AN EMPIRICAL STUDY ON FACTORS AFFECTING ELECTRICITY SAVING HABITS AMONG PEOPLE IN URAN AREA

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Abstract
This study explores the factors affecting electricity saving habits among people of Uran area of Raigad District of Maharashtra. Out of 300 questionnaires administered among rural people of 15 villages in Uran, only 170 were returned with useful responses (N=170). The findings of the study revealed that the scale used for the study was reliable with Cronbach's alpha value of 0.633 ($p<0.05$). Factor analysis was done on the data to reduce the variables into specific small number of factors. The sample used for the test was found to be adequate. 5 factors were extracted from 14 variables. 5 factors which have impact on electricity saving habits were saving attitude, environmental concern, promotional and policy measures, use of alternative source of electricity and social influence.

Introduction and Theoretical Framework

It is a well known fact that energy can neither be produced nor destroyed. But the sources from which the energy is harnessed are likely to be depleted. Further, to generate electricity most of the power plant burns coal, crude oil or other fossil fuels which creates extra carbon waste that traps too much of heat. This can impact our natural resource like land as well as our lives of living beings.

Energy Statistics 2017 reflect that there is an increasing demand for electricity from domestic sector (i.e. households). Cutting down electricity at household level reduces the demand for electricity that power plants have to produce. Subsequently, it will also reduce the amount of fossil fuels that are burned each day. Even a small change can make a great difference. But still there is an unresolved mystery pertaining to electricity saving habits.

On one hand, there are lot of research on electricity saving attitudes of people (Sony, Michael & Mekoth, Nandakumar, 2018; Zhang, Yixiang, Wang, Zhao-Hua and Zhou, Guanghui, 2012) and on the other hand, various research studies explicitly state that there is a huge amount of untapped potential in developing electricity saving habits among people (Boegle, Singh and Sant, 2019).

Therefore, it becomes necessary to determine the factors affecting electricity saving habits among people.

Objectives of the study

The following objectives were considered for the study:

1. To study the existing literature on electricity saving habits among people.
2. To explore factors affecting electricity saving habits among the people in Uran area.
3. To provide suggestions based on the findings of the study.

Research Methodology

Research design

This study uses quantitative method to collect and analyse data with the help of self developed questionnaire. The questionnaire was specifically designed to address research objective of determining factors affecting electricity saving habits of people in Uran.

To determine factors to be used in the study, an extensive review of the existing literature available on the subject matter has been made. Further to make the factors more relevant to the actual scenario of rural areas, focus group interview was conducted with those types of respondents who will form the actual sample base of the study. By combining both the sources, 14 variables were selected for the study viz.,

1. Perception about saving
2. Electricity cost
3. Awareness about environmental issues
4. Perception towards environmental issues
5. Cost and maintenance of alternative sources of electricity (e.g. solar)
6. Legislative measures
7. Electricity saving campaigns
8. Electricity saving advertisements
9. Government policy
10. Complexity of information (use of technical jargon)
11. Usage by friends and neighbours
12. Religious belief
13. Availability of alternative sources of electricity
14. Availability of information

Data Collection, Instrumentation and Sampling

Primary as well as Secondary data was used for study. Secondary data was collected from research paper, online article published. It was used to frame up the study. For collection of primary data, a self-developed questionnaire was administered. Total 300 respondents of different villages from Uran area were selected using multi stage random sampling. At first stage of sampling, a systematic sampling was used to select villages. Every fourth village on list of district census handbook: Raigarh was selected for study. Thus 15 villages were selected for the study. In second stage, on basis of information of houses in census in those selected villages, 20 houses were randomly selected by using an online randomizer utility (Haahr, 2019) for the study. The self-developed questionnaire was then administered to selected 300 respondents. The questionnaire consists of 1 question for 14 variables each the responses of which were recorded on 5 point Likert scale of agreement ranging from 5= strongly agree, 4= agree, 3= neutral, 2= disagree, 1= strongly disagree. One member of family present at time of data collection was asked to fill up questionnaire. Out of 300 responses, only 170 responses were found complete and useful for the study (N=170).

Data analysis and interpretation

The crucial part of analyzing the data was carried out entirely by using IBM SPSS Statistics ver. 23. For analyzing the data, Factor analysis with Principal Components Analysis (PCA) extraction method and Varimax rotation method with Kaiser Normalization measure was considered suitable. Factor analysis is a widely used data reduction technique and since the main aim of the study was to reduce the 14 variables into more comprehensible number of factors; factor analysis was considered suitable. Varimax rotation was used as it is one of the most widely used methods with an underlying assumption that the variables are orthogonal (uncorrelated).

Since the variables were measured as ordinal data (i.e. on a 5-point Likert Scale), the reliability of such scale to measure the underlying construct was measured by Cronbach's alpha.

Table 1: Cronbach's alpha [Source: Field Study (Primary Data]

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.633	.639	14

The Cronbach's alpha value was 0.633 (refer table 1). Since the value is greater than the accepted level of 0.5, the scale is considered to be reliable.

To justify running PCA on the sample dataset, we need to evaluate output of three aspects, viz.,

a. *Kaiser-Meyer-Olkin Test of sample adequacy* [Kaiser-Meyer-Olkin Test of sample adequacy was used to ensure whether the sample was adequate to justify running PCA.]
b. *Bartlett's Test of Sphericity* [Bartlett's test is used to test if *k* samples have equal variances (i.e. homogeneity of variances).]

c. *Communalities* [This aspect is evaluated to confirm that each item shared some common variance with other items. As a standard practice, it was decided to retain only those variables having communalities above 0.4]

Table 2: KMO and Bartlett's Test [Source: Field Study (Primary Data)]

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**.623**
Bartlett's Test of Sphericity	Approx. Chi-Square	349.316
	df	91
	Sig.	**.000**

Table 3: Communalities [Source: Field Study (Primary Data)]

Communalities

	Initial	Extraction
Perception about saving	1.000	.672
Electricity cost	1.000	.677
Awareness about environmental issues	1.000	.678
Perception towards environmental issues	1.000	.545
Cost and maintenance of alternative sources of electricity	1.000	.720
Legislative measures	1.000	.590
Electricity saving campaigns	1.000	.526
Electricity saving advertisements	1.000	.615
Government policy	1.000	.680
Complexity of information (use of technical jargon)	1.000	.396
Usage by friends and neighbours	1.000	.692
Religious belief	1.000	.583
Availability of alternative sources of electricity	1.000	.518
Availability of information	1.000	.396
Extraction Method: Principal Component Analysis		

The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.623, above the commonly recommended value of 0.5 and Bartlett's test of sphericity was significant ($\chi 2$ (91) = 349.316, $p<0.05$) (refer table 2). However, not all communalities were at the expected level of above 0.4. Hence those variables [Availability of information (0.396), Complexity of information (use of technical jargon) (0.396)] were excluded from further analysis (refer table 3). Factor analysis was run once again, this time after removing the two variables of availability of information and complexity of information (use of technical jargon) respectively. The new output was evaluated on the same tests as above. The results obtained were as followed:

Table 4: KMO and Bartlett's Test (Re-running FA)

Source: Primary Data

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.597
Bartlett's Test of Sphericity	Approx. Chi-Square	292.843
	df	66
	Sig.	.000

Table 5: Communalities (Re-run) [Source: Field Study (Primary Data)]

Communalities		
	Initial	Extraction
Perception about saving	1.000	.645
Electricity cost	1.000	.674
Awareness about environmental issues	1.000	.695
Perception towards environmental issues	1.000	.546
Cost and maintenance of alternative sources of electricity	1.000	.720
Legislative measures	1.000	.619
Electricity saving campaigns	1.000	.570
Electricity saving advertisements	1.000	.656
Government policy	1.000	.699
Usage by friends and neighbours	1.000	.717
Religious belief	1.000	.691
Availability of alternative sources of electricity	1.000	.630
Extraction Method: Principal Component Analysis.		

For the second run, KMO measure of sampling adequacy was 0.597 (refer table 4), above the commonly recommended value of 0.5 and Bartlett's test of sphericity was significant ($\chi 2$ (66) = 292.843, $p<0.05$). Finally, all communalities were at the expected level of above 0.40 (refer table 5) which further confirms that each item shared some common variance with other items. Given these overall indicators, factor analysis was deemed to be suitable with only 12 out of the 14 variables initially selected.

Once the use of factor analysis is justified, we need to further analyze two main output tables from the output generated in SPSS. They are:

1. Total Variance Explained
2. Rotated Component Matrix

Table 6: Total Variances Explained [Source: Field Study (Primary Data]

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.377	19.808	19.808	2.377	19.808	19.808	1.719	14.323	14.323
2	1.614	13.449	33.257	1.614	13.449	33.257	1.639	13.657	27.981
3	1.529	12.740	45.997	1.529	12.740	45.997	1.623	13.526	41.507
4	1.290	10.749	56.746	1.290	10.749	56.746	1.482	12.349	53.855
5	1.054	8.784	65.530	1.054	8.784	65.530	1.401	11.674	65.530
6	.804	6.703	72.233						
7	.769	6.410	78.643						
8	.575	4.790	83.433						
9	.552	4.600	88.034						
10	.533	4.445	92.479						
11	.501	4.175	96.654						
12	.401	3.346	100.000						
Extraction Method: Principal Component Analysis									

Table 7: Rotated Component Matrix [Source: Field Study (Primary Data])

Rotated Component Matrix[a]					
	Component				
	1	2	3	4	5
Perception about saving	**.804**				
Electricity cost	**.688**				
Awareness about environmental issues		**.785**			
Perception towards environmental issues		**.783**			
Cost and maintenance of alternative sources of electricity				**.543**	
Legislative measures			**.741**		
Electricity saving campaigns			**.683**		
Electricity saving advertisements			**.570**		
Government policy			**.799**		
Usage by friends and neighbours					**.453**
Religious belief					**.768**
Availability of alternative sources of electricity				**.669**	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 10 iterations.

Kaiser's rule was used to determine which factors were most eligible for interpretation because this rule requires that a given factor is capable of explaining at least the equivalent of one variable's variance. This is not unreasonable given that factor analysis has as its objective reducing several variables into fewer factors. Using this rule, five factors were extracted (see Table 6). Together they are capable of explaining roughly 65.53% of all the variable variances.
The results of an orthogonal rotation of the solution are shown in Rotated Component Matrix (see Table 7). When loadings less than 0.40 were excluded, the analysis yielded a five-factor solution with a simple structure (factor loadings =>0.40).

Labeling the five factors

Two items loaded onto Factor 1 relates to perception and cost. This factor was labeled as ***"SAVING ATTITUDE"***.
Two items loaded onto Factor 2 relates to awareness and perception towards environmental issues. This factor was labeled as ***"ENVIRONMENTAL CONCERN"***.
Four items loaded onto Factor 3 relates to government policy, legislative measures, advertisements and campaigns. This factor was labeled as ***"PROMOTIONAL AND POLICY MEASURES"***.
Two items loaded onto Factor 4 relates to availability and cost of alternative sources of electricity. This factor was labeled as ***"USE OF ALTERNATIVE SOURCE OF ELECTRICITY"***.
Two items loaded onto Factor 5 relates to usage by friend and neighbours and religious beliefs. This factor was labeled as ***"SOCIAL INFLUENCE"***.

Recommendations

The study, based on the 5-factor model proposed above, has following recommendations:

1. Effective government intervention in form of policies and legislations should be devised to encourage electricity saving habits.
2. Advertisements and campaigns specifically showing comparative benefits of saving electricity should be designed and broadcasted/ published instead of focusing on energy in general.
3. Awareness regarding alternative sources especially emphasizing the subsidies should be made among the people to encourage them to adopt such alternative sources.

Limitations of study

- This study is restricted to geographical area of Uran only.
- Sample size of 170 respondents is assumed to be sufficient for conducting the research.
- The response of the respondents might be subject to personal bias.

Conclusion

The study has effectively attempted to determine factors that affect electricity-saving habits among people in Uran. The study has proposed a 5-factor model for the purpose and has also laid out certain recommendations for improving electricity-saving habits among people in Uran. Thus, this research has provided valuable knowledge and information to encourage electricity-saving habits among people in Uran as it is one of the best alternative to reduce the ever-rising cost of electricity thereby reducing the pressure on non-renewable resources.

References

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