An empirical study on consumer buying behaviour towards solar energy products.

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Abstract

The solar power industry has fast development and its systems are now available for both commercial as well as domestic use with enhanced advantages at very low cost of maintenance. The purpose of this paper is to understand consumer buying behaviour towards solar energy products. It includes the factors that make consumers to buy solar energy products. The population area selected for the research is Gujarat state, the sample size selected for this research is 200 and we have used the convenience sampling technique.The methodology adopted in this research is descriptive research. A standard and structured questionnaire has been used during the survey as a tool for researchers to find the level of importance of each factor. The response of common people have been collected. They will be asked to rate the factors on a Likert Five Point scale in agreement with the statements and the scale range from 1=strongly disagree to 5=strongly agree.Our findings reveal that indicated that among the twelve factors selected for this research the most attractive and affecting factor for consumer behaviour towards solar power products in Gujarat State is Eco-friendly products, following Performance as the second most affecting, and thirdly Environmental Concern, fourth Cost, and fifth Perceived Usefulness and Value, sixth Enhancing Efficiency. Results have also shown that Size, Company and Product Information, Government Initiatives, Perceived Ease of Use and Social Influence are of important concern among consumer buying behaviour towards Solar Energy Products.It is expected that this study will help solar energy products sellers in Gujarat State to devise successful strategies for selling solar energy products but it will also provide a base for similar studies in the field of consumer behaviour towards solar energy products.

Key Words: Solar energy products, Consumer behaviour, Government initiatives, cost.

1. Introduction

Renewable energy has started playing an increasingly important role in the augmentation of grid power, providing energy access, reducing consumption of fossil fuels and helping India pursue its low-carbon development path.Solar energy accounts for around 6310 MW of Gujarat's total renewable energy production of 17,041 MW. The state has set a target of raising its renewable energy capacity to 68,000 MW by 2030. Energy is a very important factor and an unavoidable component of economic development. It is also significant for improving and maintaining the quality of life.

Consumer behaviour towards solar energy products refers to their psychological state of mind in terms of making purchases of solar energy products. Before making a final purchase of solar energy products, consumers are flooded by several factors

which limit or influence consumers for the final decision.

The main purpose of the study is to know the factors that affect consumer buying behaviour towards solar energy products. We focus on how consumers form such behaviour with the help of models.

Our problem area which is Consumer behaviour toward solar energy products will determine the attractive factors that affect consumers at the time of buying behaviour of solar energy products and those factors will help marketers to formulate their strategies for selling solar energy products. As our area of research is Gujarat so our research thesis will not only be helpful for marketers in general but specifically will be helpful for the marketers in Gujarat.

2. Review of Literature

Kumar, Vikas & Hundal, Bikramjit & Kaur, Kulwinder. (2019). This paper aimed to identify the factors influencing farmers' intention to purchase solar water pumping systems. It is depicted from the analysis that the foremost factor influence is "Cost", followed by the "Performance" and "Government Initiatives" dimensions. The results of the analysis confirmed that consumer buying behaviour is significantly determined by cost, government initiatives and performance dimensions. However, dimensions such as eco-friendly products, information regarding the product and company, environmental concern and social influence were found insignificant.

Kumar, V., Hundal, B. S., & Kaur, K. (2019). The study revealed that five factors namely reliability, responsiveness, assurance, empathy, and tangibility affect the service quality of solar product dealers and there is no significant difference between perceptions and expectations of solar product users except for the one dimension i.e. responsiveness. So far as gap analysis is concerned, the dimension 'responsiveness' was responsible for the highest gap score. So, the perceptions of solar product users are not completely met with their expectations.

Ayoub, Sohail & Dastgir, Ghulam & Waqas, Muhammad. (2019). In this study, it was found that four factors (Perceived Usefulness, Perceived ease of use, Attitude towards solar energy, and Cost of using solar energy) that impact the consumer purchase intentions regarding solar energy application at the domestic level. All four independent variables were analyzed with the dependent variable of consumer purchase intentions and it was found that all four factors significantly impact consumer purchase intentions.

Adam Faiers, Charles Neame(2006). The study found that the difficulties to the adoption of domestic solar systems lie primarily with the financial aspects of the systems. And with product development, the economic, operational and aesthetic aspects could be improved and with the use of sensible marketing strategies that spread awareness of the innovation and improve its visibility, the potential for solar power is greatly enhanced.

Kumar, Vikas & Hundal, Bikramjit & Syan, Amanjot. (2020). The study shows that customer attitude towards solar products is significantly determined by green purchase behaviour and government initiatives. However, dimensions such as environmental knowledge, promotion and advertisement, environmental concern, and peer influence were not found significant to

the customer attitude towards solar energy products.

Prakash, G. and Pathak, P. (2017). The study revealed that purchase intention towards eco-friendly packaging is significantly influenced by personal norms, attitude, environmental concern and willingness to pay. This study also provides interesting insights about young consumers towards eco-designed packaging. These useful insights will helpful to marketers in developing focused strategies towards young consumers and encourage them to reduce the global ecological footprint of packaging.

Jaiswal, D. and Singh, B. (2018) The study revealed that the measure of variables "environmental concern" and "perceived consumer effectiveness" were found to be a positive and significant predictor of attitude towards green products, however, "perceived environmental knowledge" was not significantly related to attitude towards green products and perceived consumer effectiveness in the model. The discussion and implications are manifested towards sustainable consumption in the context of emerging target markets.

3. Objectives of Study

1. To understand the consumer buying behaviour towards solar energy products.
2. To identify and analyze the factors affecting consumer buying behaviour towards solar energy products.
1. To examine the relationship between underlying factors and consumer buying behaviour.

4. Research Methodology

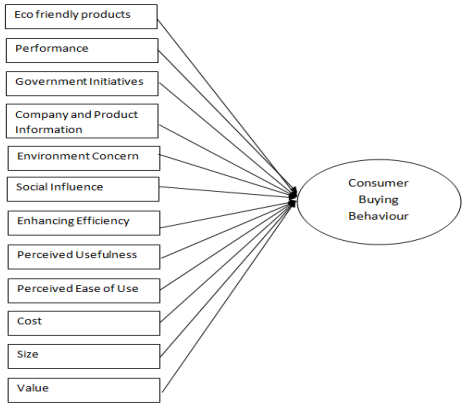
The study aimed to understand consumer buying behaviour towards solar energy products. It includes the factors that make consumers buy particular solar energy products. Respondents were selected from Gujarat state because it had convenient for the researcher. The sample selected had at least an awareness of solar energy products. The size of the sample selected was 200. A descriptive research design has been used for the study. Descriptive research studies are those that are concerned with describing the characteristics of a particular individual or group. The respondents were selected based on the convenient sampling technique. The researcher collected primary data from Surveys with the help of self-administered questionnaires. The close-ended questionnaire was used for data collection to reduce the non-response rate and errors. The questionnaire has been divided into two different sections, in which the first section consists of introductory questions that give the details of the demographic profile of the consumers and their awareness of solar energy products and the second section consists of questions related to the main research area related question.

To study the factors affecting consumer buying behaviour towards solar energy products, a five-point Likert scale with responses ranging from "Strongly agree" to "Strongly disagree", with the following equivalencies, "strongly disagree" = 1, "disagree"= 2, "neutral" = 3, "agree" = 4and "strongly agree" = 5 was used in the questionnaire with a total of 12 items.

Data was collected through Google Forms. After collecting the data, a reliability test based on Cronbach’s Alpha value was measured, for analysis of demographic profile descriptive statistics were used, and factors analysis was performed on SPSS

using a correlation regression test to find the relationship between independent variables and dependent variable and the impact of various factors on consumer behaviour towards solar energy products.

Figure 1: Conceptual framework of the study.



5. Data Analysis and Discussion

Table 1: Frequency distribution of demographic variables

Table1: Demographic Profile of Respondents			
Respondents		Frequency	Percentage
Gender	Male	104	52.0
	Female	96	48.0
Age	15-25	173	86.5
	26-35	16	8.0
	36-45	8	4.0
	Above 45	3	1.5
Income	< 200000	122	61.0
	200001-400000	40	20.0
	400001-600000	24	6.0
	>600000	14	3.5
Education	Above Master Degree	12	6.0
	Post Graduate	59	29.5
	Graduate	70	35.0
	Undergraduate	59	29.5
Marital Status	Married	20	10.0
	Single	180	90.0
Occupation	Salaried Employee	96	48.0
	Business	65	34.5
	Professional	39	19.5
Total		200	100.0

Table 1 was drawn to understand the socioeconomic background of the respondents and it was found that out of the total sample (n=200)

Gender

We have divided the gender group into two categories and we found that 104 (52%) respondents are male and 96 (48%) respondents are female.

Age group

Further, we have divided the age group into four categories and we found that more than half that is 173 (86.5%) of respondents belong to the age group 15 to 25 years, while 16 (8%) respondents belong to the age group of 26 to 35, 8 (4%) respondents belong to the age group of 36-45 years of age and only 3 (1.5%) of respondents belong to above 45 years of age.

Income

We have categorized family annual income into four categories, It is observed that out of 200 respondents, 122 (40.6%) respondents are having annual income less than Rs. 200000, 40 (20%) respondents are having annual income in the group of Rs. 200001 to 400000, 24 (12%) respondents are having annual income in income group

Rs. 400001 to 600000 and 14 (7%) respondents are having annual income greater than Rs. 600000.

Education

We have categorized education levels into four categories i.e. Undergraduate, Graduate, Post Graduate, and Above Master Degree. It is observed that out of the total 200 respondents, 59 (29.5%) respondents are undergraduate, 70 (35%) respondents are graduate, 59 (29.5%) respondents are postgraduate and, 12 (6%) respondents are above postgraduate.

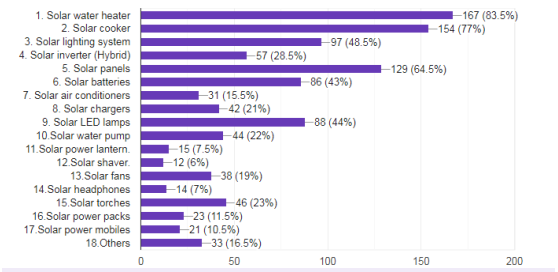
Marital Status

We have categorized marital status into two categories i.e. married and single and it is observed that more than half 180 (90%) respondents are single and 20 (10%) respondents are married.

Occupation

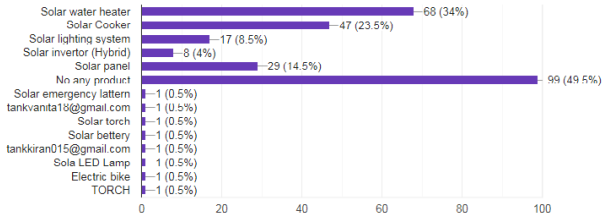
We have categorized occupation into three categories i.e. salaried employee, business and professional and it is observed that out of 200 respondents, 96(48%) respondents are salaried employees, 65(10.0%) respondents are doing business, and 59(29.5%) are professionals.

Figure 2: Number of respondents who know about different solar energy products.



From the above figure we come to know that out of 200 respondents, 167(83.5%) respondents know about the solar water heater, 154(77%) respondents know about solar cookers, 129(64.5%) respondents know about solar panels and about 97(48.9%) respondents know about solar lighting system.

Figure 3: Number of respondents who have different types of solar energy products.



From the above figure, we come to know that out of 200 respondents 101 (50.5%) respondents have solar energy products.

Table 2: Factor loading: Consumer buying behaviour.

Sr. No.	Factors	Factor loading
1	Eco-friendly products	.693
2	Performance	.838
3	Government initiatives	.783
4	Company and product information	.782
5	Environmental concern	.819
6	Social influence	.733
7	Enhancing efficiency	.791
8	Perceived usefulness	.846
9	Perceived ease of use	.803
10	Cost	.622
11	Size	.693
12	Value	.762

All the factors shown in the above table are related to the buying behaviour towards solar energy products. The respondents are

impacted by perceived usefulness to buy solar energy products which is inferred from the highest factor loading of 0.846, followed by 0.838-factor loading for performance, environmental concern with the factor loading of 0.819, followed by perceived ease of use which has the factor loading of 0.803, enhancing efficiency with factor loading 0.791, government initiatives with the factor loading 0.783, company and product information with factor loading 0.782, value with factor loading 0.762, social influence with 0.733, eco-friendly products and size with factor loading 0.693 and cost with factor loading 0.622.

Measures: Reliability and validity assessment.

The Cronbach's Alpha statistic was used to check the reliability of the scale developed for evaluation statements used in the questionnaire. The alpha coefficient for the 12 factors affecting consumer buying behaviour towards solar power products of the questionnaire is 0.934 suggesting that the items have relatively consistent as indicated in table-2.

Table 3: Reliability Statistics.

Reliability Statistics	Cronbach's Alpha	Items
Overall	0.934	12

Table 4: Respondents' opinions about the different attributes of solar energy products.

Attributes of solar energy products	SA (F)	A(F)	N(F)	D(F)	SD (F)	Total(F)
Energy saving	118	39	24	8	11	200
Cost-effective	71	46	55	13	15	200
Life long	77	50	56	7	10	200
Safety while using	84	60	35	9	12	200

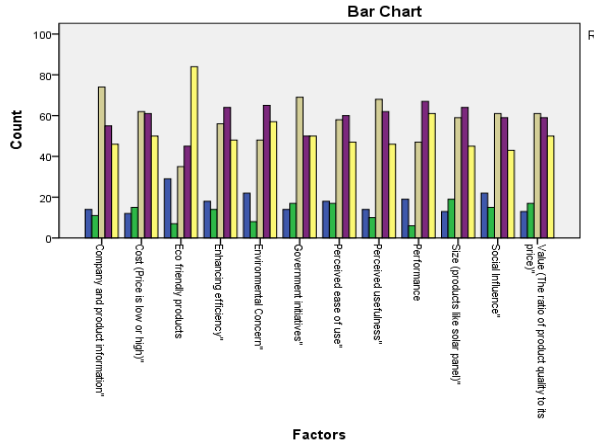
F = Frequency (N=200) SA = Strongly Agree, A= Agree, N= Neutral, D= Disagree, S.D. = Strongly Disagree.

Table 5: Frequency of respondents in respect of the level of agreeing with particular factors affecting their buying behaviour towards solar energy products.

Factor	SA (F)	A (F)	N (F)	D (F)	SD (F)	Total (F)
Eco-friendly products	84	45	35	7	29	200
Performance	61	67	47	6	19	200
Government initiatives	50	50	69	17	14	200
Company and product information	46	55	74	11	14	200

Environmental concern	57	65	48	8	22	200
Social influence	43	59	61	15	22	200
Enhancing efficiency	48	64	56	14	18	200
Perceived usefulness	46	62	68	10	14	200
Perceived ease of use	47	60	58	17	18	200
Cost	50	61	62	15	12	200
Size	45	64	59	19	13	200
Value	50	59	61	17	13	200

Figure 4: Respondents' response chart to factors affecting their buying behaviour towards solar energy products.



F = Frequency (N=200) SA = Strongly Agree, A= Agree, N= Neutral, D= Disagree, S.D. = Strongly Disagree.

To find the impact of different factors on consumer buying behaviour toward solar energy products, the researcher used a regression analysis test using SPSS.

Hypothesis formulation: -

H01 There is no impact of the factor 'Eco-friendly products' on consumer buying behaviour towards solar energy products.

H02 There is no impact of the factor 'Performance' on consumer buying behaviour towards solar energy products.

H03 There is no impact of the factor 'Government initiatives' on consumer buying behaviour towards solar energy products.

H04 There is no impact of the factor 'Company and product information' on consumer buying behaviour towards solar energy products.

H05 There is no impact of the factor 'Environmental concern' on consumer buying behaviour towards solar energy products.

H06 There is no impact of the factor 'Social influence' on consumer buying behaviour towards solar energy products.

H07 There is no impact of the factor 'Enhancing efficiency' on consumer buying behaviour towards solar energy products.

H08 There is no impact of the factor 'Perceived usefulness' on consumer buying behaviour towards solar energy products.

H09 There is no impact of the factor 'Perceived ease of use' on consumer buying behaviour towards solar energy products.

H010 There is no impact of the factor 'cost' on consumer buying behaviour towards solar energy products.

H011 There is no impact of the factor 'size' on consumer buying behaviour towards solar energy products.

H012 There is no impact of the factor 'value' on consumer buying behaviour towards solar energy products.

Factors affecting consumer buying behaviour towards solar energy products

Table 6: Squared correlation matrix of constructs

Descriptive statistics

Correlations													
	Consumer behaviour	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12
Consumer behaviour	1.000												
F1	.654	1.000											
F2	.674	.610	1.000										
F3	.606	.548	.723	1.000									
F4	.602	.477	.680	.618	1.000								
F5	.934	.596	.708	.589	.646	1.000							
F6	.641	.544	.573	.489	.529	.639	1.000						
F7	.587	.479	.612	.591	.548	.588	.594	1.000					
F8	.653	.493	.666	.610	.582	.656	.575	.717	1.000				
F9	.615	.504	.606	.545	.558	.616	.572	.632	.731	1.000			
F10	.345	.235	.435	.460	.483	.395	.362	.467	.515	.379	1.000		
F11	.484	.404	.483	.439	.438	.473	.425	.503	.539	.581	.540	1.000	
F12	.569	.474	.540	.541	.592	.555	.424	.495	.624	.602	.558	.615	1.000

F1=Eco-friendly products, F2=Performance, F3=Government initiatives, F4=Company and product information, F5=Environmental concern, F6=Social influence, F7=Enhancing efficiency, F8=Perceived usefulness, F9=Perceived ease of use, F10=Cost, F11=Size and F12=value

Correlation coefficients of variables

To examine the relationship between different variables we conducted the correlation test.

The following table shows the relationship of different variables with consumer buying behaviour towards solar energy products.

Table 8: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change
1	.947[a]	.897	.890	.414	.897

F1=Eco-friendly products, F2=Performance, F3=Government initiatives, F4=Company and product information, F5=Environmental concern, F6=Social influence, F7=Enhancing efficiency, F8=Perceived usefulness, F9=Perceived ease of use, F10=Cost, F11=Size and F12=value

The above table presents the summary of regression analysis results described as given below:

(1) R^2 accounted for 0.897 in the study showing that 89.7% of the variation of the dependent variable (customer behaviour towards solar products) was explained by twelve independent variables.

(2) An adjusted R^2 value which is the most useful measure of the success of a model shows the value of 0.890, i.e., which accounted for 89% of the variance in the dependent variable.

Apart from it, the value of R 0.947 shows a significant relationship exists between the dependent variable and independent variables.

Discussions of the results: -

The result of regression analysis represents that Null hypotheses for four factors eco-friendly product, government initiatives, environmental concern and cost were rejected at a 5% level of significance which described that these four factors have a significant impact on customer buying behaviour towards solar energy products.

Apart from these four factors, Null hypotheses for another eight factors were accepted at a 5% level of significance confirming that these eight factors namely performance, Company and product information, social influence, Enhancing efficiency, Perceived usefulness, Perceived ease of use, size and value have less impact on consumer buying behaviour towards solar energy products.

6. Findings:

1. The percentage of males is 52 (104 respondents) which is higher than the percentage of females i.e. 48(96 respondents).
2. A higher percentage of respondents (86.5%) are from the age group 15 to 25 years and a lower percentage of respondents (8%, 8% and 1.5%) are from the age groups 26 to 35 years, 36 to 45 years and above 45 years of age respectively.
3. A higher percentage of respondents (35%) are Graduates followed by 29.5% of respondents who are Postgraduates, 29.5 % of respondents who are undergraduates and only 6% of respondents are having above Master's degree.
4. A higher percentage of respondents (61%) are from income levels less than Rs. 200000 annually and a

lower percentage of respondents (7%) are from income levels above Rs. 600000 annually.

5. A higher percentage of respondents (90%) are single and a lower percentage of respondents (10%) are married.
6. Out of a total of 200 respondents, (48%) of respondents are salaried employees, (32.5%) of respondents are having business and (19.5%) of respondents are professional.

7. Limitations of the Study: -

- The study is confined to Gujarat state only.
- The data collected for the research is fully on primary data given by the respondents. There is a chance for personal bias. So the accuracy is not true.
- The limitation of this study also lies in the sample size and the age distribution of the sample used in this study. A sample size of 200 is small and approximately 86.5 per cent of the sample was in the age group of fewer than 25 years, thus, the results may not be generalized for consumers over the age of 35.

8. Conclusions: -

This empirical research aimed to capture the phenomenon of customers' behaviour towards solar energy products in Gujarat state, The proposed model of the research measures the customer behaviour which is further driven by Eco-friendly products, Performance, Government initiatives, Company and product information, Environmental concern, Social influence, Enhancing efficiency, Perceived usefulness, Perceived ease of use, Cost, Size and value.

Based on the finding it is concluded that among the twelve factors selected for this research the most attractive and influencing factors for consumer buying behaviour towards solar energy products are eco-friendly products, Government initiatives, Environmental concerns and Cost.

Therefore, this study in the context of Gujarat state so far connotes that the consumers from Gujarat perceive that their efforts positively influence ecological benevolence and surely they would buy solar products. To promote solar energy products, the government should focus on advertisements, subsidies and incentives.

Consumers must adopt solar energy products to make the environment more sustainable. However, consumers should also have a high degree of environmental knowledge and concern about the adoption of solar products. Environmental buying behaviour can form a favourable attitude towards solar products, and therefore, these provide a base for the implementation of various promotional schemes sustainable for the masses in general. On the other hand, a government is required to promote the effectiveness of solar energy products with concrete information and such deliberate movements would uplift the adoption of solar products among consumers in emerging markets including India.

Our research is an empirical study which is most appropriate to the stated objectives of the research. The results of the research are valid and reliable because data has been collected from primary sources. This research is expected to be useful to the solar manufacturer, regulators, customers, product and service providers, commercial

banks and other environmental institutions.

9. Managerial Implications of the study.

The research has recognized various factors which affect consumer buying behaviour towards solar energy products, which can further help solar manufacturers to get an idea regarding the preferences of customers and they can try to match solar energy products accordingly. This research may be useful for the regulators to frame guidelines and policies while introducing new solar technology in the industry to suit the needs of the customers at its best.

10. Future scope of the study.

Future research may be performed, taking into consideration the extra factors affecting consumer buying behaviour towards solar energy products. It may be contrasted to the results of this analysis study to identify any variations. Future analysis may be accomplished on an entirely different market, population area, and specific solar energy product or with a larger sample size.

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