

Research on the Consumption Intention of Consumers in Different Lifestyles for Portable Hydrogen Fuel Cell

Han-Shen Chen¹, Chia-Yon Chen² and Tsuifang Hsieh³

¹Associate Professor, School of Diet and Restaurant Management, Chung Shan Medical University, Taichung City 40201, Taiwan; Dept of Medical Management, Chung Shan Medical University Hospital, Taiwan.

Fax: +886-3-8652000; E-mail: allen9750@yahoo.com.tw

²Professor, Dept of Resource Engineering, National Cheng Kung University, Tainan 701, Taiwan

³Dept of Hospitality Management, Taiwan Hospitality and Tourism College, Hualien 974, Taiwan; Dept of Business Administration, National Dong Hwa University, Hualien 974, Taiwan

Abstract

The portable hydrogen fuel cells are still on the preliminary stage as 3C application products, and the consumers' acceptance of such new products and their external variables have yet to be clarified, therefore, based on the technology acceptance model, this paper adopts the structural equation model (SEM) to discuss consumers' demand, acceptance and consumption intention for portable hydrogen fuel cell products. The research findings have revealed: no matter which type the consumers belong to, their demand motive, product features and information source all positively influence their consumption intention; therein, as to product features, practicality pavorers prefer "real-time chargeable", "durable", "less weight" and "portable", taste favorers prefer "real-time chargeable", "less weight" and "portable", and conformity favorers prefer "durable" and "portable"; as to information sources, practicality favorers go for "word of mouth", taste favorers go for "network or magazine introduction" and "corporate advertising or government promotion", and conformity favorers go for "network or magazine introduction" and "word of mouth". And the above research findings are hoped to provide reference for the government, relevant enterprises and manufacturers in making strategies, to improve the market competitiveness and acceptability of the products and to achieve the goal of promoting green consumption and sustainable development.

Keywords: Lifestyle; Consumption intention; portable hydrogen fuel cells.

Introduction

Recently, with global warming worsening, nations are working to develop new energy and application technologies to reduce pollutants and save energy to cope with climate changes and reduce green house gas (GHG) emissions. Of the various new energies, hydrogen energy is clean and extremely safe, and has been recognized as a major energy to be utilized in the future by the International Energy Agency (IEA); it is expected to comprise 50 % of the energy consumed in 2050(Cao et. al, 2006).The Ministry of Economic Affairs (MOEA) of Taiwan proposed a third stage in the development program for emerging industries—the Dawning Green Energy Industry Program—selecting several green energies, hydrogen energies, and fuel cells as key industries. The Taiwan government will budget 25 billion TWD (1US\$=30 TWD) for renewable energy sources, facilities, and subsidies to promote energy saving. Additionally, the government will budget 20 billion TWD for technical developments to improve the efficiency of green energy industries and key technologies. The government expects to generate an estimated value of over 200 billion TWD in private investments, 115,800 job opportunities each year, as well as an output value of 1.158 trillion TWD from the green energy industry by 2015. The Bureau of Energy, MOEA, R.O.C. also predict that the output values of Taiwan's fuel cell industry will reach 4 billion TWD in 2011, rise to 13 billion TWD in 2016, and reach almost 100 billion TWD in 2020, holding 5 % of the international market share and occupying a vital role in

the global development of product technology and industrial-scale of hydrogen energy and fuel cell production (Bureau of Energy, Ministry of Economic Affairs, 2008).

With a public consensus on the need for environmental awareness and sustainable development of enterprises, green products, such as transportation fuel cells and stationary power generation facilities, are expected to become mainstream in the market, promoting hydrogen and fuel cell development to reduce pollutants and emissions. Additionally, with 3G/4G mobile phones emerging, portable mobile devices support more information extraction and video functions, increasing the demand for longer endurance, and establishing a foundation for portable fuel cell development. Taiwan is one of the major designers and manufacturers of portable electronic products, such as laptops, mobile phones, PDAs, and digital cameras. Instancing the 3C-application direct methanol fuel cells (DMFC), as the power supply stability and power supply duration of hydrogen fuel cells are better than that of lithium cells, major 3C manufacturers one after another rush to launch the portable hydrogen fuel cells that are applied to 3C products. However, as the portable hydrogen fuel cells are still on the preliminary stage as 3C-application products, and the consumers' acceptance of such new products and their external variables have yet to be clarified. Therefore, it is important and necessary for the manufacturers to carry out adequate market evaluation before launching the products, in which consumers' consumption intention is an important evaluation criterion. Howard and Sheth (1969) thought that consumption intention would influence consumers' purchasing (adopting) behavior; Fishbein and Ajzen (1975) also put forward the rational behavior pattern, thinking that individual behavior was based on the consumption intention; Lin (2007) took LCD TV as an example to discuss the influence of product attributes, product brand knowledge and store environment on consumers purchasing intention; and Lin (2010) took smart mobile phone as an example to discuss the consumption intention for technological product features according to different lifestyles, and all the above have shown the significance of using consumption intention to evaluate consumers' acceptance of the products.

According to the above background analysis, the research aims to probe into the consumers' demand, acceptance and consumption intention for portable hydrogen fuel cells. And the above research findings are hoped to provide reference for the government, relevant enterprises and manufacturers in making strategies, to improve the market competitiveness and acceptability of the products and to achieve the goal of promoting green consumption and sustainable development.

Literature Review and Research Hypotheses

Hollywood et al.(2007) and Lin (2010)pointed out in their research that when consumers want to purchase or consume one certain product or service to meet their physiological or psychological needs, this will make them produce the purchasing intention for the product or service. According to the above discussion, this research deduces the Hypothesis 1:

H1: Consumers' demand motive for portable hydrogen fuel cells significantly and positively influences the purchasing intention.

Garella and Lambertini (1999) thought that the better the product features the producers offered, the more they could attract the attention of consumers, and the more they could enhance the consumers' purchasing intention for the product. According to the above discussion, this research deduces the Hypothesis 2:

H2: Consumers' perceived product features of portable hydrogen fuel cells significantly and positively influence the purchasing intention.

Stafford and Stafford (2004) pointed out in their research that the internal and external information sources would both exert an influence on consumers' purchasing intention and decision-making; therein, internal information includes personal knowledge, past experience and memory etc.; and external information

includes Media introduction, promotion of dealers and government, as well as word of mouth. According to the above discussion, this research deduces the Hypothesis 3:

H3: Consumers' relevant information sources for portable hydrogen fuel cells significantly and positively influence the purchasing intention.

Plummer (1974) pointed out in the research that consumers in different lifestyles tend to have different demand motives that produce the purchasing intention for the same products. According to the above discussion, this research deduces the Hypothesis 4:

H4: Consumers in different lifestyles tend to have different demand motives that produce the purchasing intention for portable hydrogen fuel cells.

Lin (2010) thought that lifestyles encompass values, which would enhance the relevance between consumers' recognition and product features, and further influence the consumers' perceived value of products, and accordingly influence their purchasing intention. According to the above discussion, this research deduces the Hypothesis 5:

H5: Consumers in different lifestyles perceive different product features that produce the purchasing intention for portable hydrogen fuel cells.

Beatty and Smith (1987) pointed out in their research that when consumers are searching for information, their selection of information sources would be influenced by consumers' subjective factors. Schul and Crompton (1983) also pointed out that different lifestyles would make consumers' information sources different. According to the above discussion, this research deduces the Hypothesis 6:

H6: Consumers in different lifestyles have different information sources that produce the purchasing intention for portable hydrogen fuel cells.

Research Method

Research framework

The research framework shows in figure 1.

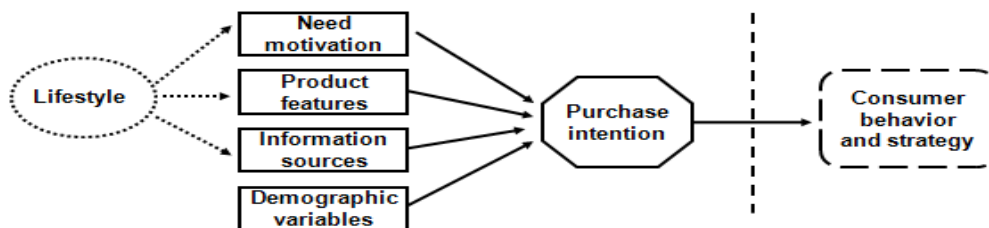


Fig. 1. Research framework

Questionnaire design

The questionnaire in this research consists of three parts. The first part discusses what consumers' lifestyles are. The research will adopt the often cited AIO scale (Plummer, 1974) and refer to the research by Lin (2010), and formulate 12 subjects; the second part discusses consumption intention, trying to find out the key factors that influence consumers' consuming behavior of portable hydrogen fuel cells, including the following perspectives: demand motive, product features, information source, and purchasing intention, and 13 subjects are formulated; and the above measuring method goes by the Likert Five-point Scale, in which 1 point indicates "totally disagree" and 5 points indicates "totally agree"; the third part is the general

information of interviewees, and there are 7 subjects including sex, age, level of education, occupation, and monthly income.

The research mainly chooses the consumers in five major metropolitan areas of Taiwan (including Taipei, Xinpei, Taichung, Tainan and Kaohsiung) as the respondents, and selects the sample number by stratified random sampling method according to proportion population. 500 questionnaires were distributed, and the investigating period is from April to May, 2011. Questionnaires with missing values are rejected, 403 valid questionnaires are recovered, and the rate of valid questionnaires is 80.6%.

Empirical Analysis

Description of sample composition

Statistical results of the interviewees' socio-economic characteristics are as follows: Sex, the male account for 46.9%, and the female account for 53.1%; 71% interviewees are currently single; Age group, 31-40 year-old people are in the majority (accounting for 41.9%), 21-30 year-old people take the second place (accounting for 30.0%), and this coincides with the findings by E-ICP(2010) on the age proportion of purchasers of technological products including notebook computers and mobile phones; level of education, college or university degree accounts for 66.0%, master or doctoral degree accounts for 14.4%, and more than 80% interviewees have received higher education; Occupational group, student accounts for 32.5%, service industry accounts for about 26.6%; the interviewees whose average monthly income ranges between 30,001-50,000 account for the major proportion (28.8%).

Reliability and validity analysis

In order to test the testees' consistency in factors answering, this research adopts the Cronbach's α coefficient for reliability analysis, and the Cronbach's α coefficient for factors of lifestyles, demand motive, product features, information source and purchasing intention is respectively 0.651, 0.652, 0.861, 0.816 and 0.710, showing that the internal consistency of this preliminary scale has met the academic requirement; In addition, the composite reliability of demand motive, product features, information source and purchasing intention is respectively 0.6, 0.9, 0.8, and 0.7, all of which are greater than the standard value 0.6 which is considered by Fornell and Larcker (1981), therefore, all the factors in this research have convergence validity.

Confirmatory factor analysis

This research adopts the structural equation model (SEM) to examine the theory model, the overall measurement model ($\chi^2/df = 1.212$; $RMR = 0.046$; $RMSEA = 0.062$; $GFI = 0.972$; $AGFI = 0.960$) has reached the standard suggested by Chiou (2011), showing that the goodness of fit of the constructed linear structure model is up to ideal level. The analysis results of the structural equation in this research are shown in Figure 2.

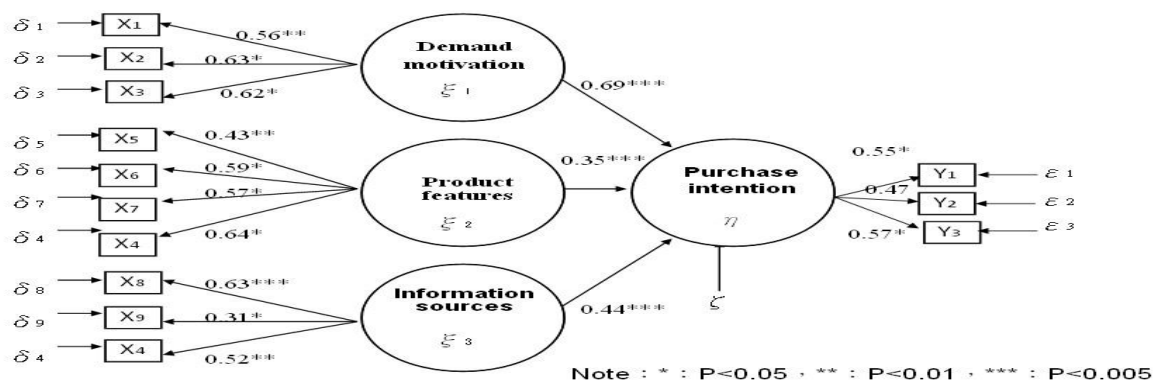


Fig. 2 The results of structural equation model analysis

The test of hypotheses in this research is shown in Table 1.

Table 1 Test of hypotheses

Hypothesis			Indicator	Results	
H1: Consumers' demand motive for portable hydrogen fuel cells significantly and positively influences the purchasing intention.			0.69***	support	
H2: Consumers' perceived product features of portable hydrogen fuel cells significantly and positively influence the purchasing intention.			0.35***	support	
H3: Consumers' relevant information sources for portable hydrogen fuel cells significantly and positively influence the purchasing intention.			0.44***	support	
Hypothesis	Different life style	Factors			
H4: Consumers in different lifestyles tend to have different demand motives that produce the purchasing intention for portable hydrogen fuel cells.	Practicality pavorers	Job demand	0.64**	support	
	Taste favorers	Showing personal style	0.69***		
	Conformity favorers	A sense of belonging to the group	0.51**		
H5: Consumers in different lifestyles perceive different product features that produce the purchasing intention for portable hydrogen fuel cells.	Practicality pavorers	Real-time chargeable	0.62**	support	
		Durable	0.50*		
		Less weight	0.47*		
H6: Consumers in different lifestyles have different information sources that produce the purchasing intention for portable hydrogen fuel cells.	Taste favorers	Portable	0.53*	support	
		Real-time chargeable	0.66**		
		Less weight	0.57*		
H6: Consumers in different lifestyles have different information sources that produce the purchasing intention for portable hydrogen fuel cells.	Conformity favorers	Portable	0.49*	support	
		Durable	0.58*		
		Portable	0.60*		
H6: Consumers in different lifestyles have different information sources that produce the purchasing intention for portable hydrogen fuel cells.	Practicality pavorers	Word of mouth	0.55*	support	
		Taste favorers	Network or magazine introduction		0.63**
			Corporate advertising or government promotion		0.58*
H6: Consumers in different lifestyles have different information sources that produce the purchasing intention for portable hydrogen fuel cells.	Conformity favorers	Network or magazine introduction	0.62**	support	
		Word of mouth	0.35*		

Note: *: P<0.05; **: P<0.01; ***: P<0.005

Conclusions and Recommendation

Conclusions

Key factors influencing consumers' purchase of portable hydrogen fuel cell products. A lot of previous research findings have indicated that, once a consumer has a demand motive for one certain product, his purchasing intention for the product will be significantly and positively influenced (Lin, 2010; Hollywood et al., 2007; Blackwell et al., 2006). And the result of this research has also found that consumers' demand motive for portable hydrogen fuel cells has a significant and positive influence on their purchasing intention. Garella and Lambertini and Lin pointed out in their researches that the product features perceived by

consumers would significantly and positively influence their purchasing intention (Lin, 2010; Garella and Lambertini, 1999); and the result of this research has also found that product features has a significant and positive influence on purchasing intention, that is to say, when consumers perceive a higher value of the product features, they will have greater purchasing intention for the product. Besides, the sources from which the consumers collect product information and the product information acquired will both significantly and positively influence their purchasing intention for the product (Lin, 2010). The result of this research has found that information source also has a significant and positive influence on purchasing intention, that is to say, the more sufficient product information the consumers have, the greater their purchasing intention will be.

Purchasing behavior of consumers in different lifestyles for portable hydrogen fuel cells. Plummer used to point out that for consumers in different lifestyles (Plummer, 1974), the demand motives that make them produce the purchasing intention for products are not exactly the same. The result of this research has found that that the demand motive that make Practicality Favorers produce the purchasing intention for portable hydrogen fuel cells is “job demand”; that for Taste Favorers is “showing personal style”; and that for Conformity Favorers is “a sense of belonging to the group”. It can be seen that for consumers in different lifestyles, their demand motives in buying portable hydrogen fuel cells are corresponding to their respective group identity.

Brunso et al. (2004) indicated that lifestyles contained individual values, which made consumers in different lifestyles perceive different values of product features, and accordingly their purchasing intention for the product was influenced. The result of this research has found that the product features that make Practicality Favorers produce the purchasing intention for portable hydrogen fuel cells are “real-time chargeable”, “durable”, “less weight” and “portable”; for Taste Favorers “real-time chargeable”, “less weight” and “portable”; and for Conformity Favorers “durable” and “portable”. It can be seen that consumers in different lifestyles perceive different values of product features of portable hydrogen fuel cell products.

In addition, it is believed by some scholars that before buying the products, consumers will collect relevant product information, and their information-collection behavior and information sources that they adopt vary according to different lifestyles (Beatty and Smith, 1987). The result of this research has found that the information source factor that makes Practicality Favorers produce the purchasing intention is “word of mouth”; that for Taste Favorers are “network or magazine introduction” and “corporate advertising or government promotion”; and that for Conformity Favorers are “network or magazine introduction” and “word of mouth”. It can be seen that consumers in different lifestyles tend to adopt different information sources in collecting product information.

Recommendation

Suggestions to the Government. As the government has made far from enough efforts in advocating and popularizing hydrogen energy and fuel cells to the populace, so that the mass consumers at large are ignorant of what hydrogen energy or fuel cells are, and by no means will they have purchasing intention for such products, and consequently, there is a variety of products on the supply side, yet there is no market at all. In face of such imbalance between supply and demand, if hydrogen-energy-technology application products are to be popularized, the government offices concerned are hoped to assimilate the experience from advanced Occidental countries in popularizing hydrogen-energy-technology application products, conscientiously formulate a set of complete strategies, and actively advocate and propagandize such products. For example, the government offices concerned can take the lead in using hydrogen-energy-technology application products, to set an example; or relevant subsidies measures can be taken to make the populace feel the government’s determination in popularizing hydrogen-energy-technology application products, and thereby acquire people’s

identification with hydrogen energy and fuel cells, this way, subsequent policies or measures related to hydrogen energy and fuel cells will in all probability win the extensive support from the mass consumers.

Suggestions to the Manufacturer. The research has found that the consumers' lifestyles, demand motive, product features and information source will all exert an influence on their consumption intention for portable hydrogen fuel cells. Therefore, this research suggests that relevant manufacturers set cost reduction as their primary development goal in the course of product development, in order to enhance consumers' consumption intention; and in product marketing, they should first determine the target market, and know well the market's specific demand for products, thereby provide the products that are geared to consumer demand, so as to enhance consumers' consumption intention.

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