

Examine Consumer Innovativeness for Green Consumer Durables with Two-Way Factorial Design

Lokesh Jasrai, Amanpreet Kaur, Suresh Kashyap

ABSTRACT--- Continuous consumption and degradation of natural resources round the world create a substantial need for environmental innovation in industry aiming to produce green products with more eco-friendly features in general and for consumer durables in particular. Emerging concept of 'Consumer innovativeness' in the context of green marketing helps to understand the green consumerism, sustainable consumption and environmentally responsible purchase behaviour. In this way, the green innovativeness refers to degree of consumers' to accept green innovation earlier in social environment with readiness to pay premium price for the same. Though, consumer innovativeness is well recognized trait of consumer behaviour, hence we explored the attribute of 'green innovativeness' in the contemporary literature for consumer durables. In view of this, the two-way Analysis of Variance (factorial) experiment design has been used to examine the influence of demographic variables on green innovativeness. By reviewing extant literature, gender and age have been identified as important demographic (predictive) variables, whereas green innovativeness as criterion variable for the experiment. The analysis used in study gives important insights about main effect of gender and age along with their interaction effect on green innovativeness to produce statistical inferences for the target population. The study also offers managerial implications for industry to strengthen green marketing activities.

Key Words— Consumer durables, demographic variables, green product, green innovativeness, green marketing activities.

I. INTRODUCTION

An emerging concept of 'Consumer innovativeness' (CI) is considered as specific discipline of consumer behaviour comprehends green consumerism, sustainable consumption and environmentally responsible purchase behaviour in order to assess the innovativeness amongst consumers. The green innovativeness refers to degree of consumers' to accept green innovation earlier in particular social group with readiness to pay premium prices for green products as compared to peer members. The consumers' with comparatively high green innovativeness view a product or service 'greenness' and willing to pay extra price and committed to eco-friendly behaviour resulting into positive social and environmental impacts (Dahlstrom, 2017). The continuous utilization, consumption and degradation of natural resources round the world create a substantial need to introduce green products and services those are originally

grown, recyclable, reusable and biodegradable with natural ingredients and caused no environmental hazard in general and for consumer durable in particular (Kotler, 2012).

Environmental innovation in industry aiming to produce green products with more eco-friendly features is required not only as corporate social responsibility but also commits sustainable development in long run (Narula and Desore, 2015). The concept of green marketing has revolutionized with recognizing and implementing marketing programs directed to environmentally conscious consumer' segment (Ercis and Cat, 2016). Past empirical studies also manifest the influence of green marketing on green cognition and identify direct as well as indirect effects of green marketing on brand image and consumer purchase intention (Wang, Chen and Chen, 2016). In view of this, Green Marketing Grid (GMG) created and proposed by Grant identified three distinct categories for business firms as *green firms*— setting new standards to produce more superior green products, *greener firms*— sharing responsibility for income and outcomes and *greenest firms*— support green innovation and reshaping the culture (Stoian, 2015). The purpose of this paper is to review contemporary literature aiming to identify most relevant demographics affecting green innovativeness in general and for consumer durables in particular. Present paper focuses on consumer durable sector as witnessed 14.7 per cent compound annual growth rate to USD 12.5 billion in 2015 (IBEF, 2016). Indian market is also expected to become 5th largest consumer durables market in the world by the end of 2017. The main focus of the present work is to gain deeper insights about influence of demographics on receptivity of green products among purchasers of consumer durables in order to assess the impact on their green innovativeness. The terms consumer innovativeness and green innovativeness are used interchangeably in the article as study focuses on the characteristic of green innovative behaviour. The entire paper has been divided and organized into six sections. Paper starts with introduction of green marketing along with related concepts of consumer innovativeness, next part of the paper is literature review, highlights on the findings of contemporary studies belonging to green innovativeness and green consumerism, third part manifests research design, fourth part of study presents analysis along with interpretation. Last but not the least, the fifth and sixth parts of paper focus on discussions and managerial implications of study.

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II. LITERATURE REVIEW AND HYPOTHESES FORMULATION

Present literature highlights consumers' purchasing behaviour along with the role of demographic variables affecting consumer innovativeness for green products. In this regards, Park and Lee (2016) indicate green products purchasing as an innovative behaviour in the social network. Chang (2015) analysed the influence of green communication on green purchase intention. Hong *et al.* (2013) interpreted the role of consumer innovativeness and self-efficacy in predicting the acceptance of green iPad2 products among the users. In the same context, Uddin and Khan (2015) have explored five factors namely environmental involvement, environmental attitude, environmental consciousness and perceived effectiveness of environmental behaviour that affect green purchasing behaviour among young urban consumers. They further suggested that high level of involvement towards 'green' activities acts as a precursor for green purchasing products and identified a significant difference between male and female in terms of green purchasing behaviour and environmental attitude. The study also manifests that females are having more positive attitude towards green innovativeness as compared to males, indicating similar results as intimated by Memery, Megicks, and Williams (2005) and Lee (2009). With perspective of green marketing, Lao (2014) explored the mechanism of influence about consumer innovativeness on consumer-reasoned green consumption and indicates that consumer innovativeness significantly influences consumer attitude, subjective norm, green purchase intention and behaviour. They further revealed that male, young, highly educated and high-income consumers are having stronger innovativeness towards green products. In the same context of green products, Matic and Puh (2015) used age, gender, purchase tendency, natural brands and health consciousness as important variables to measure purchase intention towards green organic cosmetic products. The study finds that gender, purchase tendency towards new brands have significant impact on purchase intention whereas, consumers' purchase tendency towards health consciousness has found non-significant impact. Rakic and Rakic (2015) identified age, gender, income and education as important socio-demographic variables to predict pro-environmental behaviour. They further concluded that younger consumers are more environmentally conscious and innovative; similarly females are more concerned and innovative than males about environment and sustainability issues. In the same context, they also empirically identified a positive association between general environment responsiveness (GER) with consumer's income and education during product purchasing behaviour. Similarly, Rezai *et al.* (2013) stressed on consumers' age, education level, marital status and income level that influence consumers' perception towards green acceptance and concerns about environment. The study suggests those consumers with age of 26 to 40 years, at least bachelor degree and moderate income levels having positive perception towards going green, show innovative behaviour for acceptance of green products. In the same context, Akehurst, Afonso and Goncalves (2012) examined green innovative behaviour with ecologically consciousness

as criterion and certain socio-demographics as age, gender, income and education as predictors. They indicate that psychographic variables such as perceived consumer effectiveness and altruism are more relevant than demographics to explain ecologically conscious consumer behaviour. Similarly, the study conducted by Mehmet and Gul (2014) showing a significant relationship between demographic characteristics such as gender, age, education and income level and innovative purchases behaviour of environmentally friendly products. The empirical findings from Fisher, Bashyal and Bachman (2012) indicate that gender significantly affects purchasing behaviour rather than age and marital status of consumers. Contemporary consumer researchers also identified green brand equity, green satisfaction, green trust and green purchase intention as an important green psychological variables affecting innovativeness among the consumers (Doszhanov and Ahmad, 2015; Chen and Lee, 2013). Green brand image is defined as 'a set of perceptions of a brand in consumer's mind that is linked to environmental commitments and environmental concerns' (Ng *et al.* 2014; Chen, 2010). Green brand equity refers to brand assets and liabilities about environmental concerns and green commitment linked to the brand (Chang and Chen, 2014). Chen (2010) further explained green satisfaction as a pleasurable level of consumption-related fulfilment to satisfy environmental desires, green needs and sustainable expectations (Chen and Lee, 2013). Green trust is defined as consumer's willingness to depend on a product or a service, in view of his belief about environmental credibility and ability (Lam and Lau, 2016). Despite the identification of certain consumers' socio-demographics in the contemporary empirical research on green consumerism for different domains (hotel, organic foods, automobile, cosmetics, electronics, coffee, restaurants and mobile telephony), we have considered two main demographic variables gender and age as predictors to measure the influence on consumer innovativeness as criterion towards green consumer durables in the present study. On the basis of extent literature, we proposed following hypotheses for generalization of results for the target population-

- i. First, two hypotheses are used to measure whether main effect of independent variables (gender and age) occurs on green innovativeness among consumer durables purchasers and are expressed as follows-

H_{01} : There is no significant effect of gender on consumer innovativeness among the purchasers of green consumer durables.

H_{02} : There is no significant effect of age on consumer innovativeness among the purchasers of green consumer durables.

- ii. Third hypotheses is designed to measure the interaction effect (idiosyncratic effect; Paul and Mallery, 2015) of two independent variables (gender x age) consumer innovativeness and is expressed as follows-



H_{03} : There is no significant interaction effect of gender and age on consumer innovativeness.

III. RESEARCH OBJECTIVES

The present study aims to understand the influence of demographic variables on consumer innovativeness among consumer durable purchasers. In this regard, the gender and age have been identified as important predictors to measure the effect on consumers' innovativeness towards green purchasing behaviour among the target population. The Study also gives valuable insights on gender and age biased innovativeness by using empirical means. In view of this, study also focuses to examine the main effect of gender and age along with the interaction effect (gender x age) on green innovativeness aiming to provide managerial implications for industry to strengthen green marketing activities.

IV. METHODOLOGY

The proposed study is based on single cross-sectional survey by using quantitative method. A descriptive research design has been employed to collect empirical data to ascertain the consumers' behaviour towards purchasing the green durables among target population

a. Measuring Instrument and Reliability

The measurement utilized in this study is based on self-administered questionnaire consisting of single and multiple item scales including relevant variables for originating primary data. Single item scale has been used to measure demographics, whereas multiple item scale with 5 different statements adopted and adapted from previous studies (Hartman, Gehrt and Watchravesringkan, 2004; Lao, 2014) used to measure the construct of 'green innovativeness'. The operationalization of this construct is based on a five point ascending Likert scale (1= strongly disagree; 5= strongly agree) to measure 'innovativeness'. Though, the statements incorporated in instrument are based on environment concern, nevertheless, the pre-testing has also been done on 20 sample size (10% of subject cases) to ensure the reliability of instrument. Out of 5 initial statements (GI₁: Strong interest towards green consumer durables, GI₂: More awareness towards green durables, GI₃: Always recommend others for green durables products, GI₄: Always ready to purchase green durables products, GI₅: Always keen to collect information from formal and informal media sources about green durables), one statement (GI₂) has been eliminated from the instrument in order to meet the standard limit of Chronbach's alpha (α). The α value ranging 0.7- 0.9 is considered as acceptable reliability of measure (George and Mallery, 2011). As further elimination of other statements after GI₂, no improvement noticed in α , hence instrument with 4 items (GI₁, and GI₃ to GI₅) with Chronbach's alpha (α) 0.803 has been considered as final survey instrument for measuring the construct (Table a). Remaining questions are based on nominal scale to measure gender and age of the subjects. Four different categories of age; A₁=20-30; A₂=31-40; A₃=41-50; A₄= more than 50 (measured in years) has been used as categorical scale (Census of India, 2011, Schiffman, Kaunk and Das, 2011) to measure the effect of specific age group on innovativeness.

Table a. Reliability of Measurement

Constructs	Final Items Used in Construct	α (If item deleted)	α Score
Consumer Innovativeness (CI)	Strong interest towards green products (CI ₁)	.775	0.803
	Always recommend others for green products (CI ₂)	.706	
	Always ready to purchase green products (CI ₃)	.781	
	Always keen to collect information from formal and informal media sources (CI ₄)	.746	

b. Sample Design Process

Existing users and recent purchasers (within 2 years from survey) of consumers' durables belonging to the categories of white goods (Air conditioners), brown goods (microwave ovens) and consumer electronics (PCs and Laptops) have been considered as target population for the study. The select product categories for the analysis are based on the product-wise proportion of industry in the concern segment (IBEF, 2016). A sample of 200 respondents was drawn from the residential areas of three cities of Punjab (Jalandhar, Ludhiana and Amritsar). The select cities represent as an economically developed city of a particular region in Punjab (Jalandhar-Doaba, Ludhiana-Malwa and Amritsar-Majha). A decision maker as purchaser of consumer durables in the household is considered as sampling unit during the cross-sectional survey. A non-probabilistic technique with convenient sampling method has been employed in sampling design process. This sampling technique is important due to convenient accessibility of subject cases and proximity to the researcher. A sample of 200 respondents (approximately 66 sampling unit/city) collected from the target area during the period of survey from December, 2018 to March 2019.

c. Experiment Design

The two-way Analysis of Variance (AVONA) has been used as experiment design for establishing statistical inference as per the research objectives poised in study. As we incorporated gender (two categories) and age (four categories) as two independent variables and one dependent variable as consumer innovativeness, hence 2 x 4 factorial designs with yielding eight different treatment conditions. These combinations are used in the analysis to measure the main effect of gender and age as well as their interaction effect (gender x age) on dependent variable. In this context, three F-ratios, associated degrees of freedom and two-sided asymptotic significance (probability - p value) at pre-set criterion value i.e. 5% Level of Significance (LOS) are used for statistical inference (Table b). Certain assumptions such as normality (measures of Kolmogorov-Smirnov test) of



data in target population, data scale and equal error of variance (measures of Leven's test) have also been examined to ensure the validity of experiment. The size of main effects also computed by measures of Partial Eta Squared (PES) indicating the proportion of variance in green innovativeness accounted for by gender and age of respondents.

Table b. Two-Way Analysis of Variance Factorial Design

Age (Years)	Gender	
	Male	Female
A ₁ =20-30	20-30;Male	20-30; Female
A ₂ =31-40	31-40;Male	31-40; Female
A ₃ =41-50	41-50;Male	41-50; Female
A ₄ = >50	>50;Male	>50; Female

V. RESULTS AND DISCUSSION

Results of two-way ANOVA factorial design as incorporated in experiment has been interpreted with three *F-ratios*, two related to main effect of gender and age and one interaction effect of these variables. Statistical evidence of results has been established at 5 % Level of Significance (LOS) at specific degrees of freedom. The effect size also been computed in explaining the proportion of variance accounted by each main effect and interaction effects of independent variables as shown in the following sections-

a. Assumptions for Two-Way ANOVA Factorial Design

The normality of data and equality of error variance are two important assumptions to ensure the validity of factorial design incorporated in study. Examining the normality of agreement or disagreement indicating with ratings of all four statements (GI₁ to GI₄) of green innovativeness has been assessed by Kolmogorov-Smirnov Z statistics aiming to check the assumption for applying factorial design ANOVA. As the P-value associated with test statistics is more than 0.05 (p>0.05, 0.314) at 5% LOS hence, we fail to reject the null hypothesis of normality and conclude that target population is normally distributed for applying parametric test procedures (Table c).

Table c Assessing Normality with One-Sample KS

	N	Normal Parameters		K-SZ	Sig. (2-tailed)
		Mean	Std. Deviation		
<i>Green Innovativeness</i>	200	3.91	0.99	0.961	0.314

The assumption of equality of error variance has been tested by Levene's statistics as shown in Table d. As the P-value associated with test statistics is more than 0.05 (p>0.05, 0.324) at 5% LOS hence, we fail to reject the null hypothesis of equal variance and assumed the condition of equal variance for validity of statistical inferences for target population.

Table d Levenes' Test Statistics

Levene's Test of Equality of Error Variances			
F	df1	df2	Sig.
1.166	7	192	.324

b. Sample Description

Table e presents the summary of sample indicating data descriptors separately for male and female categories. Out of 200 respondents, male and female are found 107 and 93 respectively in sample. It can be observed that rating of GI has found highest 3.67 and 3.5 for male and female respectively related to 31-40 years. It seems lowest 2.73 for the age group of >50 years in male whereas 2.5 for the female in age group of 41-50 years. Average rating of green innovativeness appears almost same in male (3.3) and female (3.0) categories. Standard deviation also varies in both the categories. The highest variation (with standard deviation- 1.07) about level of agreement and disagreement for GI noticed in male for the age of 20-30 years, whereas as in female, it (standard deviation 0.90) occurs in the age group of >50 years.

Table e Description of Sample

Gender	Age	Mean	SD	N	Gender	Age	Mean	SD	N
Male	20-30	3.62	1.07	31	Female	20-30	3.3	.88	27
	31-40	3.67	.99	32		31-40	3.5	.90	27
	41-50	2.82	.83	30		41-50	2.5	.71	27
	>50	2.73	.96	14		>50	2.6	.86	12
	Total	3.30	1.05	107		Total	3.0	.92	93

c. Analysis of Between Subject Effects

Table f presents statistical significance of independent factors (age and gender) and their interaction. Source of variation in the experiment is contributed due to first independent variable (gender), second independent variable (age) and the interaction as well as error term. The analysis of between subject effects has been interpreted by three *F-ratios* (two corresponding to main effect of gender, age and one interaction effect) associated degrees of freedom, corresponding p-values, magnitude of Partial Eta Squared and graphical interaction in reporting the final results of two-way ANOVA factorial design-

- The p-values associated with *F-ratio* for main effect of gender [$F_{\text{Gender}}(1,192) = 2.12, p > 0.05, 0.147$] is more than criterion value i.e. 5 percent LOS, hence we fail to reject the first null hypothesis (H_{01}) of non-significant effect of gender on green innovativeness. We would have evidence to conclude that gender has no significant effect on innovativeness among the purchasers of green consumer durables.
- As the p-values associated with *F-statistics* for main effect age [$F_{\text{Age}}(3,192) = 13.6, p < 0.05, 0.000$] is less than 5 percent LOS, hence we reject the second null hypothesis (H_{02}) of non-significant effect of age on innovativeness and would have evidence in support the alternative hypothesis and conclude that at least in one the age group, innovativeness differs significantly from others groups.
- Similarly, p-values associated with *F-statistics* for interaction effect between independent factors [$F_{\text{Gender} \times \text{Age}}(3,192) = 0.10, p > 0.05, 0.957$] is more than 5 percent LOS, hence we fail to reject third null



hypothesis (H_{03}) of no significant interaction between the factors and conclude that age along with specific gender also non-significant, hence no idiosyncratic effect produces by factors' interaction.

- Partial Eta Squared indicates the proportion of variance in green innovativeness accounted by each main effect and interaction effect. It can be observed that maximum proportion of variance is explained by main effect of age (17.5%) followed by less than 1 % by interaction (0.2%) and main effect of gender only (0.1%).

Table f Main Table of Two-Way ANOVA Factorial Design

Tests of Between-Subjects Effects						
Source	Type III Sum of Squares	df	MS	F	Sig.	PES
Corrected Model	37.30	7	5.32	6.35	.000	.188
Intercept	1713.2	1	1713.2	2043.9	.000	.914
Gender	1.77	1	1.77	2.12	.147	.011
Age	34.22	3	11.4	13.6	.000	.175
Gender * Age	.26	3	.087	.10	.957	.002
Error	160.93	192	.83			
Total	2241.43	200				
Corrected Total	198.23	199				

a. R Squared = .188 (Adjusted R Squared = .159)

d. Graphical Display of Interaction Effect

Figure (a) displays a multiple line graphs to examine the interaction by plotting cell means of green innovativeness along with the two categories of gender and four categories of age aiming to identify whether the effect of four different levels of age is same across the levels of gender in innovative behaviour. It can be observed that green innovativeness in both male and female is increased from 21-30 age groups to 31-40 years age. Whereas in subsequent age groups, the innovativeness decreases from 31-40 years to 41-50 years in both genders. But for the last age group, innovativeness slightly increases in female from age 41-50 to >50 years and it decreases in male for same age categories. It is also important to note, that none of the category of both factors (gender and age) is crossed among each other; hence interaction effect cannot be generalized for the target population in term of innovative behaviour.

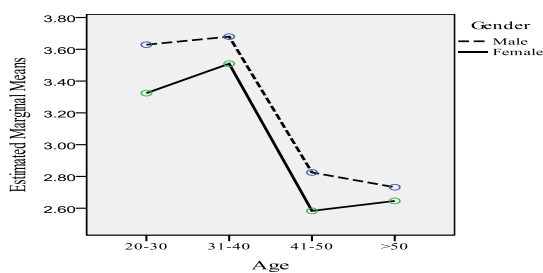


Fig. a Displaying Interaction

VI. CONCLUSION AND IMPLICATIONS

In conclusion, the empirical findings based on cross-sectional survey and two-way ANOVA factorial design experiment reveal statistical significance of each factor (gender and age) along with their interaction effect on green innovative behaviour. The study indicates that gender has no significant effect on innovativeness among the purchasers of green consumer durables, whereas age has substantial effect on the innovativeness. Nevertheless, it is also important to note that specific age group does not indicate significant effect on innovativeness with association of a specific gender, hence indicating the absence of any idiosyncratic effect in study.

Besides being theoretically insightful, the present study has several managerial implications aiming to provide strategic decisions on green marketing mix for consumer durables. The findings of study also provide useful insights on customer value based on the innovativeness subsequently, how marketers anticipate and reacting to customer needs belonging to particular age group and gender for consumer durables. Marketers of green durables may identify and develop new typology for their green target markets based on specific age group and use green communication strategies such as promotions, communications and advertising vehicles aiming to reach most potential group to consumers those are ready to buy green products. Typology for green consumer durables based on specific age groups also used to identify product-related need sets, describing each age group and selecting attractive segment (s). The managerial implications can also be acknowledged to build competitive advantage by targeting and profiling green consumers based on their innovative behaviour.

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