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Key Influencing Factors Toward Switching to Solar Technology by Households in Western Province, Sri Lanka

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Abstract: Modern technological advancement has significantly contributed to achievebenefits through renewable energy generation. Itharnessed from sources such as sunlight, wind, and water, and offers a promising path towards a sustainable energy future. Out of several technologies, the world payssignificant attention towards solar technology. Despite the global trend towards solar technology adoption, locally, acceptation level in Sri Lanka is poor. This study employs a quantitative approach to identify the factors that influence the switch towards solar technology by domestic households in the Western Province, Sri Lanka and used various statistical analysing tools such as MS Excel, SPSS and Smart PLS forsurvey data analysis. Researcher conducted an in-depth literature review to clearly identify and develop the research gap and other theoretical aspects. One aim of this study is to assess the current intentions of domestic households to adopt solar systems. Further, based on a descriptive analysis of specific survey questions, it has been identified that there is prevailing positive attitude towards solar technology adoption within the province. Moreover, the researcher analytically identifiedkey influencing factors affecting the adoption of solar technology. This outcome has considerable implications for policy makers in Sri Lanka, industry players, and researchers interested in sustainable energy options. Accordingly, outcome of this research will immensely contribute to achieve sustainable energy goals and realize the objectives in line with national interests of Sri Lanka.

Keywords: Renewable energy, Solar photovoltaic (PV) technology, Electricity demand, Technology acceptance model (TAM).

1. Introduction

Over the recent past, the energy demand has rapidly increased on par with population growth in several countries in the world. Accordingly, providing sustainable energy to the growing population is a challenge faced by many countries. Presently, most of the world's energy demand is being covered through fossil fuels. However, with the rapid depletion of fossil fuel resources in the world, several technological innovations have been made to find sustainable solutions to fulfill energy requirements with effective and efficient ways and means. Engineering solutions for renewable energy generation provides clean energy as well as removes the dependency on fossil fuel imports [1].

In Sri Lankan context, in the recent history,it experienced a severe energy crisis after covid 19 pandemic situation due to a combination of several factors. Foreign exchange shortage was one such factor, and limited foreign currency reserves hindered the import of fuel for power generation. Further, in the dry season of every year, it experiences reduced hydropower generation due to low water levels in reservoirs.On theother hand, there are several impacts of the crisis such as widespread power cuts andeconomic slowdown. Reliable and sustainable solutions for such issuesare to convert towards reliable and renewable energy sources.

In the world, continuous improvement on renewable energy generation techniques has gained much interest and efficient in the recent past [2].

Both developed and developing countries are advocating for and making changes to related policies to improve renewable energy usage on a large scale. However, presently, only a small percentage from total production of the energy is produced from renewable sources.

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Accordingly, several challenges have been encountered in this situation by limiting the large-scale acceptance of renewable sources. Identified challenges make it problematic and obstruct the realization of the required expansion of renewable energy usages.

According to the forecasting of the Asian Development Bank [3[, it predicts to fulfil the total electricity power generation process from renewable energy means by the year 2050.

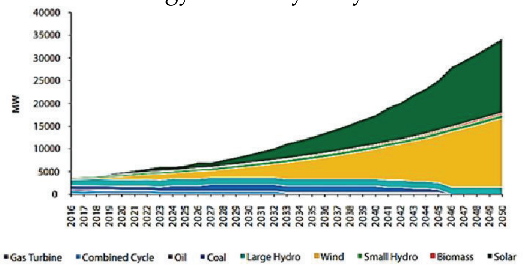

Figure 1 - Energy Generation Plan of SL 2016-2050 (Ceylon Electricity Board)

In line with technological advancement and future forecasts related to Sri Lanka's electricity power generation, it should set up its own renewable energy goals. According to future forecast, the country will be fossil fuel independent by the year 2046. Sri Lanka has planned to achieve this goal by investing in many renewable power generation sources such as wind, mini-hydro, large hydro, biomass and solar technology.

The falling pricesof solar technological equipment and the developing range and flexibility of scientific innovations related to solar, have made solar an attractive technology in the quest to create pathways to developed and sustainable energy [4]. Solar photovoltaic (PV) technology has a wide range of uses, including solar farms, concentrated solar power systems, street lighting, floating systems, and public utility buildings. Rooftop solar PV systems are quite successful in the residential market while other types are limited. However, the behaviour of the domestic users that intends to employ the technology will ultimately determine whether these deployments are successful or not. Domestic households who are active participants in this technology adoption, control whether and to what extent the ongoing solar systems expansion projects are successful.

The utilization of solar technology has gained significant attention as a renewable energy source with the potential to address energy security and environmentalconcerns. Sri Lanka,as a developing nation, seeking to transition towards sustainable energy sources is more convenient. However, slow growth rate in solar energy acceptance within domestic users could be identified as a major issue in Sri Lanka.

Most research related to this field is the implementation of solar power in Sri Lanka concluded by recommending policy changes and highlighting the deficiencies in finance. The technological innovationsand mass production of solar related accessories, have gradually reduced the cost of power generation. On the other hand, with the introduction of special loan schemes such as 'Solar Loan' initiated by the 'Soorya Bala Sangramaya' programme in Sri Lanka[5], the solar technology has not widely spread yet. As such, introducing solar technology to the existing electricity consumers is challenging, and it is of paramount importance to overcome the same in view of addressing the upcoming energy crisis in Sri Lanka.

Accordingly, the research was mainly focused to identify the key factors affecting the adoption of solar technology by domestic users.

1.1 Significance of the Study

As a developing country, it is required to differentiate the country's energy generation in the direction of more renewable and sustainable means [6]. Accordingly, it helps to reduce the spending of foreign currency on energy generation. When considering sustainable energy, focus goes onto renewable options incorporated with advanced technical systems to produce the energy with minimum cost. Among all renewable energy options, solar technology isa less costly option that can be easily implemented even at the domestic level. Further, solar power is a clean green energy source with no emission and limited recurrent cost.

Sri Lanka is located close to the equator, and it is a main geographical advantage for the country, where sunlight is available almost throughout the year; 7 to 9 hours per day is a comparatively larger intensity for producing solar energy within the region.Accordingly, it should be understood that solar technology has a huge potential as a future main energy producing source in the country.

Due to several limitations in the research, the study was limited to the Western Province since it has a large number of domestic users with high population density compared to other provinces. As such, the researcher mainly focused to find the factors affecting the adoption of solar technology by domestic users in the Western Province, Sri Lanka.

2. Literature Review

In line with the modern technological advancement, electricity has become the backbone of modern society, enabling essential services such as communication, water supply, lighting, education, public health, and industrial production. However, about 1.2 billion people, or one-fifth of the global population, lack access to electricity [7]. This energy poverty is concentrated in Africa and Asia, with over 85% of affected individuals living in rural areas. Addressing this issue is crucial for poverty eradication, reducing inequalities, and addressing climate change.

The importance of electricity access for technological tools is underscored by Sustainable Development Goal 7, which aims to provide sustainable and reliable energy to all. Developing infrastructure for modern electricity generation is a key part of this goal. Literature supports the necessity of electricity access for development [8].

The environmental impact of electricity generation includes emissions of particulate matter, CO, NOx, SO2, hot water releases, and waste [9]. Lighting alone consumes 77 billion litres of gasoline annually, producing 192 million metric tons of CO2, which accounts for 7% of global black carbon emissions [10]. Fuel consumption also leads to the destruction of approximately 6.5 million hectares of forest annually [11].

Modern advancements in battery technology, LED lighting, and solar PV technology, along with the proliferation of mobile devices, have increased the market for residential power generation [12]. An estimated one million such technological devices were sold globally, with the market expected to grow significantly [13]. The global market for household lighting for the underserved could be worth $37 billion [14].

Transitioning from conventional energy to renewable sources, such as solar PV technology, supports environmental sustainability by reducing carbon emissions and enhancing energy security. It also promotes equity by lowering electricity costs in areas without centralized infrastructure. Understanding the factors that drive household adoption of solar PV technology is crucial for promoting this transition [15].

2.1 Theories Supporting the Research

The adoption of solar technology by domestic users is influenced by various factors identified through different theories and models. These models, which provide a psychological explanation of human behaviour, are based on the principle of bounded rationality, which suggests that human decisions are not always rational [16]. Behavioural Decision-Making Models (BDMMs) aim to create interventions that influence societal behaviour patterns. The most relevant theories for this study are:

a. Diffusion of Innovation Theory (DoI) – DoIexplains how innovations are adopted by a population, considering the characteristics of adopters and the variables influencing adoption [17].
b. Technology Acceptance Model (TAM) – TAM was developed by Davis in 1989 [18], and this model explains why people adopt or reject new technologies, particularly in the context of information systems and technological advancements.
c. Theory of Planned Behaviour (TPB) – TPB focuses on the idea that intentions are the strongest predictor of actions, influenced by attitudes, norms, and perceived behavioural control.

Out of these theories, TAM is most technology related and applicable for studying of solar power adoption.

2.2 Challenges in the Adoption of Solar Power

Considering the social, technological, economic and environmental factors highlighted in past studies, the researcher identifiedmost relevant factors in local context influencing the adoption of solar technology by domestic users [19], [20], [21] and [22]. Accordingly, set of factors are categorized as independent variables, and mediators.

a. Social Influence: Seeing friends, family, or neighbours adopt solar panels can encourage others to do the same.

b. System Characteristics: Features and functionalities of solar power systems, affordability, efficiency and significantly impact adoption decisions.

c. Individual Differences: Technical knowledge, financial position, and social differences can influence adoption decisions.

d. Facilitating Conditions: Economic incentives, technical support, social influence, and policy reforms are crucial for widespread adoption.

e. Perceived Usefulness: Economic, environmental, reliability, efficiency, social, and lifestyle benefits drive the adoption of solar power systems.

f. Perceived Ease of Use: How easily individuals can use new technology influences their decision to adopt it.

2.3 Renewable Energy

According to a 2017 report, 1.2 billion people lack electricity access [19]. UN's 'Sustainable Energy for All' initiative underscores the critical need to address energy poverty. Technological advancements in solar systems, LEDs, and batteries have made affordable residential electrical technologies readily available. However, widespread adoption remains slow due to complex distribution challenges.

Studies in various countries highlight the factors influencing solar PV technology adoption.

Malaysia: Despite efforts to promote renewable energy, over 75% of electricity still comes from fossil fuels. TAM has been used to analyse factors influencing household adoption of solar PV technology [20].

Pakistan: Energy conditions are deteriorating due to poor planning. Solar PV technology could mitigate power outages, but adoption at the household level is low [21].

Indonesia: A study combining TAM and DoI theories found that perceptions of ease of use do not significantly impact the intention to use solar technology. However, awareness, perceived costs, and government initiatives do influence adoption [22].

Understanding these factors can help policymakers and industry stakeholders develop strategies to promote solar technology adoption and achieve sustainable energy goals.

3. Methodology

After proper analysis of the related literature on similar fields, the researcher recognized social influence, technical characteristics, individual differences, and facilitating conditions as independent variables, and perceived ease of use and perceived usefulness as mediators. Further, it was identified that 'adoption of solar technology' as the dependant variable. The researcher developed a conceptual framework based on the identified independent variables, mediators and dependant variables as shown in Figure 2.

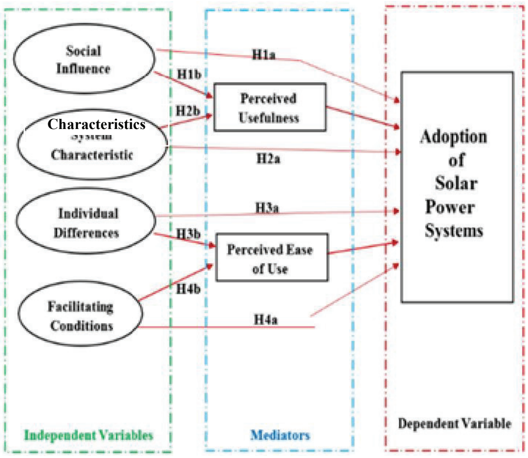

Figure 2 - Conceptual Framework (Author Developed)

3.1 Population

All domestic households in the Western Province, Sri Lanka, was the targeted population of the study. The number of householders present according to districts are as shown in Table 1.

Table 1 - Population of the Study (Department of Census andStatistics in Sri Lanka)

Provinces	No of Householders
Colombo District	673,604
Gampaha District	663,512
Kalutara District	351,997
Western Province (Total)	1,689,113

According to the reports by the Department of Census and Statistics in Sri Lanka, the population of the study was identified as a total number of 1,689,113 householders.

3.2 Operationalization

The operationalization of this study indicates how to proceed with the research, while collecting, processing and analysing and how to derive recommendations of the research. Dawes

[23] has proposed that five-point or seven-point likert scale would provide comparatively better results than higher point scales. The researcher included demography data and a five-point likert scale to measure seven variables of the study.The operationalization of this study indicates how to proceed with the research, while collecting, processing and analysing how to derive recommendations of the research. Dawes has proposed that five-point or seven-point likert scale would provide comparatively better results than higher point scales. The researcher included demography data and a five-point likert scale to measure seven variables of the study.

3.3 Sample

The creation of a representative sample with a minimal sampling error was more crucial. A smaller, more targeted subset from a larger population is chosen for scholarly inquiry by sampling. The sample size and homogeneity of its constituent parts were taken into consideration during sample design. It is also known that larger samples have lower sampling error than smaller samples. As a result, homogeneous population samples exhibit lower sampling errors than diverse population samples [24].

The researcher used the non-probability sampling approach to gather required primary data from householders in Western Province, Sri Lanka. Total households in Western Province, Sri Lanka 1,689,113 were considered as the study's population. The required minimum sample size of the study is indicated as 385 which constitute the sample with a 95% confidence interval and a 5% margin of error.

3.4 Hypotheses

The following hypotheses were developed in line with related theory models from the literature review.

3.4.1 Hypotheses based on correlation between independent variables and dependent variables

Hypotheses based on correlation between independent variables and dependent variables are as follows:

H1a: There is a positive correlation between 'Social Influence' and 'adoption of solar technology' by domestic users in Western Province, Sri Lanka.

H2a: There is a positive correlation between 'Technical Characteristics' and 'adoption of solar technology' by domestic users in Western Province, Sri Lanka.

H3a: There is a positive correlation between 'Individual Differences' and 'adoption of solar technology' by domestic users in Western Province, Sri Lanka.

H4a: There is a positive correlation between 'Facilitating Conditions' and 'adoption of solar technology' by domestic users in Western Province, Sri Lanka.

The demographic data of responders were collected through seven questions indicated under part I as depicted in Table 2.

Table 2 - Demographic Variables (Author Created)

Variable/ Dimension	Indicator	Category of data	Measurement
Demography	Age	Interval data	1. 18 - 29 years 2. 30 - 39 years 3. 40 - 49 years 4. 50 – 59 years 5. 60 years and above
	Gender	Nominal data	1. Male 2. Female
	Roof size of House	Nominal data	1. No roof (Due to apartment building) 2. Small (Approx. less than 50 m^2) 3. Medium (Approx. 50 m^2 to 100 m^2) 4. Large (Approx. more than 100 m^2)
	Occupation	Nominal data	1. Employed 2. Self-employed 3. Unemployed 4. Student 5. Retired
	Monthly household income	Interval data	1. Less than Rs. 50,000 2. Rs. 50,000 - Rs. 99,999 3. Rs. 100,000 - Rs. 149,999 4. Rs. 150,000 and more
	Level of education	Nominal data	1. No formal education 2. Primary education 3. Secondary education 4. Tertiary education
	Location of your residence belongs	Nominal data	1. Colombo 2. Gampaha 3. Kalutara

The part II of the research questionnaire was focused to collect responses on seven variables depicted in Table 3.

Table 3 - Operationalisation & Measurement of Variables (Author Created)

Variable/ Dimension	Indicator	Category of Data	Measurement	Question No
Social Influence	Influence of others, Perception of societal norms , Influence of media	Ordinal data	5-point Likert scale	Q1, Q2, Q3 and Q4
System characteristics	Capacity & storage, safety features, performance	Ordinal data	5-point Likert scale	Q5, Q6, Q7, Q8 and Q9
Individual differences	Technical Knowledge , Risk Aversion, Environmental Concern	Ordinal data	5-point Likert scale	Q10, Q11, Q12, Q13 and Q14
Facilitating Conditions	Government Incentives, Availability of Financing, Approval Process	Ordinal data	5-point Likert scale	Q15, Q16, Q17, Q18 and Q19
Perceived Ease of Use	Installation process, Complexity, Compatibility, Financial considerations	Ordinal data	5-point Likert scale	Q20, Q21, Q22, Q23, Q24 and Q25
Perceived usefulness	Economic Benefits, Environmental Benefits, Operational Benefits	Ordinal data	5-point Likert scale	Q26, Q27, Q28, Q29 and Q30
Adoption of solar power systems	Installation, Payback period, Financing Options, Environmental impact, Social impact, Existing Policies	Ordinal data	5-point Likert scale	Q31, Q32, Q33, Q34 and Q35

3.4.2 Hypotheses based on mediators' impact on correlation between variables

Hypotheses based on mediators' impact on correlation between variables are given below.

H1b: The correlation between 'Social Influence' and 'adoption of solar technology' is mediated by 'Perceived Usefulness'.

H2b: The correlation between 'System Characteristic' and 'adoption of solar technology' is mediated by 'Perceived Usefulness'.

H3b: The correlation between 'Individual Differences' and 'adoption of solar technology' is mediated by 'Perceived Ease of Use'.

H4b: The correlation between 'Facilitating Conditions' and 'adoption of solar technology' is mediated by 'Perceived Ease of Use'.

3.5 Method of Data Analysis

A sample questionnaire was distributed among 27 households from three Gramasewaka divisions in Gampaha district as a pilot survey to test the questionnaire. Researcher requested comments on the questionnaire and made few adjustments on questions according to the feedback received from the pilot survey.

To achieve the research objectives, analysis presents the summary of gathered data and offers the results of the statistical analysis. It should achieve the research goals by the end of analysis chapter to identify the current intention level of domestic households to install solar power systems, and to identify the challenges on adaption of solar technology by domestic users in Western Province, Sri Lanka.
The data analysis tools/ software used by the researcher are MS Excel, Smart PLS 4 and IBM SPSS. The information about the respondent's demographic characteristics is presented using frequency analysis. Then the researcher screened the data and checked for validity and reliability of data. The current intention level of domestic households to install solar power systems (first objective) was achieved using mean values and challenges on adaption of solar power systems by domestic users in Western Province, Sri Lanka (second objective) and was determined by using correlation and regression analysis.

4. Discussion

The numeric data collection process comprised distributing a questionnaire via Google Forms, resulting in the collection of 388 responses. These responses were converted into numerical values to facilitate subsequent quantitative analysis. Evidently, the use of Google Forms ensured there were no missing data points, enabling the presence of all collected data in the analysis. Subsequently, the collected data was coded using Excel and SPSS software. Demographic data was analysed using SPSS, while Smart PLS 4 was utilized to test hypotheses, including both direct and indirect impacts of independent variables on dependent variables through moderating variables identified in sections two and three of this study.

The research process then proceeded with an initial analysis, primarily focusing on the demographic characteristics of the respondents. This initial step was crucial in confirming the representation of population by the sample. Following this, a rigorous evaluation of the questionnaire's validity and reliability, as well as an assessment of the collected data, was carried out.

Finally, Smart PLS 4 was used to test the hypothesis test. During the initial stage,amodel fit test was conducted to check the model developed during the study, and then the direct and indirect effect of the variables was checked.

4.1Validity and Reliability

The quality of research heavily relies on the reliability and validity of the measurement instruments and tools utilized. This foundational requirement is emphasized by Mohajan[25], who asserts that reliability and validity process stand as the important features to be considered prior to analysing any collected data in an effective research study. In this study, the researcher meticulously conducted tests for both validity and reliability on the measurement instruments employed, with the overarching goal of bolstering the overall quality and integrity of our research endeavour.

Result of validity and the reliability of the instrument are shown in Table 4.

Table 4 - Result of Validity and the Reliability Test (Survey Data)

	Cronbach's alpha	Composite reliability (rho_a)	Average variance extracted (AVE)
Adoption of Power System	0.821	0.822	0.583
Facilitating Conditions	0.807	0.808	0.566
Individual Differences	0.747	0.753	0.498
Perceived Ease of Use	0.724	0.739	0.418
Perceived Usefulness	0.752	0.778	0.504
Social Influence	0.709	0.752	0.509
System Characteristics	0.77	0.77	0.520

According to Streiner's guidelines [26], Cronbach's Alpha Coefficient ranges from 0 to 1, with values closer to 1 indicating higher reliability. A value of 0.7 is considered the minimum acceptable threshold. In this study, the minimum Cronbach's Alpha coefficient is 0.709 (Social Influence) and the maximum is 0.821 (Adoption of power system), indicating that the measurement instruments used have an appropriate level of reliability.

Composite reliability is considered acceptable if it is 0.7 or higher. Average Inter-Item Correlation (rho_a) measures the average correlation between different items of a construct, indicating how closely related the variables are. Table 4 confirms composite validity. Additionally, an AVE (Average Variance Extracted) value of 0.5 or higher confirms convergent validity. Thus, as seen above, all AVE values meet or exceed this threshold, confirming the instrument's validity.

4.2 Hypotheses Testing

To test the hypotheses researcher used the Smart PLS-4 and results have been summarized in Table 5 and Table 6 as shown bellow.

Table 5 - Standard Deviation, T Statistics and p Values (Survey Data)

	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Facilitating Conditions -> Adoption of Power System	0.187	0.048	3.873	0
Facilitating Conditions -> Perceived Ease of Use	0.152	0.056	2.675	0.008
Individual Differences -> Adoption of Power System	0.14	0.055	2.51	0.012
Individual Differences -> Perceived Ease of Use	0.404	0.06	6.763	0
Perceived Ease of Use -> Adoption of Power System	0.064	0.032	2.084	0.037
Perceived Usefulness -> Adoption of Power System	0.135	0.04	3.37	0.001
Social Influence -> Adoption of Power System	0.133	0.03	4.454	0
Social Influence -> Perceived Usefulness	0.124	0.042	2.899	0.004
System Characteristics -> Adoption of Power System	0.413	0.061	6.793	0
System Characteristics -> Perceived Usefulness	0.613	0.038	16.302	0

Table 6 - Correlation Coefficient (Survey Data)

	Adoption of Power System	Perceived Ease of Use	Perceived Usefulness
Facilitating Conditions	0.186	0.15	-
Individual Differences	0.138	0.403	-
Perceived Ease of Use	0.066	-	-
Perceived Usefulness	0.133	-	-
Social Influence	0.133	-	0.121
System Characteristics	0.417	-	0.612

4.3 Regression Analysis on Independent Variables

A multicollinearity diagnostic test was done to serve the level of correlation within independent variables.With the comparison of 'Tolerance values' and 'Variance Inflation factors (VIF)', the researcher was able to find that the Tolerance values are higher than 0.2 as indicated in table 7. Further, VIF values are less than 5. In line with that, it was understood that the Tolerance values and the VIF values are between the expected value range that prevents the multicollinearity.Accordingly, it means that the multi-regression analysis can be carried out.

Table 7 - Regression Coefficients (Survey Data)

Model		Collinearity Statistics	
		Tolerance	VIF
1	SI	0.905	1.105
	SC	0.734	1.363
	ID	0.752	1.330
	FC	0.903	1.107
a. Dependent Variable: ASPS			

Table 8 summarize details of the model in which the important item is the R square statistics, which is 0.433 with a statistical significance value of $P < 0.05$. This indicates that, 43.3% of variants in the 'Adoption of Solar power by domestic households' was predicted from independent variables. Addition to that, Durbin-Watson statistic value is 2.027 and it is in between +1 and +3 which illustrates that, it achieved the independence of the observations.

Table 8 - Model Summary (Survey Data)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.658	.433	.427	.374	.433	73.173	4	383	<.001	2.027
a. Predictors: (Constant), FC, SI, ID, SC										
b. Dependent Variable: ASPS										

Considering Table 9, the Unstandardized Coefficients, B value for Social Influence (SI) is 0.147. This indicates that, for each one-unit increment of SI, there is an improvement in Adoption of solar power of 0.147-time units. The unstandardized coefficient, B value for

System Characteristics (SC), is 0.330. This illustrates that for each one-unit increment of SC, there is an increase in Adoption of solar power of 0.330-time units. Further, the unstandardized coefficient, B value for Individual Differences (ID), is 0.374.

Table 9 - Coefficients (Survey Data)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.484	.208		2.323	.021		
	SI	.147	.032	.187	4.612	<.001	.905	1.105
	SC	.330	.052	.284	6.321	<.001	.734	1.363
	ID	.374	.049	.335	7.561	<.001	.752	1.330
	FC	.099	.034	.119	2.947	.003	.903	1.107

a. Dependent Variable: ASPS

Accordingly, it is indicated that, for each one-unit increment of SI, there is an increase in Adoption of solar power of 0.374-time units. The unstandardized coefficient B value for Facilitating Conditions (FC) is 0.099. This indicates that, for each one-unit increment of SI, there is an increase in Adoption of solar power of 0.099-time units.

In line with above outcomes, it is evident that the Social Influence (SI), System Characteristics (SC), Individual Differences (ID) and Facilitating Conditions (FC) have Unstandardized Coefficient values 0,147, 0.330, 0.374 and 0.099, respectively.

4.4 Testing Hypotheses

To test the hypotheses, specific indirect effect and total effect of the variables were checked. Tables 10, 11 and 12 depict specific indirect effect, total effect and path coefficients of each variable respectively.

Table 10 - Specific Indirect Effect (Survey Data)

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Social Influence -> Perceived Usefulness -> Adoption of Power System	0.016	0.017	0.008	2.136	0.033
System Characteristics -> Perceived Usefulness -> Adoption of Power System	0.082	0.083	0.025	3.234	0.001
Facilitating Conditions -> Perceived Ease of Use -> Adoption of Power System	0.01	0.01	0.007	1.503	0.133
Individual Differences -> Perceived Ease of Use -> Adoption of Power System	0.027	0.026	0.013	1.975	0.048

4.5 Summary of Hypotheses Testing

Of the eight hypotheses seven was approved except H4b.

4.6 Findings

Research findings have been summarised in Table 13, based on the above discussion and survey results.

Demographic analysis revealed that age groups 30-39 and 40-49 exhibited the highest interest in solar technology, with 81.9% of respondents in these groups expressing positive interest. This finding bodes well for the future of solar energy. Regarding monthly income, approximately 62% of respondents reported a middle-income status, ranging from Rs. 50,000 to Rs. 150,000. Further, a majority (63.7%) of respondents had medium-sized roofs, indicating that basic physical requirements for solar panel installation are readily available within the local community of Sri Lanka.

Table 11 – Total Effect (Survey Data)

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Facilitating Conditions -> Adoption of Power System	0.196	0.197	0.048	4.07	0
Facilitating Conditions -> Perceived Ease of Use	0.15	0.152	0.056	2.675	0.008
Individual Differences -> Adoption of Power System	0.164	0.166	0.054	3.07	0.002
Individual Differences -> Perceived Ease of Use	0.403	0.404	0.06	6.763	0
Perceived Ease of Use -> Adoption of Power System	0.066	0.064	0.032	2.084	0.037
Perceived Usefulness -> Adoption of Power System	0.133	0.135	0.04	3.37	0.001
Social Influence -> Adoption of Power System	0.149	0.15	0.03	5.039	0
Social Influence -> Perceived Usefulness	0.121	0.124	0.042	2.899	0.004
System Characteristics -> Adoption of Power System	0.499	0.496	0.06	8.258	0
System Characteristics -> Perceived Usefulness	0.612	0.613	0.038	16.302	0

Table 12 - Path Coefficients (Survey Data)

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Facilitating Conditions -> Adoption of Power System	0.186	0.187	0.048	3.873	0
Facilitating Conditions -> Perceived Ease of Use	0.15	0.152	0.056	2.675	0.008
Individual Differences -> Adoption of Power System	0.138	0.14	0.055	2.51	0.012
Individual Differences -> Perceived Ease of Use	0.403	0.404	0.06	6.763	0
Perceived Ease of Use -> Adoption of Power System	0.066	0.064	0.032	2.084	0.037
Perceived Usefulness -> Adoption of Power System	0.133	0.135	0.04	3.37	0.001
Social Influence -> Adoption of Power System	0.133	0.133	0.03	4.454	0
Social Influence -> Perceived Usefulness	0.121	0.124	0.042	2.899	0.004
System Characteristics -> Adoption of Power System	0.417	0.413	0.061	6.793	0
System Characteristics -> Perceived Usefulness	0.612	0.613	0.038	16.302	0

Table 13 - Summary of Hypotheses Testing (Survey Data)

	Hypotheses	Result
H1a	There is a positive correlation between 'Social Influence' and 'adoption of solar power systems' by domestic users in western province, Sri Lanka	Approved
H2a	There is a positive correlation between 'System Characteristics' and 'adoption of solar power systems' by domestic users in western province, Sri Lanka	Approved
H3a	There is a positive correlation between 'System Characteristics' and 'adoption of solar power systems' by domestic users in western province, Sri Lanka	Approved
H4a	There is a positive correlation between 'Facilitating Conditions' and 'adoption of solar power systems' by domestic users in western province, Sri Lanka	Approved
H1b	The correlation between 'Social Influence' and 'adoption of solar power systems' is mediated by 'Perceived Usefulness'	Approved
H2b	The correlation between 'System Characteristic' and 'adoption of solar power systems' is mediated by 'Perceived Usefulness'	Approved
H3b	The correlation between 'Individual Differences' and 'adoption of solar power systems' is mediated by 'Perceived Ease of Use'	Approved
H4b	The correlation between 'Facilitating Conditions' and 'adoption of solar power systems' is mediated by 'Perceived Ease of Use'	Disapproved

Further, following findings are listed as outcomes of hypothesis testing.

There is high level of positive intention shown by the households of the Western Province of Sri Lanka and this value is as high as more than 73% of total households.

It is a positive but minimal relationship that exists between 'Social Influence' and 'adoption of solar power systems' by domestic users in Western Province, Sri Lanka

Further, there is a positive and moderate relationship 'System Characteristics' and 'adoption of solar power systems' by domestic users in Western Province, Sri Lanka

There is a positive but minimal relationship between 'System Characteristics' and 'adoption of solar power systems' by domestic users in Western Province, Sri Lanka

It is a positive but minimal relationship between 'Facilitating Conditions' and 'adoption of solar power systems' by domestic users in Western Province, Sri Lanka.

It was found that the indirect effect of 'Social Influence' and 'System Characteristic' towards 'adoption of solar power systems' in presence of 'Perceived Usefulness' exists.

There is no indirect effect of 'Individual Differences' to 'adoption of solar power systems' with 'Perceived Ease of Use' mediator. However,'Facilitating Conditions' has indirect effect to 'adoption of solar power systems' with 'Perceived Ease of Use' mediator.

Individual Differences (ID) has the highest correlation factor with the adoption of solar power system (ASPS). Further, System Characteristics (SC) has the second highest correlation and Social Influence (SI) has the third highest correlation with ASPS. Out of four independence variables, Facilitating Conditions (FC) has the lowest correlation with dependant variable.

Further, it was found that negative social influence, low grade of system characteristics, low-income rate, lack of education on the system benefits as challenges to adoption of solar power system.It is a timely requirement for a thorough examination of the identified negative factors, going beyond mere identification to understand the root causes and develop effective solutions to overcome these barriers.

5. Conclusions

This research was conducted to identify the determinants influencing household adaptation of solar energy systems in theWestern Province of Sri Lanka. The study employed the quantitative method and used associated statistical analysing tools such as MS Excel, SPSS and Smart PLS to analyse the accumulated survey data in the study.

This research began with an in-depth literature review to identify research gaps, develop a theoretical framework, and construct a study model. The researcher then investigated the current intention levels of domestic households to install solar power systems in the Western Province of Sri Lanka. Descriptive analysis of specific survey questions revealed a prevailing positive attitude towards solar technology adoption. Many households expressed satisfaction with the concept of adopting solar energy systems, emphasizing their belief in the potential to reduce electricity bills.

Furthermore, the research identified several challenges through the analysis associated with the adoption of solar power systems by domestic users in the Western Province. These challenges include negative social influence, inadequate system characteristics, limited facilitating methods, and individual factors such as low-income levels and a lack of education regarding system benefits.

5.1 Areas for Future Research

This research paper has mainly focused on identifying the key factors affecting the adoption of solar technology by domestic households in the Western Province of Sri Lanka. To further explore this important area, the following areas can be considered for future research on solar technology.

a. To conduct qualitative research to identify the effectiveness of related affecting factors to the adoption of solar technology.
b. To identify the economic impact towards adoption of solar technology under different financial assistance tools for achieving sustainable energy goals in Sri Lanka.

6. Recommendations

This research revealed a high level of positive intention among households in the Western Province of Sri Lanka towards adopting solar energy. However, the adoption process is significantly influenced by various factors, including social influence, system characteristics, facilitating conditions, and individual differences. Based on these findings, the research provides recommendations that contribute to a deeper understanding of the challenges associated with solar power adoption in Sri Lanka. These recommendations can inform policy decisions and interventions aimed at promoting sustainable energy practices.

Based on the study findings, the research recommends introducing more user-friendly facilitating processes for solar power adoption to alleviate the burden on households. This will not only positively impact solar technology adoption rates but also foster greater social influence within communities. Furthermore, the research suggests introducing a community-based solar technology adoption system to enhance social influence and facilitate adoption among a larger number of households.

Considering the direct and indirect effects of system conditions, it is recommended to introduce more standardized solar power systems, particularly those from reputable brands with warranties, to reduce uncertainty regarding system sustainability among households. Furthermore, standardizing the solar system installation process is crucial. The research findings also emphasize the need for comprehensive awareness programs to maximize the effectiveness of solar technology adoption efforts. Moreover, providing financial assistance to low-income households is crucial, as this will directly and indirectly impact the adoption of solar technology among households with lower income status.
Consistent with similar recommendations, many countries have significantly increased their renewable energy contributions to their national power requirements. Malaysia and Indonesia serve as notable examples of nations that have achieved significant progress in their power sectors through the increased adoption of renewable energy sources [20, 22].

Finally, the implementation of these recommendations would significantly enhance the adoption rate of solar technology by domestic households, not only in the Western Province but also island wide. This would significantly contribute to achieving Sri Lanka's energy-related goals and objectives, aligning with national interests.

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