FACTORS AFFECTING CONSUMER PURCHASE INTENTIONS FOR SOLAR ENERGY APPLICATION AT DOMESTIC LEVEL

Sohail Ayoub ✉

Bahria University Islamabad, Pakistan

sohail.ayoub@ymail.com

Ghulam Dastgir

Punjab University Lahore, Pakistan

engr.dasstgir@gmail.com

Muhammad Waqas

Bahria University Islamabad, Pakistan

mwaqas.mashraf@hotmail.com

Abstract

Purpose of the study was to find the factors affecting consumer purchase intentions for solar energy applications at domestic level. Quantitative methodology was used for the study. Research design was cross sectional and positivist approach is used for collection of data. Questionnaire was used as a source of data collection. A mix of systematic and convenience based sampling was used. Data from 260 participants was analyzed for result. The result found that consumer purchase intentions is significantly affected from perceived usefulness of the solar energy applications. Similarly the cost of using and purchasing solar energy, perceived ease of use and attitude towards purchase of solar energy all affect positively the consumer purchase intentions for solar energy at domestic level. This study fills the gap existing in literature to find the barriers in application of solar energy at domestic level at Pakistan. This research enables public institutions to understand the customer expectations and barriers in application of solar energy at domestic level.

Keywords: Solar energy, Renewable energy, Pakistan, Consumer behavior, Usefulness, Ease of use, Cost of solar energy

INTRODUCTION

Energy is considered back bone of an economy and it is considered as one of the most important commodities of a country (Khan & Ahmad , 2009).The demand for the energy has been increasing very sharply since last few years due to the change in people life style , industrial development throughout the world (Akroush , Zuriekat , Jabali & Asfour , 2019). This shortage has forces the world to think of some other sources of energy that is sustainable and replenishable. The concept of renewable energy has tried to alter the dynamic of energy paradigm. Renewable energy which is also known as green energy, is source of energy that is not ending and considered replenishable (Shin, 2018). The term green product (energy in our case) is defined as a source of energy as those that minimize the risk of damages to the environment (Janseen & Jagger, 2002).Renewable energy is sustainable and now a days is using as an alternative to fossil fuel energy. The concept of the renewable energy also support the environmental concerns as these sources of energy either don't create any waste or create in very negligible amount. Renewable energy have many types such as solar energy, wind energy, ocean energy, geothermal energy and some other alternative renewable energy. According to international energy agency (2017) the growth of the photovoltaic is very dynamic and it is different for different countries. According to this report the cumulative capacity for photovoltaic has increased to the total capacity of the 303 GW which is 1.8 percent of the total energy consumption throughout the world. According to the report, China, USA and India are top installer of solar photovoltaic. Pakistan like other developing countries is facing the shortage of the electricity and energy. According to a report of power division, June 25, 2018, the production of the electricity is 22,700 MW against demand of 23, 055 MW. This shows that Pakistan is having shortage of electricity. According to a report created by Islamabad Chamber of commerce, Pakistan has a potential of generating more than 100,100 Mw from solar energy .Paul and Uhomoibhi (2013) study found that solar electricity have positive impact on quality of education , health , entertainment and economic growth of people in rural areas There is increasing trend of study in solar energy. However most of the studies have covered commercial or large size application of the solar energy. Less work is done in the solar energy domestic application for daily operation for an alternative to other sources of energy. This is the first study the covers the domestic application of the solar energy. Solar electricity application range have widened from such purposes lighting, internet radio, computer, cloth pressing (Karekezi & Kithyoma, 2003) to cooling and heating, solar tube well and such other combinations. However in most cases this solar electricity work as a backup to other grid electricity (Paul & Uhomoibhi, 2013).

Research objective

The objective of the research is to find the factors that that affects the consumer purchase intentions in purchasing or installation of solar energy sources at domestic level.

Research question

What are the factors that affect the consumer purchase intentions for the installation of solar energy sources at domestic level?

Significance of the study

This study aims to fill the gap existing in literature regarding solar energy application at domestic level in Pakistan. This study covers the gap existing literature regarding the factors that affect the consumer purchase intentions for solar energy at domestic level.

LITERATURE REVIEW

Most of the studies have covered social aspects that is green energy of the solar energy. For human development it is important to have a source of energy that is long lasting, sufficient and everybody can afford to use it (Asif, 2009). Energy is important element for socio economic development of human (Bhutto, Bazmi & Zahedi, 2012). Different researchers have studied different factors related to renewable energy such as solar or wind energy or other form of renewable energy in different regions of world. Apostolopoulos and Liargovas (2016) studied regional factors on solar energy investment and production. Li and Wang (2009) studied industrial application of renewable energy in China. Castro-Lacouture and Roper (2008) studied renewable energy in USS federal buildings. Ramana, Chidambaram, Kamaraj and Velraj (2011) studied options for renewable energy based cooling system in India. Guardiola, Gabay and Moskowitz (2009) studied different preferences of public regarding solar renewable energy in US. Akroush, Zuriekat, Jabaliand Asfour (2019) studied purchasing intentions of energy efficient equipment in Jordan. Spanos, Simons and Holmes (2005) studied cost saving by application of passive solar heating in UK. Paul and Uhomoibhi (2013) studied solar electricity generation in Africa. Chandio, Jiang and Rehman (2018) studied solar application role in agricultural development of Pakistan. Hayat, Khan and Ashraf (2019) stressed government for support and initiation of policies that favors advanced and renewable energy sources in Pakistan. All the above studies show that still at domestic level, study regarding solar energy has not yet been done. This study will try to find the factors that affect practicality of the solar energy application at domestic level and the green aspect of the study will not be cover. Due to variation in economy related to energy has compelled people to look for some sustainable energy sources

in order to achieve sustainability (Can & Korkmaz, 2019 ; Nijmeijer & Metz, 2010). This sustainability can be achieve through renewable fuels (VonBorgstede et al., 2013). The renewable energy sources contribute into the economic growth of the people, improve health infrastructure and more job provision by more industrial consumption (Irena , 2016). Renewable energy sources price and cost in comparison with fossil source of energy will affect the usage of renewable energy in future (Can & Korkmaz, 2019). According to (REN21, 2015) there is total of 139 GW energy from solar photo voltaic is worldwide used, however there is still lack of awareness and attitude towards the solar energy application in public (Solangi et al. 2015). The attitude of the people towards a particular technology is helpful in predicating the people intention for purchasing or usage of the particular technology (Ajzen & Gilbert Cote, 2008). Positive attitude towards green product has positive impact on consumer purchase intention (Kang & Kim, 2013). This is also true for solar energy which is one of the most practical green energy source. This attitude is made by many factors such as Ahmad¸ Tahar, Chen and Yao (2017) concluded in their study that ease and usefulness of solar energy can make the people attitude towards the purchase intentions for solar energy. The perceived ease of usage of a technology or product is actually the consumer perception of how easy to use the product or technology (Davis, 1989). Msaed, Al-kiwfi and Ahmad (2012) defined Perceived ease of usage is actually the consumer ease of learning a technology to use. The consumer understanding about the green product (solar energy) make consumer belief for further purchasing of the green product (Bang et. al, 2012). The study also proposed that R&D should focus on development of user friendly technology for solar energy appliances. However their study lacks the important factor of cost of using the solar energy. Cost saving, environmental benefits and getting rid of the conventional sources of the energy guided the pubic intentions towards the application of the solar energy (Claudy, Peterson & Drisccoll, 2015). Castro-Lacouture and Roper (2008) predicted that cost reduction in renewable energy sources in comparison to other sources of energy will increase the demand for the renewable energy application and cost reduction of energy application should be the focus for the people. Perceived value is an important factor in determining the consumer purchase intention (Wu, 2013; Suki, 2016). It is observed that consumer prefer to use the product that value or benefits exceed their cost (Lin, 2015). Perceived usefulness is actually the consumer belief that usage of the product or technology will benefit the consumer and make possible for the consumer to perform the same task with same ease as done by other product or technology (Msaed, Al-kiwfi & Ahmad, 2012; Ziethaml, 1998). There is a need for a paradigm shift from the typical cost-based approach to a value-based approach for the promotion of SPV solutions (Andrei et al., 2007). Awareness in public and perceived benefits drive the consumer attitudes towards energy efficient product (Wilson et al.,

2015) and this energy awareness has positive impact on consumer intentions for purchasing (Ha & Janda, 2012).Consumer prefer to have technology that is enjoyable, affordable and cost effective (Guardiola, Gabay & Moskowitz, 2009). When we are talking about the perceived benefits, it is actually the performance of the product that weather it will satisfy or not the customer requirement with the same ease as alternative product (Sun, 2014). This is one of the big risk people think when they are deciding to choose the solar energy and other source of energy. Perceived value which actually drives the consumer purchase intentions is achieved through performance and quality of the product (Monroe, 2003). Consumer often doubts about the uncertainty of adopting the new products that will it fulfill their requirements or not and this thing guide their purchase intentions (Dowling & Staelin, 1994). One of the another barriers to adoption of renewable energy sources such as solar energy is the cost that negatively affects the consumer purchase intentions (Kims et al., 2005). The consumer purchase behavior is guided by predicting the consumer willingness to purchase the product (Lowe & Alpert, 2010). The same problem was also found by Kardooni et. al, (2016) that expenses of a product usage negatively affect the purchase intentions of the consumer. Renewable energy initial cost is more than other fossil fuel source, however their operational cost is less as compared to other sources of energy (Mayer et al., 1997). The same point is favored by Wang et. al, (2008) that people usually do cost to benefit analysis and if the perceived benefits are more against the product cost people prefer to purchase it otherwise they do not purchase the product. This is the point which can divert the purchase tendency for the solar energy application, if initial cost is reduced. Darby's (1999) also favored that people prefer economic and cost saving factors as compared to other factors such environmental and social in renewable energy application. Usually it is perceived that green energy resources such solar energy has relatively more prices (Awad , 2011). However, Larochi et al. (2001) advised marketer to find the segment of the market that is still paying high prices for the green product and they concern more about environmental benefits as compared to cost. Some people are price conscious and they look for some discount in the price (Palazonc & Delgado, 2009). Same factor of discount was also identified by Yeshin (2006) that people look for discount and discount motivate them for further purchase. Xiao and Noring (1994) found that perceived benefits can be increase through some incentive and sale discount which directly impact the purchase intention of consumer. Government regulation can play important role by motivating people by offering subsidy in purchasing or importing green sources of energy. However, besides this solar electricity helps society in many ways. Solar electricity helps in reduction of immigration to urban areas as people have tendency to live in a region where they have access to electricity (Van Campen et al., 2000). The consumer behavioral purchase intentions usually depends upon the familiarity

with product and knowledge obtained by possessing the product (Philippe & Ngobo, 1999). Price, quality, low maintenance cost are the factors that guide the purchase intentions in green products (Sharma & Joshi, 2017).

The comprehensive literature shows deficiency in the study regarding domestic application of solar energy in Pakistan. The study shows that there are four main factors that motivate positively for the purchase intentions. These four factors are perceived usefulness, perceived ease of use, attitude towards solar energy and price or cost of using and purchasing solar energy.

Research Framework

This study is consist of 4 independent variables and one dependent variables extracted from literature. The dependent variables perceived usefulness of solar energy, attitude towards solar energy and perceived use of solar energy have been adopted from Ahmad et al. (2017) study. As identified by Ahmad et al.(2017) their model lack in studying the price or cost of solar energy application, and it plays important role in the consumer preferences for the application of the solar energy (Guardiola, Gabay, Moskowitz, 2009), we adapted it in to our model.
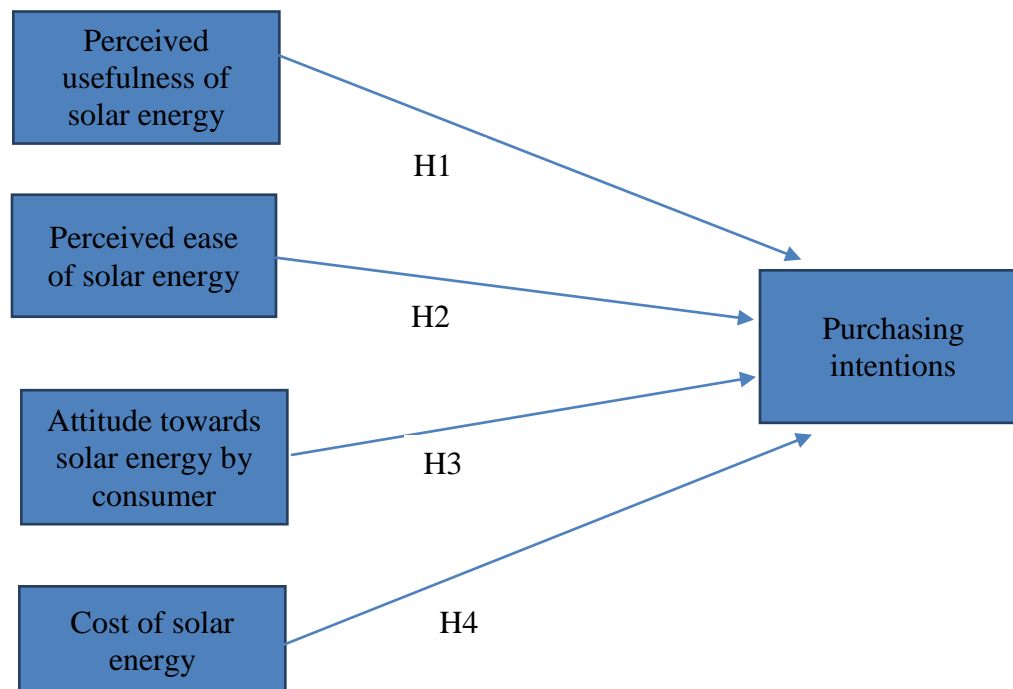

Figure 1: Theoretical framework adapted from Ahmad et al.(2017).

Hypotheses

H1: Perceived usefulness of solar energy has positive impact on consumer purchase intentions.

H2: Perceived ease of use of solar energy has positive impact on consumer purchase intentions.

H3: Behavioral attitude towards solar energy has positive impact on consumer purchasing intentions.

H4: Cost of solar energy has significant impact on consumer purchasing intentions.

METHODOLOGY

This study follows cross sectional research design. Positivist approach is used for this study. Quantitative methodology is used in this study. Questionnaire is used as a source of data collection. Questionnaire consisted of 4 independent variables and one dependent variable. The perceived usefulness of solar energy consist of 3 items, perceived usefulness of solar energy consist of 4 items, behvioural attitude towards solar energy is consist of 4 items. All the items are adopted from Ahmad et al. (2017). The cost of solar energy has been divided into three items of purchasing cost, operational cost and repair cost. The three Items for consumer purchase intentions are adopted from Akrouch et. al, (2019) study. All the items were assessed on Likert scale of 5 with 1 showing strongly disagree and 5 showing strongly agree. The ontological position for the study is objective and since we are measuring the reality, the epistemological position of the study is objective.

In the study, unit of analysis is individual. Convenience based sampling technique is used for the study. A data from 278 students of IBA were collected. An online survey form was developed and class representatives were requested to distribute in WhatsApp group of class for filling. A total of 268 responses were collected. Since 18 response were incomplete and they were not considered for data analysis so 260 responses were considered for data analysis. The collected data was analyzed using SPSS.

ANALYSIS AND RESULTS

Validity and Reliability

It is common practice to assess the validity and reliability of the questionnaire in social sciences (Kember & Leung, 2008). To measure the accuracy of the questionnaire usually reliability test and to measure the consistency usually validity test is conducted (Bolanrinwa, 2015).To measure the face validity , the questioner were sent to 15 professional working in solar energy production or services. After their response the questionnaire was finalized as they suggest no change in the questionnaire we already adapted. To measure the reliability of the variables used

in questionnaire Cronbach Alpha test was used. Different researcher proposed different value for acceptance of the reliability. George and Mallery (2016) proposed all the value should be above than 0.70 while Hair et al., (2017) suggested that Cronbach alpha value should be above 0.60. We followed Hair et al., (2017) standard. All the variables were having value than threshold value of 0.60 as suggested by Hair et al., (2017). Table 1 summarizes the result.

Table 1: Reliability of the variables

Sr.No.	Variable	Cronbach Alpha Value	items	Remarks
1	Perceived usefulness of solar energy	0.779	3	valid
2	Perceived ease of solar energy	0.794	3	valid
3	Attitude towards solar energy by consumer	0.769	4	valid
4	Cost of solar energy	0.616	3	valid
5	Purchasing intentions	0.761	3	valid

Demographics of the study

Gender

223 male and 37 female participated in our survey. Summary of respondents based on gender is summarized in table 2.

Table 2: Respondent Gender

Sr.No	Gender	Frequency	%
1	Male	223	85.76
2	Female	37	14.23

Respondent Age

Our data is consist of people from different age. 132 respondents (50.8%) were between age 20 to 30. A total of 93 respondents (35.8 %) were age between 31 to 40. Similarly 21 respondent (8.1 %) were between age of 41 to 50. 14 respondents (5.4%) were having age above 50.

Table 3: Respondent age

Sr.No	Age	Frequency	%
1	20-30	132	50.8
2	31-40	93	35.8
3	41-50	21	8.1
4	above 50	14	5.4

Respondent Profession

Respondents from different profession participated n our survey. Total of 145 engineers (55.3%) participated in our study. Similarly 37 students (14.1%) participated in our study.

Table 4: Respondent professions

Sr.No	Profession	Frequency	(%)
1	Engineer	145	55.3
2	Teacher	13	5.0
3	armed force	4	1.5
4	other	57	21.8
5	Housewife	3	1.1
6	Doctor	1	0.4
7	student	37	14.1

Descriptive statistics

Table 5 shows descriptive statistics for different variables. Perceived usefulness of solar energy has mean value of 3.96 which shows that participant have tendency towards perceived usefulness of the solar energy as data is assessed on Likert scale of 5 , ranging from 1 to 5 , 1 with strongly disagree and 5 strongly agree. Perceived ease of solar technology has a mean value of 3.68 showing that respondents are somewhat neutral and sometime they feel ease and sometimes not. Attitude towards solar energy has a mean value of 4.04 which shows that participants have tendency towards solar energy application. The mean value for the purchase intentions (PI) has a mean value of 3.91 which shows that participants have tendency towards purchase intentions in future.

Table 5: Descriptive Statistics

	N	Mean	Std. Deviation	α	PU	PE	AT	COST	LOYAL
PU	251	3.9641	.69987	0.779	1				
PE	251	3.8220	.74011	0.794	0.554	1			
AT	251	4.0488	.59570	0.769	0.653	0.577	1		
COST	251	3.5790	.77363	0.736	0.345	0.435	0.384	1	
PI	251	3.9203	.62598	0.761	0.566	0.57	0.684	0.448	1

Note: PU = Perceived Usefulness, PE = Perceived ease of use, AT = Attitude towards solar energy, COST= Cost of using solar energy, PI = Purchase intentions

Correlation coefficients of variables

To examine the relationship between different variable we conducted the correlation test .the symbol of ** shows that the result will be the same with 99% reliability if the test is conducted again.

Table 5 shows that there is moderate positive correlation coefficient (.553) between Perceived usefulness and perceived ease of solar energy. Similarly there is positive correlation (.648) between perceived usefulness and consumer attitude towards solar energy. Consumer attitude towards solar energy and perceived ease have moderate positive correlation coefficients .561**). There is weak positive correlations (.341) between cost of using solar energy and perceived usefulness of the solar energy. Cost of solar energy and perceived ease of solar energy have weak positive (.417) correlations. Similarly cost of solar energy has weak positive correlation with attitude towards solar energy. Purchase intentions has moderate positive correlation (.546) with perceived usefulness and weak positive correlation (.495) with perceived ease of solar energy. Purchase intentions has strong positive correlation (.670) with attitude towards solar energy and weak positive correlations (.432) with cost of solar energy.

Model summary

Table 6 shows that multiple correlation coefficients (R = .737) consumer purchase intentions have positive correlations with perceived usefulness of the solar energy , perceived ease of solar energy, cost of solar energy and consumer attitude towards solar energy. The model summary also shows that 54.3% changes in purchase intentions are explained by perceived usefulness, perceived ease , consumer attitude and cost. 46 percent of purchase intentions can be explained by other factors such as social and economical factors, marketing, government regulations etc.

Table 6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.737[a]	.543	.536	.4265
a. Predictors: (Constant), COST, PU, PE, AT				

Table 7: Regression Coefficients

Model	B	Sig.	Remarks
1 (Constant)			
PU	.113	.034	Accepted
PE	.151	.002	Accepted
AT	.459	.000	Accepted
COST	.129	.001	Accepted

    a.   Dependent Variable: Purchase Intentions

    b.   Note : PU = Perceived Usefulness, PE= Perceived ease of use, AT = Attitude towards solar energy, COST= cost of using solar energy, purchase intentions

Perceived usefulness of the solar energy:

The beta value (.113) shows positive relationship between perceived usefulness of the solar energy and purchase intentions. Perceived usefulness has significance level of .004 which is less than the threshold level of .05 and shows that our variable is significant. This shows that our first hypothesis (H1)) qualify.

Perceived ease of Solar energy:

The beta value (.151) for perceived ease of solar energy shows it has positive relations with Supplier intentions. The significance value is 0.034 lies under acceptable limit which shows that this variable is significance and our hypothesis (H2) is valid.

Attitude towards solar energy:

The beta value (.459) for attitude towards solar energy shows that it has positive relation with purchase intentions. The significance value is .000 which lies under acceptable range of less than .05. This shows that our variable is significant and our third hypothesis (H3) is valid.

Cost of solar energy:

The beta value (.129) for cost of solar energy shows that it has positive relations with purchase intentions. The significance value is .001 which lies under acceptable range. The significance level is .000 <.05 shows that our fourth (H4) is valid.

Following is the final equation for our model:

Purchase intentions = .575 (constant) + .113*(perceived usefulness of the solar energy) + .118* (perceived ease of solar energy +.459*(attitude towards solar energy) +.129*(cost of solar energy)

This equations shows that 1 unit increase or decrease in perceived usefulness of solar energy .113 increase or decrease in purchase intentions. Similarly 1 unit change in perceived ease in solar energy applications change .118 change in purchase intentions. Similarly for all other independent variable changes the dependent variable accordingly.

DISCUSSION

Energy is important factor for human development and it is important that the source of the energy is long lasting, affordable and everybody have access to it (Asif, 2019). The demand for the renewable energy has increased due to the scarcity of the fossil fuel electricity. The result of the regression model shows that 53 % of the variation in purchase indentation are dependent upon perceived usefulness, perceived ease, cost and attitude towards solar energy. Our result favors the literature that perceived usefulness drive the consumer purchase intentions for solar energy application at domestic level (Ahmad et. al, 2017). The beta value for the perceived usefulness (.113) shows that purchase intentions impact positively the purchase intentions. Our result also favors the literature for the ease of solar energy application that easily and flexible control of the solar energy applications will increase the demand for the solar energy (Ahmad et. al, 2017; Guardiola , Gabay & Moskowitz, 2009). The beta value for the ease of solar energy (.108) shows that ease of solar energy will drive the consumer purchase intentions positively. As identified by Thar et. al, (2017) further R & D in solar technology will increase the application of the solar energy at domestic level by making easily controllable devices. The regression model result or attitude also shows that attitude of the consumer also plays an important role in the consumer purchase intentions. The beta value (.459) for the attitude towards solar energy shows that public awareness through effective marketing will drive the consumer preferences for solar energy as identified by Wilson et al., ((2015) and Ha and Janda, (2012). Another important factor that drive the consumer purchase intention is the cost. Our regression model shows that cost of the solar energy impact the purchase intentions (beta value =.129). Since the initial cost for the solar energy is high, this will negatively affect the purchase intentions (Mayer et al., 1997). However the positive aspect of the solar energy is that it lowers the operational cost of using the solar energy as identified by Mayer et al., (1997) and Darby's (1999). As found people are now having tendency to evaluate the product based upon the perceived value as

compared to the cost analysis, further R & D and government regulation will lower the initial cost and this demand for the environment friendly solar energy will increase.

IMPLICATIONS OF THE STUDY

This is the first study that covers the factors that affect the consumer purchase intentions regarding solar energy at domestic level in Pakistan. The study provides literature for more advance studies in solar energy in Pakistan. The study also helpful for the solar energy appliances provider to understand the expectations of the consumer while purchasing solar based product. The study will also helpful for public institution to understand the consumer expectations while designing policy regarding solar energy and other form of renewable energy.

CONCLUSION AND RECOMMENDATIONS

The objective of the study was to find the factors that affect the practical use of the solar energy at domestic level. After available literature, it was found that there are four factors that impact the consumer purchase intentions regarding the solar energy application at domestic level. All the four independent variables were analyzed with the dependent variable of consumer purchase intentions and it as found that all the four factors significantly impact the consumer purchase intentions.

Based on the findings, it is recommended that more awareness of the people needs to create regarding the perceived benefits of the solar energy. Similarly the government should support more legislation regarding the application of the solar energy. Government should support more R & D in making solar energy more flexible and easily applied at domestic level. Government may support in terms of providing subsidy and lower taxes in case of solar energy appliances usage. This will reduce the cost of using solar energy Government may train people in repairing and maintenance of the solar energy appliances. This will create more job opportunities for people and hence more addition to the revenue.

LIMITATIONS OF THE STUDY AND FUTURE STUDY

This study is limited to only specific region. Due to time constrain, data from only 260 participants were collected. This level can be enhanced for more reliable result. This study is limited to only four factors. More factors such as government regulation and incentive from government can also be study. A comparative study of the developing country can also be done. A comparative study with develop country could find out the gap and barriers in application of the solar energy at domestic level. Since the study is conducted at small regions, this can be conducted at different regions of Pakistan for more generalized result.

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