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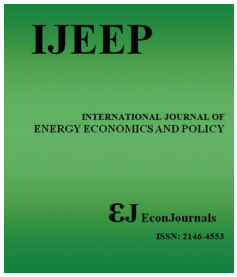

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Determinants of Green Energy Technology Purchase Intention: An Analytical Study

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ABSTRACT

Intensive use of non-renewable resources like coal and crude oil has created several issues and challenges such as the worsening greenhouse effect, depletion of fossil fuels, air pollution, global warming, and climate change. A few remedies have been implemented to address these issues caused by the heavy use of nonrenewable fuels. Developing and adopting green energy technologies is a step in the same direction. Green energy technologies have the potential to reduce the world's carbon footprint, and waste and increase the efficiency of energy production. This can lead consumers to save money and the environment. This research work intends to determine important factors affecting the purchase intention of green energy technologies. There are four independent variables and one dependent variable. Data was collected from 342 randomly selected respondents from Delhi and NCR. Structural Equation Modeling (SEM) was used to analyze collected data. The main findings of this study are that perceived risk and functional factors impact the consumers' green technology purchase intention substantially.

Keywords: Risk, Cost, Green Technology, Functional Factors, Purchase Intention
JEL Classifications: M31, O33, Q32, Q43, Q56

1. INTRODUCTION

Green energy technologies are technologies that harness natural resources such as sunlight, wind, water, and geothermal heat to generate energy without producing harmful emissions. In recent years, there has been an increasing interest in green energy technologies due to their potential to reduce the world's carbon footprint, increase energy efficiency, and reduce dependence on fossil fuels. One of the most popular green energy technologies is solar energy. Solar energy involves the conversion of sunlight into electricity through the use of photovoltaic cells. These cells are made of silicon, a semiconductor material that absorbs photons of light and converts them into electricity. Solar energy is becoming increasingly affordable and accessible, with many governments offering incentives for homeowners and businesses to install solar panels.

Long-term green strategies are needed for sustainable development and to solve major problems like global warming and climate change (Williams and Rolf, 2017). Countries across the world are thinking and deliberating how these pressing global issues can be solved for the sake of humanity. Adopting green energy technologies appears to be a more effective and practical strategy in this context (Hartmann et al., 2018). Adoption of green energy technologies is vital to control global warming, air pollution and biodiversity loss. All these problems are due to human behavior and will emerge as main challenges in the sustainable development (Testa et al., 2016; Sangroya and Nayak, 2017). This has been reported repeatedly that present methods of electricity production are the main reasons of climate change (Williams and Rolf, 2017; Hartmann et al., 2018). Without consumers support, green energy technologies adoption and consumption will not be sufficient (Perlaviciute and Steg, 2014). What motivates consumers to

purchase green energy technologies must be examined on an urgent basis. The factors affecting the purchase intention of green energy technologies must be known to practitioners and discussed among researchers and academicians in order to frame strategies to make green energy technologies choices for every consumer (Hobman and Fredrick, 2014; Sangroya and Nayak, 2017). Therefore, this is inevitable to examine factors affecting the purchase intention of green energy technologies.

This study is structured in such a way that the following section survey existing literature to identify the factors affecting green technology purchase intention. The successive section details the research methods used in the study. The later section explains the findings. Lastly, the final section describes the implications of this research work and possible future courses of action.

2. LITERATURE REVIEW

2.1. Theoretical Perspective

There is a drastic change in the consumers' preference towards green energy technologies in order to protect the environment (Nikas et al., 2000). Researchers and practitioners have also paid more attention to the advantages of adopting green energy technologies. This is now of immense importance to investigate factors affecting consumers' purchase intention of green energy technologies (Stavrakas et al., 2019). This type of research work is inevitable now because it will help to uncover major determinants of green technology's purchase intention. In various studies, it has been concluded that despite consumers' preferences towards green energy technologies, there are many bottlenecks in the adoption of green energy technology cost, risk, functional value, and user-friendliness (Jabeen et al., 2021).

2.2. Purchase Intention

Consumers prefer to purchase green energy technologies to save our environment over non-renewable energy (Rashid, 2009). It is believed that consumers are responsible towards the environment and they do not want to buy any product which degrades the environment. Gradually, consumers are more aware of environmental issues and their consequences on health and the earth (Peattie, 1995). Green energy technology purchase intention reflects the consumers' attitude towards the environment and environmentally friendly products (Ramayah et al., 2010). The strong green purchase intention positively affects green energy technology purchase intention (Chen, 2013; Han et al., 2009; Li et al., 2023). Dehghanan and Bakhshandeh (2014) also supported the same view as they investigated 412 consumers and found that the benefits of adopting green energy technologies strongly affect purchase intention.

2.3. Emotional Factors

Emotional factors are those that provide consumers novelty, differentiation, and attachment to green energy technologies. Consumers become loyal and have a positive attitude toward green energy technologies (Sheth et al., 1991). Emotional factors are more connected with consumers' feelings and emotions that a consumer realizes while buying green energy technologies. Emotional factors are the major determinants of purchasing green energy technologies (Wiedmann et al., 2007). It is believed that when a buyer is purchasing a green energy technology, the impact of emotional factors is much higher than functional benefits (Hartmann et al., 2005). When consumers purchase or consume environment-friendly products, they felt that they are more socially responsible than others and contribute positively to saving the environment (Nunes and Schokkaert, 2003). Wüstenhagen and Bilharz (2006) confirmed that the green energy technology purchasing experience made consumers to feel superior (Hartmann and Apaolaza-Ibanez, 2012). Marketers should also incorporate emotional dimensions in marketing campaigns such as environment-friendly, healthy, and distinguished (Hartmann and Apaolaza-Ibanez, 2012). Numerous other studies have confirmed a strong relationship between emotional factors and purchase intention of green energy technologies (Hansla, 2011; Hansla et al., 2008).

Hypothesis 1 (H_1). There is a positive and significant association between emotional factors and green energy technology purchase intention.

2.4. Cost

The advantages of adopting green energy technologies are huge for the firms as well as for consumers such as saving the environment, improving work efficiency, and doing work in an environment-friendly way (Xu et al., 2019). Cost is the main determinant of adopting green energy technologies in several countries, particularly in developing countries (Board, 2020). The main costs in the adoption of green energy technologies are building costs and installation costs. Most of the cost has to be bear in the initial phase of adoption (Khalid et al., 2021). The costs of adopting wind and solar energy are relatively low as they use free air and sunlight. However, high cost may impact consumers' decision to adopt green energy technologies negatively which leads to slow adoption of green energy technologies (Jabeen et al., 2021). Jabeen et al. (2021) examined the factors affecting the adoption of renewable energy in the context of Pakistan. In their study, they concluded that high costs negatively impact consumers' adoption of renewable energy.

Hypothesis 2 (H_2). There is a positive and significant association between cost and green energy technology purchase intention.

2.5. Risk

Consumers evaluate the extent of risk in adopting green energy technology. High risk affects consumers' adoption decisions negatively. Low risk motivates consumers to adopt green energy technologies. Roh and Kim (2017) concluded that consumers have a positive attitude towards nuclear technology and are aware of the benefits of adopting nuclear energy but the adoption rate is very slow because the safety risk is very high in the case of adopting nuclear energy. Along similar lines, high-risk perception in green energy adoption affects the adoption decision negatively. Consumers are risk averse and they do not want to purchase any product which involves high risk. Furthermore, consumers also take into account social and environmental costs too while purchasing green energy technology (Anser et al., 2021).

Hypothesis 3 (H_3). There is a positive and significant association between risk and green energy technology purchase intention. (Roh and Kim, 2017; Anser et al., 2021).

2.6. Functional Factors

Functional factors are those that increase the perceived benefits of adopting green energy technologies (Sheth et al., 1991). Functional factors improve functional utility for consumers and motivate them to purchase green energy technologies. Sweeney and Soutar (2001) defined functional factors as those which reduce the cost of purchasing green energy technologies and multiply both utilitarian and functional benefits for the consumers. Functional factors would be made green energy technologies cheaper to adopt relative to conventional energy sources. Consumers decide to purchase green energy technologies after evaluating the cost and benefits associated with green energy technologies. Generally, a rational consumer would always try to maximize benefits and minimize costs. Functional factors are the main drivers behind the consumers' decision to purchase green energy technologies (Long et al., 2014). Kaenzig et al. (2008) investigated attributes of green energy technologies that enhance functional values for consumers. Green energy technologies not only minimize energy costs, and save money and the environment, but also have several functional benefits such as saving energy cost which influences consumers' decision to buy green energy technologies. Clark et al. (2003) confirmed that consumers perceived green energy technologies as environment-friendly and significantly contribute to saving the environment.

Hypothesis 4 (H_4). There is a positive and significant association between functional factors and green energy technology purchase intention.

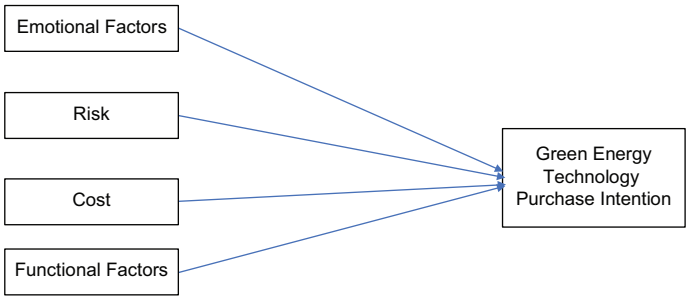
2.7. Hypotheses Development and Research Model

Based on an intensive literature review in the preceding section, it has been decided that there are multiple factors impacting consumers' green energy technology purchase intention. The major determinants of consumers' purchase intention are summarized in Figure 1 in the form of a proposed research model. In addition to it, the following hypotheses are framed for the purpose of testing.

Hypothesis 1 (H_1). There is a positive and significant association between emotional factors and green energy technology purchase intention.

Hypothesis 2 (H_2). There is a positive and significant association between cost and green energy technology purchase intention.

Figure 1: Proposed research model



Hypothesis 3 (H_3). There is a positive and significant association between risk and green energy technology purchase intention.

Hypothesis 4 (H_4). There is a positive and significant association between functional factors and green energy technology purchase intention.

3. RESEARCH METHODS

This study has used a structured questionnaire for the purpose of data collection. The questionnaire was divided into two parts; the first part deals with the demographic profile of the respondents, while the second part of the questionnaire collects data related to the study variables. The data was collected between November 2022 and January 2023 from Delhi and National Capital Region (NCR) in India on the five-point Likert scale where 1 represents strongly disagree, 2 represents disagree, 3 represents neutral, 4 represents agree and 5 represents strongly agree. Delhi and NCR are taken intentionally for this study because most people are aware of green energy. The questionnaire was filled out by the respondents who are above 18 years of age and aware of green energy technologies. This study is based on five constructs: Four are independent variables and one is the dependent variable. Functional factors, emotional factors, risk, and cost are the independent variables and purchase intention is the dependent variable. For the purpose of data collection, a random sampling technique was used and 600 questionnaires were distributed to get them filled from the respondents. A total of 500 filled questionnaires were returned, and some were not filled in all respects. After proper analysis of all filled questionnaires, only 342 were considered for further analysis and the final sample size was 342. More than a few statistical techniques like correlation, exploratory factor analysis, and confirmatory factor analysis were used to analyze the data using IBM SPSS 23 and IBM AMOS 23. Confirmatory factor analysis (CFA) and structural equation modeling (SEM) is used as the study intends to analyze factors affecting the purchase intention of green energy technologies. Confirmatory factor analysis (CFA) and structural equation modeling (SEM) is highly used in research studies due to their reliability and versatility. SEM is most appropriate to use in order to establish a relationship between multiple-dependent variables and independent variables.

4. RESULTS OF DATA ANALYSIS

Data analysis results are based on various statistical parameters to determine the factors influencing the purchase intention of green energy technologies. We adopted Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) as the statistical method to investigate the proposed research model in this study using SPSS and AMOS. The first step in data analysis is to analyze the demographic characteristics of the respondents. Table 1 exhibits demographic profile of the respondents.

Table 1: Respondents' characteristics

Gender			Marital status		
Particular	**Frequency**	**Percentage**	**Particular**	**Frequency**	**Percentage**
Male	226	66.1	Single	296	86.5
Female	116	33.9	Married	46	13.5
Total	342	100.0	Total	342	100.0
Age			**Annual income**		
18-25	220	64.3	0-5 Lakh	255	74.6
26-35	114	33.3	6-10 Lakh	61	17.8
36-45	6	1.8	11-15 Lakh	18	5.3
46 and above	2	0.6	16-20 Lakh	2	0.6
Total	342	100.0	21 Lakh and above	6	1.8
			Total	342	100.0
Education					
Under graduate	51	14.9			
Graduate	150	43.9			
Post graduate	133	38.9			
Any other	8	2.3			
Total	342	100.0			

Table 1 exhibits that 66.1% of respondents are male which accounts for the majority of the respondents while female accounts for 33.9% of the respondents. In addition, 64.3% of the respondents fall between 18 and 25 years of age, 33.3% fall between 26 and 35 years of age, 1.8% fall between 36 and 45 years of age, and. 6% fall between 46 years and above. Further, 86.5% of the respondents are single while 13.5% of respondents are married. 14.9% of the respondents are undergraduate, 43.9% are graduate, 38.9% are postgraduate and 2.3% have any other educational qualification. Finally, 74.6% of respondents earn 0-5 lakh per annum, 17.8% of respondents earn 6-10 lakh per annum, 5.3% of respondents earn 11-15 lakh/annum. 6% earn between 16 and 20 lakh, and 1.8% earns 21 lakhs and above per annum.

4.1. Exploratory Factor Analysis

Exploratory factor analysis is widely used in research studies to condense large datasets to uncover underlying variables. It assistances in determining the most important factors for the study. The exploratory factor analysis was conducted using Principal Axis Factoring in this study along with Non-Orthogonal Promax rotation with Kaiser Normalization. Table 2 contains values of KMO and Bartlett's test. KMO and Bartlett's test examines the sufficiency of data for further analysis. Table 2 exhibits that the KMO value is 0.866 which is excellent and acceptable as per the laid down criteria. Furthermore, Bartlett's test of sphericity value is 0.000 which indicates that further analysis can be done with the existing dataset.

Table 2: KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.866
Bartlett's test of sphericity	
Approx. Chi-square	7972.536
df	300
Sig.	0.000

Table 3: Reliability and validity

Variables	Indicators	Loading	CR	Cronbach's alpha	AVE
Risk	RI4	0.93	0.94	0.946	0.79
	RI2	0.89			
	R3	0.88			
	R1	0.85			
Cost	CO4	0.90	0.91	0.939	0.77
	CO3	0.88			
	CO5	0.85			
Functional Factors	FF3	0.90	0.92	0.921	0.71
	FF4	0.87			
	FF2	0.87			
	FF1	0.80			
	FF5	0.75			
Emotional Factors	EF2	0.88	0.9	0.922	0.74
	EF4	0.87			
	EF3	0.84			
Purchase Intention	PI2	0.88	0.92	0.915	0.71
	PI5	0.86			
	PI1	0.83			
	PI4	0.83			
	PI3	0.80			

AVE: Average variance extracted

4.2. Reliability and Validity Test

Reliability scrutinizes the internal consistency and quality of the scale. The reliability test examines the questionnaire's quality and ability to produce consistent results. Cronbach's alpha and composite reliability are the two main instruments to measure the reliability of the questionnaire. The values of Cronbach's alpha between 0.70 and 0.80 are good and acceptable whereas values of Cronbach's alpha between 0.60 and 0.70 show fair reliability between various items (Chawla and Sondhi, 2010). Cronbach's alpha score must be more than 0.6 (Hair et al., 2011). In Table 3, it is clear that Cronbach's alpha value of all five constructs is more than the upper threshold of 0.70. On the other hand, the validity test examines the ability of the scale to produce an accurate result. The Average Variance Extracted (AVE) is used to find the validity of the scale to measure the construct. A value of 0.5 or greater of Average Variance Extracted (AVE) assures sufficient convergence and validity. In Table 3, all constructs have an AVE value of more than 0.5 which is much above the target value. Furthermore, the loadings of all items are more than 0.70 which also confirms the reliability and validity of the research questionnaire.

4.3. Discriminant Validity

Discriminant validity is widely used in research studies to measure how distinct are the constructs from each other. All constructs in a particular research study must be different from each other because each construct measures a different dimension than others (Hulland, 1999). Discriminant validity is measured by comparing the square root of AVE with the correlation of latent variables (Fornell and Larcker, 1981). Table 4 confirmed that discriminant validity exists among all constructs because the value of the square root of the average variance extracted must be greater than the correlation value of other constructs (Figure 2).

4.4. Measurement Model

The confirmatory factor analysis technique is used for the measurement of the overall research model. The measurement model empowers the researcher to use various indices to confirm model fitness. The confirmatory factors analysis is a visual relationship among constructs, indicator variables, and the interrelationship between the variables (Mishra, 2015). In order to assess the measurement model using confirmatory factor analysis, it is recommended to check the goodness of fit of the model (Hair et al., 2010; Mishra, 2015). The model fitness is confirmed through various indices. There are three types of indices; absolute indices, Parsimonious indices, and Incremental indices. Frequently reported absolute indices are Normed Chi-square (Chi-square/df), GFI (Goodness of Fit Index), and AGFI (Adjusted goodness of fit Index). Further, the commonly reported index parsimonious index is PNFI (Parsimony normed fit index) (Hair et al., 2010). Some of the highly used Incremental fit indices are NFI (Normed Fit Index), TLI (Tucker Lewis Index), and CFI (Comparative Fit Index) (Hair et al., 2010). Table 5 exhibits various values of indices to confirm the fitness of the model. Various indices values in Table 5 confirmed fitness between the data and conceptualized model. All indices' values are above the recommended values.

Table 4: Discriminant validity

	FF	RI	CO	EF	PI
FF	0.84				
RI	0.407	0.89			
CO	−0.067	−0.041	0.88		
EF	−0.045	0.054	0.473	0.86	
PI	0.435	0.351	−0.049	−0.062	0.84

Table 5: Model fit indices (confirmatory factor analysis)

Fit indices	Recommended values	Observed values	Result
CMIN/df	<3	2.141	Acceptable
CFI	0.8-0.9	0.970	Acceptable
GFI	≥0.9	0.917	Acceptable
AGFI	≥0.80	0.890	Acceptable
PNFI	>0.5	0.663	Acceptable
RMSEA	<0.08	0.058	Acceptable

CFI: Comparative fit index, GFI: Goodness of fit index, AGFI: Adjusted goodness of fit index, PNFI: Parsimonious normal fit,

RMSEA: Root mean square error of approximation

4.5. Structural Model

The structural model measures the relationship between latent constructs and measuredn variables. Figure 3 exhibits the relationship between risk and purchase intention, cost and purchase intention, functional factors and purchase intention, and emotional factors and purchase intention. The main difference between measurement model and structural model is that measurement model measures the nature and magnitude among constructs, whereas structural model measures the relationship between dependent variables and independent variables. Table 6 shows that there is no positive relationship between purchase intention and emotional factors (CR = −1.61. β = −0.077, P > 0.05). In

Figure 2: Model fit

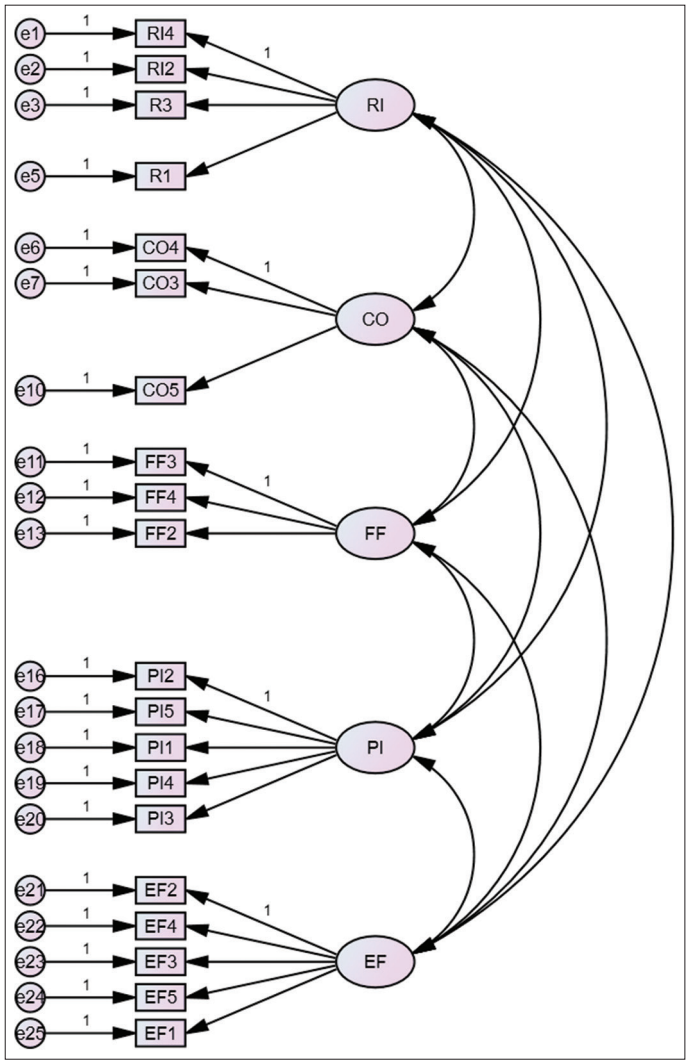
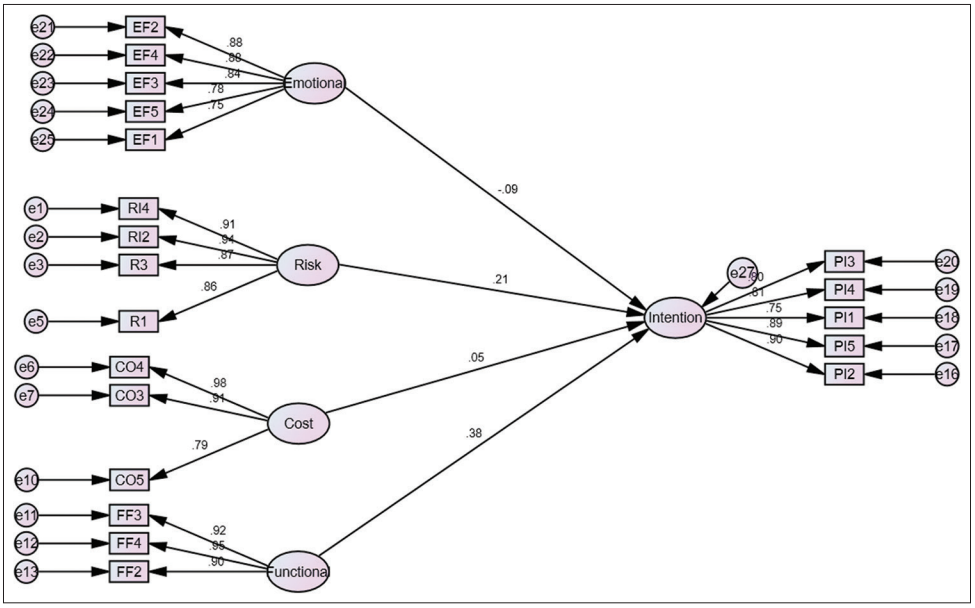


Table 6: Summary results of hypotheses testing

H	Path			Estimate	C.R.	P-value	Status
1	Purchase intention	<---	Emotional factors	−0.077	−1.61	0.107	Rejected
2	Purchase intention	<---	Risk	0.273	4.016	***	Accepted
3	Purchase intention	<---	Cost	0.05	0.877	0.381	Rejected
4	Purchase intention	<---	Functional Factors	0.336	7.17	***	Accepted

H: Hypothesis

Figure 3: Structural model



fact, emotional factors do not influence consumers' purchase intention of green energy technologies. Hence, H1 is rejected. Table 6 confirmed that there is a positive and significant relationship between purchase intention and risk (CR = 4.016. β = 0.273, P < 0.05). In fact, risk influences the consumers' purchase intention. Hence, H2 is accepted. Table 6 shows that there is positive but insignificant relationship between purchase intention and cost (CR = 0.877 β = 0.05, P > 0.05). In fact, cost do not influence consumers' purchase intention of green energy technologies. Hence, H3 is rejected. Table 6 confirmed that there is a positive and significant relationship between purchase intention and functional factors (CR = 7.17, β = 0.336, P < 0.05). In fact, functional factors influence the consumers' purchase intention. Hence, H4 is accepted.

5. DISCUSSION

The main objective of this research work is to outline the major determinants of green energy technology purchase intention. Additionally, the two-fold research objectives are summed up as (i) to examine the impact of demographic variables on green energy technology purchase intention (ii) to ascertain major factors affecting green energy technology purchase intention. This study is very important because climate change, global warming and air pollution are some of the biggest challenges. Green energy technologies are one of the remedial steps needed to be taken to deal with these problems. Therefore, this becomes important to know what affect consumers while purchasing green energy technologies. This study is also significant for government and companies because this will aid in formulating various policies and incentives.

This study was initiated with four independent variables, namely emotional factors, risk, cost and functional factors and one dependent variable namely purchase intention. Based on these four independent variables, four hypotheses were framed for testing. The measurement model was found significant on various parameters. Yet, the result of hypothesis testing is mixed, which indicates that functional factors impact the consumers' green energy technology purchase intention (CR = 7.17, β = 0.336, P < 0.05). This result is similar with the finding of previous research studies (Sheth et al., 1991; Sweeney and Soutar 2001; Long et al., 2014) etc. Because Indian buyers are price sensitive and cannot afford very high prices (Sweeney and Soutar, 2001). Other factors such as risk were found positive and statistically significant (CR = 4.016. β = 0.273, P < 0.05). This finding is also on the similar line of earlier research studies (Roh and Kim, 2017; Anser et al., 2021) because consumers do not want to purchase any technology which pose risk in any way. By nature, consumers are risk averse and they prefer to purchase risk free technologies. The next construct for the study is emotional factors, which was supposed to have significant impact on consumers' purchase intention but the result of this study is contradictory (CR = −1.61. β = −0.077, P > 0.05). This could be because consumers are rational while purchasing green energy technology. They emphasize more on perceived benefits, functional values rather than emotional values. This study contradicts the findings of (Hansla, 2011; Hansla et al., 2008), both of which strongly claim that there is a strong association between emotional factors and purchase intention. The last variable in the study is cost which presumed to cost influences the consumers' green technology purchase intention. But it found insignificant (CR = 0.877 β = 0.05, P > 0.05) in the current study. The results of current study appeared to contradict previous studies (Board, 2020; Jabeen et al., 2021).

6. CONCLUSION

The main factors affecting green energy technology purchase intention are emotional factors, risk, cost and functional factors. The current study confirms that risk and functional factors are the key determinants of green energy technology purchase intention. On the other hand, other independent variables such as emotional

factors and cost are found to be insignificant and do not impact consumers' purchase intention. The current study also reveals that green technology are more effective to control worsening effect of greenhouse gases due to heavy use of nonrenewable resources. Moreover, marketers and policy makers should maximize functional benefits of green energy technologies so that consumers at large scale decide to purchase.

6.1. Managerial Implications

The following managerial implications can be advised based on the findings and discussion (i) the companies developing and selling green energy technologies to consumers must address cost issues as high cost demotivates consumers to purchase green energy technologies. (ii) Functional factors are the major determinant of purchase intention as consumers consider all benefits that they will receive after purchasing green energy technologies. (iii) Businesses must try to minimize risk associated with green energy technologies as high-risk lead to demotivation and consumers decide not to buy green energy technology. (iv) Businesses must formulate some strategies to maximize emotional values. Consumers must feel distinguished and give a sense of pride after purchasing and using green energy technologies.

6.2. Limitations and Future Research Direction

The primary limitation in the current study is that this study was conducted in Delhi and NCR only, thus result of this study cannot be applied pan-India. All respondents in the study are mainly from Delhi and NCR. As a result, this study does not reflect attitude and opinion of all citizen of India. Green energy technologies are the need of the hour. Thus, such studies examining factors affecting consumers' purchase intention of green energy technologies are vital. Future researchers may conduct the same study with larger sample size to further validate the finding of this study. Furthermore, researchers in future can take different or more independent variables to examine their impact on consumers' green energy technology purchase intention. Researchers in future research studies can take some mediating variables like government policies and attitude and conduct some comprehensive research studies.

7. ACKNOWLEDGMENT

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