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Purchase Behavior of Energy-Efficient Appliances Contribute to Sustainable Energy Consumption in Developing Country: Moral Norms Extension of the Theory of Planned Behavior

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Abstract: Since energy consumption in developing countries has increased significantly, motivating energy-saving habits among citizens is an important issue both from the academic and industrial perspectives. Thus, this study aims to predict consumer purchase intention for energy-efficient household appliances based on an extended model of the Theory of Planned Behavior (TPB). This study incorporated two additional constructs of moral norms and environmental concern in the model of the TPB. A self-administered questionnaire was distributed to 1155 Bangladeshi consumers, and partial least squares structural equation modeling (PLS-SEM) regression was used to test the hypotheses. Results show that attitude, subjective norms, and perceived behavior control significantly influence consumer purchase intention of energy-efficient appliances (EEAs). This study also proved that the extension of moral norms is a significant predictor of consumers' purchase intention in the classic theory of planned behavior (TPB). However, environmental concerns had no significant influence in the Bangladesh context. As far as the authors' knowledge, this is the first empirical survey in Bangladesh to predict energy-efficient household appliance (EEHA) purchasing intentions using an extended model of the TPB. Marketers and policymakers can use the findings of this study to design strategies for generating more value for green consumers. The study also provides insights into environmental marketing and sustainable energy consumption in developing countries from theoretical and practical perspectives.

Keywords: environmental marketing; sustainable energy consumption; purchase intention; consumer behavior; pro-environmental behavior; moral norms; energy-efficient appliances; theory of planned behavior

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1. Introduction

Climate change is one of the major environmental concerns on the planet, broadly discussed in international forums and conferences. In the 1990s, ozone layer depletion and global warming increased the desire for green product consumption [1,2].

As a result, environmentally-friendly products are demanded by consumers as a new segment to protect against climate change [3]. One of the most important initiatives to combat climate change is to reduce energy consumption [4–8]. According to the Intergovernmental Panel on Climate Change (IPCC), current global warming results from human activities, mainly consumption patterns [9]. As a result, governments worldwide have highlighted the need for citizens to take responsibility for their local ecosystems. Human responsibilities include recycling [10,11], using energy-efficient items, purchasing green label products, and lowering electricity usage [12].

During the last few decades, electricity consumption has grown rapidly, mainly in the residential and service sectors. This rapid electricity consumption has led to increasing CO_2 emissions and ultimately impacts global warming [4,13]. Increasingly, household appliances are the primary source of energy consumption and CO_2 emissions. According to the International Energy Agency IEA (2017), the residential sector consumed approximately 21% of total global energy consumption in 2017. Consumer demand for energy will increase 32% by 2040 due to the growth of the worldwide population, with most of that demand coming from China, India, ASEAN, and the Middle East [14]. Energy efficiency can be improved significantly by accelerating the diffusion of energy-efficient appliances. In turn, lower fossil fuel use and fewer greenhouse gas emissions can be achieved [15]. The installation of energy-efficient appliances (EEAs) plays a significant role in reducing household energy consumption [4].

Moreover, consumers who engage in pro-environmental behavior (PEB) have a lower negative impact on the environment [1,16]. Pro-environmental consumer behavior research is conducted in developed markets but is still in its early stages in several emerging markets, including Asia. Energy conservation is therefore essential for developing countries to ensure a sustainable future.

Thus, household consumers must play an important role in energy conservation by using energy-efficient appliances (EEAs) [2,17]. Previously, several developed and developing countries explored the influencing factors of consumer purchase intention of energy-efficient appliances, such as India [18], Pakistan [2,19], South Africa [20], and China [21]. A study investigated the barriers to purchasing intentions of energy-efficient appliances in India. However, this study focuses on the fast-growing, developing country of Bangladesh. The major hurdle in Bangladesh is maintaining economic development after assuring commercial and residential energy for its people, who predominantly rely on fossil fuels [22]. Bangladesh has managed the energy sector poorly [23] and contributes very little to emitting greenhouse gas globally. Bangladesh's energy sector faces several challenges, including extreme system losses and a lack of infrastructure for installing new power plants quickly. This infrastructural development causes a big gap between energy supply and demand. Therefore, adapting consumer pro-environmental behavior to energy-efficient appliances is mandatory to solve the problems.

However, the previous empirical study extended current theories of green marketing by adding new variables that can be considered significant in behavioral and marketing research [24]. Regarding green products, scholars modify models of the theory of planned behavior (TPB) [9,25,26]. Recent studies have used the theory of consumption value (TCV) [27], integration of the theory of planned behavior [4] and technology readiness index [27], the theory of reasoned action (TRA), and the technology acceptance model (TAM) [28] on electronic products. Similarly, several studies applied TPB theories to predict consumer purchase intention of energy-efficient appliances in different countries, e.g., India, Pakistan, and South Africa [2,18–20]. In this study, we applied the extension of TPB with added moral norms and environmental concern variables better to understand consumers' purchase behavior toward energy-efficient appliances. The TPB is considered the best theory to measure consumer pro-environmental behavior since it considers behavioral intention [29].

The primary objective of this study is to predict consumer purchase intention for energy-efficient household appliances (EEHA) based on an extended model of the TPB. This study incorporates two additional constructs of moral norms and environmental concern in the model of the TPB. To the best of the authors' knowledge, the current study is the first empirical survey in Bangladesh to predict purchase intention for energy-efficient household appliances based on an extended model of the TPB. Moreover, this study seeks to understand the present scenario of sustainable energy consumption behavior of Bangladeshi consumers on the basis of previous studies. This study will explore how consumer purchase behavior of energy-efficient appliances contributes to sustainable energy consumption.

The main research question of this study is how do Bangladeshi consumers predict purchase intention for energy-efficient household appliances (EEHA)? To answer this question, we follow the structure. Firstly, Section 2 discusses the theoretical orientation and literature. Secondly, Section 3 describes the methodology, data processing, and path modeling. Section 4 explains the results of hypothesis testing. The discussion, conclusions, and implications for future consumer energy-efficient purchase intentions are presented in Sections 5 and 6.

2. Literature Review

2.1. Sustainable Energy Consumption and Energy-Efficient Appliances (EEAs)

Sustainability of energy consumption is defined as reducing energy consumption and increasing energy efficiency [30]. Sustainable energy consumption involves purchasing energy-efficient products that reduce energy consumption and cost and enhance energy efficiency [31]. The use of energy-efficient household appliances (EEHA) involves utilizing sustainable energy sources within the home, as well as preventing energy waste more generally. Energy-saving appliances facilitate the development of low-carbon economies by saving energy resources [32–34]. A household can generate significant levels of GHG (greenhouse gas) emissions through the consumption of energy, goods, and services [35,36]. Purchasing energy-efficient products with less environmental impact are considered sustainable or green consumption [1,6,31,37]. Consumer energy-efficient products include:

- hybrid electric vehicles
- air-conditioning appliances, e.g., heaters, fans, humidifiers
- white goods (major household electrical appliances such as air conditioners, refrigeration, washing machines, and so on
- brown goods (household electrical entertainment appliances such as televisions, CD players)
- small appliances (kitchen appliances such as ovens, electric kettles, bread makers)
- computers and servers

2.2. Hypotheses Development

The Theory of Planned Behavior (TPB) was used to predict purchase intentions for energy-efficient household appliances (EEHA) as the underpinning theory and added two context-wise variables, moral norms, and environmental concern, based on the massive literature review. TPB theory was developed as an extension of the reasoned theory of action (TRA), one of the most influential social psychology theories for predicting behavior [38]. According to the TPB framework, the behavior of individuals can be explained by determining behavioral intents, subjective norms, and perceptions of behavioral control [38–40]. The TPB is considered the best theory to measure consumer pro-environmental behavior since it considers behavioral intention [29]. Previous scholars applied the TPB to support their model and measure pro-environmental behaviors in particular products such as electricity savings behavior [41], energy savings behavior [42], and energy-efficient appliances [43]. Table 1 presents the previous ten years (2012–2022) of research on consumer purchase behavior of energy-efficient appliances in different counties, whereas several researchers have employed the TPB to examine whether consumers intend to practice environmentally friendly behavior, e.g., [44–47]. Previous studies attempted to improve the explanatory power of the TPB by adding additional constructs such as environmental concern, moral obligation [45], moral norms [44,46,48], energy knowledge, energy information, living habits, and demographic variables [42].

Table 1. Previous ten years of research on consumer purchase behavior of energy-efficient appliances (EEAs).

Country Context and Valid Samples	Study Focus	Applying Theory	Methods	Factors with Significant Direct	Factors with Insignificant Effect	Years (Authors)
Bangladesh (1510)	measuring pro-environmental behavior for energy-efficient appliances (EEAs)	TRA and TPB	SEM	environmental knowledge, eco-label knowledge, attitude, and green trust→PEB		2022 [31]
Pakistan (240)	predicting young consumer purchase behavior of EEAs	TPB	SEM	attitude, subjective norms, and perceived behavioral control→P.I.		2022 [49]
Pakistan (50)	antecedents of consumers' purchase intention towards EEAs	TPB	SEM	attitude, consumer social responsibility, functional value, knowledge of eco-labels, functional value, green trust→P.I.	personal norms→P.I.	2022 [50]
Pakistan (673)	investigating consumers' intentions in Pakistan to purchase EEAs	TPB	SEM	attitude, subjective norms, and perceived behavior control→P.I.		2021 [51]
Pakistan (289)	determinants of consumers' intentions towards the purchase of EEAs	TPB	SEM	attitude, perceived behavioral control, policyinformation campaigns, and past-purchase experiences→P.I.	subjective and moral norms→P.I.	2021 [52]
Pakistan (50)	evaluating consumers' purchase intention of EEAs	TPB	CB-SEM	knowledge of eco-labels, environmental concern, attitude, and consumer effectiveness-P.I.		2020 [53]
Pakistan (446)	developing a theoretical framework of consumers' purchase intention of EEAs	TPB	SEM	knowledge of eco-labels, environmental concern, and perceived consumer effectiveness→P.I.	green trust and functional value→P.I.	2020 [54]
Pakistan (446)	evaluating the antecedents of consumers' purchase intention of EEAs	TPB	SEM	attitude, functional value, environmental concern, perceived effectiveness, age, income, gender, education→P.I.		2020 [54]
Pakistan (472)	predicting the antecedents of consumers' purchase intention of EEAs	TPB	SEM	subjective norms, green trust, attitude, perceived behavior control, demographic profile→P.I.		2020 [2]
South Africa (298)	identifying the influencing factors on purchase of EEAs	TPB	SEM	attitude, perceived behavior control, moral norms, environmental concern, perceived benefits, informational publicity→P.I.	subjective norms→P.I.	2020 [20]
China (369)	exploring the influencing factors of Chinese consumers' purchase of EEAs	NAM and TPB	SEM	personal norm, subjective norm and attitude→P.I.		2019 [21]

Table 1. *Cont.*

Country Context and Valid Samples	Study Focus	Applying Theory	Methods	Factors with Significant Direct	Factors with Insignificant Effect	Years (Authors)
South Africa (440)	identifying the key drivers of consumers' attention to energy-efficiency labels affixed to EEAs	Signaling theory and attitude-to-behavior theory	SEM	environmental concern, environmental attitude, social norms and product quality→P.I.	product price, environmental knowledge→P.I.	2018 [55]
India (300)	identifying the barriers topurchase intentions of EEAs			societal norms, price sensitivity, perceived product risk, skepticism about label claims, perceived personal inconvenience→P.I.		2018 [18]
Vietnam (682)	Measuring the EEAs in emerging markets	VKAB	SEM	attitude, environmental protection and individual inconvenience→P.I.		2016 [56]

As a result, the current study added moral norms and environmental concerns as the extension of the classic TPB model. To improve the TPB's predictive ability, it is suggested that moral issues should be considered in consumers' pro-environmental behavioral research [39]. Similarly, it has been noted that moral dimensions should be contained in a model for predicting consumers' conservation behavior in pro-environmental contexts [48]. Moral norms are a crucial factor in the developing country context. Thus, using additional variables such as environmental concern and moral norms, this study improves the model by examining consumer intentions in developing countries to purchase energy-efficient household appliances. Figure 1 shows the extension model of TPB.

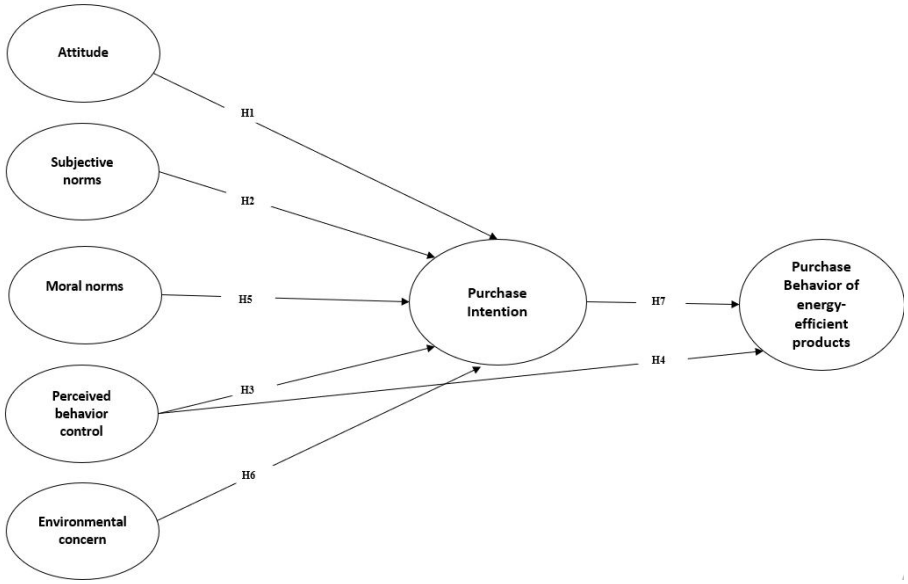

Figure 1. extended model of TPB for measuring consumer purchase intention of energy-efficient appliances (EEAs).

2.2.1. Attitude

A consumer's attitude is considered to be the most important predictor of behavior in the context of psychology [2]. It is one of the important constructs of TPB [40], which refers to the degree of one's favorable or unfavorable evaluation of the behavior [39,57]. According to [40], a person with a positive attitude towards action is more likely to perform that action. Earlier studies proved that attitude has a significant relationship with purchase intention in different areas, e.g., green products [1,26], organic food [42,58], recyclable products [1], etc. Attitudes towards the environment directly affect pro-environmental behavior [10]. Regarding energy-efficient products, an attitude has a significant positive relationship with consumers' intention to purchase [4,59]. Recent studies proved that attitudes positively affect the intention to purchase energy-efficient home appliances [2,60]. Thus, we propose the following hypothesis:

Hypothesis 1 (H1): *Attitude is positively correlated with consumer purchase intentions for energy-efficient appliances.*

2.2.2. Subjective Norm

Subjective norms (SN) can be described as the social pressure that is exerted on consumers from the surrounding environment to perform or not to perform a certain behavioral decision [38,39,61]. A consumer's intention towards buying or not buying a certain product is subjected to his or her referents' beliefs and opinions [62]. Similarly, social pressure influences purchasing behavior, and it comes from people (family, friends, and neighbors) who are valuable to consumers. The consumer's purchasing intention rises when referents show positive feelings towards the product; otherwise, it will decline [26,63].

Recent studies have confirmed that SN is a powerful predictor of consumer purchases of sustainable consumption [6,38] and green products [1]. SN motivates the engagement of consumers in pro-environmental behavioral activities [2]. Studies by [2,64] show that SN has significant predictors for the purchase intention of energy-efficient appliances. However, SN does not affect the intention to purchase energy-efficient household appliances in Malaysia [4]. We can propose the following hypothesis based on prior consensus findings:

Hypothesis 2 (H2): *Subjective norm has a positive and significant effect on consumer purchase intentions for energy-efficient appliances*.

2.2.3. Perceived Behavior Control

Perceived behavior control (PBC) measures an individual's degree of having the opportunity and ability to perform a behavior [57]. PBC is strongly influenced by beliefs regarding why one's behavior is facilitated by both situational and internal factors [4]. PBC refers to people who have available resources and knowledge e.g., the ability to buy energy-efficient household appliances and determination, for example, energy-saving household appliances, even if they are a bit more expensive. PBC independently predicts the purchase intention of green products [65]. Therefore, low perceived behavioral control leads to low intentions to behave, regardless of positive attitudes and favorable subjective norms [66,67]. Prior study assumes that it is required to have knowledge of the particular issues and products to increase perceived behavior [68]. If the lack of knowledge, information, trust, labelling and performance of their purchase intentions continues, then the purchase of organic food is likely to stay low [69]. Previous studies confirmed that PBC had been a significant contributing factor to the behavioral intention of organic products [1], green hotels, and green products [26]. Similarly, some scholars confirmed that PBC significantly affects purchasing of energy-efficient household products [4,21]. Therefore, we propose the following hypothesis:

Hypothesis 3 (H3): *Perceived behavioral control has positive and significant effects on consumer purchase intentions for energy-efficient appliances*.

Hypothesis 4 (H4): *Perceived behavioral control is positively correlated with consumer purchase behavior for energy-efficient appliances*.

2.2.4. Moral Norms

Moral norms (MN) refer to one's belief that performing in a certain way is fundamentally right or wrong [70]. Moral norms, moral obligations, and personal norms are all terms that are frequently used interchangeably [71]. Beliefs influence personal and moral norms about environmental conditions where one construct should be considered [72]. Consumer education also helps to promote a consumer's moral norms [73]. Previous studies considered moral norms as an extension of the theory of planned behavior to evaluate consumers' purchase intentions for energy-efficient households [4], green products, green hotels, and recycling household waste [44]. Moral obligations or norms components may help improve understanding the research framework on environmental purchasing and behavior [44–46]. Moral and personal norms directly affect the intention to purchase various green products, e.g., hydrogen fuel, eco-fuel vehicles, and eco-innovations [72]. Similarly, [4,74] recently demonstrated that moral norms significantly predict purchase intention for energy-efficient household appliances in Malaysia. Previous experiments confirmed the role of moral norms on the purchase intention of energy-efficient appliances. So, we propose the hypothesis:

Hypothesis 5 (H5): *Moral norms have positive and significant effects on consumer purchase intentions for energy-efficient appliances*.

2.2.5. Environmental Concern

Environmental concern (EC) is consumer awareness of ecological issues, e.g., water pollution, air pollution, climate change, and natural resource depletion. Consumers who care about the environment are more likely to buy environmentally friendly products [75]. Environmental concern is the materialization of the attitude dimension in the TPB, which can decrease the negative consequences of pro-environmental behaviors [76]. In the context of green marketing, prior research investigated whether environmental consciousness has a significant relationship with behavioral intentions [26]. The TPB was used by [77] to connect environmental consciousness among Chinese and American customers and observed a significant relationship between environmental consciousness and green purchase intentions [78]. Previous research has shown that EC influences buying intent for energy-efficient appliances [4,45,55,79]. EC is proven to be one of the most widely used variables in environmental behavioral research. Thus, it should be considered when dealing with pro-environmental investigations [4]. We consider the following hypothesis

Hypothesis 6 (H6): *Environmental concern has a positive correlation with consumer purchase intentions for energy-efficient appliances*.

2.2.6. Intention-Behavior Relationship

Ajzen (1991) asserts that intention reflects a person's overall motivation and commitment to a particular behavior. The TPB considers intention to be a direct cause of behavior [39]. Previous several studies examined the relationship between intention and behavior, mainly in the pro-environmental field, e.g., [1,10]. The logic behind the intention-behavior link applies to consumer purchase intentions of energy-efficient appliances, assuming that consumers who have a positive intent to purchase an energy-efficient product are more likely to do so if they cognitively intend to do so. Therefore, based on the TPB, the stronger intentions to buy energy-efficient appliances, the higher the engagement in purchase behavior should be. Mostly, an energy-efficient product intention reflects consumer motivations in the aspects of direction and intensity. Thus, we propose the following intention-behavior relationship:

Hypothesis 7 (H7): *There will be a significant correlation between consumer intentions to purchase energy-efficient appliances and purchase behavior*.

3. Methods

3.1. Data Collection Procedure

Our study investigates factors of consumers' purchase intention for energy-efficient products by extending TPB. We used a structured questionnaire and considered Bangladeshi consumers who have the experience of purchasing energy-efficient household products such as LED bulbs/lights, energy-saving air conditioners, refrigerators, T.V., solar energy panels, energy savings space and water heaters, cooking appliances, micro-oven, high-efficiency laundry machines, energy-saving fan and so on.

Following the respondents' selection criteria, data was collected through (1) direct person-to-person contact and (2) social media platforms. Final year Bachelor's and MBA students were selected to collect data. We made four groups, and each group had five interviewers. Every member received instruction on how to approach the responses. For data collection, each group was administered in 25 supermarkets in three different states of Bangladesh. In addition, they gathered data from their family and friends. On the other side, due to the COVID-19 epidemic, a Google Docs-based questionnaire was created to collect data from direct person-to-person communication on the Facebook platform. As a convenience sample technique, the authors applied unrestricted self-selected surveys by posting their Facebook status, and further, by inboxing the questionnaire to their Facebook friends who live in Bangladesh. Besides requesting a valid response on the social media timeline, we sent the questionnaire to those well-known respondents. In

addition, to ensure geographic coverage of the population, the questionnaire is posted in some popular Facebook groups where people find out about electronic products via local stores that sell them. Finally, after collecting responses for three months (August-October, 2021) online and face-to-face survey, we received responses from 1600 respondents. However, ultimately, we identified 1155 questionnaires as valid. Another 90 questionnaires were found not correctly answered. Respondents, in some cases, answered all moderate responses without considering the reality. Table 2 demonstrates the socio-demographic profile of the participants.

Table 2. The socio-demographic profile.

Variables	Frequency	Percent
Gender		
Male	772	67
Female	383	33
Age		
21–30 years	220	19
31–40 years	208	18
41–50 years	422	37
51–60 years	180	16
61–70 years	120	10
Above 70 years	05	1
Level of Education		
secondary	162	14
Higher secondary	291	25
Undergraduate	421	36
Master/Postgraduate	281	25
Family Size		
2–3	150	13
4–5	410	35
6–7	455	40
More than 7	140	12
Income (monthly)		
120–240 USD	367	32
241–360 USD	317	27
361–480USD	210	18
481–600 USD	148	13
601–720 USD	50	4
Above 720	63	6
Profession		
Farmer	381	33
Government job	197	17
Private job	109	9
Entrepreneur	309	27
Others	159	14
N =	1155	

3.2. Instrument Development

The research used a survey questionnaire with constructs and items which are derived from previous literature. The questionnaire had three parts; demographic characteristics, general questions about energy-efficient appliances, and measurement items. Three items of attitude [4,64], subjective norms [45], perceived behavior control [47], moral norms [48], and environmental concern [76] are adapted from previous sources, four items of purchase intention and purchase behavior were used from prior studies [80–82]. Five-point Likert scales were used for question statements where 1 represents strongly disagree, and 5 indicates strongly agree. In Appendix A, Table A1 describes the details of all constructs and their items with literature sources). Before finalizing the questionnaire, we conducted a pilot test. We interviewed four experts (two are university professors and two are industry

experts working on energy-efficient companies), asking them to review and comment on the questionnaire. We collected 60 items of data from target respondents to confirm its validity and reliability. We calculated the reliability test of construct where all items of factor loading of Cronbach's alpha were above 0.70. The questionnaire was written in English and then translated into Bengali. Because Bengali is the first language of Bangladesh, it was easier to understand than English.

3.3. Data Analysis Approach

We applied PLS-SEM (partial least square-SEM) for data analysis to measure the key constructs of the proposed model instead of covariance-based SEM (CB-SEM) approaches [83]. PLS-SEM could evaluate more complicated models, non-normal data, structural indicators, and facilitate theory building [84,85]. We applied SmartPLS 3.2.3 statistical software [86], which is very popular in the marketing and management field. A bootstrapping of 7000 sub-samples was used for analysis assumptions using the no sign changes option, bias-corrected and accelerated (BCa) bootstrap confidence interval, and two-tailed testing at a 95% confidential level [87,88].

4. Analysis and Results

A PLS-SEM assessment involves assessing the two steps of the measurement and structural models [89]. First, the measurement model is evaluated for its validity, reliability, and relationship between each construct and item. Second is the structural model's assessment of the relationships between constructs and hypotheses test [89,90].

4.1. Assessment of the Measurement Model

4.1.1. Convergent Validity

We investigated seven reflective constructs. To evaluate the reflective constructs, convergent validity and construct reliability need to be evaluated, which are shown in Table 3.

Table 3. the results of the measurement model.

Constructs	Items	Loading	CR	Cronbach's Alpha	AVE	VIF
Attitude	AT1	0.730	0.826	0.686	0.614	1.269
	AT2	0.797				1.381
	AT3	0.820				1.379
Subjective norms	SN1	0.845	0.869	0.773	0.688	1.676
	SN2	0.835				1.700
	SN3	0.807				1.460
Perceived behavior control	PBC1	0.744	0.803	0.632	0.576	1.249
	PBC2	0.757				1.233
	PBC3	0.775				1.242
Moral norms	MN1	0.829	0.862	0.759	0.675	1.532
	MN2	0.857				1.703
	MN3	0.777				1.454
Environmental concern	EC1	0.830	0.871	0.778	0.692	1.523
	EC2	0.862				1.894
	EC3	0.802				1.602
Purchase intention	PI1	0.798	0.880	0.818	0.647	1.703
	PI2	0.791				1.683
	PI3	0.802				1.750
	PI4	0.826				1.775
Purchase behavior	PB1	0.774	0.800	0.669	0.503	1.404
	PB2	0.793				1.493
	PB3	0.647				1.208
	PB4	0.607				1.172

Source: authors' explanation.

The convergent validity (CV) was accepted if the loading for each indicator was higher than 0.7 [89]. Table 3 presents that all outer loading values were more significant than the ideal value of 0.7, except for items PB3 (0.647) and PB4 (0.607). But, according to [91], all indicator factor loadings should be significant and have a cut-off value of 0.50. Thus, CV was acceptable in our model.

In addition, convergent validity is often assessed by way of AVE (Average Variance Extracted) [89]. Thus, all latent variables of the AVE range are from 0.503 to 0.692, higher than 0.50, indicating satisfactory convergent validity [92]. The calculation model was consistent internally with a clear convergent validity (CV).

4.1.2. Reliability Test

Table 3 shows the reliability results with composite reliability and Cronbach's coefficient alpha for testing the internal consistency of the constructs. Composite reliability (CR) tends to converge into similar values with a factor-based algorithm [93]. CR values of all variables are above 0.80, which met the 0.70 thresholds [84], suggesting very strong process reliability and error-free operation.

Cronbach's alpha value was also provided in the table as an alternative way to measure internal consistency. Cronbach's alpha values of all constructs exceeded the ideal value of 0.70 without constructs attitude (0.686) and perceived behavior control (0.632). But CR values of attitude (0.826) and perceived behavior control (0.803) were sufficient. The composite reliability exceeded the recommended level of the reflective measures, and the processes were highly reliable and error-free.

According to [94], if the VIF value is less than 5.00, the data are not collinear. The VIF values for each item range from 1.172 to 1.894, implying no negative effects in the structural model, and there is no multicollinearity between items or predictor constructs.

4.1.3. Discriminant Validity

According to Chin and Dibbern (2010), discriminant validity determines how distinct each construct is from the others in the model [90]. When the square root of the AVE is larger than the construct correlations, it indicates a stronger correlation between the construct and any other construct [90]. Table 4 reflects the diagonal entries (in bold) that signify the square root of the AVE for each construct and correlations among the constructs, indicating that the model possesses acceptable discriminant validity. On the other hand, all ratios for HTMT were less the 0.85 (HTMT < 0.85) [95].As a result, it suggests all constructs within the model had good discriminant validity.

Table 4. PLS results of discriminant validity.

	Constructs	Fornell-Larcker Criterion						
		1	**2**	**3**	**4**	**5**	**6**	**7**
1	AT	**0.784**						
2	EC	0.478	**0.832**					
3	MN	0.422	0.363	**0.822**				
4	PBC	0.425	0.376	0.451	**0.759**			
5	PB	0.410	0.320	0.509	0.528	**0.710**		
6	SN	0.416	0.389	0.440	0.546	0.547	**0.829**	
7	PI	0.453	0.368	0.591	0.528	0.685	0.592	**0.804**
		Heterotrait-Monotrait Ratio (HTMT)						
1	AT							
2	EC	0.653						
3	MN	0.583	0.472					
4	PBC	0.646	0.538	0.641				
5	PB	0.597	0.426	0.682	0.822			
6	SN	0.565	0.500	0.573	0.780	0.746		
7	PI	0.598	0.453	0.747	0.730	0.779	0.741	

Source: authors' explanation.

4.2. Evaluation of the Structural Model

The structural model examined the model fit and significance of the path and R^2 coefficients for endogenous constructs (see Table 5). The standardized root means that the square residual (SRMR) is presented by Heenseler et al. (2014) as a measure of model fit that can be used to prevent model misspecification [95]. The "unweighted least squares discrepancy" (dULS) and SRMR are examined to determine the model fit. According to Henseler et al. (2016), the criteria of overall model fit are: dULS < 95 percent of bootstrap quantile and SRMR < 95 percent of bootstrap quantile [96]. According to the results of the model fit indices, dULS is 1.292, which is lower than 3.167 (HI95 of dULS). The model value of SRMR is 0.068, which is lower than the threshold value of 0.08 [97], and which indicates the model has a "good fit". The RMS theta measures the degree of correlation between the outer model residuals. The RMS theta estimated value is 0.156, close to zero to indicate a good model fit, as it implies very low correlations (close to zero) between the outer model residuals [95].

Table 5. Results of hypothesis testing.

Hypothesis		Path Coefficient	M	Std.	*t* Values	*p* Values	Supported
H1	AT -> PI	0.110	0.109	0.028	3.899	0.000	Yes
H2	SN -> PI	0.308	0.308	0.029	10.625	0.000	Yes
H3	PBC -> PI	0.157	0.156	0.030	5.274	0.000	Yes
H4	PBC -> PB	0.224	0.224	0.026	8.573	0.000	Yes
H5	MN -> PI	0.333	0.333	0.026	12.896	0.000	Yes
H6	EC -> PI	0.015	0.016	0.027	0.575	0.566	No
H7	PI -> PB	0.570	0.571	0.026	22.236	0.000	Yes
		Saturated model	Estimated model			R Square	R Square Adjusted
	SRMR	0.068	0.070	purchase intention		0.517	0.515
	d_ULS	1.292	1.355	purchase behavior		0.508	0.507
	d_G	0.420	0.428				
	RMS Theta	0.156					

Source: authors' explanation.

Moreover, *p*-values were calculated for each relationship in the model. Nevertheless, R^2 coefficients are largely conditional upon the research area. The value of 0.2 for R^2 is generally considered acceptable for behavioral research [84]. Our study represents that the model clarified 51% for purchase intention and 50% for purchase behavior. Thus, it indicates a relatively higher and acceptable R^2 value.

Table 5 and Figure A1 (see Appendix A and Figure A1) present the results of the path coefficient and hypotheses. All variables are accepted except environmental concern, where the *p*-value is less than the ideal value of 0.05. The coefficient and t-values indicate a favorable attitude toward energy-efficient household appliances ($t = 3.899$, $p < 0.05$), SN ($t = 10.625$, $p < 0.05$), PBC ($t = 5.274$, $p < 0.05$) and MN ($t = 12.896$, $p < 0.05$) were significantly positive impacts of consumers' purchase intentions to energy-efficient household appliances. Thus, H1, H2, H3, and H5 are accepted. However, environmental concern has negative effects on purchase intention for energy-efficient appliances ($t = 0.575$, $p > 0.05$). Findings also indicated that PBC ($t = 8.573$, $p < 0.05$) and PI ($t = 22.236$, $p < 0.05$) both have significant positive relationship purchase behaviors. Thus, hypotheses H4, and H7 are accepted in the current study.

4.3. Direct Effects, Indirect Effects, and Total Effect

Table 6 presents the effects of the variables. In terms of direct effects, consumer purchase intention directly affects consumer purchase behavior toward energy-efficient appliances. Similarly, subjective norms and moral norms directly affect consumer purchase intention of energy-efficient household appliances. Environmental concern has a less negative direct effect on purchase intention. In indirect influence, subjective norms have a significant indirect impact on purchase behavior. In the context of the total effect, we

found that purchase intentions and subjective norms have the most significant total effect on consumer purchase behavior of energy products.

Table 6. Results of direct, indirect and total effects.

Relationships between Constructs	Direct Effects	*p* Value	Indirect Effects	*p* Value	Total Effects	*p* Value
AT -> PI	0.110	0.000				
AT -> PB	0.048	0.074	0.062	0.000	0.098	0.001
SN -> PI	0.308	0.000				
SN -> PB	0.145	0.000	0.175	0.000	0.283	0.000
PBC -> PI	0.157	0.000				
PBC -> PB	0.224	0.000	0.089	0.000	0.211	0.000
MN -> PI	0.333	0.000				
MN -> PB	0.107	0.000	0.089	0.000	0.257	0.000
EC -> PI	0.015	0.566				
EC -> PB	−0.006	0.814	0.009	0.564	−0.002	0.955
PI -> PB	0.570	0.000			0.448	0.000

Source: authors' explanation.

5. Discussion and Conclusions

We examined the factors of consumers' purchase intention for energy-efficient appliances by extending TPB. Besides, we investigated how moral norms and environmental concerns work as important factors in the TPB model.

The path results suggest that consumers' attitude toward energy-efficient household products (EEHA) positively correlates with consumers' purchase intention of energy-efficient appliances, because EEAs would generally be purchased by consumers who have favorable attitudes towards them. Our result is reliable with earlier research by [2,4,46,59,60]. For example, Pakistan's consumers also have a positive attitude towards purchasing energy-efficient appliances [49–51].

The study found that subjective norms and purchase intention of energy-efficient appliances significantly correlate with results agreed by prior studies in Pakistan [2], and Korea [64]. It is explained that Bangladeshi consumers are easily influenced by friends, family, and people's opinions when purchasing energy-efficient household products. More positive comments about energy-efficient appliances very significantly influenced consumers to purchase products. But a study by [4] found a negative relationship between subjective norms and purchase intention of energy-efficient household appliances in the Malaysian context. There is most likely a discrepancy between Bangladesh and Malaysia due to cultural differences. A similar result is found in the South African context [20].

Several studies confirmed PBC as an essential determinant of pro-environmental behavior since the TPB's beginning [4,21,45,47], but a small number of others do not find such a significant effect, e.g., [46,98]. Using the TPB model, we confirmed that PBC plays an important role in predicting consumers' intentions and behavior toward purchasing EEAs. The result is consistent with previous studies in developing countries such as Pakistan [49–51], and South Africa [20]. Our result suggests that consumers are more likely to purchase energy-efficient appliances when they have the ability and resources to do so.

On the other hand, moral norms have a positive and significant effect on consumer purchase intention of energy-efficient appliances, consistent with the early studies [4,72,74]. Moral norms have increased the total explained diversity with the intention of purchasing. Moral norms of Bangladeshi consumers consider conserving natural resources and environment because they are limited. Consumers' moral obligation is to reduce electricity usage to the environment. Because of this change, energy-efficient appliances will become more widely adopted in the future. However, a recent study in Pakistan shows that moral norms have insignificant effects on determinants of consumers' intentions towards purchasing EEAs [52].

The path result shows that a positive relationship between environmental concerns and purchase intention for energy-efficient appliances does not exist. The result is not consistent with the previous experiments [4,45,55,79]. But this result is similar to a recent

study in Malaysia, where [4] found that environmental concern does not significantly influence energy purchase intention. As a result, it is safe to conclude that Bangladeshi consumers are concerned with various environmental issues like air pollution. However, energy-efficient household appliances are unlikely to result in more purchase intentions. Educated people are concerned with environmental issues but have no sense of obligation to purchase energy-efficient appliances.

Finally, results exhibit that energy purchase intention significantly influences consumer purchase behavior toward EEAs. It implies that when consumers have a positive intention to purchase energy-efficient products, it ultimately helps them adapt their future purchase behavior.

6. Implications

There are several managerial and practical implications in promoting the use of energy-efficient household appliances in developing countries such as Bangladesh. Our results show that Bangladeshi consumers have favorable attitudes toward energy-efficient appliances; thus, marketing people should target consumers and influence them to purchase energy-efficient household appliances. Marketers for major brands (e.g., Samsung, Walton, Hitachi, Toshiba, Panasonic, LG, Haier, and Sharp) can take the initiative for promotional events to obtain a favorable image for consumers. They can participate in governmental and international programs such as World Environment Day, Energy Saving Day, Climate Day, and Global Warming Day to inform consumers about energy-efficient appliances. Eco-labeling is an essential part of green products to create awareness of the environment. Governments, NGOs, and environmental organizations or groups may also have to initiate advertising campaigns to establish credibility for eco-label information regarding using energy-efficient products. To increase the adoption rate of energy-efficient household appliances, the Ministry of Energy, Technology, and Energy Commission could better promote Energy Star Labels and inform consumers about the benefits of such energy-efficient appliances. Additionally, mass media and several media agencies could organize roadshows with the participation of leading household appliances producers from Bangladesh, such as Walton, Sony, Samsung, and so on, to reach such an outcome.

Trust is the most significant factor for consumers when purchasing energy-efficient products [31]. Thus, marketing managers should use references and expert groups in advertising so that consumers can believe it. Most people in Bangladesh have insufficient knowledge about energy-efficient appliances. Thus, public awareness about energy-efficient products needs to be raised by government and environmental groups. Marketers and policymakers can use mass media advertising, social media advertising, education system, and so on to spread information about energy-efficient appliances and teach the general public about the benefits of consuming energy-efficient household appliances.

Consumers in Bangladesh are more concerned with the price of products [99], so marketers must explain to customers that energy-efficient appliances will reduce the cost of electricity. As marketers should explain to consumers, energy-efficient appliances are comparatively cheaper than traditional products. In this sense, consumer literacy is one of the most important issues [100]. Therefore, the Moral Education (ME) curriculum should be included in the Bangladeshi education system. It is seen as one of the most successful tactics for inspiring young generations to become responsible for energy conservation. As part of the ME curriculum, one of the learning values emphasizes love and care for the environment, harmony between people and the environment, environmental sustainability, and focusing on issues that affect the environment [4]. Using energy-efficient appliances contributes to reducing energy consumption and helps achieve sustainable development and overall quality of life globally.

7. Limitations and Future Studies Guidelines

This study had some limitations to consider in future studies. Firstly, we gathered data from Bangladesh, a developing country; therefore, the results from developed countries

might differ from ours. Thus, cross cultures and nationality should be considered for future studies on the purchase intention of energy-efficient appliances. Secondly, future research may incorporate or compare our proposed model with the value consumption model to understand the appropriateness of the theory. Thirdly, qualitative methods should be considered in the future; therefore, they can provide deeper insight into consumers' psychological states by investigating their purchase intention for energy-efficient household appliances (EEHA). Fourth, there were no categorizations of household energy-efficient products in this research, so further study needs to improve the optimal market segmentation approach. Future research can use the demographics variable as a control variable in the model. Future researchers should investigate the moderating effects of consumer characteristics, e.g., self-image, recycling, and cultural facts, as part of our proposed model.

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Appendix A

Table A1. Variable measurement.

Constructs	Items	Sources
Attitude	ATT1: Environmental protection is important to me when making purchases. ATT2: If I can choose between energy-efficient household appliances and conventional products, I prefer energy-efficient ones. ATT3: I have a favorable attitude toward purchasing energy-efficient appliances	[4,64]
Subjective norms	SN1: Most people who are important to me think I should buy energy-saving ones when it comes to the choice of household appliances. SN2: Most people who are important to me would want me to purchase energy-saving appliances. SN3: People whose opinions I value would prefer that I purchase energy-saving appliances.	[45]
Perceived behavioral control	PBC1: I am confident that I would use energy-efficient household appliances even if it is slightly more expensive PBC2: I am confident that I would use energy-efficient household appliances in the future, even if another person advises me to use non-energy-efficient appliances. PBC3: I have the resources, knowledge, and ability to use energy-efficient household appliances.	[47]
Moral norm	MN1: It is morally responsible to the environment for me to conserve natural resources. MN2: It is my moral obligation to the environment for me to save natural resources because they are limited. MN3: It is my moral obligation to the environment to reduce my electricity usage for me	[48]
Environmental concern	EC1: I am concerned about air pollution. EC2: I am concerned about climate change. EC3: I am concerned about natural resources depletion	[76]

Table A1. *Cont.*

Constructs	Items	Sources
Purchase intention to use	PIU1: I hope to use energy-saving products as much as possible PIU2: I am likely to use energy-saving products in my life continually PIU3: I recommend others use energy-saving products in their houses PIU4: I will buy an energy-efficient product more effectively.	[81,82]
Purchase behavior	PB1: I try to buy energy-saving household appliances that don't harm the environment PB2: I have purchased an energy-saving household appliance because it uses less electricity than other non-energy saving products PB3: I have replaced household appliances in my home with those of smaller wattage to conserve the electricity I use. PB4: I have purchased energy-saving households that were more expensive but saved energy	[80–82]

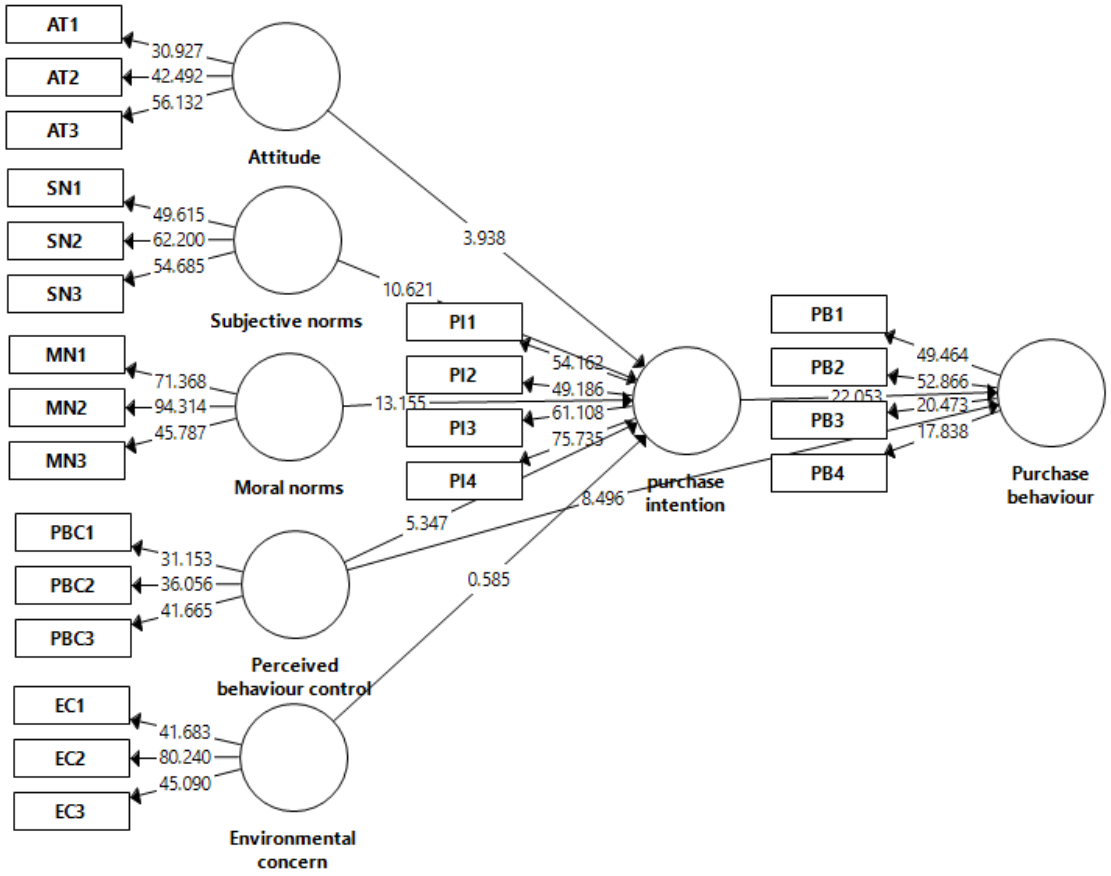

Figure A1. empirical research model based on TPB (results of the path coefficient).

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