Factors Influencing Solar Energy Technology Adoption by Households in Western Province Sri Lanka

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Abstract

The acceptance and slow growth of solar energy in Sri Lanka is a major barrier. The aim of this study was to identify the factors which are more considerable when adopting solar energy technology. Technology Acceptance Model (TAM), Diffusion Of Innovation (DOI), Theory of Planned Behavior (TPB) and Transaction Cost Economics theory (TCE) are the theories that are used to develop the research foundation. Basically five key factors have been identified: namely Relative Advantage, Perceived Behavioural Control, Perceived Ease of Use, Awareness of the Technology and Perceived Cost. A self-administrated questionnaire was conducted to collect data from a sample of 384 respondent households. Structural Equation Modeling (SEM) was used to test the hypothesis. The result of the study indicates that all the key factors have a positive impact with adoption of solar energy technology. Creating better awareness of the benefits of solar energy usage and increase awareness among people towards their responsibility to use green energy sources can encourage the rate of usage amount in domestic consumers. Providing financial support, obtaining continuous feedback and providing free technical advisory schemes are also good practical implications. From a managerial viewpoint these findings can be used for strategic planning to determine effective marketing activities to change customer's intention to ensure sustainable business growth. Important policy making decision and investment decisions can be taken by these estimates. In consumer's perspective the study enhances knowledge on solar energy as a power source of green energy for small scale households in urban areas. Though geographical unfairness act as the main limitation, since the high density of population, income level and urbanization of observed area, the result can be generalized to the urbanized households.

Key words: Adoption, Relative advantage, Perceived behavioural control, Perceived ease of use, Awareness, Cost, Solar energy

INTRODUCTION

To preserve the ecological balance of this planet, it is necessary to motivate users to opt for renewable energy technologies. Rapidly increasing energy demand and growing concerns are gradually pushing the world to the use of Renewable Energy sources. There are three generations of hydro power namely first, second and third. Hydropower, biomass combustion, and geothermal energy which are referred to as matured renewable energy technologies are categorized in to generation one. Fast growth renewable energy technologies are considered as the second generation, and it consists of solar, wind, and new-fashioned bio-energy. The third generation consists with a wide range of renewable energies as concentrating solar power, ocean energy, modern geothermal energy, and integrated bio-energy. (IEA, 2006).

Many experts consider solar energy as one of the most promising technologies among them all. Solar energy is derived from the sun through the form of solar radiation and it is the most abundant energy source on earth. The sun is a very reliable, pollution free, renewable source of energy.Sustainable energy is a highly interesting and innovative concept which needs serious attention as energy costs are always on the rise, the human population is increasing, the environment is being polluted, and resources are being depleted.

At the global level, renewables represented approximately 58.5% of net additions to global power capacity in 2014, with significant growth in all regions (Purohit & Purohit, 2017).The International Energy Agency (IEA) estimated that in 2050, about 11% of electricity production would be provided by solar energy worldwide (Katinas, et al., 2013). Sri Lanka's annual average solar irradiation is in the range of 5.5KWhm^{-2}d^{-1} and throughout the year with low seasonal variations. The solar irradiation that arrives at ground level depends mainly on the day of the year, the latitude of the location and on atmospheric transmittance, also termed as clearness index K_T(Department of Meterology, 2016). Since Sri Lanka is a country near the equator getting sunlight throughout the year without much seasonal variations, we have much possibility of using Solar Energy throughout the year without interruption.

This is an analysis for the identification of factors that effects the adoption of solar energy technology in Western province, Sri Lanka. Sri Lanka is 98.4% electrified with grid electricity (Board, 2016), and they already have electricity supply to energize their households and equipment. Therefore introducing solar panels to the same consumer base will be big a challenge. But considering about world requirement of introducing renewable energy sources (Solar Energy) due to the upcoming Energy crisis, here we have to analyze the factors affecting when doing the same with Sri Lankan households.

Studying the factors affecting the adoption with solar energy implementation in households in Sri Lanka is a contemporary issue which needs to be addressed due to global requirements and the energy crisis. Fuel diversifying and energy security in the generation of electricity was identified as a strategic objective and development of renewable energy projects was identified as a part of this strategy in the National Energy Policy 2006. (Sustainable Energy Authority, 2017)Introducing solar panels to the existing electricity users will be big a challenge. But considering the upcoming energy crisis we have a duty to move to solar energy and find the factors which are more considerably affecting the adoption with its technology.

There are five main research questions addressed in this study. They are respectively addressed to observe the impact of relative advantage, perceived behavioural control, perceived ease of use, awareness of technology and perceived cost with respect to the intention of adopting solar energy technology in Sri Lanka. Throughout the research questions it is addressed respectively whether the relative advantage has an impact to adopt with solar energy technology, whether the perceived behavioural control has an impact to adopt with solar energy technology, whether the perceived ease of use has an impact to adopt with solar energy technology, whether the awareness of the technology has an impact to adopt with solar energy technology whether the perceived cost has an impact to adopt with solar energy technology. Core objective of the research is to address mentioned questions.

LITERATURE REVIEW

Background

The devices that convert daylight without delay into power are called solar photovoltaics (PV) or solar cells or simply PV. In the year of 1954, the modern shape of the solar cell was invented at Bell Telephone Laboratories. The conversion of light (photons) to electricity (voltage), is a physical technique of is the term "photovoltaic" impact and it is so-referred to as "PV impact". (Taylor, et al., 2014).Global PV production ability was exceeded as much as 500 kW within the year of 1997. Total installed solar PV capacity changed into 2 GW and in year 2002, and 10 years later, in 2012, it exceeded 100 GW. New additions of Photo Voltaic solar cells in 2013 came alone with 39 GW and according to the Tylor et al, for the first time it exceeded the new capacity additions of wind in a given year. Year 2014 was estimated as the year with records according to Tylor et al, with total installed PV capacity of 180 GW at the end of the year world widely. (Taylor, et al., 2014).

Sri Lankan Energy Situation

By the end of the year 2014, 98.4% of the households in the Sri Lanka was electrified. The average per capita electricity consumption increased to 540 units from 519 units (kWh/person) in the previous year thus recording an increase of 21 units. (Ceylon Electricity Board, 2014). The total electricity sales during the year increased from 10,621 GWh in the previous year to 11,063 GWh which was a percentage increase of 4.2%. The average daily consumption of electricity in the year was 30.3 GWh as against 29.1 GWh in the year 2013.The trend of using renewable energy sources has increased with time to a considerable amount. Among the renewable energy sources, solar power is the most common method used is Sri Lanka. Meanwhile in solar Energy, installed capacity in megawatts as well as the number of solar

connections have increased.Renewable energy usage to produce electricity in Sri Lanka was limited to large investors a few years ago, because it usually costs millions of rupees. But with the introduction of the “Net Metering” concept by 2008, the opportunity to produce electricity using renewable energy was possible even for small investors and it was open to all electricity customers in Sri Lanka.

Factors Influencing Adoption of Solar Power Systems

Due to the rapid consumption of conventional energy resources such as crude oil, coal, and natural gas, many initiatives taken all over the world have addressed towards the efficient use or replacement of the resources. Several renewable energy sources have been introduced and argued as alternatives to traditional sources to protect environmental resources and improve the quality of life. With the growing concerns about Green House Gas (GHG) emissions and consequent climate change, renewable energy sources have become more attractive options for power Generation around the world.(Luthra, et al., 2015)

Relative Advantage of Using Solar Energy

Relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes. The percentage of relative advantage can be measured in economic terms, social-prestige factors, convenience, and satisfaction.(Rogers, 1983).It does decide by the innovation’s "objective" advantage, but by the individual’s consideration as advantages. The greater the perceived relative advantage of an innovation, the higher its rate of adoption of the innovation. (Rogers, 1983)

Consumer’s perception on potential expectations about their benefits are the main key point of individuals associated with attitude towards new technology, and this was proved in several researches.(Chen, et al., 2013). Prior research on Technology acceptance model (TAM) and theory of planned behavior (TPB) has proved that benefits of newly introduced technologies or relative advantage are indirect influence with user’s intention to adopt with new technology. (Mathieson, 1991),(Rogers, 1983).Relative advantage is moreover defined as the extent to which an innovation is perceived as better than the idea it supersedes or its nearest alternative. Relative advantage is one of the best predictors of the innovation and it is positively related to the innovation’s rate of adoption. Most of the users consider renewable energy as an environmental perspective as well as the benefit of future generations. This can be measured in financial terms as well social status, comfort, and satisfaction. The greater the perceived relative advantage of renewable energy, the more rapid its rate of adoption will be.(Rogers, 1983).

Perceived Behavioural Control

Perceived behavioral control is the degree to which a person feels to engage in a behavior (Ajzen, 1991), the two aspects on influential are how much control a person has over his behavior and how confident a person feels about being able to perform or not perform the behavior. Perceived behavioral control is determined by the individual's beliefs regarding the power of both situational and internal factors to facilitate performing the behavior (Ajzen, 1991). Perceived behavioral control is the extent to which a person feels able to engage in a behavior(Armitage & Conner , 2001). Existing energy technologies have been developing for centuries. Therefore as per Wiser and Pickle, explains to switch between an alternative energy technologies, consumers have to do number of calculations regarding its cost, change in living standards and changes to other socio-economic parameters.(Wiser & Pickle, 1997).Technology acceptance model identifies Attitude towards using as a mediator between behavioral intention to buy and perceived ease of use and perceived usefulness. In the theory of reasoned action attitude towards behavior is acting as a mediators between beliefs and evaluations and behavioral intention.

Individual behaviors are not only impacted by progressions of valuation and expectations but they also rely on the belief of the technology. In the TPB,Ajzenproposed the variable of Perceived behavioral control (PBC). He suggested that perceived behavioral control belief starts from two sources. First one is the inner force of individual, such as self-sufficiency, and the outer force that controls external conditions(Ajzen , 2002) For example, after a specific attitude is formed, people need to evaluate higher relative advantage and higher perceived behavioral control. Perceived behavioral control is hypothesized to directly influence intention to use solar energy.

Perceived Ease of Use

Ease of use can be defined as the degree to which users easily understand, operate and maintain a new technology. Ease of public use of renewable energy can be ensures by using an effective quality control mechanism and by understanding the living standards of the target group. (Fishbein & Ajzen, 1975). Wider public support and use of renewable energy are possible if users find the technology to be user-friendly, family-friendly and identical to their standard of living (Seyal & Rahim, 2006). New technology decision implementation is based on its perceived ease of use(Seyal & Rahim, 2006). Technology acceptance model (TAM) suggests that user's acceptance of new technology is based on their perceived ease of use. Perceived

ease of use is influenced by users' opinion regarding installation, regular use, maintenance and recycling of the new technology. Ease of use is explained from the technical standpoint of renewable energy. Studies perceive that the use of solar energy has numerous technical barriers to end users. As a result, mass users show unwillingness to invest in solar energy. Stephen and Ioannou have argued that family and community friendly renewable technology will positively influence the intention to use renewable energy.

Awareness of the Technology

The degree to which users are conscious of the current new technology and its benefits and weaknesses can keep track of updates on new technologies. Awareness is one of the key issues in adoption. Creating awareness of the product is important to the customer. (Fishbein & Ajzen, 1975) Information gap makes the acceptance of new technology much less likely(Zografakis, et al., 2010). Adoption can be defined as the acceptance and continued use of a product, service or idea. According to Rogers and Shoemaker consumers go through "a series of processes in knowledge, conviction, decision and confirmation" before they are ready to adopt a new product or service.(Rogers & Shoemaker, 2001) The adoption or rejection of an innovation begins when "the consumer becomes aware of the innovation" (Rogers & Shoemaker, 2001). Howard and Moore stressed that in adoption, "consumers must become aware of the new brand."(Howard & Moore, 2002). More knowledgeable consumers are assumed to be more willing to adopt.

Perceived Cost

The cost of Renewable energy incorporates both a holistic outlook on the initial requirement to set up the machines as well as their periodic costs. Higher the cost of the technology, the lower its value to users, and lower its rate of usage (Premkumar, et al., 1997). Price/costs is one of the single most important factors that influences consumer adoption of innovation. If consumers are to use new technologies, the technologies must be reasonably priced relative to alternatives. Otherwise, the acceptance of the new technology may not be viable from the standpoint of the consumer.

According to many researches it is found that there is a direct and significant relationship between cost and the adoption of technology.(Seyal & Rahim, 2006). Higher the benefit-cost ratio, the positive the intention to switch to renewable energy. This scenario is common for solar energy as well. The minimum investment required to install renewable energy can be higher. Rogers et al. (2008) and West et al. (2010) suggested availing economic incentives to ease the financial burden from the users. The summary of these studies report that on the

average users are reluctant to pay more than 5% when compared to their existing energy expenses on conventional energy. This negative attitude may reduce users' intention to switch to renewable energy.

Theories Supporting the Research

Factors affecting adoption of Solar Energy technology is based on any one or a combination of the following key determinants, as per the literature. Past findings provide guidance to the researcher to draw links between current situations and the literature which play a major role. During the research of Shah Alam et al they have drawn attention to few factors affecting adoption of renewable energy sources using few of the theories. (Shah Alam, et al., 2014) Different theories have been used to explain the determinants of PV adoption. The most common theories applied in the literature are Diffusion of innovation DIT (Rogers, 1983) , Technology Acceptance Model, TAM(Davis, 1989), Theory of Planned Behaviour (TPB) (Fishbein & Ajzen, 1975)and Transaction cost economies theory (TCE) (Williamson, 1979)

HYPOTHESIS AND CONCEPTUAL FRAMEWORK

In adoption of solar energy technology from conventional energy technologies is a socially oriented process and an individual's perception plays a vital role in it. (Frankfurt School of Finance & Management, 2012).The conceptual model for the study was formulated using the concepts of Alam et al.(Shah Alam, et al., 2014)and the findings of (Kim, et al., 2014), and other unique factors that were identified during the literature review as the influencing factors that affect solar energy adoption. Usage of technology is largely influenced by multidimensional forces such as regulatory, economic dimensions and societal forces. This study focuses on a preliminary understanding of household users' perceptions of the solar energy concept. Therefore the conceptual framework also focuses on pre-adoption focus on solar energy technology.

Relative Advantage

Several studies have shown that consumer's perception about potential expectations of own benefits is individually associated with consumers attitude towards new technology.(Chen, et al., 2013).Prior research on Technology acceptance model (TAM) and theory of planned behavior (TPB) has verified that relative advantage or benefits of newly introduced technologies are indirect associate with user's intention to employ the technology. (Mathieson,

1991),(Rogers, 1983). Relative advantage has been found to be one of the best predictors and is positively related to an innovation's rate of adoption. Users consider renewable energy both from an environmental perspective as well as for the benefit of future generations. Relative advantage can be measured in financial terms as well social status, comfort, and satisfaction. The greater the perceived relative advantage of small- scale renewable energy, the more rapid its rate of adoption will be.(Rogers, 1983). Thus hypothesis 1 (H1) has been formulated as follows.

H1: Relative advantage has an impact on solar energy technology usage intention in the Western Province, Sri Lanka

Perceived Behavioural Control

Perceived behavioral control has two aspects, one is how much control a person has over the behavior and the other is how confident a person feels about being able to perform or not perform the behavior. (Ajzen, 1991). Existing energy technologies have been developing for centuries and therefore switch between an alternative energy technologies, consumers have to do number of calculations regarding its cost, change in living standards and changes to other socio-economic parameters.(Wiser & Pickle, 1997).Therefore the second hypothesis (H2) is formulated as follows.

H2: Perceived behavioural control has an impact on solar energy technology usage intention in the Western Province, Sri Lanka

Perceived Ease of Use

New technology decision implementation is based on its perceived ease of use(Seyal & Rahim, 2006). The degree to which users easily understand, operate and maintain a new technology is called ease of use. Ease of public use of renewable energy can be ensured by using an effective quality control mechanism. (Fishbein & Ajzen, 1975). Solar energy as a renewable energy should be simple to install, rather without the help of any technical expert. The usage policy and maintenance also should be simple to understand. Thus hypothesis 3 (H3) is developed as follows.

H3: Perceived ease of use has an impact on solar energy technology usage intention in the Western Province, Sri Lanka

Awareness of the Technology

Several studies have found that awareness is one of the primary issues in technology adoption(Zografakis, et al., 2010). The information gap makes the acceptance of new technology much less likely(Zografakis, et al., 2010). Therefore the fourth hypothesis (H4) is formulated as follows.

H4: Awareness of the technology has an impact on solar energy technology usage intention in the Western Province, Sri Lanka

Perceived Cost

Cost for solar energy consists of an initial investment to set up the machines as well as their periodic maintenance costs. The higher the cost of the technology, the lower its value to users, and the lower its rate of usage(Premkumar, et al., 1997). According to many researches it is found to be a direct and significant relationship between cost and the adoption of technology.(Seyal & Rahim, 2006). Thus hypothesis 5 (H5) is developed as follows.

H5: Perceived cost has an impact on solar energy technology usage intention in the Western Province, Sri Lanka

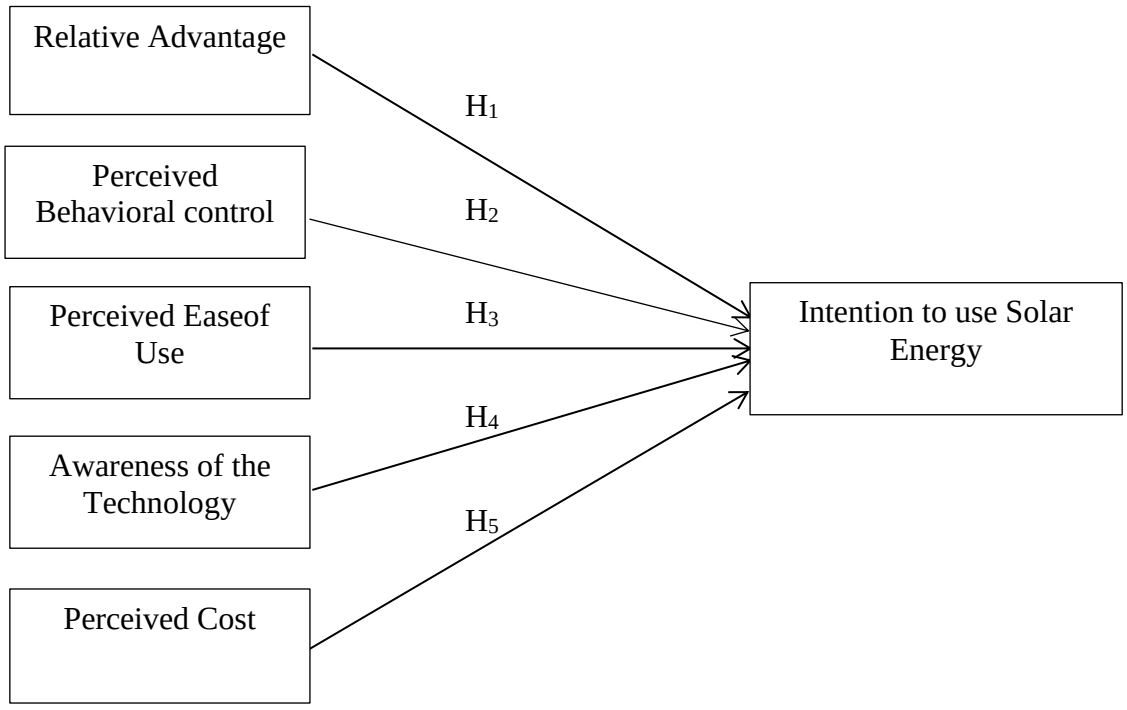

Figure 1: Conceptual framework

Source: Author Construct

Methodology

Participants and Procedure

As per the nature of the objectives, this study falls under the positivist paradigm. According toRamenyithe researcher is working with observable social realities and the end result can be generalized to similar circumstances.(Remenyi, et al., 1998). For this, a simple random sampling technique was employed to draw the sample from the population.The main data collection tool of this study is the questionnaire survey. The data collected on all variables comprise primary data, where the nature of the data mainly involves the perceptions of the respondents. The study administered the questionnaire through an electronic form (email &google form) as well as printed questionnaires.

More than 1000 questionnaires were distributed randomly among Western province households during a three month period. As a result, a total of 393 (39.3%) of questionnaires were returned. Of the 393 questionnaires collected, the completed once were used in the analysis. This response rate is considered sufficient considering that, according to (Sekaran U. , 2003), a response rate of 30% is acceptable for surveys.Then, the questionnaires were screened and incomplete questionnaires were rejected. Accordingly, 384 questionnaires were forwarded for the data analysis. The data were analyzed using Structural Equation Modeling (SEM) with the aid of AMOS (Analysis of Moment Structures) 23.0.

Measures

The questionnaire comprises 28 questions to measure the 5 constructs (Relative Advantage, Perceived Behavioural Control, Perceived ease of use, Awareness of the technology, Perceived cost).The Part (A) includes questions formulated in order to obtain a general understanding of demographic information of the respondents, such as their gender, age, highest education qualification, occupancy status and establishment size. The Part (B) includes adoption factors related information. All questions used in the study were from pretested questions used by other researchers, for example, Kim et al and Alam et al. The Part (B) was developed by drawing on existing scales. All constructs were measured using multiple items.

Data Analysis and Results

A pilot survey was conducted using 30 respondents to identify and eliminate potential problems in the questionnaire design (Malhotra & Peterson, 2006)and to examine the validity and reliability of the measures used in the questionnaire (Sekaran & Bougie, 2009). The Cronbach's

alpha coefficient of the pilot survey was greater than 0.7 for all constructs which is an acceptable value for a pilot test (Hair, et al., 1998).

After the pilot survey, all data were winsorized at 95% level to remove outliers and the 384 cases were forwarded for missing value analysis. In this study, there were no missing values in the 384 questionnaires. After missing value data analysis and outlier detection, there were 9 outliers found and removed. The data were tested for multivariate assumptions such as normality,linearity, homoscedasticity and multicollinearity. Normality was tested by skewness and kurtosis where the values were within + 2.0 (Garson, 2009). To measure linearity and homoscedasticity normal probability plots (p-plots) and scatter plots were drawn respectively (Hair, et al., 2010)and no deviations were identified. Finally, multicollinearity was assessed using a correlation matrix and all inter-correlation values were less than 0.9. Summarizing the results of multivariate assumptions, all variables were assured of normality, linearity, homoscedasticity and multicollinearity.The Kaiser-Meyer-Olkin (KMO) was used to measure the adequacy of the sample of the study. KMO results showed that the sample adequacy of all constructs is greater than 0.5 which indicates that the sample is adequate (Malhotra & Dash, 2011). The unidimensionality of all constructs was ensured using Exploratory Factor Analysis (EFA). Cronbach's alpha was used to measure the reliability of all constructs and its value is greater than 0.7, and thus, it can be concluded that the reliability is established for all constructs. Thereafter, data were forwarded for multivariate analysis.

The Measurement Model

The measurement model "specifies the indicators for each construct, and enables an assessment of construct validity" (Hair, et al., 2010). Based on the conceptual model, there are 5 latent variables, namely,relative advantage, perceived behavioural control, perceived ease of use, awareness of the technology and perceived cost.As the initial measurement model portrayed a poor fit, the model was improved using modification indices. Stepwise deletion of items below 0.5 factors loading was applied to further refine the initial model. During the modification process,further, covariance were drawn between the error terms of several items for improvement purposes. The final measurement model showed acceptable fit.

Table 1: Model-fit statistics of measurement model

Source: Survey Data

Absolute					***Incremental***		***Parsimony***
CIMIN/DF	*GFI*	*AGFI*	*RMSEA*	*IFI*	*TLI*	*CFI*	*PRATIO*
1.167	*.911*	*.875*	*.046*	*.977*	*.973*	*.926*	*.922*

According to Hair et al., (2010), CMIN/DF (X^2/df) value close to one and not exceeding 3, Comparative Fit Index (CFI) value close to 1, Tucker- Lewis Index (TLI) value close to 1 and Root Mean Square Error of Approximation (RMSEA) value of about 0.08 or less indicates a good model fit. As further recommended by Hair et al., (2010), the stated GOF (goodness of fit) indicates must include at least one absolute measure (X^2/df/ p value/GFI/RMSR/RMSEA), one incremental measure (NFI/CFI/TLI/RNI) and one parsimony (PRATIO/PCFI/PNFI) fit measure. As shown in Table 1, the CIMIN/DF of the measurement model is close to 1 and below 3, the RMSEA is 0.046, thus providing absolute model fit. Also, all incremental and parsimony indices depicted in the Table 1 are close to 1, assuring satisfactory model fit.

Table 2: Convergent and discriminant validity

Source: Survey Data

Construct	***Measurement***	***RA***	***PBC***	***PEU***	***Awareness***	***Cost***
Relative Advantage	*RA*	***0.717***	*0*	*0.001*	*0.004*	*0.002*
Perceived Behavioral Control	*PBC*		***0.747***	*0.053*	*0.001*	*0.022*
Perceived ease of use	*PEU*			***0.708***	*0.044*	*0.002*
Awareness	*Awareness*				***0.866***	*0*
Cost	*Cost*					***0.822***

Note:Diagonal entries (in bold) are the square root of AVE for all constructs; sub-diagonal entries are the correlation coefficients estimates between each construct

The Confirmatory Factor Analysis (CFA) was used to further test convergent and discriminant validity of the constructs. As explained by Malhotra & Dash (2011) 0.5 or higher factor loading and 0.5 or greater Average Variance Extracted (AVE) assures satisfactory convergent validity.

In addition, Composite Reliability (CR) must be 0.7 or higher. Generally, discriminant validity can be ensured if the square root of the AVE is larger than the correlation coefficients(Malhotra & Peterson, 2006). Further, in ensuring discriminant validity, Maximum Shared Variance (MSV) and Average Shared Variance (ASV) must be less than AVE (Hair, et al., 2010). Moreover, the correlation coefficients among the study constructs do not exceed 0.85 (Kline, 2011). Thus, all the constructs in the study represent different concepts. As all of the above requirements are fulfilled, the convergent and discriminant validities are satisfactory, as shown in Table2.

The structural model

The structural model defines the relationships among the latent (unobserved) constructs (Byrne, 2010). The proposed structural model is composed of six major latent constructs, of which five are exogenous (relative advantage, perceived behavioural control, perceived ease of use, awareness &cost) and one endogenous (intention to adoption). All hypotheses were tested at the 95% confidence level.

Table 3: Model-fit statistics of structural model

Source: Survey Data

Absolute					***Incremental***		***Parsimony***
CIMIN/DF	*GFI*	*AGFI*	*RMSEA*	*IFI*	*TLI*	*CFI*	*PRATIO*
2.440	*.868*	*.807*	*.063*	*.931*	*.907*	*.938*	*.904*

Model fit statistics for the structural model 1 are summarize in Table 3. Accordingly, model fit statistics values of structural model 1 shows a good model fit. (CIMIN/DF 1.148, GFI .903, RMSEA .031, IFI .988, TLI.985, CFI .988). CIMIN/DF is less than 3. GFI is greater than 0.9 and RMSEA shows a good absolute model fit. Further, incremental measures (IFI, TLI, CFI) also shows a good model fit. In addition, parsimony indices confirm the satisfactory level of model fit.

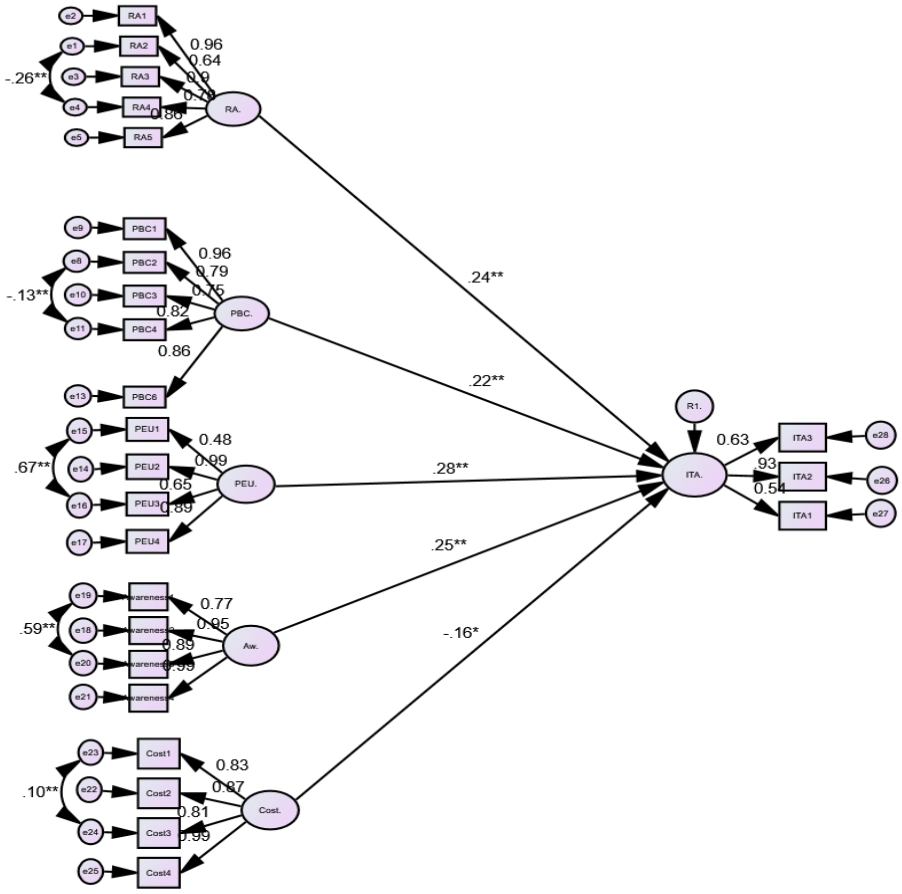

Figure 2 - The structural model
Source: Author Construct

Hypothesis 1 investigated the relationship between relative advantage (RA) and intention to adopt solar energy (ITA). It was hypothesized that there would be a significant effect on the adoption of solar energy technology with relative advantage. The results, demonstrated positive and significant paths from perceived ease of use and intention to use solar energy technology. ($\beta = 0.24$, $p < 0.008$). Thus, hypotheses 1 was supported.

Hypothesis 2 tested the impact with perceived behavioural control (PBC) and intention to adopt with solar energy technology. (ITA). It was hypothesized that there would be an impact on intention to adoption due to the perceived behavioural control. The results suggested that the impact on intention to adoption and perceived behavioural control are positive and statistically significant ($\beta = 0.22$, $p < 0.009$). Thus, hypothesis 2 was supported.

Hypothesis 3 tested the impact with perceived ease of use (EU) and intention to adopt solar energy technology. (ITA). It was hypothesized that there would be an impact on intention to adopt due to the perceived ease of use of the technology. The results suggested that the impact on intention to adopt and perceived ease of use are negative and statistically significant ($\beta = 0.28$, $p < 0.008$). Thus, hypothesis 3 was supported.

Hypothesis 4 tested the impact with awareness (Aw) and intention to adopt with solar energy technology. (ITA). It was hypothesized that there would be an impact on intention to adoption due to the awareness of the technology. The results suggested that the impact on intention to adoption and awareness on technology are positive and statistically significant ($\beta = 0.25$, $p < 0.026$). Thus, hypothesis 4 was supported.

Hypothesis 5 tested the impact with perceived cost (Cost) and intention to adopt solar energy technology. (ITA). It was hypothesized that there would be an impact on intention to adopt due to the perceived cost of the technology. The results suggested that the impact on intention to adopt and cost of the technology are negative and statistically significant ($\beta = -0.16$, $p < 0.057$). Thus, hypothesis 5 was supported.

DISCUSSION

The first research question addressed is the impact has the relative advantage on solar energy technology. Specifically, relative advantage has a positive influence on adoption of solar energy technology, and also concerns of environmental benefits, environmental involvement, environmental involvement benefits over individual, air pollution decrease due to solar consumption, decrease on carbon foot print production, reducing pressure on energy production and competitive advantage to the country have an effect on solar energy adoption. This study also reveals relative advantage as the second-most important factor.

The second research question addressed the impact on solar energy technology has with the perceived behavioral control. The results of this study revealed that perceived behavioral control has a positive impact with solar energy technology adoption. Thus, perceived behavioral control increase the influence to adopt with the solar technology. This finding is consistent with recent research by (Shah Alam, et al., 2014) and (Alam & Rashid, 2012) reported that, the influence on perceived behavioral control and an intention to adopt a solar energy technology has a positive influence. These findings are also consistent with the Technology acceptance model (TAM), and Diffusion of Innovation theory of (Rogers, 1983)

where the individuals behavioral patterns are observed. This study also reveals perceived behavioral control as the least important factor.

The third research question addressed the impact solar energy technology has on the perceived ease of use. Four items to measure ease of use were, ease of installation, its understandability, ease of in operation and skills on handling. Perceived ease of use is influenced by users' opinion regarding installation, regular use, maintenance and recycling of the new technology. (Shah Alam, et al., 2014) The perceived ease of use was identified as an influencing factor for the adoption of solar energy technology. It could be argued that the greater the ease of use the new technology is perceived to have, the more likely it is that it would be adopted.(Stepehnson & Loannou , 2010.) To enhance users' intention to purchase solar energy for household usage, manufacturers and suppliers of solar energy can provide a simple and easily used product. This study also reveals perceived ease of use as the most important factor in adoption.

The fourth research question addressed the impact solar energy technology has with the awareness of the technology. The results show that awareness of the technology has a big impact of adoption with solar energy technology. Specifically, awareness has a positive influence on adoption of solar energy technology. Consequently people will associate this technology with solar power and recognize it immediately. It will increase people's concern of a recalling power of the technology, recognition, and imaging.

The findings of this study revealed that perceived cost has an impact on intention to adopt solar energy. Further, these results suggest that, perceived cost does have a statistically direct negative effort on adoption of solar energy in the Western province. Specifically, perceived costs reduce the intention to adopt solar technology. Further if the cost is the high adoption of the technology will reduce.

These findings are consistent with the findings of previous research in Malaysia, for renewable energy technologies.(Shah Alam, et al., 2014), (Alam & Mamunur, 2012)

THEORITICAL CONTRIBUTIONS

The study provides inferences made from an instrument that is valid and reliable for the current study's context for evaluating the relative advantage, perceived behavioural control,and perceived ease of use, awareness and cost. Further, the study provides a research framework that identifies significant relationships between them. This framework provides a foundation and insight for future researchers in the area of solar energy related researches. Although several previous studies discussed the challenges on implementing renewable energy sources

they have not spoken about the impact of solar energy technology adoption specifically. Therefore, the instrument developed in this study captures three important factors that affect solar energy technology adoption. The new instrument provides better guideline for researchers in exploring solar energy issues, and thus, can be considered as a strategic management tool.

LIMITATIONS AND FUTURE DIRECTIONS

Although this research has made significant contributions from both theoretical and practical points of views, it also has some limitations, which are described below. The examination of those limitations will assist future researchers to work around them.

The main limitation in this study is geographical unfairness. The population of the Western province was taken into consideration and compared, to get an idea for the whole of Sri Lanka. However, the findings of this study may not represent the views of all potential consumers of Sri Lanka due to the geographical differences and social cultural differences. Their life style differences may also affect. Therefore, it may not be appropriate to generalize the results to all potential solar consumers in Sri Lanka.

Due to the limited number of observations collected, data may be limited to the area tested through the survey questionnaire. New mailing lists and research methods can be used to improve the response rate. The way we collected data for this research was through google forms and distributed forms among Western province households. But if its' possible to distribute questionnaires among random households in a more appropriate manner with high frequency, that would be more effective.

CONCLUSION AND RECOMMONDATIONS

The research has shown the five important factors that have an impact on solar energy adoption. The analytical results prove that there is an impact on solar energy adoption with all the factors. Generally all the results gained were are consistent with previous studies. It would be interesting to study the same factors with a more average solar energy user population with different user patterns.

The aim of this study was to examine the factors affecting the intention to use solar energy in Western province households. This study also enhances our knowledge and expands it about solar energy as a source of green energy for small-scale household use in urban areas. This

examines the rationales of accepting or rejecting the use of alternative energy sources i.e solar. From a managerial perspective, these findings provide support for investment decisions for the investors who are interested in the green energy concept with the environment friendliness, as well as for decisions concerning the improvement of renewable energy, which could be taken into consideration for residential needs.

This research was performed under a theoretical framework that was developed based on theories of Technology acceptance model (TAM), Theory of planned behavior (TPB) and Diffusion of Innovation (DOI). The data analysis interpreted by AMOS shows that perceived ease of use and is the most important elements of intention to use solar energy for household purposes. As a good sign of improvement the Sri Lankan government has focused its attention on developing renewable energy technologies in Sri Lanka like wind, solar and geo thermal. This is a good sign for future endeavors in green energy.

Regardless of certain limitations, this research has put forward some important contributions. Firstly the researcher reviewed the existing literature in the solar energy adoption area and found there is a small gap for a research which has not yet been filled by any researcher. Then combining a few established theories alone with the literature a theoretical framework was built. We lastly examined the factors contributing to the usage intention of solar energy.

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