

Evaluation of Perception and Attitudes towards Hybrid Vehicles: A Developing Country Approach

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Abstract

The perceptions and attitudes of the society and potential consumers is a major issue to adopt energy-sustainable product innovations. Current critical issues such as global warming, reducing energy sources and air pollution make it important to understand and manage the diffusion of sustainable transportation vehicles. The transport sector is responsible for more than 14% of harmful gas emissions worldwide and measures should be taken not only by industrialized countries but also the developing countries must take the issue seriously. Industrialized countries are able to investing in fully electric vehicles and its infrastructure through the country. On the other hand, instead of expensive investments in infrastructure for electric vehicles, policies to encourage the usage of hybrid vehicles seems to be a better short term approach for developing countries. This paper reports the results of a case study about the perceptions and attitudes of potential consumers towards hybrid vehicles. A questionnaire survey was conducted with the prep class and 4th year engineering students. The survey included 154 filled forms of which 149 were taken into analysis. Perceptions about the hybrid vehicles change according to the gender, age, class and income of the participants. An overall environmentally friendly perception and a positive attitude to purchase hybrid vehicles were observed.

Keywords: *Hybrid vehicles, environmentally-friendly products, consumer perception, consumer attitude*

Hibrit Araçlara Karşı Algı ve Tutumların Değerlendirilmesi: Gelişmekte Olan Ülke Yaklaşımı

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Öz

Toplumun ve potansiyel tüketicilerin algı ve tutumları enerji açısından sürdürülebilir yeniliklerin geniş kabulü açısından önemli bir konudur. Günümüzde küresel ısınma, azalan enerji kaynakları ve artan hava kirliliği sebebiyle sürdürülebilir ulaşım araçlarının toplumdaki karşılığının anlaşılması ve yönetilmesi önem arz etmektedir. Ulaşım sektörü dünyadaki zararlı gaz salınımlarının %14'ünden fazlasından sorumludur ve bu konuda sadece gelişmiş ülkeler değil gelişen ülkelerin de önlem alması zaruri hale gelmiştir. Gelişmiş ülkeler tamamen elektrikli araçlara ve belirli mesafe aralıklarında ülke çapında yayılmış altyapı yatırımlarına kaynak ayırabilmektedir. Gelişmekte olan ülkeler için yüksek maliyetli bu yatırımlardan ziyade hibrit araç kullanımının özendirilmesi kısa vadede daha mantıklı bir seçenek olarak ortaya çıkmaktadır. Bu makale, potansiyel tüketicilerin hibrid araçlara yönelik algıları ve tutumlarıyla ilgili bir vaka çalışmasının sonuçlarını bildirmektedir. Hazırlık ve 4. sınıf mühendislik öğrencileri ile anket çalışması yapılmıştır. Çalışma doldurulan 154 anketten 149 tanesini analize dahil etmiştir. ibrit taşıtlara ilişkin algı, katılımcıların cinsiyetine, yaşına, sınıfına ve gelirine göre değişmektedir. Genel olarak çevre dostu bir algı ve hibrid araç satın alma konusunda olumlu bir tutum gözlenmiştir.

Anahtar Kelimeler: Hibrit araçlar, çevre dostu ürünler, tüketici algısı, tüketici tutumu

Introduction

Worldwide one of the major harmful gas emitting sources is transportation and the amount of emission is yearly increasing. A slow upward trend of energy related CO₂ emissions are expected until 2040, however, this is still far out of the necessary trend to deal with the global climate change (www.iea.org). Extensive use of fossil fuel is mainly responsible for the pollution caused by the transportation vehicles. Although it is not a new idea, electric vehicles are currently promoted as a solution for the problem. Beside consumer attitudes and the policy of governments, there are technical challenges such as building a nation-wide infrastructure and increasing the capacity of the batteries as well as decreasing their costs. Although every major car producer is offering electric vehicles, the change from fossil based fuels to electric seems to happen not as a revolution but a stepwise evolution in the market.

As industrialized countries are funding and building infrastructure for fully electric vehicles, it is financially difficult for developing countries to develop an electric vehicle infrastructure. Instead, hybrid vehicles offer a good choice of transition to decrease emissions because there is no need to invest in infrastructure. Much research was conducted about the technical limitations of batteries and systems (Egbue and Long, 2012). On the other hand, it is also important to consider and analyze the attitudes of potential consumers towards hybrid vehicles as an innovative and market penetrating technical system.

Within the scope of this study, we investigated the attitudes of young potential consumers towards hybrid cars. We asked questions directing their feelings, experiences and expectations. We categorized the perceptions of potential consumer by using a survey. The results of this study provide insights to policy policymakers and professionals of automotive sector about the structuring of hybrid vehicle market of a developing country.

Background

Standard vehicles are utilizing an internal combustion engine which are powered by fossil fuels and emit harmful gasses. There are increasingly

offered alternative power vehicles in the market such as fuel cell, natural gas, bio-diesel, fully electric, hybrid and plug-in hybrid models. Bio-diesel is a sustainable option however it still has comparable emissions with the standard models. Emissions of compressed natural gas powered engines are lower than conventional ones due to the nature of its chemical structure. There are safety concerns to drive with a compressed fuel tank and an infrastructure is necessary to its widespread adoption. Similarly, electric vehicles and plug-in hybrid models also require electric loading stations. The main constraint of electric vehicles is sufficient energy storage to avoid frequent and time consuming loading of batteries. In this sense, hybrid vehicles seem to have the highest chance in developing countries as the next technological step to decrease emissions and fuel consumption as well as to cope with the climate change and air pollution problems.

Studies on the purchase motivation of consumers for hybrid vehicles were mainly executed in industrialized countries such as US, Japan, Korea and Switzerland (Peters, Mueller, de Haan and Scholz, 2008; Kishi and Satoh, 2005; Ewing and Sarigollu, 2000; Horne, Jaccard and Tiedemann, 2005). Environmental friendliness is one of the major purchase motives of consumers to buy hybrid vehicles. For these consumers, driving a hybrid car is a way to express their green way of thinking and living (Turrentine and Kurani 2007).

Another major purchase motivation for hybrid vehicles is about consuming less fuel and saving money. There is a tendency to change large and high fuel consumption vehicles with the compact hybrid cars. Governmental support and increasing oil prices also lead customers to buy hybrid vehicles (Heffner, Kurani and Turrentine, 2007; de Haan, Mueller and Peters, 2006).

In the literature, purchase motivations for hybrid vehicles were found as followed:

- Being an environmental friendly consumer of the society
- Paying less for fuel
- Paying less tax
- Being a technological pioneer and trend maker
- Enjoying to be different than others

In behavioral research of consumers, intentions are determined by attitudes and experiences and the decisions are made to find the best outcome within the offered alternatives in the market (Lane and Potter, 2007). Beside the feelings involved with the products, consumers tend to maximize a kind of internal utility function based on benefits considering their budgets (Roche, Mourato, Fishedick, Pietzner and Viebahn, 2010). However in today's world consuming holds more parameters such as position in the society, image, cultural aspects etc. than a mere benefit based meaning. Consuming became a way of communication for the values of consumer both to the outside world and to the inside (Slater, 1997). Thus, there is no doubt that the action of consumption consists of both rational and emotional aspects. Therefore it is important to analyze these two main pillars of consumption motives in order to see how they affect the adoption of innovative hybrid vehicles particularly in a developing country.

Methodology

A questionnaire survey in printed form was prepared and executed in this research to gather data from potential customers. Both closed and open form questions were asked throughout the survey. The population of the survey consists of engineering students of a technical university which specializes in developing innovative systems within the ecosystem of a developing country. We observed that many of the students are interested in buying innovative products. The students are easily adapting to new technologies and buying new electronic products if they are in their budgets. Therefore engineering students are naturally technology enthusiasts who are likely to consider buying a hybrid vehicle after graduation.

Chi square test was applied to see the relation between the variables. Null hypothesis was tested between responses which meant no association. The standard 5% or 0.05 was used to determine the statistical significance. Therefore a p-value less than 0.05 means that there is significant evidence of an association between variables.

Results and Discussion

The sample had a higher representation of males (55.7%) than females (44.3%). The ages of the students were between 17 and 32. The prep class and 4th year students of mechanical engineering, industrial engineering and electrical and electronic engineering attended the survey. The sample may not be fully representative of the whole society, however, valuable information about technology enthusiasts and potential customers of hybrid vehicles were provided.

Most of the students were between the ages of 18 and 24 (82%). 63% of the students were from families of yearly income lower than 60.000TL and 36.9% of the students' families earned more than 60.000TL. 61.7% of the students rated their interest towards hybrid vehicles more than 5 out of 10 points. The students responded to the question "do you consider buying a hybrid car?" with 87.9% possibility of buying. 59.1% preferred standard hybrid cars to the plug-in hybrid models. Comfort, less fuel consumption and environmental friendliness were almost similarly weighted criteria to buy a hybrid vehicle. Seemingly less maintenance costs of the hybrid vehicles is not effectively communicated to the society. 51% of the students claimed that they believe hybrid cars are a safe choice of transportation which shows that there are no significant concerns about the safety of hybrid vehicles. 63% of the students claimed that they pay attention to the environmentally friendliness of the cars. Table 1 shows the questions of the survey and the number of responses as well as the percentages of the responses.

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Table 1. Questions and responses to the survey

Question	Number of Responses	%
Are you male or female?	149	%100
Male	83	%55.7
Female	66	%44.3
What is your age?	149	%100
17	2	%1.3
18	18	%12.1
19	18	%12.1
20	21	%14.1
21	21	%14.1
22	23	%15.4
24	15	%10.1
25	6	%4.0
27	2	%1.3
28	1	%0.7
32	1	%0.7
What is your family income per year? (TL)	149	%100
20.000-40.000	55	%36.9
40.000-60.000	39	%26.2
60.000-80.000	26	%17.4
80.000-100.000	18	%12.1
>100.000	11	%7.4
How would you rate your interest in hybrid cars?	149	%100
1	16	%10.7
2	5	%3.4
3	13	%8.7
4	11	%7.4
5	12	%8.1
6	17	%11.4
7	17	%11.4
8	27	%18.1
9	18	%12.1
10	13	%8.7
Do you consider buying a hybrid car in the future?	149	%100
Not at all	18	%12.1
Maybe	72	%48.3
Likely	40	%26.3
Very Likely	19	%12.8
Which type of hybrid car would you prefer?	149	%100
Hybrid	88	%59.1
Plug-in hybrid	61	%40.9
Which would be the most important criteria for you to choose a hybrid car?	149	%100
Fashion	30	%20.1
Comfort	35	%23.5

Less fuel consumption	36	%24.2
Environmental friendliness	34	%22.8
Less maintenance	14	%9.4
Do you think hybrid cars are a safe choice for transportation?	149	%100
Strongly agree	15	%10.1
Agree	61	%40.9
Neutral	55	%36.9
Disagree	9	%6.0
Strongly disagree	2	%1.3
Unsure	7	%4.7
Do you pay attention that the cars you buy are environmentally friendly?	149	%100
Strongly agree	33	%22.1
Agree	61	%40.9
Neutral	36	%24.2
Disagree	9	%6.0
Strongly disagree	3	%2.0
Unsure	7	%4.7

Table 2 summarizes the cross comparison of the demographic properties of the sample as gender, age, class and income with the 6 main questions of the survey. The Pearson chi-square results show no statistically meaningful difference between the variables throughout $4 \times 6 = 24$ comparisons. Only two exceptions occurred. As the income increases the likelihood to buy a hybrid car slightly increased as well ($p=0.040 < 0.05$). Another association occurred between income and the most important buying criteria. The subgroup of the sample with family income higher than 100.000TL considered the less maintenance costs as the most important criteria.

Table 2. Chi-square comparison results

	Gender		Age		Class		Income	
	df	chi square	df	chi square	df	chi square	df	chi square
Interest	9	0.088	99	0.232	9	0.289	36	0.155
Consider buying	3	0.841	33	0.256	3	0.522	12	0.040
Type of hybrid	1	0.318	11	0.237	1	0.710	4	0.561
Most important criteria	4	0.067	44	0.195	4	0.049	16	0.002
Hybrids are safe	5	0.822	55	0.902	5	0.323	20	0.683
Hybrids are environmentally friendly	5	0.707	55	0.428	5	0.646	20	0.070

Conclusion

Although the participants of the survey may not be representative for the whole society, it gives helpful insights about the perceptions and attitudes of the potential technologically educated customers. The analysis of the data showed that there are no significant differences across gender, age, class and income level of the participants concerning the perceptions of hybrid vehicles. Only some differences of opinions observed depending on the yearly income of the families. Standard hybrid vehicles were preferred to the plug-in hybrid models. Comfort, less fuel consumption and environmental friendliness were the main criteria to choose a hybrid vehicle. Most of the participants believed that hybrid vehicles are a safe and environmentally friendly way of transportation, so a wide acceptance of the society already exists for these products. Unlike electric vehicles, hybrid vehicles do not require an infrastructure to promote its wide spread usage. In recent times, air pollution and lack of sufficient access to energy sources became more the problem of developing countries. Thus, hybrid vehicles provide a stepwise solution to reduce greenhouse gas emissions and reduction of fuel consumption.

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