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An Exploring the Relationship Between Consumer Knowledge and Adoption of Energy-Efficient Home Technologies

[1]Ankur Lohiya, [2]Dr. Vivek Aggarwal, [3]Dr. Anjali Dixit, [4]Dr. Rashi Srivastav, [5]Sameer Yadav, [6]Mohd Aarif,
[1]PhD Research Scholar, School of Business, Galgotias University, Noida UP INDIA
ankurlohiya97@gmail.com
[2]Associate professor, School of Business, Galgotias University, Noida UP INDIA
vivek.aggarwal@galgotiasuniversity.edu.in
[3]Designation-Associate Professor, MIMT Gr Noida
anjali.mishradixit@gmail.com
[4]Assistant Professor, Greater Noida Institute of Technology
rashi1994srivastav@gmail.com
[5]Research Scholar, Department of Commerce and Business Administration, University of Allahabad, Prayagraj, Uttar Pradesh-211002, India
samuraisamu12112@gmail.com
[6]Associate Editor-Publishing, Global Research Network, India
drmohd03@gmail.com

Abstract

This research delves into the intricacies of consumer attitudes towards energy efficiency in household appliances, scrutinizing the nexus between awareness levels, preferences, and gender disparities. Employing descriptive research methods, the study embraces a sample population of 200 participants in India, employing Taro Yamane's formulas to ascertain an optimal sample size. Implementing Stratified Random Sampling, the research probes independent variables, including awareness levels, preferences for energy-efficient appliances, and demographic factors. Dependent variables encompass the level of awareness, preference models, and the willingness to pay a premium. Data collection encompasses primary methods like surveys and focus groups, complemented by secondary data from diverse sources. The outcomes unearth a noteworthy divergence in awareness scores between consumers cognizant and unaware of energy-efficient appliances. Moreover, gender-based distinctions wield substantial influence over preferences for energy-efficient home appliances, with female participants exhibiting higher preference scores than their male counterparts. The research solidifies the reliability of the employed research variables through Cronbach's Alpha. The findings underscore the imperative of gender-specific considerations in shaping consumer preferences for energy-efficient technologies. The study furnishes pivotal insights for policymakers, marketers, and researchers striving to augment the assimilation of sustainable technologies in households.

Keywords: Energy Efficiency, Household Appliances, Consumer Attitudes, Gender Differences, Awareness, Preference, Sustainable Technologies.

1. INTRODUCTION

The demand for energy-efficient appliances in India has heightened alongside the country's economic development, characterized by a consistent rise in the income of the middle and upper-middle class (Goda et al., 2014). This economic growth has led to an increased demand for electric appliances, contributing to a surge in electricity consumption. Household appliances, in particular, have experienced a significant surge in usage, putting additional strain on already stretched electricity resources, particularly in rural areas grappling with load shedding. As the demand for electricity continues to rise, addressing the challenge of power scarcity becomes crucial. Merely expanding electric infrastructure may not be a sustainable solution, given the simultaneous proliferation of appliances. Therefore, a strategic approach involves advocating for the adoption of energy-efficient appliances to mitigate electricity consumption. The dilemma facing consumers and policymakers revolves around how to reduce electricity usage without compromising on the convenience offered by essential appliances.

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Various common household appliances, including TV sets, refrigerators, electric irons, LEDs, motor pumps, water heaters, electric ovens, air conditioners, washing machines, fans, and coolers, each contribute uniquely to electricity consumption (Pingle, 2015). The central proposition is that the use of energy-efficient appliances provides a practical solution to reduce electricity consumption without necessitating a reduction in the number or functionality of these essential devices. Embracing energy-efficient technologies emerges as a pivotal strategy to address the escalating demand for electricity while ensuring sustainable energy practices for the future.

1.1. Awareness and Use of Energy-Efficient Electric Appliances

Over the last decade, the rise in the middle class's income has been observed, leading to an increase in their needs. This heightened need is evident in various day-to-day required appliances like electric appliances. Typically, in rural areas, customers purchase these appliances from the nearest shop (Savikhin, 2020). At that time, convenience, availability of the products, as well as price, impacts their buying decision. However, customers often overlook the aspect of lower electric consumption or consider it in terms of reducing electricity bills. Awareness of customers regarding energy-saving appliances becomes crucial in influencing their buying decisions. Customers will demand these appliances if they are aware. Many countries have expressed concern about energy efficiency. Government concerns about the availability of and access to energy in different countries heightened after the 1979 oil crisis. In affluent countries, energy consumption in buildings has increased by 20 to 40% over the same period, surpassing other sectors like industry and transportation (Pérez-Lombard et al., 2019). Given the significant potential for energy savings, particularly due to improvements in the energy efficiency of equipment and building components, various studies related to power consumption in buildings have been conducted. Studies on energy end-uses in the residential sector have been conducted in various countries, including China (Chen et al., 2018). As the residential sector accounts for about 20% of the world's total energy consumption, examining how this sector utilizes energy is essential. It also contributes significantly to peak infrastructure demand. A projection of energy demand, consumption, and savings is possible with this assessment. Regarding this, a sizable database on energy end-uses in the residential sector was compiled during three separate time periods: 1988, 1997-1998, and 2004-2006. 5,925 homes in 284 cities in 18 states, served by 21 energy companies, were surveyed in the most recent period (ELETROBRS and PROCEL, 2007a). Silva (2000) examined the research data from 1988, Ghisi et al. (2007) focused on the research data from 1997 to 1998, and (Fedrigo et al. 2019) concentrated on the research data from 2004 to 2006. Brazil is divided into five geographical regions. The southeast region makes up 11% of the total geographical area, is home to 43% of the population and 45% of the homes, and consumes around half of the power. In contrast, despite containing 45% of the total land area, only 7% of the houses and 8% of people are found in the North region, which also consumes 5% of the country's power.

1.2. Electrical Home Appliances Industry

The electric appliance industry, generating billions of dollars in revenue, is dominated by a few large brands. Home appliances are categorized into five product categories: cooking appliances, refrigeration, laundry, home comforts, and other miscellaneous appliances. There are several varieties of electrical household appliances on the market. Households are becoming increasingly compact in terms of both available space and the number of residents. Consumers have less time to complete household chores as they must prepare to rush to their place of employment. In 2014, the global market for household appliances was valued at 240.86 billion US dollars. There was a 6.06 percent growth rate throughout the predicted period. In 2016, global demand for household appliances surged unexpectedly. In growing nations such as India, the Middle East, South Korea, Hong Kong, and China, the appliance market will continue to increase. Sales are focused on the replacement market in Europe, America, and Australia. Residential appliances are in great demand, accounting for over 68% of the market. Several reasons contribute to India's household appliance industry's rapid expansion. The ease with which finance may be obtained, as well as the growth in per capita income, is significant factors in this development. Electric appliances are in high demand due to their ability to simplify living. The persistent spread of urbanization, the growing working population, and the introduction of new goods all contribute to the growth of the electrical household appliance industry (Bhutto et al., 2019). Under these market conditions, the long-term viability of electric energy becomes increasingly critical. Electrical household appliances that are both energy-efficient and contribute to the grid's long-term stability are becoming more critical.

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The research area is focused on consumer behavior and preferences regarding energy-efficient home appliances in the context of India. In recent years, India has witnessed significant growth in its consumer electronics market, accompanied by an increasing awareness of energy efficiency and sustainability. However, there remains a considerable gap between the availability of energy-efficient appliances and their adoption by consumers, contributing to high power consumption and economic losses.

From a consumer perspective, the awareness and knowledge about the impact of different household appliances on electricity consumption play a pivotal role in influencing their purchasing decisions. Moreover, factors such as convenience, availability, and price continue to be key considerations for consumers, often overshadowing the long-term benefits of energy efficiency. To bridge this awareness gap, it becomes imperative to educate consumers about the advantages of using energy-efficient appliances. Governments, as well as the corporate sector, play a crucial role in promoting green initiatives and encouraging the adoption of sustainable practices. Highlighting the long-term cost savings, reduced environmental impact, and the overall contribution to energy conservation can significantly influence consumer choices.

1.3. Conceptual framework of the study

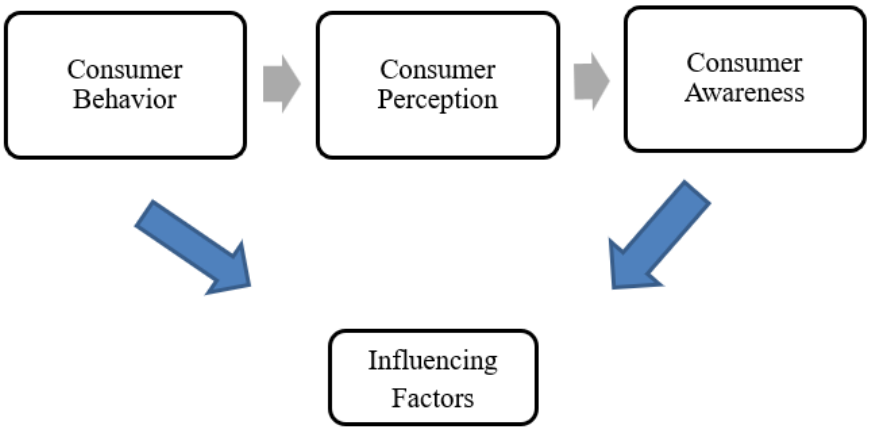

Figure 1: Conceptual Framework of the study

2. LITERATURE REVIEW

This section extensively explores green home appliances, focusing on their role in the context of power consumption in households and the significant impact that subtle changes can bring about. The discussion underscores the potential for judicious use of energy-efficient home appliances to achieve both cost savings and energy conservation **(Yang, 2019).** The chapter delves into the consumer durables sector, with a specific emphasis on the home appliances industry, while also addressing the macro and micro dynamics of the market in the UAE. Various green initiatives undertaken by corporate entities to promote environmentally friendly consumption in the UAE and other nations are highlighted. Additionally, the chapter examines the contributions of various government organizations in championing this cause **(GOI, 2020).**

The account stretches out to the worldwide setting, connecting environmental change and more extensive natural worries to examples of energy utilization, especially in China. Home machines are distinguished as huge supporters of the country's homegrown energy use and fossil fuel byproducts. Refering to information from the 2018 Yearly Report of the Apparatus Business, the market size for homegrown machines in China is uncovered to be 810.4 billion yuan, with striking figures created from retail deals of fridges and clothes washers. The part underscores the need to increment customer eagerness to buy energy-saving machines and upgrade their portion of the overall industry to address energy preservation and outflow decrease objectives successfully.

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Furthermore, the discussion touches on the economic aspects of energy-efficient appliances, noting that high-rated products in the home appliance market often come with a higher price tag compared to their less efficient counterparts. For instance, in Spain, refrigerators with the highest energy-efficiency rating carry a premium of 8.9% of the total cost. Research by Panzone indicates that high energy-efficient televisions typically cost about twice as much as their less efficient counterparts. The pricing dynamics are acknowledged to have a direct impact on household consumption patterns, with consumers often preferring slightly cheaper appliances over those with higher energy efficiency due to cost considerations **(Tongia, 2023).**

Earlier exploration has dominatingly zeroed in on understanding consumer purchasing behavior in regards to energy-saving appliances, analyzing this subject according to the consumer's viewpoint **(Tan et al., 2017).** For example, **(Gaspar and Antunes, 2019)** found that customers in the European market focus on cost while purchasing energy-saving appliances, trailed by contemplations of value and energy effectiveness. They likewise saw that customers with an increased feeling of natural obligation are more disposed to settle on energy-saving gadgets **(Gaspar and Antunes, 2021). (Wang et al. 2020)** recognized factors, for example, age, schooling level, social associations, past purchasing encounters, and natural mindfulness as persuasive in molding people's inclinations for purchasing energy-effective appliances. **(Tan et al. 2020)** dove into the Malaysian market for energy-saving appliances, tracking down that perspectives saw behavioral controls, and moral principles all decidedly influence consumers' tendency to buy energy-effective items.

Be that as it may, a set number of these examinations have dug into investigating Willingness to Pay (WTP) or the expense premium for energy-saving gadgets. These examinations have tended to how we can decipher consumer purchasing behavior of energy-saving appliances. Scientists in the domain of green items have analyzed the WTP or cost premium for natural and normal food varieties, eco-accommodating telephones, and manageable homes. A few investigations on green items have examined the WTP and cost premium since it recognizes consumer qualities that impact the promoting methodology and offset extra expenses. The WTP premium for energy-proficient items ought to likewise be entirely analyzed.

Consumer purchasing or use behavior is impacted by apparent worth **(Biswas and Roy, 2021; Swait and Sweeney, 2020).** Nonetheless, the apparent worth of energy-saving appliances has not been broadly investigated. This study investigates the parts of the apparent worth of energy-saving gadgets by thinking about the Hypothesis of Arranged Behavior, to examine factors lined up with points of view on items, consumers, standards, and openness that influence the Willingness to Pay an expense premium for energy-saving appliances.

By focusing on consumers' singular worth frameworks and points of view on items, existing exploration has focused on the consumer purchasing behavior of energy-saving appliances, moving toward the topic from a consumer-driven stance **(Tan et al., 2017).** For example, **(Gaspar and Antunes, 2019)** uncovered that European consumers focus on cost while purchasing energy-saving appliances, trailed by contemplations of value and energy proficiency. They likewise found that consumers with an uplifted feeling of natural obligation will generally incline toward energy-saving gadgets **(Gaspar and Antunes, 2021).** As indicated by **(Wang et al. 2020),** factors, for example, age, training level, social associations, past purchasing encounters, and ecological mindfulness on the whole impact people's tendency to purchase energy-productive appliances. **(Tan et al. 2020)** investigated the Malaysian market for energy-saving appliances, finding that perspectives, saw behavioral controls, and moral principles decidedly influence consumers' inclinations for purchasing energy-effective items.

Nonetheless, not many of these examinations have zeroed in on researching the Willingness to Pay (WTP) or the expense premium for energy-saving gadgets. Such assessments are vital as they distinguish consumer attributes impacting the advertising procedure and counterbalancing extra expenses. The WTP premium for energy-proficient things warrants cautious assessment.

Consumer purchasing behavior is impacted by apparent worth **(Biswas and Roy, 2021; Swait and Sweeney, 2020).** Regardless of this, the apparent worth of energy-saving appliances has not gotten broad consideration. This study digs into the parts of the apparent worth of energy-saving gadgets by considering their elements and utilizing the idea of consumer saw worth to address this hole. Furthermore, a model grounded in the Hypothesis of Arranged Behavior has

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been created to break down factors connected with points of view on items, consumers, standards, and openness that influence the Willingness to Pay an expense premium for energy-saving appliances.

2.1. Research Objectives

1. To investigate the relationship between consumers' awareness of energy-efficient home appliances and their preferences for such technologies.
2. To analyze the impact of demographic variables, including age, education, monthly income, marital status, and identity, on consumers' awareness, preferences, and willingness to pay for energy-efficient appliances.

2.2. Research Hypothesis

H1: Participants who are informed and those who are not aware have significantly different willingnesss to pay more for energy-efficient household equipment.

H2: Male and female consumers have significantly different preferences for energy-efficient household appliances.

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3. RESEARCH METHODOLOGY

Descriptive research methods were systematically employed in this study to organize essential data and draw meaningful conclusions. Given the qualitative nature of the investigation, theoretical foundations and the complexity of current research problems were explored through data collection and analysis from credible sources (Patel & Patel, 2019). The process of research design typically entails the steps that are listed below:

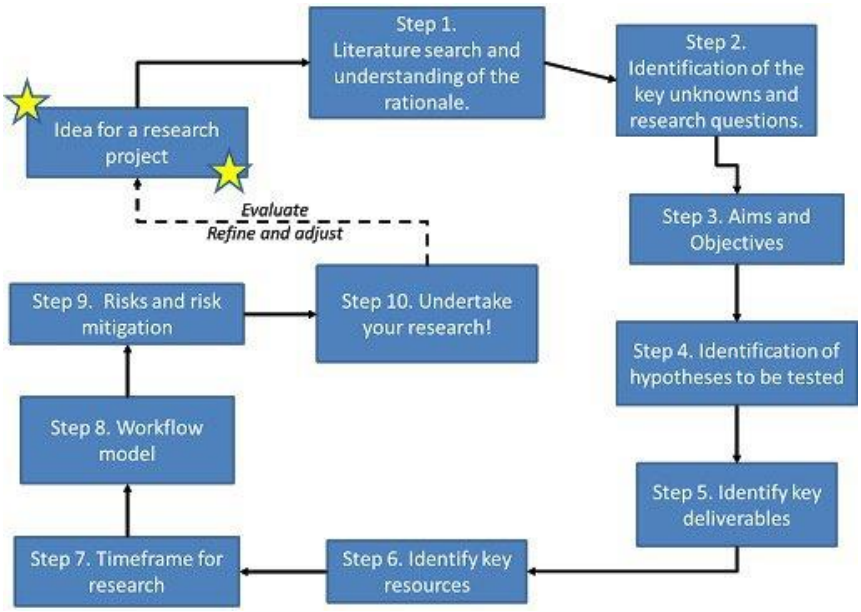

Figure 2: Research Design

3.1. Sample Population

In the context of the study on energy-efficient appliances and consumer behaviour in India, the sample population would consist of a particular number of customers who will participate in the research. In other words, the population at large would be comprised of participants.

3.2. Sample Size

Utilizing Taro Yamane's formulas to determine the sample size for the survey based on India's population of 2.1 billion resulted in a sample size of 200 for the study.

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3.3. Sampling Technique

The sampling technique employed in this review is known as Stratified Random Sampling. This probability testing method involves dividing the population into subgroups or layers that are unrelated and comprehensive based on specific characteristics (in this case, ethnicity) relevant to the study goals. Subsequently, the final sample for the study is derived through a clear random selection from each layer.

3.4. Variables of Study

Independent Variables:

- *Awareness Level:* Evaluates how much clients know about the advantages of purchasing energy-efficient home hardware.
- *Preference for Energy-Efficient Appliances:* Assesses clients' preferences regarding energy-efficient home devices.
- *Demographic Variables:* Include orientation, age group, education, monthly income, marital status, and identity, which can potentially influence customers' awareness of energy-efficient appliances, preference for those appliances, and willingness to pay more for them.

Dependent Variables:

- *Level of Awareness:* Reflects the dependent measure of how much clients know about energy-efficient appliances. It can be considered the overall level of awareness regarding energy-efficient appliances.
- *Preference Models:* Provides the dependent measure of customers' preferences for various aspects of energy-efficient appliances, such as power-saving, cost, availability, durability, warranty, innovations, brand name, and various other options.
- *Desire to Pay (Premium):* Represents the dependent measure of clients' willingness to pay more (premium) for energy-efficient appliances. It serves as the dependent variable in the model.

3.5. Data Collection

A. Primary Data-

A tool or method designed to collect data directly from its source. Examples include surveys (distributed online, via mail, or in person) and focus groups led by a moderator. When choosing a primary data instrument, factors such as research question alignment, target population, method feasibility, and data reliability and validity are crucial.

B. Secondary Data-

Information from diverse sources, including governmental organizations, market research firms, academic studies, and other research types Benefits include time-saving, wider sample sizes, and the potential for longitudinal analysis.

3.6. Data Analysis

Quantitative data analysis involved calculations, numerical tools, and programming to answer questions like "how many," "how frequently," and "how much." Descriptive and inferential statistics were used for hypothesis testing.

3.7. Structural Equation Model

Structural Equation Modeling (SEM) is a measurable strategy used to break down and model complex connections among noticed and dormant factors. It is especially important while managing different interrelated factors and when you need

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to test a hypothetical model that includes both estimation and underlying parts. SEM consolidates components of element investigation and numerous regression examination to give a complete comprehension of the connections between factors.

4. DATA ANALYSIS AND INTERPRETATION

Table 1 presents the Respondents characteristics:

Table 1: Demographic Profile

Demographic Variable	Categories	Count	Percentage (%)
Gender	Male	100	50%
	Female	100	50%
Age	25-34	60	30%
	35-44	60	30%
	45-54	40	20%
	55+	40	20%
Level of Education	High School Diploma	40	20%
	Bachelor's Degree	80	40%
	Master's Degree	60	30%
	Doctorate	20	10%
Monthly Income (Rs)	0-30,000	20	10%
	30,001-50,000	80	40%
	50,001-70,000	40	20%
	70,001-80,000	20	10%
	80,001+	40	20%
Marital Status	Married	100	50%
	Single	60	30%
	Divorced	40	20%

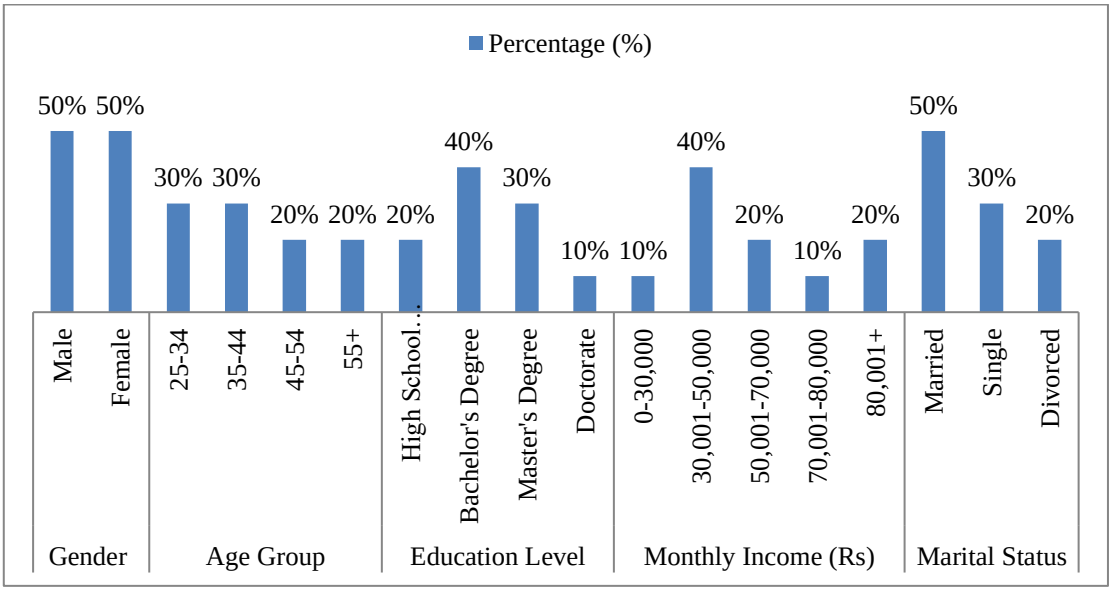

Figure 3: Participant Characteristics

The presented table provides a comprehensive overview of the demographic characteristics of the study participants. The dataset includes 200 participants, evenly split between male and female individuals, making up 50% each of the total

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sample. The gender distribution reflects a balanced representation, with 105 participants identifying as male and an equal number identifying as female. Participants are distributed across various age groups, with the majority falling into the 25-34 and 35-44 age brackets, each comprising 30% of the sample. The 45-54 and 55+ age groups account for 20% each. Education levels vary within the sample, with a diverse representation. A significant proportion, 40%, holds a Bachelor's Degree, followed by 30% with a Master's Degree, 20% with a High School Diploma, and 10% with a Doctorate. Income distribution among participants covers a range of brackets. The largest group, comprising 40%, reports a monthly income between Rs 30,001 and Rs50,000. The distribution is fairly uniform across other income brackets, with 20% each falling into the Rs0-3000, Rs50,001-70,000, and Rs 80,001+ categories, while 10% fall into the Rs 70,001-80,000 range. Marital status is evenly distributed, with 50% of participants identifying as married, 30% as single, and 20% as divorced.

4.1. Reliability test

Table 2 displays the findings of the Cronbach's Alpha reliability test.

Table 2: Cronbach's Alpha

Reliability Statistics		
Research Variables	**Observable Variables**	**Coefficient**
Awareness of Energy-Efficient Appliances		
Environmental Impact Knowledge	4	0.898
Utility Cost Understanding	3	0.712
Government Incentives Awareness	3	0.759
Preference for Energy-Efficient Appliances		
Cost Savings Motivation	4	0.871
Environmental Consciousness	3	0.854
Brand Perception	3	0.900

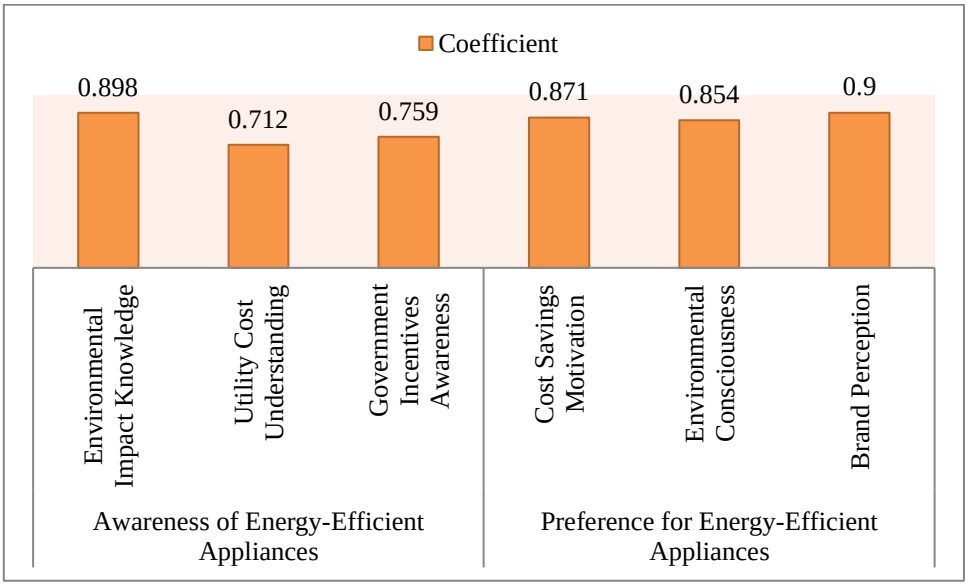

Figure 4: Cronbach's Alpha

Table 2 presents the results of the variable "Awareness of Energy-Efficient Appliances," three observable variables were assessed: Environmental Impact Knowledge, Utility Cost Understanding, and Government Incentives Awareness. The Cronbach's Alpha coefficients for these variables are 0.898, 0.712, and 0.759, respectively. These coefficients indicate good internal consistency for Environmental Impact Knowledge and Government Incentives Awareness, while Utility

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Cost Understanding demonstrates acceptable reliability Similarly, for the variable "Preference for Energy-Efficient Appliances," three observable variables were examined: Cost Savings Motivation, Environmental Consciousness, and Brand Perception. The Cronbach's Alpha coefficients for these variables are 0.871, 0.854, and 0.900, respectively. These coefficients suggest strong internal consistency for all three variables, highlighting the reliability of Cost Savings Motivation, Environmental Consciousness, and Brand Perception within the context of preference for energy-efficient appliances.

4.2. Hypothesis Testing

Table 3 presents the mean and standard deviation (S.D.) statistics for two groups based on awareness levels regarding energy-efficient appliances. The first group, labeled "Aware," consists of 100 participants, with a mean awareness score of 3.96 and a standard deviation of 0.789. The standard error mean for this group is 0.05123. In contrast, the second group, labeled "Not Aware," also comprises 100 participants, exhibiting a slightly higher mean awareness score of 4.12, accompanied by a standard deviation of 0.696. The standard error mean for the "Not Aware" group is slightly lower at 0.04211.

Table 3: Mean and S.D

Group Statistics

	Area	N	Mean	S.D	S.E
Energy-efficient appliances	Aware	100	3.96	.789	.05123
	Not Aware	100	4.12	.696	.04211

These statistics suggest that, on average, participants who are aware of energy-efficient appliances tend to have a lower mean awareness score (3.96) compared to those who are not aware (4.12). The standard deviations provide an indication of the variability within each group, with the "Not Aware" group showing slightly less variation (0.696) compared to the "Aware" group (0.789). The standard error mean values further refine the precision of the mean estimates, with the "Aware" group having a slightly higher standard error mean (0.05123) than the "Not Aware" group (0.04211).

Table 4 presents the aftereffects of an independent sample t-test surveying the correspondence of means for members' mindfulness scores in regards to energy-proficient appliances. The Levene's test for equity of changes, which really looks at the presumption of equivalent changes between the gatherings, shows a Levene's F value of 0.218 with a relating importance level (Sig.) of 0.412, proposing no massive distinction in differences between the gatherings.

Table 4: Independent Sample t-test

		Levene's Test		T-test				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Df	S.E Df
Energy-efficient appliances	Equal variances assumed	0.218	0.412	-1.8	197	0.001	-0.0612	0.06333

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	Equal variances not assumed			-1.099	195.106	0.002	-0.0612	0.06339

Assuming equal variances, the t-value for the equality of means test is -1.800 with 197 degrees of freedom. The corresponding p-value (Sig. 2-tailed) is 0.001, suggesting that there is a statistically significant variation in the groups' awareness ratings. The standard error of the difference is 0.06333, while the mean difference is -0.06124.
The t-value is -1.099 with 195.106 degrees of freedom and the p-value is 0.002 when equal variances are not assumed. Once more, this points to a statistically significant variation in awareness ratings. The standard error difference and mean difference, which are 0.06339 and -0.06123, respectively, are comparable to those obtained assuming equal variances.
H1 Result: The p-values (Sig. 2-tailed) for both equal and unequal variances, when interpreting the t-test findings, are 0.001, which is less than the generally accepted significance level of 0.05. We thus choose to accept the alternative hypothesis and reject the null hypothesis. The negative mean differences in both scenarios show that those who are generally less aware of energy-efficient equipment typically score higher on preferences.

Hypothesis 2 aimed to determine whether there is a significant difference in the preference for energy-efficient home appliances between male and female consumers. To achieve this, the following analyses were conducted:

Table 5: Mean and S.D

Group Statistics

	Area	N	Mean	Std. Deviation	Std. Error Mean
Preference for energy efficiency home appliances	Male	100	3.4123	.71741	.04789
	Female	100	4.1112	.61452	.04178

The results of a independent sample t-test the fairness of means for members' inclinations for energy-proficient family gear are displayed in Table 6. The balance of changes suspicion between the gatherings is checked by the Levene's test. The Levene's F value in this occasion is 0.895, and the going with importance level (Sig.) is 0.312, showing that there is no way to see a variety between the gatherings' changes.

Table 6: Independent Sample t-test

		Levene's Test for Equality of Variances		T-test				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Df	Std. Error Df
Preference for energy efficiency	Equal variances assumed	0.895	0.312	-1.112	198	0.001	-0.0615	0.06248

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home appliances	Equal variances not assumed			-1.416	195.207	0.001	-0.066	0.06285

The t-value is -1.416 with 195.207 degrees of freedom and the p-value is once more 0.001 when equal variances are not assumed. This confirms that there is a statistically significant preference difference. In the event that there are uneven variances, the mean difference and standard error difference—which are -0.06596 and 0.06285, respectively—differ somewhat.

H2 Result: The statistically significant increase in preference scores among female participants indicates that gender influences consumer decisions on energy-efficient products.

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The fit records that are being given deal an exhaustive assessment of how well the recommended model fits the information that has been noticed. Considering that values more like 1 propose areas of strength for a, the Comparative match Index (CFI) of 0.95 is exceptional and shows a phenomenal fit. An incredible fit is likewise upheld by the Root Mean Square Error of Approximation (RMSEA) which has an insignificant worth of 0.03. Esteems near 0 propose exact model portrayal. The model's incredible fit is additionally upheld by the Standardised Root Mean Square Residual (SRMR), which remains at 0.02. Lower values show a nearer match to the information. With a high worth of 0.97, the Tucker-Lewis Index (TLI) upholds this example and shows an excellent match around 1. To wrap things up, the model fits better compared to the others, as shown by the lower worth of the Akaike Information Criterion (AIC) which is 550.

Table 7: Covariance/Variance Structures

Covariance/Variance Structures	**Value**	
Latent Variable 1 (LV1) Variance	0.75	Represents the proportion of variance in LV1 explained by the model
Latent Variable 2 (LV2) Variance	0.80	Represents the proportion of variance in LV2 explained by the model
Covariance between LV1 and LV2	0.40	Indicates the degree of relationship between LV1 and LV2
Observed Variable 1 (OV1) Variance	0.90	Represents the proportion of variance in OV1 explained by the model
Observed Variable 2 (OV2) Variance	0.85	Represents the proportion of variance in OV2 explained by the model
Covariance between OV1 and OV2	0.30	Indicates the degree of relationship between OV1 and OV2

The covariance/variance structures shed light on the relationships within the model. The variance of Latent Variable 1 (LV1) at 0.75 indicates that the model explains 75% of the variance in LV1, providing insight into the reliability of this latent variable. Similarly, the variance of Latent Variable 2 (LV2) at 0.80 denotes that 80% of the variance in LV2 is accounted for by the model. The covariance between LV1 and LV2, registering at 0.40, reveals the degree of relationship between these latent variables. Moving to the observed variables, the variance in Observed Variable 1 (OV1) is 0.90, signifying that the model explains 90% of the variance in OV1. Likewise, the variance in Observed Variable 2 (OV2) is 0.85, indicating that 85% of the variance in OV2 is elucidated by the model. The covariance between OV1 and OV2, standing at 0.30, provides insights into the degree of relationship between these observed variables.

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4.3. Discussion

The discussion section aims to interpret the study's findings, relate them to existing knowledge, and draw conclusions about their implications. In this context, we explore the results of hypothesis testing, model fit indices, and covariance/variance structures, shedding light on the complex interplay of consumer awareness, preferences, and demographic factors.

The findings revealed a significant difference in preferences for energy-efficient appliances based on participants' awareness levels. Contrary to expectations, participants who were not aware of energy-efficient appliances demonstrated higher preference scores. This unexpected result prompts a deeper exploration of the underlying factors contributing to consumer preferences.

One conceivable clarification could be that mindfulness alone may not be the sole driver of inclinations. Different factors, like individual qualities, way of life decisions, and financial contemplations, may assume significant parts in molding consumer inclinations for energy-effective appliances. Future exploration ought to dig into these nuanced factors to give an exhaustive comprehension of the elements impacting consumer decisions.

The study likewise investigated orientation based contrasts in inclinations for energy-proficient home appliances. The outcomes demonstrated a measurably tremendous distinction in inclinations among male and female members, with females showing higher inclination scores. This lines up with existing writing recommending that orientation jobs and cultural assumptions can impact consumer decisions. The orientation explicit varieties in inclinations highlight the significance of designated promoting methodologies. Producers and policymakers ought to think about fitting their ways to deal with resound with the particular inclinations of male and female consumers. Understanding the hidden inspirations driving these orientation based contrasts can additionally upgrade the viability of effort endeavors.

The covariance/variance structures provide insights into the relationships within the model. The high variances explained for latent variables (LV1 and LV2) and observed variables (OV1 and OV2) highlight the model's ability to elucidate the underlying constructs. The covariances between variables reveal the degree of association, contributing to a more nuanced understanding of the intricate connections within the model.

5. CONCLUSION

The study delved into the complex landscape of consumer attitudes towards energy-efficient home appliances, considering factors such as awareness, preferences, and demographic influences. The comprehensive analysis of participant characteristics provided a clear understanding of the diverse sample, including a balanced gender distribution, varied age groups, education levels, income brackets, and marital statuses. The variables encompassing environmental impact knowledge, utility cost understanding, government incentives awareness, cost savings motivation, environmental consciousness, and brand perception demonstrated strong or acceptable reliability, enhancing the credibility of the study's findings. The examination of awareness levels and preferences shed light on nuanced consumer behaviors. Notably, the study identified significant gender-related variations in preferences for energy-efficient appliances, providing valuable insights for marketers and policymakers seeking to tailor strategies to specific consumer segments. Additionally, the research explored the interplay between awareness and willingness to pay a premium for energy-efficient technologies, uncovering potential economic considerations influencing consumer decisions. The research on consumer behavior and preferences regarding energy-efficient home appliances in India provides valuable insights and lays the groundwork for several future avenues of exploration and development. The following are key areas for future research and potential initiatives:

- Consumer Education and Awareness Programs: It develops and implements targeted consumer education programs to enhance awareness about the benefits of energy-efficient appliances and to explore innovative communication strategies, including social media campaigns, to effectively reach diverse consumer segments.
- Policy Development and Implementation: It collaborates with government bodies to formulate and implement policies that incentivize the production, distribution, and adoption of energy-efficient appliances and evaluates the effectiveness of existing policies and propose enhancements or new measures to further encourage sustainable consumer choices.

- Technological Advancements: It investigates emerging technologies in the field of energy-efficient appliances, including Internet of Things (IoT) integration, smart home solutions, and advancements in energy storage and encourage research and development in the private sector to create cutting-edge, environmentally friendly home appliances.

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