Impacts of Environmental Motivational Factors on Consumers' Intention to Consume E5 Biofuel

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Abstract

Vietnam began to put E5 biofuel into consumption in early 2015. By 2018, E5 biofuel was officially replaced A92 gasoline in the market. After 4 years, by the first 3 months of 2019, E5 gasoline consumption reaches 37.8% of total gasoline types. Compared to 2018 consumption (42%), E5 gasoline consumption in the first period of 2019 decreased by 4.2%. The reason for the expansion of E5 gasoline sales volume but the decrease in consumption is the appearance of information that the quality of E5 gasoline is not guaranteed, biofuel consumption is higher than that of A95 gasoline. Besides, some of vehicle are not considered suitable to use E5 as a fuel.

Contrary to the subjective opinion of most Vietnamese people, international experience indicates that biofuel in general and E5 in particular are fully guaranteed for quality. Moreover, biofuel is an environmentally friendly gasoline, reducing greenhouse gas emissions, creating livelihoods for people in some areas by growing agricultural products as input materials.

To complement research gaps that there is no study comparing the impact of risks when using E5 gasoline (in terms of quality and suitability with vehicles) with motivational environment (environmental knowledge and concern, environmental friendliness, reduction of greenhouse gas emissions, ...) for consumer intention to use E5 gasoline, the research team focuses on analyzing the topic "Impacts of environmental motivational factors on consumers' intention to consume E5 biofuel"

By using the expanded TPB structure (Theory of planned behavior), combining risk factors and environmental motivations, data based on 153 people in Hanoi showed that environmental motivations and risk awareness is two factors that affect the intention of consuming E5 gasoline of Hanoi people. However, the impact of these two factors is different. The results of the study indicate that factors of environmental motivations have a more powerful impact than the risk awareness for the intention to consume biofuel E5.

Keywords: E5 biofuel, Environmental motivations

1. Introduction

In 2013, when there was news that E5 biofuel was about to be officially launched and marketed, Nguyen Van Duy conducted a study "Factors affecting the adoption trend of E5 biofuel". The study used Rogers' diffusion of innovation theory (1983) and the Technology acceptance model (TAM) of Davis (1989) to evaluate the factors affecting the trend of using biofuel E5. The research results show that there are 3 factors that influence the trend of accepting the use of E5 biofuel as (1) Accessibility, (2) Related benefits, (3) Observability. Because at that time E5 gasoline was still not widely used, the author proposed to use E5 gasoline widely, use advertising measures and propagate information about E5 so that people could understand the benefits and the values of E5. Le Thi Kieu Oanh and Luu Tien Thuan (2014) also studied "Factors affecting the acceptability of using biofuel E5 of people in Can Tho city". The study has identified 6 factors affecting the acceptability, ranked from large to small as follows: (1) E5 petrol quality, (2) E5 petrol price, (3) Widely sold at petrol stores, (4) Realizing that E5 petrol is better for the environment than traditional gasoline, (5) Propagated and encouraged by the government, (6) Selected by many other consumers. Vo Thi Truc Nga (2015) chose an analytical framework "Theory of consumption value" by Sheth et al. (1991). Based on the original model, the author made appropriate adjustments by integrating the two independent variables of social and emotional values into meaningful values, as well as adding variables of concern to the environment. (refer to the research model of Beyzavi and Lotfizadeh (2014)). Han Hoang (2017) researches "The determinants of pro-environmental behaviour: the purchase of bio-ethanol in Vietnam" has identified factors that influence the purchase of E5 through the application of a model of "Theory of Interpersonal Behaviour" (TIB) with edits (1977). In addition to considering the impact on E5 buying behaviour of the original TIB structures including Intention, Habits and Favourable Conditions, the study also investigated the impact of respondents' environmental knowledge on E5 and their cognitive power to overcome barriers about E5 consumption. This factor have shown strong predictability in previous studies. In 2018, when E5 gasoline was officially replaced for A92 gasoline, the National Economics University research team inherited the research of Nguyen Van Duy (2013) and developed a new research model. Still based on the innovation diffusion theory of Rogers (1983) and the technology-accepting model (TAM) of Davis (1989), combined with Theory of Reasoned Action (TRA) of Ajzen and Fishbein (1975), the model proposed by the authors include 5 dependent variables including 3 variables from Rogers (1983) model: (1) accessibility, (2) compatibility, (3) benefits associated with others variables (4) perceived usefulness (selected from the TAM model) and (5) subjective standard (TRA model). The research has only recognized the advantages of E5 biofuel without recognizing the limitations, thereby arguing that the poor assessments of E5 gasoline are due to the lack of knowledge about this type of gasoline and the bad quality of E5. This judgment is unrealistic because the problem is due to the compatibility of E5 petrol with vehicles. From 2013 to 2018, there has been a lot of research on E5 gasoline consumption behaviour, but no studies have explained the decline in consumption volume while the scale of gasoline production increased as well as whether the reduction of consumption can indicate the opinion of consumers about the disadvantage of E5 gasoline or not.

Originating from that research gap, the research team proposed an expanded TPB model to evaluate the factors affecting the intention of consuming E5 gasoline of people in Hanoi. On the basis of quantitative research on the impact of environmental motivations factors on the purchase of biofuel, the thesis has discovered new theoretical and practical contributions: Firstly, the research confirms the role of environmental motivations in the implementation of green behaviour, especially in this study environmental motivation is Perceived Environmental Effectiveness with the behaviour of buying E5 gasoline which has not been considered in previous studies on biofuel. When perceived environmental effectiveness is controlled, the impact of the two environmental knowledge factors and environmental concerns is positive on the intention to buy E5 biofuel. Second, the research team has added the factor "Risk Awareness" to the model to study the behaviour of buying E5 biofuel. Being different from previous studies, the research team looked at E5 biofuel products more comprehensively and objectively, both on the advantages and disadvantages of the products, which prior studies on biofuel did not mention. Thereby, the study assesses which factors have a stronger impact on the intention to consume biofuel E5 of people in Hanoi. Since then, the research team have found solutions to boost biofuel consumption, improve the quality of the environment, create livelihoods for the people and improve policy solutions to raise environmental awareness and people's consuming green products like E5.

The research team used The Theory of planned behaviour developed by Ajzen (1991) from the previous theory of rational action (TRA) of Ajzen and Fishbein (1980). Both Ajzen's theoretical models have a wide range of applicability and prediction, can be applied to voluntary acts and supported by rational intentions and thoughts. TPB theory has proven its value and effectiveness in a series of psychological studies related to human behaviour (Armitage and Conner, 2001). The theory of planned behavior postulates three conceptually independent determinants of intention. The first is the attitude toward the behavior and refers to the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question. The second predictor is a social factor termed subjective norm; it refers to the perceived social pressure to perform or not to perform the behavior. The third antecedent of intention is the degree of perceived behavioral control which refers to the perceived ease or difficulty of performing the behavior and it is assumed to reflect past experience as well as anticipated impediments and obstacles.

In addition to the three main TPB structures, the research team proposes two new factors, namely Risk Awareness (RA) and Environmental Motivation Factors (include Perceived Environmental Effectiveness (PEE), environmental knowledge (EK) and environmental concern (EC). The purpose of adding these two new elements to the TPB model is to evaluate the impact of these two factors on E5 biofuel consumption, the strong and weak impact of these two factors on intention to consume E5 of the people.

2. Method

2.1 Data collection methods

The research team collects data through two main methods: online and direct interviews for people aged 18 and older who use personal transportation vehicles using E5 bio-petrol as fuel in Hanoi.

For participants who answered online, after being specifically provided with information and purpose of the study, if they agreed to participate in the response, they would be forwarded to the questionnaire posted online. In addition, the group is also proactively reaching out to less or infrequent internet users to conduct surveys in order to obtain a result that can best represent the people living in the city.

2.2 Instrumentation

The questionnaire included measures of all independent and dependent variables. To reduce measurement artefacts, the scale assessing the dependent variable was presented prior to all other scales. All measurement items were adopted and modified from existing measures with reported acceptable reliabilities. Participants responded to all scale items using 5-point Likert-scales.

3. Results

3.1 Participant characteristics

Over half of the participants were woman (58.82%) with an average age of 24 years. Most participants attended college (81.7%). Details of participants' demographic characteristics are presented in Table 1

Table 1: Demographic profile of participants.

Variable	Category	Frequency	%
Age	18-under 22	87	56.86
	22-under 30	43	28.1
	31-under 45	18	11.76
	45-under 60	5	3.27
	60 or up	0	0
Gender	Male	63	41.18
	Female	90	58.82

Income	Under 3 million	80	52.29
	3-under 5 million	31	20.26
	5-under 10 million	21	13.73
	10-under 20 million	17	11.11
	20 million or up	4	2.61
Education	High school or less	13	8.5
	Some college	7	4.58
	Bachelor's degree	125	81.7
	Master's degree or up	8	5.23

3.2 Preliminary data analyses

3.2.1 Means, standard deviations and reliability

In order to evaluate the internal consistency and precision of the observed items measuring a given variable, reliability tests of all measures were conducted with Cronbach's alpha. Most measures were above 0.8. We removed the variable mismatch. Results are presented in Table 2

Table 2: Cronbach's Alpha coefficients for factor groups

Ordinal number	Factor	Number of initial observed variables	Number of observed variables remaining	Cronbach's Alpha	The variable is disqualified
1	Attitudes	3	3	.820	
2	Subjective Norms	4	4	.844	
3	Perceived Behavioural Control	4	4	.873	
4	Risk awareness	4	4	.911	
5	Perceived environmental effectiveness	8	7	.910	PEE6
6	Environmental concern	7	5	.909	EC5; EC7

7	Environmental knowledge	9	9	.946	

Through the results of the reliability test for each variable through Cronbach's Alpha coefficient, almost all variables which have correlation coefficient with total variable > 0.3 are satisfactory. However, there are variables PEE6, EC5, EC7 with total correlation coefficient less than 0.3, so the team decided to remove this PEE6, EC5, EC7 variables for further analysis.

3.2.2 Correlations

The correlations between purchase intention of E5 biofuel (PI) and variables were examined (See Table 3). The three primary constructs of purchase intention (ATT, SN, PBC), situation- and issue-specific variables (PEE, NS), the general environmental motivations (EC, EK) were significantly and positively correlated with PI (all $p < .05$).

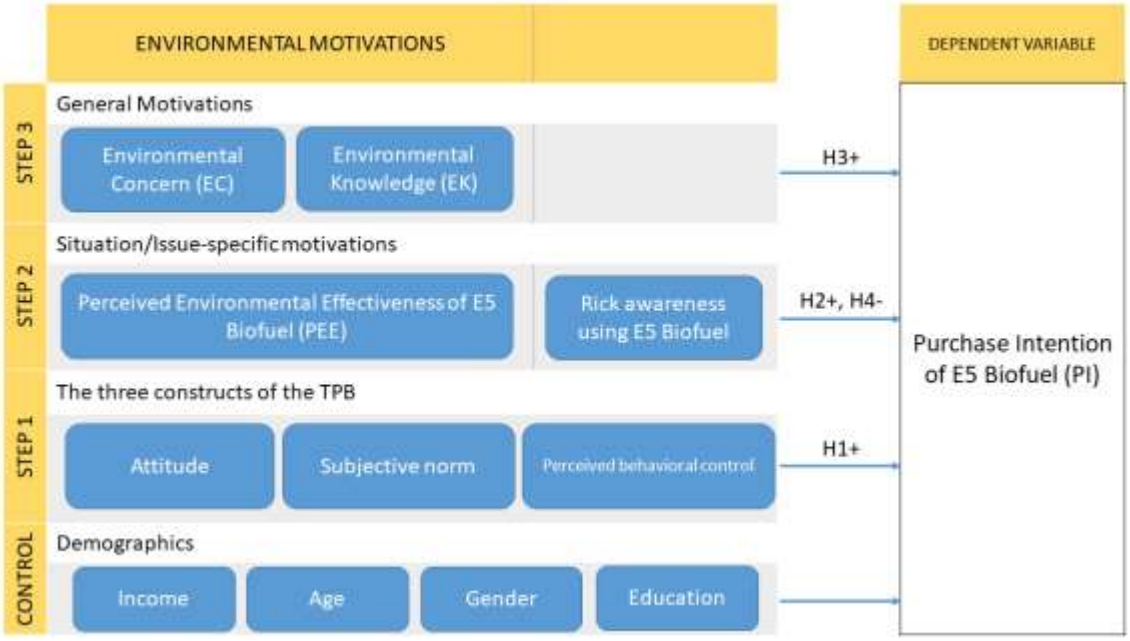
Table 3: Correlations between all variable

Construct	*ATT*	*SN*	*PBC*	*RA*	*PEE*	*EC*	*EK*	*PI*
ATT	1							
SN	0.43	1						
PBC	0.57	0.32	1					
RA	-0.05	0.24	-0.04	1				
PEE	0.42	0.26	0.40	0.04	1			
EC	0.41	0.20	0.50	-0.02	0.62	1		
EK	0.31	0.10	0.44	-0.05	0.41	0.72	1	
PI	0.68	0.50	0.66	-0.10	0.71	0.71	0.59	1

3.3 Regression

This study investigated motivations for purchasing E5 biofuel by testing and extending the theory of planned behavior in a E5 biofuel purchasing setting. Because the conceptual model of the study was designed based on a particular theory (i.e., TPB) and prior research findings, we used hierarchical regression analyses to specify a hierarchical model of E5 biofuel purchasing.

Fig 1. The conceptual model of the study



The three major constructs of the TPB (i.e., ATT, SN, PBC) were examined as a basic set of predictor variables after controlling for the demographic variables (H1). The effects of environmental motivations were examined after controlling the main effects of demographic variables and the TPB constructs. If the issue-specific environmental motivation (i.e., perceived environmental effectiveness; PEE) accounts for a significant amount of variance in green product purchase intention over and above that accounted for by demographic variables and the TPB constructs was tested (H2). If the general environmental motivations (i.e., environmental knowledge and environmental concern; EC and EK respectively) account for a significant amount of variance in green product purchase intention over and above that accounted for by demographic variables, the TPB constructs, and the situation-specific environmental motivation (PEE) was also tested (H3). The perception of E5 petrol risk has a negative impact on the intention to buy E5 gasoline.

3.3.1 Regression analyses

Table 4: Model Summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.919[a]	.845	.838	.292

a. Predictors: (Constant), ATT, SN, PBC, RA, PEE, EC, EK
b. Dependent Variable: PI

R Square = .845 means that the independent variables of the model explain 84.5% of the variation of the dependent variables (PI).

Table 5: ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	67.674	7	9.668	113.247	.000[b]
	Residual	12.378	145	.085		
	Total	80.052	152			

a. Dependent Variable: PI

b. Predictors: (Constant), ATT, SN, PBC, RA, PEE, EC, EK

F = 113.247 with P-value = .000 so the regression model is appropriate, can be used.

Table 6: Regression coefficient

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	-.189	.165		-1.148	.253		
ATT	.152	.035	.190	4.354	.000	.558	1.792
SN	.220	.033	.255	6.645	.000	.725	1.380
PBC	.134	.033	.173	4.036	.000	.580	1.725
PEE	.305	.039	.347	7.781	.000	.535	1.868
RA	-.112	.032	-.118	-3.453	.001	.909	1.100
EC	.140	.050	.151	2.814	.006*	.368	2.717
EK	.155	.043	.165	3.577	.000	.501	1.996

a. Dependent Variable: PI

With a 10% significance level, the P-value of factors satisfies <0.1, so the factors used are the factors that influence the intention to consume E5 biofuel.

VIF of factors is less than 2, so no multi-collinear phenomenon occurs.

For constants, Sig = .253 > 0.1 with Hypothesis H_0, H_1 , respectively:

H_0: Constant = 0

H_1: Constant ≠ 0

Since P-value> 0.1, H_0 is accepted. It means that we accept constant = 0.

From Table 6, we have the following regression equation:

PI = 0.190*ATT + 0.255*SN + 0.173*PBC + 0.347*PEE – 0.118*RA + 0.151*EC + 0.165*EK

The standardized regression coefficient helps team conclude that the factor that has the most influence on consumers' intention to use E5 bio-petrol is based on the absolute value of the coefficient B. The greater the number of absolute values, the greater effect of that factor on the dependent variable. Thereby, the research team concludes that the biggest factor affecting consumers' intention to use E5 bio-petrol is Perceived Environmental Effectiveness (PEE) because coefficient B4 = 0.347 is the biggest. The next level of influence on the dependent variable is Subjective Norm (SN); Attitude (ATT); Perceived Behavioural Control (PBC); Environmental Knowledge (EK); Environmental Concern (EC) and factor that has the least effect on consumers' intention to consume E5 is Risk Awareness (RA) with Coefficient B5 = -0.118.

Through the regression results, it can be concluded that the environmental motivational factors affecting the intention of using E5 bio-fuel are stronger than risk awareness. The reason can be explained that the environmental motivation and environmental friendliness of E5 have been widely proven in the world, while the risks of using E5 biofuel are not statistically and specifically researched. All risks when using E5 gasoline are only subjective and unofficial perceptions of consumer, so the amount of E5 biofuel consumed in the first half of 2019 have had such a slight decrease. In fact, many consumers still believe in the quality and benefits of the environment that E5 biofuel brings, so the impact of environmental motivations is still much greater than that of the risk awareness. This is also the basis for building policies to promote E5 biofuel consumption in Hanoi in particular and the country in general.

3.3.2. Hypothesis testing

Table 7: Hypothesis testing

No.	Hypothesis	Regression Coefficient	Sig.	Conclusion
1	Attitude towards E5 biofuel positively affects the intention to consume E5 biofuel	0.190	.000	Accepted
2	Subjective Norm have a positive effect on the intention to consume E5 biofuel	0.255	.000	Accepted
3	Perceived Behaviour Control have a positive effect on the intention to consume E5 biofuel	0.173	.000	Accepted
4	Perceived Environmental Effectiveness have a positive	0.347	.000	Accepted

	effect on the intention to consume E5 biofuel			
5	Risk Awareness has a negative impact on the intention to consume E5 biofuel	-0.118	.001	Accepted
6	Environmental Concern have a positive effect on the intention to consume E5 biofuel	0.151	.006	Accepted
7	Environmental Knowledge have a positive effect on the intention to consume E5 biofuel	0.165	.000	Accepted

After testing, the research team concludes that all variables are accepted to explain the fluctuation of the dependent variable.

4. Discussion and Conclusion

The research results show that the factors of environmental motivations have a great impact on intention to consume green products in general and E5 biofuel in particular. The biggest factor affecting the intention to consume E5 gasoline is perceived environmental effectiveness (PEE), in addition to other factors that have a positive impact on consumption intentions, except risk awareness (RA) factor which has opposite effect. The impact of environmental motivations is still much greater than that of the risk awareness.

The limitation of the study is the limited time, the sample is not large enough. Objects of research also focus on one age group who are highly qualified people but have not gone into manual workers.

From the research results, the team also proposed some solutions to improve the intention of using E5 bio-fuel: promoting communication reducing environmental taxes (from 90% to 70%) to create a price gap between A95 gasoline and E5 biofuel; gradually imposing the use of E5 biofuel for suitable vehicles; eliminating the "Petrol Stabilization Fund" to make fairness for both sellers and buyers. Good communication, increasing people's awareness about the environmental efficiency brought by E5 biofuel, providing complete information about the quality and compatibility of E5 for current vehicles. From there, building people's belief in E5 bio-fuel consumption.

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