Antecedents Affecting Consumer's Intention to use Solar Panel in India: A Way for Green Energy

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Abstract

The increasing global concern over environmental degradation and the need for sustainable energy sources have prompted a shift towards renewable energy options, such as solar power. India, being a developing country with a rapidly growing energy demand and a high potential for solar energy generation, has witnessed a significant increase in the adoption of solar panels. The aims is to provide an overview of the factors influencing consumers' intention to use solar panels in India, thereby contributing to the promotion of green energy.

Understanding the factors that influence consumers' intention to adopt solar panels is crucial for policymakers, industry professionals, and researchers to develop effective strategies and policies that encourage widespread solar panel usage. This abstract synthesizes existing literature and identifies key factors affecting consumers' intention to use solar panels in India.

The identified factors can be broadly categorized into three dimensions: environmental, economic, and social. Environmental factors include concerns about climate change, pollution reduction, and environmental consciousness. Economic factors involve the availability of subsidies, financial incentives, and cost-effectiveness of solar panel installations. Social factors encompass social norms, peer influence, and social responsibility.

This research highlights the significance of awareness and knowledge about solar energy as a catalyst for consumer intention. The findings suggest that education and awareness campaigns can positively impact consumers' attitudes and intentions towards solar panel adoption.

Hence, this sheds light on the factors influencing consumers' intention to use solar panels in India. Recognizing and addressing these factors can contribute to the promotion of green energy and help India achieve its renewable energy targets. Future research should focus on exploring innovative ways to overcome barriers and enhance the adoption of solar panels, leading to a sustainable and greener energy future for India.

Purpose: Although the Indian government is promoting the use of clean source of energy such as solar energy, the application of the green product is still very much at infancy stage in the country. This study investigates whether Indian consumers' intention to purchase solar panel are influenced by perceived government policy, perceived costs and maintenance, product knowledge and experience, solar panel aesthetics, social influence, environmental concern, product benefits and demographic factors (education level, income)

Design/methodology/approach: Self-administered questionnaire survey was utilized to collect data from India consumers who are non-solar panel users. Factor Analysis analysis carried out on the data with the demographic analysis of respondents

Findings: Demographic factors (education and income level) were found to have insignificant relationships with purchase intention.

Research limitations/implications: The research emphasized on non-solar panel users from India. Other users from other states and other countries can also be the target in the future.

Practical implications: The findings have contributed towards the advancement of knowledge on green marketing as both government and marketers now understand better purchase intention behaviour of indian consumers of solar panels and can move forward to create suitable government policy and incentives to further promote the adoption of the product among Malaysians.

Originality/value: The field study provides new insights on green energy purchase in India .

Keywords: Solar Panel, SDG, Climate Risk

Introduction

1.1 **Sustainable Development Goal (SDG) 13** calls for urgent action to combat climate change and its impact. It is intrinsically linked to all 16 of the other goals of 2030 Agenda of SDG. Global Climate Risk Index 2021[1], states that people all over the world are dealing with the effects of climate change, which are showing themselves in many regions of the world as an increased volatility of extreme weather events. More than 11 000 extreme weather events caused damages of US$ 2.56 trillions (in PPP) and the deaths of over 475 000 persons between 2000 and 2019 worldwide. Since many nations, cities, and businesses have declared climate crises and set net-zero targets, the politics of climate change

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[1] Indices, Climate Change Performance Index, Klimaschutz-Index

have become more urgent (Climate Emergency Declaration 2020; Williams,2019). Since the 1970s, there has been a nearly 10-fold rise in the global economic losses caused by natural disasters, with the United States alone suffering damages of $300 billion in 2017. The rise in the population and wealth concentrated in areas vulnerable to tropical cyclones, floods, and other disasters is the main factor driving this trend. Therefore, controlling growth in these areas is essential to reducing losses due to natural disasters, especially when climate change changes the frequency and severity of extreme weather occurrences. Worldwide precipitation patterns have been altered by global warming, which has increased rainfall and temperature variability. As a result, droughts, floods, and heat stress have increased in frequency, intensity, and duration **(Haile et al., 2020a; Haile et al., 2020b; Kassaye et al., 2020, Makondo and Thomas 2020, Trenberth 2006)**. Additionally, crop pests and illnesses have become more common as a result of climate change **(Salih et al., 2020).** People in underdeveloped nations are more vulnerable as a result of these increased climate hazards, especially those whose livelihoods depend on climate-sensitive sectors **(Aryal et al., 2020a; Kalimba and Culas, 2020; Kogo et al., 2021).**

Already, severe climate catastrophes have wiped out people's lives and means of support. Midway through the 1980s, drought in Africa led to the deadliest famine, which affected over 20 nations and about 35 million people **(Katengeza et al., 2019; Shiferaw et al., 2014)**. The most severely impacted nations included Zimbabwe, Malawi, Ethiopia, Kenya, and Mozambique **(Shiferaw et al., 2014)**. Droughts have two effects: they decreased food output and decreased the availability of potable water **(Sani and Chalchisa, 2016).** As a result, the droughts intensified the lack of access to food and water and limited the options for coping with climatic hazards (Davis-Reddy and Vincent, 2017). Therefore, it is anticipated that climate change will have negative economic and social effects on countries in Africa **(Baarsch et al., 2020).** According to the Global Starvation Index 2022, every country examined here confronts significant risks of malnutrition and hunger **(Von Grebmer et al., 2019).** In the nations studied, the percentage of the population living in poverty ranges from 23.5% (Ethiopia) to 50.7% (Malawi). As climate threats rise, already-existing food insecurity, hunger, malnutrition, and poverty will get worse, eventually halting economic growth **(Cacho et al., 2020; IPCC, 2014a).** In order to achieve the SDGs in Africa, agriculture must be modified to deal with climate risk **(Baarsch et al., 2020; Cacho et al., 2020; Kalimba and Culas, 2020).**

1.2 INDIA: Climate Risk

India is among the countries most vulnerable to climate change. It has one of the highest densities of economic activity in the world, and very large numbers of poor people who rely on the natural resource base for their livelihoods, with a high dependence on rainfall. By 2020, pressure on India's water, air, soil, and forests is expected to become the highest in the world.

One of the most significant ways that climate change will impact the lives of people in India will be through its water resources. While water sustains life, it all too often wreaks havoc through devastating floods and droughts. A changing climate will only aggravate these shocks.

1.2.1 Potential Effects of climate change in India

Extreme Heat: India is already experiencing a warming climate. Unusual and unprecedented spells of hot weather are expected to occur far more frequently and cover much larger areas. Under 4°C warming, the west coast and southern India are projected to shift to new, high-temperature climatic regimes with significant impacts on agriculture.

a. **Changing Rainfall Patterns**: A decline in monsoon rainfall since the 1950s has already been observed. A 2°C rise in the world's average temperatures will make India's summer monsoon highly unpredictable. At 4°C warming, an extremely wet monsoon that currently has a chance of occurring only once in 100 years is projected to occur every 10 years by the end of the century. Dry years are expected to be drier and wet years wetter.

b. **Droughts:** Evidence indicates that parts of South Asia have become drier since the 1970s with an increase in the number of droughts. Droughts have major consequences. In 1987 and 2002-2003, droughts affected more than half of India's crop area and led to a huge fall in crop production. Droughts are expected to be more frequent in some areas, especially in north-western India, Jharkhand, Orissa, and Chhattisgarh. Crop yields are expected to fall significantly because of extreme heat by the 2040s.

c. **Groundwater**: Even without climate change, 15% of India's groundwater resources are overexploited. Falling water tables can be expected to reduce further on account of increasing demand for water from a growing population, more affluent lifestyles, as well as from the services sector and industry.

d. **Glacier Melt**: Most Himalayan glaciers have been retreating over the past century. At 2.5°C warming, melting glaciers and the loss of snow cover over the Himalayas are expected to threaten the stability and reliability of northern India's primarily glacier-fed rivers. Alterations in the flows of the Indus, Ganges, and Brahmaputra rivers could significantly impact irrigation, affecting the amount of food that can be produced in their basins as well as the livelihoods of millions of people

e. **Sea level rise:** With India close to the equator, the sub-continent would see much higher rises in sea levels than higher latitudes. Sea-level rise and storm surges would lead to saltwater intrusion in the coastal areas, impacting agriculture, degrading groundwater quality, contaminating drinking water, and possibly causing a rise in diarrhoea cases and cholera

outbreaks, as the cholera bacterium survives longer in saline water. Kolkata and Mumbai, both densely populated cities, are particularly vulnerable to the impacts of sea-level rise, tropical cyclones, and riverine flooding.

f.   Health Care risk: As climate change increases the risk of communicable diseases, India needs a more resilient healthcare infrastructure to counter its impact.

"Climate change creates a conducive environment for the creation and transmission of several communicable diseases like malaria, dengue, diarrhoea, etc.," she continues. "For example, when flood water gets contaminated with human or animal waste, water-borne diseases like diarrhoea and cholera start spreading faster. Similarly, we have seen increased respiratory diseases owing to polluted air in Delhi." A big challenge for India right now is to address the imbalances being created due to climate change. Recent studies also point out India's poor performance in addressing climate-related concerns. In the Environment Performance Index 2022, India ranked at the bottom of the list. This raises concerns about the future impact of climate change on the economic and social life of people across the country.

1.2.2 India's response to Climate Change

National Action Plan on Climate Change (NAPCC): outlines existing and future policies and programs addressing climate mitigation and adaptation. The Action Plan identifies eight core "national missions" running through to 2017: Solar Energy; Enhanced Energy Efficiency; Sustainable Habitat; Water; Sustaining the Himalayan Ecosystem; Green India; Sustainable Agriculture; and Strategic Knowledge for Climate Change. Most of these missions have strong adaptation imperatives.

National Clean Energy Fund: The Government of India created the National Clean Energy Fund (NCEF) in 2010 for financing and promoting clean energy initiatives and funding research in the area of clean energy in the country. The corpus of the fund is built by levying a cess of INR 50 (subsequently increased to INR 100 in 2014) per tonne of coal produced domestically or imported.

Paris Agreement: Under the Paris Agreement, India has made three commitments. India's greenhouse gas emission intensity of its GDP will be reduced by 33-35% below 2005 levels by 2030. Alongside, 40% of India's power capacity would be based on non-fossil fuel sources. At the same time, India will create an additional 'carbon sink' of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030.

International Solar Alliance: ISA was launched at the United Nations Climate Change Conference in Paris on 30 November 2015 by India and France, in the presence of Mr. Ban Ki Moon, former Secretary-General of the United Nations.

Bharat Stage (BS) Emission Norms: Emissions from vehicles are one of the top contributors to air pollution, which led the government at the time to introduce the BS 2000 (Bharat Stage 1) vehicle emission norms from April 2000, followed by BS-II in 2005. BS-III was implemented nationwide in 2010. However, in 2016, the government decided to meet the global best practices and leapfrog to BS-VI norms by skipping BS V altogether.

All these efforts need to be implemented well to mitigate the effects of climate change.

1.3 In more recent years, researchers have found links between climatic factors and a variety of socio-economic outcomes, including social conflict, health outcomes, and agricultural productivity (Adams et al.; Gallup and Sachs.; Miguel et al.; Schlenker et al.; Mendelsohn, Dell et al.; Hsiang et al.). The majority of these essays have concentrated on the influence of average climatic conditions, seasonality, or exceptional events. But there are other aspects of climate that matter as well. In example, climatic unpredictability from year to year has historically been a significant source of risk for activities reliant on natural resources like agriculture. Even now, variations in temperature and precipitation are responsible for a despite the widespread availability of irrigation, chemical fertilizers, and new crop types that lessen yield sensitivity to climatic conditions, agricultural yields and crop failure rates nevertheless show significant year-to-year volatility (Lobell and Field, Mendelsohn,). When these tools were less common and rural societies were more reliant on natural resources for subsistence in earlier ages, vulnerability to unpredictable weather was even more obvious (Le Roy Ladurie, Solomou and Wu, Brunt,). The rhythm, quality, and lack of harvests, it was noted, "organized all material life" after people began practicing agriculture.

The main reason for climate change is pollution due to the burning of fossil fuels. Most of the air pollution takes place due to the burning of fossil fuels such as coal, oil, and gasoline to produce energy for electricity or transportation. The release of carbon monoxide at a high level indicates how much fossil fuel is burned. This also emits other toxic pollutants into the air. Inhaling air induced with pollutants due to the burning of natural gas and fossil fuel reduces heart's ability to pump enough oxygen causing one to suffer from respiratory illness. Fossil fuels also getting depleted day by day. The reason of fuel exhaustion is its consumption rate is very high, it's getting exhausted which leads to people struggling for electricity. It takes millions of years for fossil fuels to form. For that, as an alternative, solar panels is being used and it is much safer and has its own benefits.

1.4 Why India need non-renewable source of energy

One of the reasons for growing greenhouse effect or climate change is sources of electricity production such as coal, oil, and natural gas. According to a World Energy Council [8] prediction, global electricity demand will peak in 2030. India is one of the largest coal consumers in the world and imports costly fossil fuel [8]. Close to 74% of the energy demand is

supplied by coal and oil. According to a report from the Centre for monitoring Indian economy, the country imported 171 million tons of coal in 2013–2014, 215 million tons in 2014–2015, 207 million tons in 2015–2016, 195 million tons in 2016–2017, and 213 million tons in 2017–2018 [9]. Therefore, there is an urgent need to find alternate sources for generating electricity.

By definitively committing to 50% of India's electricity generation from non-coal or gas sources by 2030 is nothing short of transformative. India also strengthened its Paris target by committing to: further reduce the carbon intensity of its economy to less than 45%, from the earlier target of 33 to 35 percent, from 2005 levels by 2030; increase non-fossil energy capacity to 500 gigawatts (GW) by 2030, formalizing India's earlier renewables commitment; and reduce India's total projected carbon emissions by one billion tons from now to 2030. India also joined other nations in announcing a net zero emissions target by 2070.

Unlike finite and non-renewable energy sources, solar energy is a sustainable, free source of energy that is supportable and unlimited. Additionally, it is a non-polluting source of energy and does not release any pollutants that harm the ozone when generating electricity.

India has now undertaken the task of exploring and investing in multiple sources of renewable energy. However, since wind energy is severely limited to coastal regions and hydro-projects require extensive capital investment, investing in solar power has the advantage of creating a new energy source for the interior without huge capital stimulus. This is probably why the Indian government has worked extensively to develop the solar sector since 2019. Moreover, India is dealing with an aggressive air pollution problem. In 2020, Delhi's Air Quality Index (AQI) stood at 328 which indicated severe pollution, with pollution exceeding the emergency level twice in November (air quality below 100 is considered safe under the index). The major contributory factor in extreme levels of pollution is stubble burning, where farmers clear agricultural fields by burning the residue after harvesting.This is done because it is the cheapest and most convenient way of getting rid of residue, allowing farmers to cut costs without undergoing any trouble. Despite severe penalties, stubble burning has continued in the North despite the pandemic. In addition, the lack of regulation on industrial and vehicular air pollution has been on the rise and only fell in 2020 due to the pandemic; vehicular pollution accounts for 41% of the air pollution in Delhi. Solar production does not cause any toxic emissions and can help mitigate the pollution caused by fossil fuel usage. It is clear that solar energy is a useful energy source that will enable India to attain energy security and meet prospective energy demands without substantially straining non-renewable energy sources. India's commitment to solar power has amplified despite the damage caused by the pandemic.

On the basis of the above discussion, this project aims to study the antecedents of consumer perception about the usage of solar panel in India. The study will help in increasing the penetration of solar energy and reduce pollution.

2. 2Literature Review

For this study, three databases were used, namely Web of Science, Google Scholar and WorldCat. The search engine Web of Science was used because it contains several databases that index the world's leading academic literature across a variety of disciplines, Researchers should conduct a minimum search of Web of Science and Google Scholar. A requirement to ensure adequate and efficient reporting. However, due to Google Scholar's low recall capabilities as a result of the search result limit, WorldCat, the largest network of library content and services in the world, was also used.

2.1 Searching Criteria:

The search criteria were standardized across all three platforms and were conducted using key terms and controlled vocabulary focused on the themes 'solar', 'impact', and 'household'.

In Santiago, Chile, the economic situation is great for choosing PV innovation households, but recruitment is not important. To investigate this conundrum, the developers conducted a targeted Delphi study to gather input from a panel of Chilean PV specialists. The research question is also of particular importance in developing countries such as India. Solar energy is an increasingly important part of India's current energy mix and will play a crucial role in our clean energy future. According to the Government of India's Department of Trade and Industry, the Indian renewable energy sector is the fourth most attractive renewable energy market in the world. In October 2018, India ranked fifth in adopting a cap on sustainable energy sources.

Previous literature on home PV diffusion has shown that "barriers and facilitators tend to transcend technical and political advances" and are instead at the intersection of "social, economic, and technical" (Sovacool, 2014; Popp et al., 2011). In Senegal, for example, Thiam (2011) has shown the importance of "social acceptance of renewable technologies". According to Walter et al. (2018, p.126) "Adoption has been hampered by consumer perceptions of the aesthetics of solar panels; Residents considering the introduction of solar panels were also influenced by other peer-related effects, such as B. engaging conversations between neighbours and solar PV owners, which led to solar panel owners forming clusters" (Rai et al., 2016; Graziano and Gillingham, 2015; Richter, 2014; Rai and Robinson, 2013; Faiers and Neame, 2006; Margolis and Zuboy, 2006).

Knowledge of consumers "customers were strongly influenced, for example, by their ignorance of PV technology, including issues related to permitting, planning, and maintaining it over its lifecycle" may also play a significant role in diffusion (Walter et al.,2018, p.128;2012, by Beck and Martinot;2006 (Margolis and Zuboy).According to one study,

"some consumers disregard renewable energy sources because they do not know of its economic benefits or their energy consumption, or because their paradigms of permissible energy sources point them to traditional fossil-fuel power plants" (Walter et al.2018, p. 130;2009 Sovacool;2006 (Margolis and Zuboy).

Consumers' hesitancy to install solar panels is exacerbated by the "relatively high capital costs of installation may even be exacerbated by competing for energy providers who offer subsidies for fossil fuels" (Walteret al., which they perceive as a "financial risk and are hesitant to invest in solar PV."2018, p. 129;Rai and co.,2016; 2012, by Beck and Martinot;2012, Rai and McAndrews;2006, Faiers and Neame;Popp and others,2011). Numerous additional studies point to additional socioeconomic factors, such as "high capital and maintenance costs;lack of familiarity with cutting-edge energy technology;as well as of underestimating environmental investments' long-term benefits" (Masini and Menichetti, 2013, p. 7).

Along with their lack of confidence in the PV information that is readily available, consumers must also deal with "the long timeframe for return on investment (ROI)" and "the uncertainty of the expenses connected with operation and maintenance." (Rai et al., 2016, p. 502; Rai and Robinson, 2013; Rai and McAndrews, 2012).

Due to the path dependence of earlier carbon-based technology, several studies have demonstrated that "consumers must realise that the present value of a PV investment considerably exceeds the initial cost by a factor that may transcend consumer uncertainty." (Bauner and Crago, 2015, p. 31). Individual investors stop using PV as a result of all these changes "until market and policy maturity reach a sufficient level of perceived risk, defined as the optional value," (Bauner and Crago, 2015, p. 31). Additionally, on account of Bangladesh, one study revealed that a client's satisfaction with the use of a sun-oriented home framework is determined by a variety of factors. (Komatsu et al., 2013).

In the study, the client's perception of the benefits of the sunlight-based home framework led to a greater degree of adopters' fulfilment. These benefits included the nature of the equipment and changes to the family's way of life, such as an IJPPM expansion in the kids' study time. Several studies have looked at the influence of friend outcomes for family unit sunlight-based energy innovation adoption choices. (Rai et al., 2016). Another investigation concluded that the state's push for solar-powered innovation had positive results. (Crago and Chernyakhovskiy, 2017). Similar to this, a study of Pakistani households revealed evidence that the administration's financial assistance for the installation of small solar-powered PV frameworks affected the families' decision-making regarding expenditures. (Qureshi et al., 2017)

These efforts produced 26 influences on PV dispersion, including both inspirations and obstacles. The significance of 21 out of the 26 was generally acknowledged by experts. The article suggests that various specialised, financial, and social factors influence how PV advancements are dispersed. In essence, the experts saw the effects of monetary, ecological, and energy supply issues. They identified institutional, financial, specialised, and informational reasons as the main causes of the rising appropriation barriers. They believed that monetary motivations and financial restraints were the two most important factors influencing decision-making. They considered the less important elements to be specialised obstacles and natural inspirations. Using this knowledge, the developers construct a family PV selection system that illustrates the interaction between the acknowledged inspirations and limitations.

This framework provides strategy recommendations for Santiago, Chile, and expands the body of material examining the interrelated frameworks of issues that affect overall common foundation and PV choice (factors impacting home solar adoption in Santiago, Chile, by (Walters et al., 2018))
A growing amount of research on the subject examines how public regulators might structure their policies to promote the development of new renewable energy technologies. Researchers have generally questioned the effectiveness of different configurations of emotionally supportive networks in achieving approach goals. The beneficial role of feed-in levies in encouraging an increase in the share of sustainable electricity sources by decreasing the risk associated with the speculation of choice (Menanteau et al., 2003).

In contrast to market-based alternatives, feed-in tariffs are a more effective policy strategy, according to other studies. (Butler and Neuhoff, 2008) Other analyses, however, suggest that by calculating liabilities in the long run, feed-in tariffs' advantages may be outweighed by their hidden costs. (Liebreich, 2009). A variety of studies highlighted the environmental, financial, social, and political drivers of family unit private PV selection behaviour. (Davidson et al., 2014; De Groote et al., 2016).

In China, incentives such as the feed-in levy were acknowledged as the primary force behind the development of domestic solar energy systems. (Zhang et al., 2007)

Four fundamental factors, including "the apparent relative preferred standpoint of the innovation, the multifaceted nature of the advancement, social influence, and knowledge of grants and costs," were identified by another study on the adoption and non-adoption of solar-powered PV in the Netherlands. (Vasseur et al., 2010, p. 891). Increasing the private solar-powered PV limit in the United States is encouraged by the adequate state policy framework. According to the study, expert ecological predisposition, sunlight-based explicit commands, and financial motivating factors that lower the upfront cost of sun-oriented PV appropriation strongly impact demand for solar-powered PV. (Crago and Chernyakhovskiy (2017)).

2.3 Research Gap:
There are various studies which have been conducted to understand the low penetration of solar panel. But most of the studies are related to western world which is not applicable in India. For India solar panel is very important, so the study aim to understand the customer perception about solar panel.

2.4 Research Question:
1. To study the relationship between demographic variables and awareness about the solar panel
2. To study the relationship between demographic variables and Usage of solar panel
3. To identify the reasons for using or not using solar panels
4. Relationship between usage of solar panel and Insurance of the same

3.Research Methodology
The study is based on research methodology given by Saunder's as it is the most accepted by researchers. For this study we have used Saunder's Research Onion Approach, the research onion described by Saunders describes the various decisions a person need to make when developing a research methodology, whether for dissertation, thesis, or any other formal research project. The six layers of Saunder's research onion:

This research is situated within a **Pragmatic philosophical paradigm** based on the premise that academics should employ the philosophical and/or methodological approach that works best for the research problem under consideration. According to Kaushik and Walsh (2019), pragmatic research philosophy is concerned with the facts and prioritizes research questions and consequences over methods. Pragmatist researchers use a variety of data collection techniques and analysis procedures because, unlike positivism and interpretivism, pragmatic research can incorporate multiple research approaches, research strategies, and research methods into the same study (Sahay, 2016; Kaushik and Walsh, 2019). According to the onion model (Figure 3.1), the following research concepts were included in this research study and will be discussed in detail in the following sections.

For this study, the approach adopted can be described as exploratory, which is based on quantitative data collection and analysis using SPSS . This study uses a systematic review to collect qualitative data from 16 sets of questions to analyse the data. Sample strategy to select subjects at random who are willing to be approached and participate in the study rather than having to select participants based on any criterion (such demographic variables). Around 180 data samples were collected from cities throughout India, including Delhi, Mumbai, Lucknow, Bangalore, Bhopal etc.

All the participants are Adult Indians. For the approach this research can be determined as Deductive as it takes in account of the existing theories and any new theories haven't been developed. By Survey and Sample techniques raw data will be analysed. In this technique we gather data or sample from willing volunteers. A set of questionnaires is provided to them. The Questionnaires were designed to meet the demographics, working class population and people who have their own household and make their own decisions and not dependent on others were chosen.

Hence in the early part of questionnaires their age,This research is based on quantitative methods. 'Quantitative methods' is a research approach whereby researchers collect and analyse both quantitative and qualitative data within the same study.A cross-sectional time horizon is employed in this research methodology.

A cross-sectional study examines data from a single point in time. Participants in this type of study are chosen based on specific variables of interest. Researchers do not change factors; instead, they collect data from a population. Hence in this research also a sample size is defined in which data or set of questionnaires are provided to them based on their characteristics The sample of 184 people through google forms and print outs of the same to carry out the survey.SPSS Statistics is used for analysing the data.

4.Data Analysis & Interpretation
1. Demographic Analysis

a. Table 1: The number of respondents are 184 out of which 51.1% belong to 18-25 age group, 33.7% belong to 26-35 age group, 5.4% belong to 36-45 age group, 5.4% belong to 46-55 age group and 4.3% respondents belong to the age of 56 & above.

Age					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	18-25	94	51.1	51.1	51.1
	26-35	62	33.7	33.7	84.8
	36-45	10	5.4	5.4	90.2
	46-55	10	5.4	5.4	95.7
	56& Above	8	4.3	4.3	100.0
	Total	**184**	**100.0**	**100.0**	

b. Table 2: The number of respondents are 184 out of which 55.4% have service as their occupation, 8.7% have business and 35.9% have not specified about their occupation.

Occupation					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Service	102	55.4	55.4	55.4
	Business	16	8.7	8.7	64.1
	Not Specified	66	35.9	35.9	100.0
	Total	**184**	**100.0**	**100.0**	

c.Table 3: The number of respondents are 184 out of which 77.2% are unmarried and the rest 22.8% are married.

Marital Status					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Unmarried	142	77.2	77.2	77.2
	Married	42	22.8	22.8	100.0
	Total	**184**	**100.0**	**100.0**	

d. Table 4: Out of the 184 respondents, 5.4% have higher secondary qualification, 56.5% are graduate and the rest 38% are post graduate.

Highest Educational Qualification					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Higher secondary	10	5.4	5.4	5.4
	Graduate	104	56.5	56.5	62.0
	Post Graduate	70	38.0	38.0	100.0
	Total	**184**	**100.0**	**100.0**	

e.Table 5: Out of the 184 respondents, 10.9% are from the eastern region of India, 17.4% people are from the southern region of India, 42.4% are from the northern region and the rest 29.3% are from the western part of India.

Region		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	EAST	20	10.9	10.9	10.9
	SOUTH	32	17.4	17.4	28.3
	NORTH	78	42.4	42.4	70.7
	WEST	54	29.3	29.3	100.0
	Total	184	100.0	100.0	

2. Relationship between awareness and demographic variables

a. Age & Awareness: Out of the 184 respondents, 182 were aware about solar panels while the rest 2 were unaware of the same. The 2 respondents which were unaware of solar panels belonged to age group of 26-35. Rest all age groups were all aware about solar panels.

Table 6:

Age * 1. Are you aware about Solar Panels? Cross tabulation				
Count				
		1. Are you aware about Solar Panels?		Total
		Aware	Not Aware	
Age	18-25	94	0	94
	26-35	60	2	62
	36-45	10	0	10
	46-55	10	0	10
	56& Above	8	0	8
Total		182	2	184

b. Occupation & Awareness: Out of the 184 respondents, only 2 respondents were unaware of solar panels who did not specified their occupation, it can be assumed that either their occupation was different from business or service, or they were unemployed.

Table 7:

Occupation * 1. Are you aware about Solar Panels? Cross tabulation				
Count				
		1. Are you aware about Solar Panels?		Total
		Aware	Not Aware	
Occupation	Service	102	0	102
	Business	16	0	16
	Not Specified	64	2	66
Total		182	2	184

c. Marital status & Awareness: The number of respondents are 184 out of which only 2 are unaware of solar panels and both of them are married. Out of the rest 182 respondents, all are aware of solar panels.

Table 8:

Marital Status * 1. Are you aware about Solar Panels? Cross tabulation				
Count				
		1. Are you aware about Solar Panels?		Total
		Aware	Not Aware	
Marital Status	Unmarried	142	0	142
	Married	40	2	42
Total		182	2	184

d. Educational qualification & Awareness: The number of respondents are 184 out of which only 2 respondents are unaware of solar panels, both of which have higher secondary as their highest educational qualification.

Table 9:

Highest Educational Qualification * 1. Are you aware about Solar Panels? Cross tabulation				
Count				
		1. Are you aware about Solar Panels?		Total
		Aware	Not Aware	
Highest Educational Qualification	Higher Secondary	8	2	10
	Graduate	104	0	104
	Post Graduate	70	0	70
Total		182	2	184

e. City & Awareness: The number of respondents are 184 out of which 182 people are aware of solar panels and the rest 2 that are unaware of the same belong to southern parts of India

Table 10:

City * 1. Are you aware about Solar Panels? Cross tabulation				
Count				
		1. Are you aware about Solar Panels?		Total
		Aware	Not Aware	
City	East	20	0	20
	South	30	2	32
	North	78	0	78
	West	54	0	54
Total		182	2	184

3. Relationship between awareness and usage: Out of the total 184 respondents, only 50 of them use solar panels. Rest 134 do not use solar panels.

Table 11:

Awareness * Usage Cross tabulation				
Count				
		Using		Total
		Yes	No	
Aware	Yes	48	134	182
	No	2	0	2
Total		50	134	184

4. **Relationship between usage and consumption:** Out of the 184 respondents, 50 are using solar panels. 26 of them have less than 1000 units of electricity consumption, 18 have 1000-3000 units electricity consumption, and 6 have more than 3000 units electricity consumption.

Respondents which have electricity consumption of less than 1000 units but not using solar panels are 90 while the respondents which have electricity consumption of more than 1000 units but not using solar panels are 44.

Table 12

Usage * Consumption Cross tabulation					
Count					
		Consumption			Total
		Less than 1000 Units	1000-3000 Units	More than 3000 Units	
Using	Yes	26	18	6	50
	No	90	40	4	134
Total		116	58	10	184

5. Factor Analysis

Table 13:

Factors	Buyer	Seller
Govt. subide		0.631
Price-Affordable		0.532
Clean		0.598
Independence		0.632
Protect Env		0.445
Roof Damage	0.785	
ugly	0.760	
costly	0.583	
Price-Different	0.580	
Knowledge	0.549	
Benefit	0.594	
Promotion		0.667

Exploratory factor analysis (EFA) was used in this study to examine the factors responsible for low penetration of solar panel.

The principal component analysis by using the varimax rotation technique was conducted to determine the reasons for not buying solar panel. Table 11 presents the rotated pattern matrix displayed two -factor solutions and their items. The Kaiser–Meyer– Olkin measure of sample adequacy (KMO) was 0.8 and Bartlett's Test of Sphericity was, significant ($p< 0.05$). This satisfied the assumptions of EFA (Kaiser, 1974; Bartlett, 1954).

These two components explained 64.477 % of the total variance and contributed eigen value >1 by using Kaiser's criteria. In this study, standardized factor loadings of all the items are 0.823-0.504. The standardized factor loadings for each item should be at least 0.5. as per the recommendation of Hair et al. (2010). Two components obtained from Principal component analysis with a total of 10 items (after deletion of one low factor loading items) explain the attitude of individual households are reported as follows:

a. Factor 1: Buyer Side (Factor 1): The factor comprised of 6 items with high factor loadings and a Cronbach's Alpha of 0.588. The factor refers to the Insufficient fund with buyer, inadequate knowledge and Inadequate time to compare the products varoom the market. The factor reflects that limitations of the respondent in his daily life.

b. Factor 2: Supplier Side/ Insurance Companies (Factor 1): The factor comprised of 6 items with high factor loadings and a Cronbach's Alpha of 0.588. The factor refers to poor services culture, difficult claim process, available products are insufficient, does not cover Act of god, complex process, costly and unavailability of product through existing distribution channel.

Table 14:

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.607
Bartlett's Test of Sphericity	Approx. Chi-Square	554.043
	df	66
	Sig.	0.000

Chapter 5: Recommendations

There is a clear global trend toward penetration of solar panel technologies. In the past, this was mainly driven by energy security, but now climate change is the main driver. Per-capita CO_2e emissions in india are considerably high because of the country's high reliance on fossil fuels. This has led to consideration of solar panel especially as india is rich in solar energy potential. An action plan was approved aimed at fostering the spread of solar panel in india , and this includes installation of solar PV in government-built housing. However, there have been no surveys examining public acceptance, which is where this study makes a contribution. The study aimed to explore how the public perceives residential solar PV, its knowledge about solar energy in Bahrain, willingness to pay, barriers to installation, and preferred channels for information communication. The results showed that more than half of the participants had a low level of knowledge about the topic in the context of Bahrain, but greater knowledge about general facts. Interest was seen in residential solar PV, as over 30% of respondents expressed willingness to pay either fully or partially for installation. However, many saw

the relatively high capital cost as a barrier. Absence of relevant information was also a commonly chosen barrier, implying the government's efforts were not effectively communicated to the public, as knowledge about solar PV in India was minimal compared with general knowledge about the topic.

Several policy implications may be drawn in light of the results of this study:

Addressing the barriersQW the respondents' chose is critical not just for deploying solar panel technologies in India but also to respond to environmental issues in general.

Improving communication with the general public using channels the participants preferred is crucial. This is because information dissemination is among the SEU responsibilities, though its intended means differ from those preferred by the participants.

Managerial Implications

The study provides critical insights to insurance companies and the Regulators to bridge the protection gap in using solar insurance. If only one percent of the population having solar panels is buying the solar insurance, then there exists a significant gap of 99 percent that needs to be plugged by the insurance companies. The study also specifies important inputs that will help in designing better solar insurance by including the factors which are not covered like the 'Act of God'. Under the new concept of sandboxing of IRDA, pilot testing of the new product can also be done by the companies. The study also identifies areas of improvement in services provided by Insurance companies like simplification of the lengthy claim process, technical language of the policy document which is incomprehensible by the potential buyers, and improvement of the distribution channels (as direct marketing by insurance companies stands as one of the worst distribution channels) and launch of more awareness programs. Finally, the study also detects popular and unpopular channels of distribution of services. The more advanced channels like P2P Model adopted by developed countries can also be tested by regulator and insurance companies in India to bolster the sale of solar insurance.

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