TEST Engineering & Management

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A Study on Consumer Perception towards Energy Efficient Electrical Appliances

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Article Info
Volume 82
Page Number: 14333 - 14342
Publication Issue:
January-February 2020

Article History
Article Received*: 18 May 2019*
Revised*: 14 July 2019*
Accepted*: 22 December 2019*
Publication*: 28 February 2020*

Abstract:
Electric energy is crucial and the most precious source of all types of measures for human activities and nature. It is proved to be an ideal energy among all types of sources available and indispensable commodity for human being. It drives economy growth of a nation. However, usage more than required may pose a threat for a nation. It will have adverse effect on the environment and the respective government. Therefore, one of the alternatives for energy conservation is through energy efficient appliances.

An electrical appliances manufacturing company which would understand consumer perception, apply right marketing strategies to promote energy efficient appliances will generate more value to consumers in the present scenario of electrical appliances market. By providing better value in the form of energy efficient appliances, all stakeholders including a nation will be rewarded through enduring energy efficiency.

The study revealed that more focus should be given to awareness regarding Energy efficient electrical appliances. Customer Support, Customer review, Product Trust and Reliability. Important sources of information regarding Energy efficient electrical home appliances are Magazines, Social media and Mobile phones.

Keywords: *Electrical energy, Consumer Perception, Usage, Awareness, Information, EEHA (Energy efficient electrical home appliances).*

I. INTRODUCTION

Natural resources are consumed by human being to generate electrical energy. Electricity as we know is generated from coal, natural gas, crude oil, nuclear energy, hydroelectric energy and geothermal energy. Out of these, coal, natural gas produce hazardous by products. Nuclear energy can still supply fissionable material. However, there is huge cost involved and there are environmental impacts. It is need of the day that resource consumption and new innovative technology have to move towards sustainability. Energy as known is used in households, industries telecommunication, agriculture, sectors. It meets ever-increasing day to day requirements and improves quality of life. Energy is consumed on a large scale and may lead to its availability issues and financial burden on the nation. With growth in industrialization, mechanization of agriculture and development of transportation sector, the demand for energy resources is increasing proportionally. Consumption of energy for domestic use and public lighting has also been increasing. At the same time environmental adverse effects may get ignored. It may often have considered as an external factor in marketing activities and commercial analysis. Energy conservation is considered as a quick and economical way to solve the problem of power shortage. This also conserves country's finite sources of energy. There is a potential for energy conservation through various ways. Energy management is an important alternative and has various options. One of the alternatives is appropriate selection of energy efficient appliances and its proper usage that would affect favorably.

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The Government of India has introduced the National mission for enhanced energy efficiency in 2010 to curb growing electricity demand .The objective is to make people know the importance of energy consumption and encourage them to switch to energy efficient appliances. Indian Bureau of Energy Efficiency (BEE) had introduced Standards and labeling program to choose energy saving home appliances through an Energy Star Rating System. 80 countries have set standards for efficient appliances and lighting. According to International Energy Agency, labeling program can reduce country's energy consumption by around 10-25% and help carbon emission reduction efforts. Consumers may not know enough about the options available in the market to make an informed choice. This can be solved by providing direct information to consumers, companies and retailers. Authorization of power is divided among central, state and local governments. A systematic and quantitative foundation to calculate energy consumption, setting long term programs for energy conservation may increase energy conservation to a considerable extent.

Energy efficiency can be achieved by consumers' exposure to real-time price and consumption through smart electricity meters. If consumers can view the price of electricity with the help of technology, they will be able to shift their usage pattern of home appliances. This would eventually lead to more-efficient use of energy. Power companies are getting incentives to deploy technologies that help consumers use their product more efficiently. The government can recruit private players in this program to curb energy waste. Energy-efficient appliances help upgrade the benefits of power resources and reduce its consumption. With the help of informative programs, consumers will be able to understand the importance of energy consumption and will try to save energy resources.

When a consumer goes to buy an electrical appliance, number of choices available exceed his capacity to understand and evaluate them. He gets loads of information on a large number of products. This may land in purchasing something that might not be the best option. However once purchased, he uses till the life of the appliance; say 8-10 years for expensive appliances like refrigerators, air conditioners or washing machines. Hence, it makes a lot of sense to understand the services that need to be derived from the appliance and expectations from its performance. Depending on whether consumer is purchasing it for the first time or replacing an existing item, various factors such as cost, size, design, features, color are considered in his priorities. An important factor is how much electricity that the appliance will consume once it is purchased. Understanding how much extra money he may need to pay for an appliance that consumes less energy will prove useful.

Research has proven that consumer's purchase decisions are largely affected by the cost of owning the appliance paid at the time of purchase and he may tend to overlook the cost of using the appliance paid in installments in the electricity bill. Research has also shown that once he is informed about the future benefits, he can be able to make more rational decision. As mentioned previously, Bureau of Energy Efficiency, Ministry of Power introduced the Standards and Labeling Program in May 2006. Under this program the manufacturers are required to place a label showing how much electricity the appliance will consume. The program is implemented for refrigerators, air conditioners, televisions, geysers, tube lights and fans. The scheme is mandatory for some of the appliances while voluntary for others. However, once it is decided to save electricity and reduce bills, it becomes mandatory for everyone to look at wherever these labels are, what they inform; more the stars, more efficient are the appliances. For ceiling fans, tube lights, computers, laptops and televisions smaller labels are used while for refrigerators, air conditioners, geysers and washing machine big labels are used. The best option could be five-star label for an appliance. For example, refrigerators, labels provide expected annual consumption in kWh. This can be multiplied by

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average cost of electricity to arrive at an approximated cost of using refrigerator.

II. REVIEW OF LITERATURE

Sudhakara Reddy of Indira Gandhi Institute of Development Research in his article Energy and Environment has clarified that consumer discount rates are good indicators of the potential of energy conservation programmes. They can be used to evaluate penetration of different energy carriers and are useful to study the carrier shifts. Households shift from one energy carrier to another if their income increases and the consumer discount rates decrease exponentially with household income. This income-dependent consumer discount rate for the carrier shifts implies that the cost aspects dominate the decisions of Bangalore's households regarding the choice of energy carrier.

Kanupriya Bhardwaj and Eshita Gupta in their analysis; Analyzing the Energy-Efficiency Gap; An Empirical Analysis of Air conditioners in the Household Sector of Delhi have explained that individual's habits, attitude, awareness of energy efficiency measures and perceptions significantly determine the size of the energy efficiency gap. A central role information can play in guiding investment in energy efficient technologies. Sufficient information has significant impact on reduction in the expected private energy efficiency gap from 10 % to 20 % at the household level.

Ramya.L.N, published a case study in which he states that placing the existing ceiling fans and lights with 5-star rating appliances can reduce the energy consumption by 82.37 kWh per month. Using sensor based switching model can reduce the energy consumption by 18.95 kWh per month. CF6 emissions are controlled to greater extent when 5 star rated appliances are used, thus making the system environment friendly. Simple steps such as keeping refrigerator in optimal temperature, unplugging the plugs when the appliance is not in use, enabling the computer in sleep mode when inactive for a long period and setting the air conditioner in optimal temperature can reduce the bill. For every kilowatt hour of energy saved, 0.9 kg of carbon dioxide emission is reduced.

Lesic V, Bruin de Bruin, Davis mentions that the Background Policy makers and program managers need to understand consumers' perceptions of their energy use and savings to design effective strategies for promoting energy savings. He has stated that (1) Electricity use is often overestimated for low-energy consuming appliances and underestimated for high-energy consuming appliances; (2) Curtailment strategies are typically preferred over energy efficiency strategies. (3) Consumers lack information about how much electricity can be saved through specific strategies. (4) Consumers use heuristics for assessing the electricity use of specific appliances. However, there are variations in the measurement of perceived and actual electricity use.

Mark cooper, Director of Research, Consumer Federation of America states that the public overwhelmingly believes that improving appliance energy efficiency is beneficial and strongly supports appliance efficiency standards. Those people who are aware of minimum efficiency standards set by the government, support them. They are willing to pay more for the product knowing that the additional cost will be made up over time in lower energy bills. They will ultimately save money. Public recognition of the benefits of efficiency and support for performance standards is consistent across products and across time.

YashShukla, Rajan Rawal, Sophie Shnapp, in their paper; Residential buildings in India: Energy use projections and savings potentials, put forth that energy consumption from residential buildings is predicted to rise by more than eight times by 2050. It is crucial for India to develop energy-efficiency strategies focused on the residential sector to limit the current unsustainable escalating energy demand. Projections show that the electricity consumption will rise by more than eight times under the business-as-usual scenario. With the focused policy and market efforts, the electricity rise in residential sectors can be restricted to multiple folds that of current energy use under modest, aggressive and very aggressive scenarios.

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RESEARCH GAP

Most of the studies related to consumer behavior are focused on FMCG products and consumer durables. It is also found that significant amount of research has being done on electrical consumer durables. This study is specifically focused on Energy efficient electrical home appliances as this specific segment of electrical products has not given sufficient importance for studying consumer behavior.

III. SCOPE OF THE RESEARCH

This research is taken over in Pune city to understand consumer behavior towards Energy efficient electrical home appliances. Research also aims to study various dimensions of consumer behavior like awareness and factors affecting consumer behavior. The relationship between the purchase decision of Energy efficient electrical home appliance and factors affecting the decisions is established in this research study. This research study is taken over during 2019 which is highly vibrant in terms of technological innovations and consumer behavior as well.

IV. RESEARCH METHODOLOGY

The descriptive research design is adapted to test hypothetical relationships. A quantitative study is carried out with the help of structured questionnaire to collect primary data. The questionnaire is circulated using social media platforms to 417 respondents with purposive sampling technique. The variables coded in the forms of questions are measured using nominal and Likert scale.MS-Excel & SPSS tools are used for analyzing the data in order to justify objectives and to test hypothesis. One sample test is carried out to know the preference for variables regarding various aspects about energy efficiency, considered while consumer buying. Variance is determined to identify the most preferable factor while buying electrical appliance. Grouping of variables according to the importance given by consumers is found out through component matrix. The most important source of information is determined through Component Matrix.

V. OBJECTIVES

- To understand consumer behavior towards Energy efficient electrical home appliances.
- To identify important factors affecting purchase decision of Energy efficient electrical home appliances.
- To determine the most effective source of information regarding Energy efficient electrical home appliances.

VI. HYPOTHESES

- H0= There is no significant correlation between Preference given to EEEHA and consumer perception towards elements of EEEHA marketing mix.
- H1= There is significant correlation between Preference given to EEEHA and consumer perception towards elements of EEEHA marketing mix.

VII. DATA ANALYSIS

Objective 1: To understand consumer behavior towards Energy efficient electrical home appliance.

Mean analysis and t-test distribution is estimated to understand consumer behavior towards Energy efficient electrical home appliances. The level of agreement of consumers towards their opinion about Energy efficient electrical home appliances is measured on five point Likert scale. The mean more than 3 and close to 5 describes their positivity and the mean less than 3 and close to 1 describes their negativity towards the statement. Mean and t-test results are shown in tables below:

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One-Sample Statistics				
	List of Variables	Mean	Std. Deviation	Std. Error Mean
EEE home appliances are sufficiently available in the market	417	1.51	1.156	.057
There are many promotional schemes of various companies for EEEH	417	2.42	1.583	.077
Buying EEE home appliances significantly saves electricity bill	417	3.34	1.842	.090
It sometimes becomes difficult to buy EEEHA due to its high cost	417	3.47	1.668	.082
EEE home appliances are more reliable	417	2.65	1.736	.085
EEEHA are preferable to buy as their usage cost is lower	417	2.62	1.631	.080
I have bought EEEHA mostly by availing schemes offered by the companies	417	2.12	1.481	.073
I am aware of the Government energy efficiency standards for EEEHA	417	2.46	1.449	.071
I will attend a training programme on awareness of EEEHA	417	2.12	1.424	.070
Electrical store audit by the concern authority is 4 for reliability of the	417	3.45	1.873	.092
I am aware of Standard and Labelling Programme of the Ministry of Power, India	417	2.15	1.518	.074
I am aware of the Government programs for energy saving	417	2.01	1.311	.064
Considerable variation is there in the pricing of EEEHA having the same category	417	3.67	1.492	.073
Dealers provide detailed information about benefits of EEEHA	417	1.85	.820	.040

One-Sample Test						
	Test Value = 3					
	List of Variables	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
EEE home appliances are sufficiently available in the market	-26.342	416	.000	-1.492	-1.60	-1.38
There are many promotional schemes of various companies for EEEH	-7.426	416	.000	-.576	-.73	-.42
Buying EEE home appliances significantly saves electricity bill	3.775	416	.000	.341	.16	.52
It sometimes becomes difficult to buy EEEHA due to its high cost	5.724	416	.000	.468	.31	.63
EEE home appliances are more reliable	-4.061	416	.000	-.345	-.51	-.18
EEEHA are preferable to buy as their usage cost is lower	-4.804	416	.000	-.384	-.54	-.23
I have bought EEEHA mostly by availing schemes offered by the companies	-12.138	416	.000	-.880	-1.02	-.74
I am aware of the Government energy efficiency standards for EEEHA	-7.638	416	.000	-.542	-.68	-.40
I will attend a training programme on awareness of EEEHA	-12.552	416	.000	-.875	-1.01	-.74

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Electrical store audit by the concern authority is 4 for reliability of the 2	4.916	416	.000	.451	.27	.63
I am aware of Standard and Labeling Programme of the Ministry of Power, India	-11.451	416	.000	-.851	-1.00	-.71
I am aware of the Government programs for energy saving	-15.390	416	.000	-.988	-1.11	-.86
Considerable variation is there in the pricing of EEEHA having the same category	9.156	416	.000	.669	.53	.81
Dealers provide detailed information about benefits of EEEHA	-28.678	416	.000	-1.151	-1.23	-1.07

All the significant t-test values justify the interpretations of mean values that shown in above tables

Objective 2: To Identify Important Factors Affecting Purchase Decision of Energy Efficient Electrical Home Appliances

Factor Analysis test with principle component method is used with the help of SPSS tool to find out the most important parameters affecting purchase decision of Energy efficient electrical home appliances

Communalities		
	Initial	Extraction
Energy savings	1.000	.590
Price	1.000	.601
Aesthetics	1.000	.527
Quality	1.000	.642
Safety	1.000	.642
Power rating	1.000	.638
Technological Innovation	1.000	.579
Energy efficiency class	1.000	.335
Warranty	1.000	.637
Customer Support	1.000	.906
Brand name	1.000	.640
Convenient Size	1.000	.434
Customer Review	1.000	.811
Resulting Pollution	1.000	.457
Payback Period	1.000	.376
Product Trust	1.000	.802
Appropriate usage awareness	1.000	.780
Extraction Method: Principal Component Analysis.		

Component Matrix[a]		
	Component	
	1	2
Energy savings	.473	.605
Price	.757	.165
Aesthetics	.402	.604
Quality	.801	-.018
Safety	.801	-.018
Power rating	.481	.638
Capacity	.896	.030
Technological Innovation	.539	.537
Energy efficiency class	.260	.517
Warranty	.793	.088
Customer Support	.815	-.492
Brand name	.486	-.635
Convenient Size	.650	.108
Customer Review	.550	-.713
Resulting Pollution	.256	.625
Payback Period	.604	.109
Product Trust	.833	-.328
Appropriate usage awareness	.709	-.527
Extraction Method: Principal Component Analysis.		
a. 2 components extracted.		

Principle component analysis method was used while performing factor analysis. Based on which two components, are extracted among all variables having Eigen value greater than 1. Both the components have grouped closely related variables affecting purchase decision of Energy efficient electrical home appliances. Capacity, Product Trust and Customer Support formed first group with highest factor weightage affecting purchase decision of Energy efficient electrical home appliances. Second group of factor affecting purchase decision of Energy efficient electrical home appliances is formed by Power rating, Resulting Pollution and Energy savings

Objective 3: To Determine the most Effective Source of Information Regarding Energy Efficient Electrical Home Appliances

Factor Analysis test is used with the help of SPSS

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tool to determine the most effective source of information regarding Energy efficient electrical home appliances. The test statistics have highly significant (α=0.000) results and it proves that the variables used for the test do fit in hypothesized relation.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.488
Bartlett's Test of Sphericity	Approx. Chi-Square	2802.794
	df	36
	Sig.	.000

Communalities

	Initial	Extraction
TV commercials	1.000	.002
Internet	1.000	.023
Social media	1.000	.802
Electrical retail shop	1.000	.035
Magazine	1.000	.815
Newspaper	1.000	.562
Hoarding	1.000	.025
From Relatives/Friends	1.000	.372
Mobile phone	1.000	.872
Extraction Method: Principal Component Analysis.		

Total Variance Explained

Component		Initial Eigenvalues			Extraction Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
dimension 0	1	3.509	38.987	38.987	3.509	38.987	38.987
	2	1.915	21.273	60.260			
	3	1.402	15.578	75.838			
	4	1.060	11.774	87.612			
	5	.390	4.338	91.950			
	6	.321	3.561	95.512			
	7	.254	2.826	98.337			
	8	.121	1.339	99.677			
	9	.029	.323	100.000			
Extraction Method: Principal Component Analysis.							

Component Matrix[a]

	Component
	1
TV commercials	.904
Internet	-.152
Social media	.896
Electrical retail shop	-.187
Magazine	.603
Newspaper	.750
Hoarding	.159
From Relatives/Friends	.610
Mobile phone	.734
Extraction Method: Principal Component	

Principle component analysis method has extracted single component based on Eigen value showing a factor weightage of the most effective source of information regarding Energy efficient electrical home appliances. A descending order of most important source of information are TV commercials, Social media, From Newspaper, Mobile phone, From Relatives/Friends, Magazine.

VIII. HYPOTHESES TESTING

- **Hypothesis 1**: H0= There is no significant correlation between Preference given to EEEHA and consumer perception towards elements of EEEHA marketing mix.
- H1= There is significant correlation between Preference given to EEEHA and consumer perception towards elements of EEEHA marketing mix.

A correlation analysis is performed to test null hypothesis stating that there is no significant

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correlation between Preference given to EEEHA and consumer perception about elements of EEEHA marketing mix.

Correlations

		Preference to EEEHA	Buying EEE home appliances significantly saves electricity bill	EEE home appliances are more reliable	Quality	Safety	Power rating	Warranty	Customer Support
Preference to EEEHA	Pearson Correlation	1	0.845	0.714	.683**	.683**	0.071	.340**	.717**
	Sig. (2-tailed)		0.087	0.148	0	0	0.15	0	0
	N	417	417	417	417	417	417	417	417

It is found that there exists a strong significant correlation between Preference given to EEEHA and consumer perception towards elements of EEEHA marketing mix based on the significant values is shown in above table

Correlations

		Preference to EEEHA	There are many promotional schemes of various companies for EEEH	It sometimes becomes difficult to buy EEEHA due to its high cost	EEEHA are preferable to buy as their usage cost is lower	Price	I have bought EEEHA mostly by availing schemes offered by the companies
Preference to EEEHA	Pearson Correlation	1	0.258	-.380**	.386**	.532**	-0.008
	Sig. (2-tailed)		0.612	0	0	0	0.877
	N	417	417	417	417	417	417

It is found that there exists a strong significant correlation between, 'Preference given to EEEHA and consumer perception about the promotional strategies of elements of EEEHA marketing mix based on the significant values', as shown in the table.

Correlations

		Preference to EEEHA	EEE home appliances are sufficiently available in the market	I am aware of Standard and Labelling Programme of the Ministry of Power, India	Dealers provide detailed information about benefits of EEEHA
Preference to EEEHA	Pearson Correlation	1	.179**	-.477**	-.219**
	Sig. (2-tailed)		0	0	0
	N	417	417	417	417

A correlation between, 'Preference to EEEHA and EEE home appliances are sufficiently available in the market', is significantly positive at 0.179, 'Preference to EEEHA and awareness of Standard and Labeling Programme of the Ministry of Power India', is significantly negative at the level of -.477 whereas the correlation between, Preference to EEEHA and Dealers provide detailed information about benefits of EEEHA, is found significantly negative at the level of -.219.

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Correlations							
		Preference to EEEHA	I am aware of the Government programs for energy saving	I will attend a training programme on awareness of EEEHA	I am aware of the Government energy efficiency standards for EEEHA	Dealers provide detailed information about benefits of EEEHA	I have bought EEEHA mostly by availing schemes offered by the companies
Preference to EEEHA	Pearson Correlation	1	-0.096	.264**	-.334**	-.219**	-0.008
	Sig. (2-tailed)		0.051	0	0	0	0.877
	N	417	417	417	417	417	417

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The relation between, 'Preference to EEHA and 'I am aware of the Government programs for energy saving' is tested with the correlation test for statistical significance and it is found that there is a negative correlation between them.

The relation between, 'Preference to EEHA and 'I will attend a training programme on awareness of EEEHA' is tested with the correlation test for statistical significance and it is found that there is a positive correlation between them.

The relation between, 'Preference to EEHA and 'I am aware of the Government energy efficiency standards for EEEHA' is tested with the correlation test for statistical significance and it is found that there is a negative correlation between them.

The relation between, 'Preference to EEHA and 'Dealers provide detailed information about benefits of EEEHA' is tested with the correlation test for statistical significance and it is found that there is a negative correlation between them.

The relation between, 'Preference to EEHA and 'I have bought EEEHA mostly by availing schemes offered by the companies' is tested with the correlation test for statistical significance and it is found that there is a negative correlation between them.

Expected value of correlation test was +/-1 and observed values are -0.096, .264**,-.334**, -.219** and-0.008 at significance of less than 0.05 levels. So the null hypothesis is rejected.

IX. FINDINGS

- Customer Support, Customer review, Product Trust and Reliability are the most important factors considered by consumers while buying electrical home appliances.
- They are followed by Brand name, Appropriate usage, Safety, Quality, Warranty and Power rating.
- Capacity, Product Trust and Customer Support formed first group with highest factor weightage affecting purchase decision of Energy efficient electrical home appliances. Second group of factor affecting purchase decision of Energy efficient electrical home appliances is formed by Power rating, Resulting Pollution and Energy savings.
- Magazine is found to be the most important source of information regarding Energy efficient electrical home appliances. Then the information sources; Social media and Mobile phones assume the second position.

X. CONCLUSION AND DISCUSSION

As Customer Support, Customer review, Product Trust and Reliability are the most important factors considered by consumers while buying electrical home appliances, importance must be given to

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awareness, appropriate usage programs also for Energy efficient electrical appliances. Preference for Energy efficient electrical appliances does not seem to be noticed prominently as compared to the mentioned factors.

Television Commercials is found to be the most important source of information regarding Energy efficient electrical home appliances. Then importance is given to Social media and Newspaper and Mobile phones. These sources of information should be used to their maximum extent to spread awareness about Energy efficient electrical appliances.

Limitations And Scope For Further Research

- The research study is conducted in Pune city and nearby areas.
- There is no specific Electrical home appliance considered for the study.

Scope for Further Research

- A study can be conducted covering respondents across the state or the country.
- A study can be carried out regarding consumer expectations towards energy efficient electrical home appliances.

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