hydrogen-electric motorcycle purchase intention. The result may serve as a reference to the government or relevant industries and researchers for further studies.

2. Research Method

2.1. Research framework

The purpose of this study is to verify the causal relation among the influential dimensions of purchase intention on hydrogen-electric motorcycle. Based on the hypothesis, the causal relation between the potential variables is analyzed by using Structure Equation Modeling (SEM). The research framework is as following.

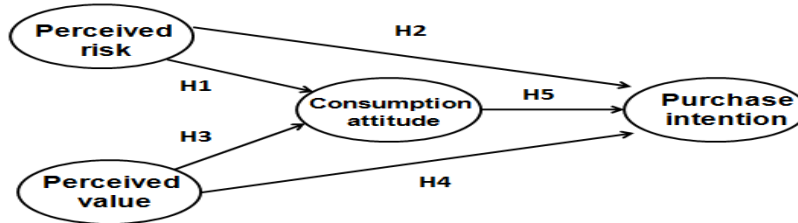


Fig. 1. Research framework

2.2. Measurement design

This article evaluates the influential factors of purchase intention toward hydrogen-electric motorcycle and their effectiveness. The result serves as a managerial implication to the government and hydrogen fuel cell vendors. The questionnaire structure consists of 5 sections:

- Consumption attitude: there are 8 items covering 3 dimensions including cognitive, affective and conative; the reference is made on Rosenberg and Hanland (1960).
- Perceived value: there are 4 items covering 2 dimensions including value and rationality; the reference is made on Dodds et al. (1991) with few modifications.
- Perceived risk: there are 12 items covering 6 dimensions including financial, functional, physical, social, time and psychological.
- Purchase intention: there are 10 items covering 4 dimensions including “Want to purchase”, “Purchase Immediately”, “First Choice” and “Recommend” (Kim et. al., 2008); the assessment is made using Likert five-point scale.
- Background: the questions cover socioeconomical variable and demographic variables including gender, marital status, age, education, occupation, income and etc; the purpose is to have further understanding on the investigated subjects.

As to verify the evaluation content validity, three experts are invited to examine the question items and its fitness. After rephrasing seven questions, pilot run is carried out and questionnaire expert validity has been verified. The survey starts from December 2001; there are 100 pilot run questionnaires with 74 valid ones. This study utilizes item analysis and reliability estimation to examine the discriminant validity and internal consistency of the assessment. The result of item analysis shows that each dimensions' reliability index is above 0.7. Therefore, the questionnaire is regarded to have discriminant validity and internal consistency suitable for formal dispense.

The formal survey starts from January to February in 2012 covering the major five urban regions in Taiwan (including Taipei, Hsinchu, Taichung, Tainan and Kaohsiung). The investigated subjects are adults with age above 18. The number of samples for each region is determined proportionally in accords to the regional population. There are 500 questionnaires dispensed in total with 468 responded. There are 431 valid questionnaires after the removal of 37 invalids; the response rate is 86.2%.

3. Empirical analysis

3.1. SEM model analysis

Preliminary fit criteria. According to Table 1, each dimension scales' factor loading is greater than 0.6 and has reached significant level; Also, there is no negative value in measurement errors. Therefore, theoretical model has complied basic fitness requirement.

Fit of internal structure of model. Table 1 shows that theoretical model dimensions' Cronbach's α reliability are all above 0.8. The lurking variables' structural reliability are also above 0.8 and their variance extracted rate are also greater than 0.58. Overall, the internal structural fitness of the theoretical model is satisfactory.

Table 1. Measurement model analysis result

Dimension	Standardized coefficient β	<i>t</i> value	AVE	CR	Cronbach's α
Perceived risk			0.63	0.82	0.84
Financial (X1)	0.66	15.00***			
Functional (X2)	0.67	15.18***			
Social (X3)	0.66	15.00***			
Physical (X4)	0.72	16.79***			
Psychological (X5)	0.73	17.13***			
Time (X6)	0.68	15.61***			
Perceived value			0.65	0.85	0.80
Value (X7)	0.72	16.79***			
Rationality (X8)	0.71	16.06***			
Consumption attitude			0.58	0.84	0.82
Cognitive (Y1)	0.61	—			
Affective (Y2)	0.74	11.55***			
Conative (Y3)	0.63	10.75***			
Purchase intention			0.70	0.79	0.85
Want to purchase (Y4)	0.63	—			
First Choice (Y5)	0.64	10.96***			
Recommend (Y6)	0.65	10.75***			

Note: *** $P < 0.001$; ** $P < 0.01$; * $P < 0.05$

3.2. Overall model fit

The NFI of this research is 0.94 and NNFI is 0.96 (all above 0.9); that is, the model fitness is very well. The CFI is 0.96, signifying that the model fitness is very stable and it is an ideal theoretical model. Also, the RMR is 0.034 and SRMR is 0.049 (all less than 0.05). Table 2 shows the statistics of the external quality assessment of the overall model. The result complies with the recommended level (Chiou, 2011), CFI and AGFI greater than 0.9; RMR less than 0.05; RMSEA less than 0.08; $X^2/df < 3$. Therefore, the fitness of the established linear structural model has reached a satisfactory level.

3.3. Path analysis

According to the path analysis of SEM model (figure 2), dimensions correlations can be classified as direct and indirect effect path as shown in Table 2. In regards to direct effect, the higher the perceived risk the stronger the purchase intention is toward hydrogen-electric motorcycle; the direct effect is 0.06. Also, the higher the perceived value, the stronger the purchase intention is toward hydrogen-electric motorcycle; the

direct effect is 0.18. As for indirect effect, the perceived risk (through consumption attitude) has positive influence on purchase intention toward hydrogen-electric motorcycle; the effectiveness is 0.09. Also, perceived value (through consumption attitude) has positive influence on purchase intention toward hydrogen-electric motorcycle; the indirect effect is 0.24. The total effect of perceived value and consumption attitude on hydrogen-electric motorcycle purchase intention are 0.15 and 0.42 respectively.

Table 2. Paths analysis and Structural model analysis of research framework

Hypothesis Path	Direct effect	Indirect effect	Total effect	Standard β	t-value	Support or not
H1: Perceived risk \rightarrow Consumption attitude	0.22***	— — —	0.22***	0.22	4.10***	Support
H2: Perceived risk \rightarrow Purchase intention	0.06	0.09*	0.15*	0.06	1.08	Not
H3: Perceived value \rightarrow Consumption attitude	0.61***	— — —	0.61***	0.61	8.96***	Support
H4: Perceived value \rightarrow Purchase intention	0.18*	0.24***	0.42***	0.18	2.11*	Support
H5: Consumption attitude \rightarrow Purchase intention	0.40***	— — —	0.40***	0.40	4.31***	Support

Note: *** $P < 0.001$ (t-value > 3.29); ** $P < 0.01$ (t-value > 2.58); * $P < 0.05$ (t-value > 1.96)

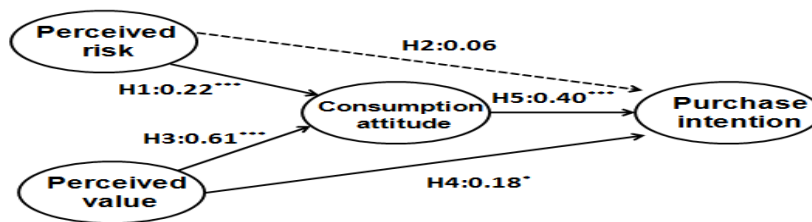


Fig. 2. Paths analysis of the structural equation modeling

4. Results and discussion

As shown in Table 2, under the significant level of 0.001, perceived risk and perceived value are related to consumption attitude; while consumption attitude is also significantly related to hydrogen-electric motorcycle purchase intention. Under the significantly level of 0.05, perceived value has significant relation with hydrogen-electric motorcycle purchase intention. Also, the hypotheses of perceived risk having effect on hydrogen-electric motorcycle purchase intention. Therefore, four out of five hypotheses are supported. The explanations are as follow:

The influence of perceived risk on hydrogen-electric motorcycle purchase intention (H2) is not supported; however, its influence through the mediating consumption attitude (H1) is supported. This means that consumers' believe, cultivated in their daily lives, require right green consumption attitude to further develop into hydrogen-electric motorcycle purchase intention. Similar to what MaCarthy and Shrum (1994) have pointed out, perceived risk and purchase intention do not have direct relation; but it will become influential through attitude. Therefore, the abovementioned assumption is supported.

The hypothesis of the indirect effect of perceived value on hydrogen-electric motorcycle purchase intention (H3) verifies MaCarthy and Shrum (1994) value-attitude-behavior theory. Therefore, perceived value is a determining factor of consumption attitude; the two have positive relationship. In regards to the direct influence of perceived value on hydrogen-electric motorcycle purchase intention (H4), Monroe and Krihnan (1985) states that consumers' perceived value influences hydrogen-electric motorcycle purchase intention. The researches reveal that perceived value has direct influence on purchase decision (Dodds et al., 1991; Agarwal and Teas, 2001). The result supports that perceived value is positively related to hydrogen-electric

motorcycle purchase intention; furthermore, the hypothesis of consumption attitude having positive causal relationship with hydrogen-electric motorcycle purchase intention is also supported.

5. Management Implication

In the trend of green consumption and rising waves of the global environmental awareness, government should educate the consumers by broadcasting messages through news and promotion campaigns to communicate its policies. With appropriate plans and policies, a communication mechanism between the government, businesses and consumers in facilitating consumers' trust and understanding. On the other hand, clear rules can be enforced to protect green products, which often have less competitiveness with higher prices. After all, consumers are more likely to purchase green products with motivation of competitive price. As time progresses, the supply of recycled materials will increase, therefore vendors will gain more bargain power in negotiation with the suppliers. Green product price is expected to be more competitive with refined cost structure and economic scale. Hence, only if government, businesses and consumers work together, the society may progress toward the sustainable development.

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