

Factors Affecting Customer Satisfaction towards Solar Panel

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Abstract

Energy is a vital factor and an inescapable component for economic advancement. It is also substantial for enhancing and sustaining the quality of life. The solar power goods can be a useful choice for energy production as it is effortlessly accessible and is a fresh resource of energy generation. So, to brand solar products an authenticity, it is indispensable that different research expansion is completed to inventively diminish the cost of solar energy products to make it a worthwhile energy opportunity for all. Solar energy has a dazzling capability to be the clean source of energy for the future and to be employed by individual consumers in India. The study focuses on various factors affecting the satisfaction of the solar panel users. A total of 216 self-administered questionnaire were filled from the respondents through convenience sampling. The factors identified are Environmental concern, Performance and Government initiative. This study will be valuable for marketers and for advertisers to comprehend and reach the target buyers in an efficient way and design marketing plan accordingly.

Keywords: solar energy, environmental concern, government initiatives, customer satisfaction

1. Introduction

Electricity is the versatile form of energy which can be transformed to other forms easily. But it is becoming expensive with each passing day. Its price will increase heavily as the fossil fuel reserve is decreasing. Dependence on fossil fuel for energy is the main reason for environmental pollution. Along with this, Power cuts and dependence on DG sets is making people going for more and better sources. Renewable energy resources are suitable for this context as most of them are environment friendly.

Solar PV panels provide a very good alternative. The greatest advantage of solar power is its versatile availability and abundance all over the earth. But solar energy is scattered in nature which means more area is required for installation. As the area increases, installation cost also increases. Majority (58%) of India receives solar radiations of 5 watts or above per square meter per day. Solar energy usage can reduce our dependence on fossil fuel and reduce carbon emission. It can turn our energy consuming home to producing one.

The solar PV installed can be on grid or off grid depending on daily energy consumption. There are a lot of people keen in buying solar panels in India. Ministry of New and Renewable Energy (MNRE), Government of India is also promoting solar PV systems under the Jawaharlal Nehru National Solar Mission in the country. They also provide subsidy (30% - 40%) for buying solar panels under this scheme. But most people don't have proper knowledge on economic side and efficient side of PV solar panel. The efficiency of solar panel varies from 12 % to 20% and area of solar panel needed depends on it. The output from

PV panel depends on solar radiation received and the location of panel.

The capacity utilization factor (CUF) determines the performance of PV Panel. Since Independence, the Indian Power Industry has continuously faced the issues with meeting its power generation goals. The conventional energy sources especially coal hasn't been able to meet the demand and the country needs a true approach to meet its ever-increasing energy demand. Solar energy, a clean source of renewable energy which emits zero carbon, has got a remarkable potential of the energy which can be harnessed using several types of devices.

Solar power industry has gain a pace in its development and its systems are now available for commercial as well as domestic use with enhanced advantages at minimal cost of maintenance. Usage of Solar Power systems or devices has become financially viable with various government-initiated tax incentives, subsidy schemes and rebates. Now a days, solar energy is getting more and more popular in developing and developed nations. In developing nations, it is on early adoption stage whereas in developed nations, most of them are trying to switchover to renewable energy sources completely.

2. Literature Review

2.1 Environmental concern

Since solar energy technologies are the major key to give various types of benefits such as more jobs and low greenhouse gas emissions, awareness among the people to adopt the solar energy technologies must be encouraged (Zhai and Williams, 2012). Customer psychological and situational variables are important as far as eco-friendly behaviour is concerned. To maintain balance between humanity and nature, human has to save the environment. Climate change is a major part of global warming which is due to human activity and efforts are needed to overcome the impacts of anthropogenic climate change (Crosby et al., 1981). Human initiatives are needed to help society to adopt the solar energy products to protect the future climate (Chen, 2001). The energy-efficient technology, green energy and replacement of conventional fuels are required for the development of the sustainable environment.

H1: Environmental concern has positive and significant impact on Customer Satisfaction

2.2 Government Initiatives

The energy crisis has led to the energy formulation policy framework by which the growth rate of energy consumption could be regulated (Pandey, 2007). In the absence of government efforts, air pollution and global warming are estimated to get deteriorate in future (Sharma and Joshi, 2006). But solar energy will play a significant part in managing various energy-related problems (Tan, 2011; Haron et al., 2005). The government is already providing various subsidies schemes, financial assistance, and loans to encourage the adoption of solar energy products. Various promotional measures that can be taken by the government to increase the growth of the solar energy products in the country are subsidy on solar energy products, interest subsidies, loans to solar user as well as solar manufacturers, zero import duty on the raw materials of solar products and excise duty exemption on solar products (Pandey, 2007).

H2: Government initiatives has positive and significant impact on Customer Satisfaction

2.3 Performance

The solar photovoltaic (PV) systems are promoted in India primarily for remote and rural

areas. Solar energy is a very good source of energy, but the efficiency of the solar panel system also depends on the location and amount of sunshine. The latest photovoltaic panels have helped in overcoming this issue by installation of certain latest components which can absorb the minimum sunlight to create energy (Allaby, 1990). Most of the consumers who installed solar water heater are satisfied with the performance, usages, life, and capacity of the system (Chegaar and Mialhe, 2008). Solar energy generates electricity which is beneficial for the rural area where there is shortage of power supply (Sharma and Joshi, 2006). A new design of solar energy products can improve adoption behaviour of the customers (Sameti and Haghighat, 2019; Sameti, 2018). As compared to conventional solar energy systems, new systems are economical and provide more environmental benefits (Sameti and Haghighat, 2018).

H3: Performance has positive and significant impact on Customer Satisfaction

2.4 Customer satisfaction

Customer satisfaction measurements help to promote an increased focus on customer outcomes and stimulate improvements in the work practices and processes used within the company (Bhave 2002). Customer satisfaction is a judgment that a product or service has provided or is providing a pleasurable level of consumption-related fulfilment (Oliver 1997). An extensive literature has explored the role of satisfaction in determining post-purchase attitude and intentions and has demonstrated that satisfied customers engage in repurchase behaviour. The relevance of customer satisfaction in winning loyal customers has been empirically verified by a number of studies which found that satisfaction is a leading factor in determining loyalty (Garbarino 1999 & Anderson 1994).

2.5 Research Framework

Based on literature review, following Conceptual Framework was framed for research

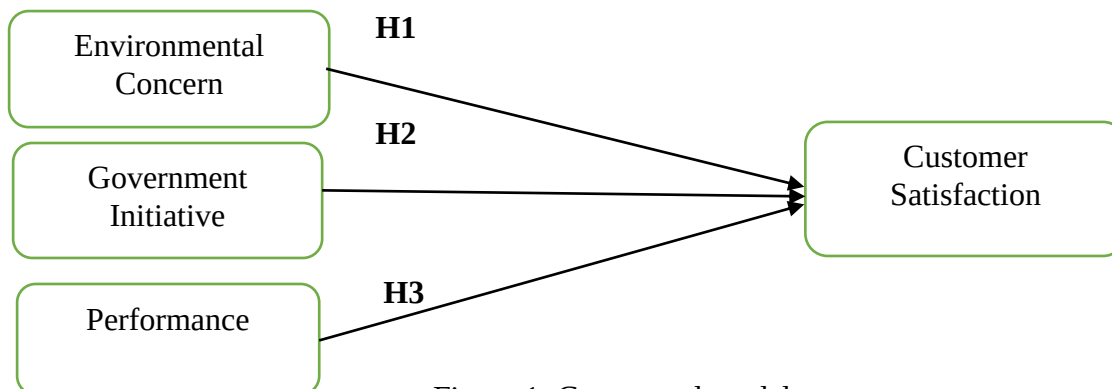


Figure 1: Conceptual model

3. Research Method

Structural Questionnaire was used for the purpose of research. Measurement scales of the research model constructs were adopted from previous related studies. Questionnaire was divided into 2 parts. The first part covered the demographic profile of the respondents whereas the second one was related to factors affecting the Customer satisfaction towards solar panel. Five-point Likert scale was used for measuring the factors ranging from Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree. Pilot testing of the questionnaire was done on 55 respondents before proceeding for the further research. The results 55 respondents

were acceptable. Hence, the researcher proceeded for the further research. The study was conducted in the Chhattisgarh area. Sampling technique used for this study is Random Sampling. The population for the research was the customers who were associated with usage of solar panels. The data was collected from 253 respondents out of which 216 were used for further purpose

4. Findings and Discussions

4.1 Descriptive Statistics

Under the descriptive statistics, the results as shown in Table 1 shows that 66 percent of the respondents are males and 33 percent are females. 48 percent of the respondents are married. The age of respondents revealed that about 54 percent are in the age of 20-30, followed by 38 percent in the age of 31-40, 8 percent are in the age of 40-50. The education level of the respondents from the study is 36 percent respondents are graduate, 52 percent are post graduate and only 10 percent are PhD degree holders. 36 percent of respondents are students, followed by 14 percent as private employee, 39 percent of the respondents are government employee and 11 percent are having their business. Monthly income of the respondents in the income group below 20000 is 17 percent, followed by 22 percent in income group of 20001-40000, followed by 33 percent in the income group of 40001-60000, 28 percent are in income group of above 60000.

4.2 Assessment of Reliability

Standardized Cronbach's alpha coefficient was used to check the reliability of the questionnaire. As recommended by Nunnally, 1978 0.7 is considered acceptable and a good indication of construct reliability. Table 2 shows that all the factors measure above 0.7, indicating high internal consistency.

Table 1. Reliability of scale

Variable	Cronbach's Alpha Scores
Customer Satisfaction	0.765
Environmental Concern	0.719
Government Initiatives_	0.734
Performance	0.816

4.3 Assessment of Validity

Validity refers to the soundness of a research. Research validity represents the extent to which the data being measured is related to the construct. Construct validity gives how accurate the measurement is (Hair, 2007). It can be classified into convergent, discriminant and nomological validity (Churchil, 1979). The uni-dimensionality of the construct was checked using Confirmatory factor analysis (CFA). In this research the convergent and discriminant validity is assessed using Confirmatory factor analysis.

The validity of variables was tested using PLS measurement model. The indicator loading

value equal to or greater than 0.7 is good (Hulland, 1999). As shown in table 3, the indicator loading for every item is above 0.7 leaving one item behind resulting to good factor loading.

Table 2. Factor loading values for all items of solar panel users on satisfaction scale

	CS	EC	GI	P
	Customer Satisfaction	Environmental Concern	Government Initiatives_	Performance
CS1	0.806			
CS3	0.714			
CS4	0.748			
EC1		0.772		
EC2		0.632		
EC3		0.774		
GI1			0.774	
GI2			0.726	
GI3			0.774	
P1				0.728
P2				0.751
P3				0.757

Convergent validity is the extent to which the construct converges to explain the variance of its items. The metric used for evaluating a construct's convergent validity are

- Table 3 represents AVE values of all factors are near or above 0.5 which represents a strong convergent validity. (Hair et al, 2007)
- Internal consistency values (Cronbach's Alpha) and the Composite Reliability (CR) was also observed. CA values above 0.60 and 0.70 are considered fitting and CR values of 0.70 and 0.90 are considered satisfactory (HAIR et al., 2014). Table 3 demonstrates that the CA and CR values are adequate.

The values reported states that all variables explain the variances.

Table 3. Convergent validity

	Cronbach's Alpha	Rho A	Composite Reliability	Average Variance Extracted (AVE)
CS	0.765	0.774	0.868	0.528
EC	0.719	0.734	0.839	0.592
GI	0.734	0.74	0.802	0.575
P	0.816	0.721	0.856	0.509

High discriminant validity shows the uniqueness of a construct (Hair et al 2007). Fornell and Larcker (1981) suggest that the “square root” of AVE of each latent variable should be greater than the correlations among the latent variables. Table 4 shows that the AVE of each variable is greater. Therefore, it can be concluded that all the variables supported discriminant validity.

Table 4. Fornell-Larcker criterion

	Customer satisfaction	Environmental concern	Government initiative	Performance
Customer satisfaction	0.727			
Environmental concern	0.335	0.702		
Government initiative	0.372	0.267	0.758	
Performance	0.502	0.075	0.395	0.713

Heterotrait Monotrait Ratio (HTMT) criterion to check discriminant validity is also used. HTMT is contemporary technique developed by Henseler, Ringle and Sarstedt (2015). The studies of Kline,(2011) suggest the values obtained by HTMT ratio should be below 0.85. Table 5 exhibits the results are below 0.85.

Table 5. HTMT criterion

	Customer satisfaction	Environmental concern	Government initiative	Performance
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4.4 Structural Model Assessment

The absence or presence of multicollinearity issue in the model is checked through the variance inflation factor (VIF). Table 6 represents that all the values of construct range between 1.353 to 3.31 (Diamantopoulus and Sigouw,(2006). Thus, it is predicted that there is no multicollinearity issues in the model. The hypotheses are tested through Bootstrapping analysis with sample size of 5000.

Table 6. Inner VIF values of model

	CS	EC	GI	P
CS1	1.509			
CS2	1.350			
CS3	1.138			
EC1		1.206		
EC2		1.167		
EC3		1.076		
GI1			1.278	

GI2			1.278	
GI3			1.199	
P1				1.161
P2				1.080
P3				1.161

4.5 Structural Model

The hypotheses in the structural model are tested using the bootstrapping method which assesses the significance of the path coefficient and evaluates their confidence intervals. Figure 2 represents the path analysis for one such bootstrap sample.

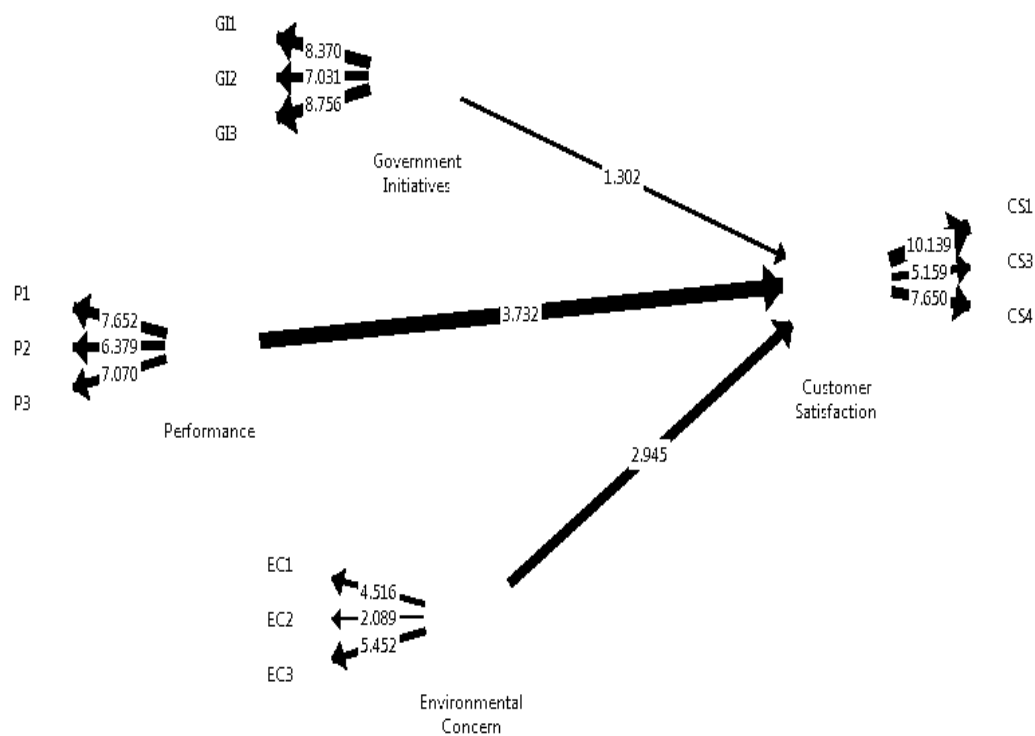


Figure 2: Structural equation model

4.6 Hypothesis testing

The results of hypothesis testing in this study are shown in table 8 below

Table 7. Hypothesis Testing

H1: There is significant and positive impact of Environmental concern and satisfaction of customers

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Value	Adjusted R ²	Result
Environmental Concern → Customer Satisfaction	0.267	0.279	2.879	2.879	0.004	0.792	Supported
Government Initiatives → Customer Satisfaction	0.132	0.159	0.111	1.18	0.239		Not Supported
Performance → Customer Satisfaction	0.43	0.42	0.116	3.695	0.00		Supported

Shang et.al. (2005) in his studies stated that environmental concern influences the satisfaction of the customers. The table represents that the p value < 0.05 (p value- 0.004, t value 2.89) which supports H1. It indicates that there is a positive and significant impact of Environmental concern and satisfaction of customers.

H2: There is significant and positive impact of Government initiatives on Satisfaction of customers

Agrawal et. al (2000) ,Chau (2001) in their study mentioned that when government initiative is bashed with self-efficacy has a significant impact on satisfaction of customers. The table above shows that the p value > 0.05 (p value- 0.239, t value 1.18) indicating that H2 is not supported. This means that there is Government initiatives donot have any significant and positive impact on Satisfaction of customers.

H3: There is significant and positive impact of Performance on Satisfaction of customers

Agrawal and Kharanna (2005) have stated that performance influences the satisfaction of customers. The table shows that the p value < 0.05 (p value-0.000, t value 3.69) supports H3. This shows that Perceived performance has a significant and positive impact on Satisfaction level of the customers.

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