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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 is a major barrier for the Sri Lanka's expansion of Solar. The aim of this study is to identify the factors that important when adopting to 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 used to develop the research foundation. A self-administrated questionnaire was used to collect data from a sample of 384 household respondents. Structural Equation Modeling (SEM) was used to test the hypothesis. The result of the study indicates that perceived ease of use has the most significant impact on adopting to solar energy technology. Awareness of the technology and relative advantage become second and third influential factors of adoption. Perceived behavioral control also has a positive impact on adoption to solar energy technology while cost shows a negative impact. From a managerial viewpoint these findings can be used for implementing the solar energy technology as a household renewable energy source for upcoming future energy crisis. 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.

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Keywords

Adoption; Relative advantage; Perceived behavioral 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 use 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 into generation one. Fast growth renewable energy technologies are considered as the second generation, and it consists of solar, wind, and new-fashioned bioenergy. The third generation consists with a wide range of renewable energies as concentrating solar power, ocean energy, modern geothermal energy, and integrated bioenergy (IEA, 2006).

Many experts consider solar energy as one of the most promising technologies which derives 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 cost is always rising, 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 $5.5 KWhm^{-2}d^{-1}$ 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, people have much possibility of using Solar Energy throughout the year without interruption.

This is an analysis for the identification of factors influencing 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 a big challenge. But considering about world requirement of introducing renewable energy sources (Solar Energy) due to the upcoming 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). Therefore, though introducing solar panels to the existing electricity users is challenging, it becomes a must to address them upcoming energy crisis.

In worldwide analysis there have not been enough researches which have discussed about factors affecting solar energy technology. Studying the factors affecting the adoption to 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.

The model discussed in this study is developed using four theories named Innovation Diffusion Theory (Rogers, 1983), Technology Acceptance Model (Davis, 1989), Theory of Planned Behavior (Fishbein & Ajzen, 1975) and Transaction Cost Economies Theory (Williamson, 1979).

Five main research questions are addressed in this study to investigate the impact of relative advantage, perceived behavioural control, perceived ease of use, awareness of the technology and perceived cost on intention of adopting solar energy technology in Sri Lanka. Objectives of the study is to examine the impact of relative advantage, perceived behavioural control, perceived ease of use, awareness of the technology on solar energy technology usage intention in Western province.

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).

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)

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). If people are indeed, as Fiske and Tylor (Fiske & Tylor, 1991) put it, "cognitive misers", striving towards relatively simple and heuristic methods of decision making, it seems very plausible that not all innovation attributes are rated before making the decision to reject or adopt an innovation. For instance, although an adoption decision might be based on less information processing.

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). 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 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 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 technology, 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 mediator between beliefs and evaluations and behavioral intention.

Individual behaviors are not only impacted by the progressions of valuation and expectations but they also rely on the belief of the technology. In the TPB, Ajzen proposed 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.

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

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 (2010) have argued that family and community friendly renewable technology will positively influence the intention to use renewable energy. 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

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 (2002) 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. 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

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 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. Thus hypothesis 5 (H5) is developed as follows.

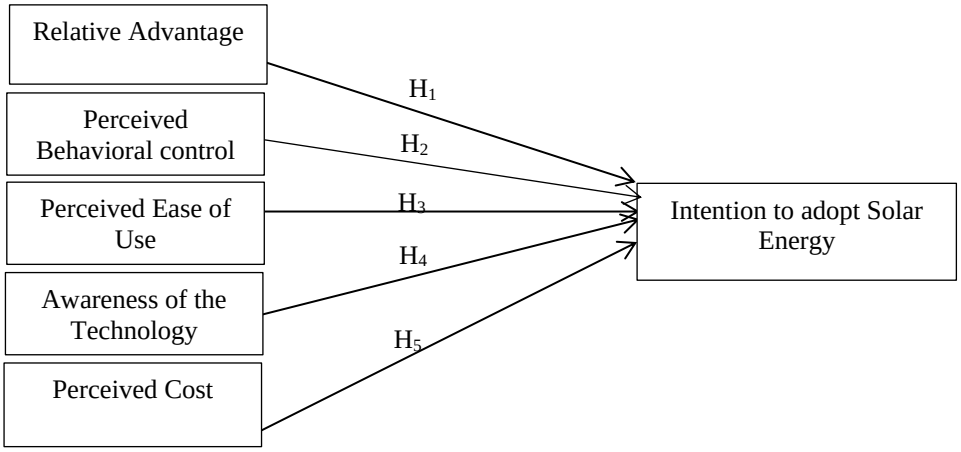
H5: Perceived cost has an impact on solar energy technology usage intention in the Western Province, Sri Lanka

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 and Management) (2012).The conceptual model for the study was formulated using the concepts of 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. One of the key factors identified that is not specifically tested on Alam et al. (2014) was perceived cost and its affects to adopt the solar energy technology. Usage of technology is largely influenced by multidimensional forces such as regulatory, economic dimensions and societal forces. This study focuses on the factors affecting to the adoption of solar energy technology of the households. Therefore,

the conceptual framework in Figure 1, also focuses on the factors affecting the adoption of solar energy technology of the households.

Figure 1: Conceptual Framework



Methodology

Participants and Procedure

As per the nature of the objectives, this study falls under the positivist paradigm. The 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. Population were selected and drawn from the population statistics issued from provincial council each year. This list of populations was sorted by different provincial councils throughout Western province. They were randomly picked and data were gathered. The main data collection tool of this study is the questionnaire survey. All households of the Western province except for the one who already use solar power are the target population of this research. Main target of the household was the employee or the person who spends on the house since the cost factor was included inside the questionnaire. Only the potential consumers have been considered for the survey. According to the department of census and statistics total number of households in Western province of Sri Lanka is 1466,488. Three main districts of Western province are Colombo (566,524), Gampaha (598,420) & Kaluthara (301,544). There are 40 divisional secretariats divided in Western Province, by district. There are 13 in Colombo District, 13 in Gampaha District and 14 in Kalutara District. Colombo District is divided into 13 Divisional Secretary's Division (DS Divisions), each headed by a Divisional

Secretary the DS Divisions are further sub-divided into 566 Grama Niladhari Divisions (GN Divisions). The total number of Grama Niladhari Divisions (GND) in Kalutara District is 762. The total number of Grama Niladhari Divisions (GND) in Gampaha District is 1177. When it comes to the potential consumers, the research reduces the current consumers from this amount. From the CEB statistics it was possible to find the current solar energy consumers.

More than 1000 questionnaires were distributed randomly among Western province households during a three-month period. Basically, those were selected from Divisional Secretariats, considering the population density of each divisional secretariat. 350 questionnaires were distributed among 13 divisional secretariats of Colombo district, 350 questionnaires were distributed among 13 divisional secretariats of Gampaha district and 300 questionnaires were distributed among 14 divisional secretariats of Kaluthara district. Meter readers of Ceylon Electricity Board are the people who always interacts with the households. They have a good communication bound relationship with house owners. The help of them were taken when distributing printed questionnaire among households. Before the questionnaires were distributed small observations and analysis was carried out by discussing with them. The study administered the questionnaire through an electronic form (email & google form) as well as printed questionnaires, as the respondents are general population of western province households and all of them might not familiar with the e-sources. Most of the time researcher tried to get the responses from the head of the household. Responding through email to an online questionnaire eliminates the problem of receiving questionnaires which are incomplete, as the online questionnaire does not allow the respondents to skip questions and the final questionnaire can only be submitted if they have answered all questions.500 number of printed forms and 500 emails were forwarded to collect data and that compromised the total number of 1000 questionnaire. Collecting data from a printed questionnaire might come across with the problem of missing data, and therefore more concentration focused on collecting data from electronic form.

As a result, a total of 393 (39.3%) of questionnaires were returned. 231 respondents from printed form and 162 respondents from electronic media were collected. Non-response (60.7%) bias was happened mostly because some households simply did not return the form back and some of the e mails were not returned. And other than that some of the house wives were not educated enough to go through some technical questions version. Therefore, they have refused to answer the printed version of questionnaire to the data collector meter readers. Of the 393 questionnaires collected, the completed once were used in the analysis.

This response rate is considered sufficient since Sekaran (2003) says 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 consists with two parts, part A and B. The part A consists with 5 questions which 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 questions designed for collecting information on factors affecting the adoption. It comprises 28 questions to measure the 6 constructs (Relative Advantage, Perceived Behavioural Control, Perceived ease of use, Awareness of the technology, Perceived cost and intention to adoption). Each of the construct consists the indicators as follows; Relative Advantage; 7 indicators, Perceived Behavioural Control; 6 indicators, Perceived ease of use; 4 indicators, Awareness of the technology; 4 indicators, Perceived cost; 4 indicators and intention to adoption; 3 indicators. All questions used in the study were from the literature, for example, Kim et al (2014) and Alam et al (2012). The part (B) was developed by drawing on existing scales. Five point Likert scale, which was categorized 1= strongly disagree, 2=disagree, 3= neither agree or disagree, 4= agree, 5= strongly agree was used to measure the domain of constructs.

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 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 minorized at 95% level to remove outliers and the 393 cases were forwarded for missing value analysis. In this study, there were no missing values in the 393 questionnaires. After missing value data analysis and outlier detection, there were 9 outliers found and removed and data set was set as 384. 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. Kaiser-Meyer-Olkin (KMO) test measures the suitability of a data set is for Factor Analysis. The statistic is a measure of the proportion of variance among variables that might be common variance. (Malhotra & Dash, 2011). The Kaiser-Meyer-Olkin is the measure of sampling adequacy, which varies between 0 and 1. Kaiser (1974) recommends the values greater than .5 as acceptable range. Table 1 confirms that, the Kaiser-Meyer-Olkin values are >.5 as acceptable. Therefore, it can be concluded that factor analysis is appropriate for these data set. Cronbach's alpha was used to measure the internal consistency 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.

Table 1: Test Adequacy of Sample

Construct	KMO
Relative Advantage (RA)	0.802
Perceived Behavioral control(PBC)	0.876
Perceived Ease of use(PEU)	0.665
Awareness(AW)	0.794
Cost(Cost)	0.809
Intention to Adoption(ITA)	0.502

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 6 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 was drawn between the error terms of several items for improvement purposes. The final measurement model showed acceptable fit.

Table 2: Model-fit Statistics of Measurement Model

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 and, Tucker- Lewis Index (TLI) value close to 1. 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) 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 2, 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 Table 2 are close to 1, assuring satisfactory model fit.

Table 3: Discriminant validity

Construct	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 (AW)				**0.866**	0
Cost (Cost)					**0.822**

Note: Diagonal entries (in bold) are the square root of AVE for all constructs; over-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. Factor loading equals or greater than 0. 5 or greater Average Variance Extracted (AVE) and composite reliability (CR) equal or greater than 0.7 assures satisfactory convergent validity (Malhotra &

Dash, 2011) .Generally, discriminant validity can be ensured if the square root of the AVE is larger than the correlation coefficients of respective variables. Fornell & Larcker (1981). Further, in ensuring discriminant validity, Maximum Shared Variance (MSV) and Average Shared Variance (ASV) must be less than AVE (Hair, et al., 2010). All the above requirements are satisfied as shown in table 3 and 4.

The Structural Model

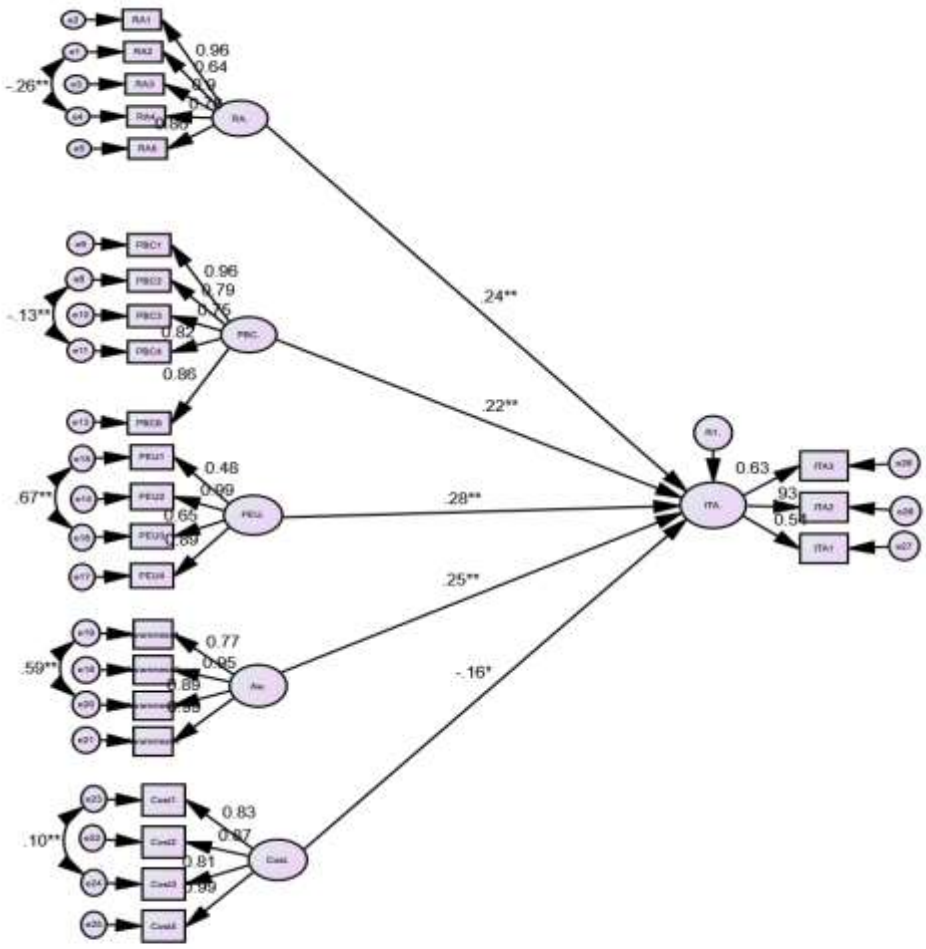
The structural model defines the relationships among the latent (unobserved) constructs (Byrne, 2010). The proposed structural model is composed of six major latent constructs, of which five are exogenous (relative advantage, perceived behavioural control, perceived ease of use, awareness & cost) and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

Table 5: Model-fit statistics of structural model

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 (Figure 2) is summarize in Table 5. 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



Hypothesis 1 investigated the relationship between relative advantage and intention to adopt solar energy. The results in Figure 2, demonstrated positive and significant paths from perceived ease of use and intention to use solar energy technology. ($\beta = 0.24$, $p < 0.008$) (Figure 2). Thus, hypotheses 1 was supported.

Hypothesis 2 tested the impact of perceived behavioural control on intention to adopt with solar energy technology. The results suggested that the impact of

the PBC on intention to adoption is positive and statistically significant ($\beta = 0.22$, $p < 0.009$). (Figure 2). Thus, hypothesis 2 was supported.

Hypothesis 3 tested the impact of perceived ease of use on intention to adopt solar energy technology. The results suggested that the impact of PEU on intention to adopt is negative and statistically significant ($\beta = 0.28$, $p < 0.008$) (Figure 2) Thus, hypothesis 3 was supported.

Hypothesis 4 tested the impact of awareness on intention to adopt with solar energy technology. The results (Figure 2) suggested that the impact of awareness of technology on intention to adoption is positive and statistically significant ($\beta = 0.25$, $p < 0.026$). Thus, hypothesis 4 was supported.

Hypothesis 5 tested the impact of perceived cost on intention to adopt solar energy technology. The results (Figure 2) suggested that the impact of the cost of technology on intention to adopt is negative and statistically significant ($\beta = -0.16$, $p < 0.057$). Thus, hypothesis 5 was supported with the 10% confidence interval.

Discussion

The first hypothesis tests the impact of relative advantage on solar energy adoption. 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 hypothesis tests the impact of perceived behavioural control on solar energy technology adoption. The results of this study revealed that perceived behavioral control has a positive impact on 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 Alam et al (2014) and Alam and Rashid (2012). They found that, the influence of perceived behavioral control on an intention to adoption with 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 individual's behavioral patterns are observed. This study also reveals perceived behavioral control as the least important factor.

The third hypothesis examined the impact of PEU on solar energy technology. 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 hypothesis examined the impact of the awareness of the technology on solar energy technology adoption. The results show that awareness of the technology has a big impact on solar energy adoption. 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 a negative impact on intention to adopt solar energy. 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. (Alam et al,2014; Alam and Mamunur,2012)

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 researcher collected data for this research was through google forms and distributed forms among Western province households. However, if its' possible to distribute questionnaires among random households in a more appropriate manner with high frequency, that would be more effective.

Conclusion and Recommendations

There are five important factors identified throughout the research as the factors affecting to the solar energy adoption. Among these five factors four of them shows positive impact for the adoption and one last factor shows the negative impact on adoption. Generally, all the results gained were consistent with previous studies and proved literature. However, all those studies have done for the European countries and the results were generalized to the European society which are more developed and economically stable than third world country like Sri Lanka. Therefore, the same proven factors in here this research has discussed for the third world country like Sri Lanka with the different social, cultural and economic backgrounds.

The aim of this study is to examine the factors affecting the intention to use solar energy in Western province households. Green energy sources are emerging technology the whole world is looking forward for the next decades. Among the renewable energy sources which are more reliable, and user friendly, solar energy becomes the top most considered source among all. Here this research helps to expand knowledge among households about the technology which is more convenient them to use. Especially the research discusses the factors more towards the urban population who are more economic sustainable. This examines the rationales of accepting or rejecting the use of alternative energy sources. 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 adopt solar energy for household purposes. As a duty of the government, should focus alternative energy sources which can be catered for the upcoming crisis such as wind and geo thermal.

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