Factors Affecting Rooftop Solar Photovoltaic System Adoption Intention: With Special Reference to Middle-Income Households in Kaduwela Municipal Council Area, Sri Lanka

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Abstract

The generation and supply of electricity is a prominent contemporary topic in Sri Lanka. Due to high dependency on non-renewable imported energy sources and due to various economic instabilities, a number of challenges have emerged leading to disruption of continuous electricity supply at affordable prices. Thus, it is high time to consider alternative renewable sources of energy and most specialists consider solar energy as one of the most promising technologies. Despite of benefits of solar energy and all the initiatives taken by different parties, Sri Lanka is still at a lower level of producing electricity using solar systems. This study aims to identify the factors affecting rooftop solar photovoltaic system adoption intention of middle-income households in Sri Lanka. The data was collected through a structured questionnaire targeting 75 middle-income residents in Kaduwela area selected using simple random sampling technique. The collected data were analysed using descriptive and inferential analyses. The study findings revealed that both motivating factors and barriers make an impact on rooftop solar photovoltaic system adoption intention. However, situations prevail where not all components of those factors impact adoption intention

Article History

Received: 11th October 2022	Received in revised form: 17th November 2022
Accepted: 24th November 2022	Published Online: 31st December 2022

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DOI: 10.31357/sljre.v19i02.6315

similarly. The study findings lead to a better understanding of the complex relationships between motivating factors, barriers and rooftop solar photovoltaic system adoption. These insights may be used to evaluate motivating factors and barriers to find relevant interventions in encouraging motivating aspects more while mitigating the barriers, as immense number of benefits can be gained from rooftop solar photovoltaic systems to the country.

Keywords: Rooftop solar, photovoltaic, motivators, barriers, adoption intension, Sri Lanka

INTRODUCTION

The generation and supply of electricity is a prominent contemporary topic in Sri Lanka. It has led to continuing, endless discussions and debates due to various prevailing issues in the sector. The three sources of the world's largest source of energy listed by the International Energy Agency - IEA (2021), include petroleum, natural gas, and coal. In Sri Lanka, Thermal Coal (36.6%), Hydro (24.9%) and IPP Thermal (17.3%) are the main sources of electricity generation (Ceylon Electricity Board - CEB Annual Report, 2020).

As the statistics in Ceylon Electricity Board Annual Report (2020) reveal, electric power sector has major concerns on energy sources due to high dependency on nonrenewable energy sources which have to be imported from other countries. According to the details received by IEA (2017), coal is increasing by an average of 0.6%, being the world's slowest-growing energy source. As revealed in CEB Annual Report 2020, Sri Lanka was proud to be the only country in South Asia that has almost 100% electricity accessibility with 24-hour electricity supply. However, due to various economic instabilities, a number of challenges have emerged leading to disruption of continuous electricity supply at affordable prices.

With the economic down turn witnessed in Sri Lanka during the past few years due to inflation rate hovering at 40-73%, depreciating currency, rapidly increasing import cost of coal and other sources, etc. the industry had to face many issues. As a result, the cost of electricity generation has skyrocketed. As a solution, CEB has proposed and already obtained approval from the Public Utilities Commission of Sri Lanka (PUCSL) to increase electricity tariffs by 66% from February 2023 onwards (Ceylon Electricity Board, 2022). This will definitely be a huge burden on domestic users (Jayasinghe, 2022), especially due to shrunken purchasing power due to high inflation. Thus, it is high time to consider alternative renewable sources of energy in order to get rid of these challenging issues in the sector being less dependent on nonrenewable energy sources and imports.

The alternative generation of renewable energy technology consists of solar, wind, novel types of bio energy, concentrated bioenergy, solid waste, geothermal energy, and ocean energy (IEA, 2020). Most specialists consider solar energy that derives from the sun as one of the most promising technologies, most abundant source of energy on earth, in the form of solar radiation. The reasons for that are rooftop solar photovoltaic (PV) systems consist various advantages such as simple operation, easy maintenance, durability, flexible installation and affordable costs (Moosavian et al., 2013; Simpson & Clifton, 2015). As the statistics of Asian Development Bank report (2019) disclosed, the share of electricity sales to households was 37% and to industrial customers was 32%, and the sales to the commercial sector was 29% and the majority was sold to domestic end and the annual sales growth in the past five years was between 5-7% per year. Thus, transformation of energy sources of the residential sector to rooftop solar PV systems may lead the country to be less dependent on non-renewable imported energy sources.

Solar PV accounted for 3.6% of global electricity generation, and it remains the third largest renewable electricity technology behind hydropower and wind. Power generation from solar PV increased by a record in 2021, marking 22% growth on 2020 (IEA, 2021). However, as EIA further reveals, an average annual generation growth of 25% in the period 2022-2030 is needed to follow the Net Zero Emissions by 2050 Scenario. Nevertheless, when looking at the current situation in the world and Sri Lanka, the situation is less likely to achieve these goals. The Sri Lankan statistics also show that the accumulated share of IPP Solar (0.8%) and Rooftop Solar (1.7%) accounts for only 2.5% with only 0.56% and 0.02%

insignificant increases respectively when compared to 2019 statistics (CEB Annual Report, 2019; 2020).

The government is also taking certain initiatives to encourage adoption of rooftop solar PV systems and solar energy technologies in the country. For an instance, the “Soorya Bala Sangramaya” (Battle for Solar Energy), as intended by the government, was launched in September 2016 by the Sri Lankan government to increase solar PV system capacity. However, despite all these initiatives and benefits of solar energy, Sri Lanka is still at a lower level of producing electricity using solar systems. Thus, it is required to examine this phenomenon to promote the adoption level. Even though several research have shown the variables affecting the adoption of solar PV for household usage, the factors tend to vary depending on the income levels and the geographical contexts. Following that path, this study aims to identify the factors affecting rooftop solar PV system adoption intention of middle-income households in Sri Lanka. The findings of the study will be useful for the public and private sector related organisations and government to increase their awareness on the factors that encourage and discourage potential adopters of rooftop solar PV systems.

LITERATURE REVIEW

Rooftop Solar Photovoltaic Systems

Renewable energy uses energy sources that are continually replenished by nature; sun light, wind, water, earth’s heat, plants, etc. The photovoltaic effect also referred to as the "PV effect," is a physical process that converts light into electricity (Schulte et al., 2022). In 1954, Bell Telephone Laboratories developed the modern solar cell. Rooftop power generation with the installation of PV systems provided significant benefits for energy efficiency and sustainability. Figure 1 shows some examples of rooftop PV system installations.

Figure 1: Examples of Rooftop PV System Installations

Source: Energy and Buildings (2022)

Advantages and Disadvantages of Rooftop Solar PV Systems

According to the reviewed literature, the advantages and disadvantages of rooftop solar PV systems can be summarized as shown in Table 1. As the table shows, the number of benefits of solar PV energy are higher than its disadvantages.

Table 1: Advantages and Disadvantages of Rooftop Solar PV Systems

Advantages	Disadvantages
▪ Reduces electricity bill. ▪ Produce clean and green energy. ▪ Protect environment being a sustainable energy alternative. ▪ Do not contain any mechanically moving elements. ▪ Requires little maintenance and solar PV panels do not require any upkeep or operating expense. ▪ Do not make any noise and are completely silent. ▪ Space optimization by utilization of rooftop areas. ▪ Increases the lifetime value of covered roof. ▪ Easier and faster to install than ground-mounted systems. ▪ Peak energy demand can be effectively addressed. ▪ One key renewable energy source that are promoted through government financial subsidies.	▪ Functioning depends on weather and will not function properly during cloudy or rainy days as well as at night. ▪ Need additional hardware. (Inverters, DC, AC, etc.) ▪ Storage batteries are needed in addition to inverters when using solar PV panels. ▪ Solar PV panels' efficiency levels are relatively low.

▪ Can be designed for easy expansion if power demand increases. ▪ Offset the need for grid electricity generation to meet expensive peak demand during the day. ▪ Fuel savings from PV systems typically offset their relatively high initial cost. ▪ Create no pollution or waste products while operating, and production impacts are far outweighed by environmental benefits.	▪ Solar PV panels are fragile and can be easily damaged. ▪ May have shading losses due to structure obstacles ▪ Roof may not properly fit to the required system capacity.

Source: ADB (2014); Ahmed et al. (2022); Schulte et al. (2022)

Determinants of Rooftop Solar PV System Adoption

The scientific community has been concerned for a long time about how to meet the ever-increasing global energy needs while avoiding environmental damage. Consequently, procuring green, clean energy from renewable sources is essential. Among the various renewable energy sources, solar energy has become one of the most appealing of the environmentally friendly power sources since it is abundant, freely available, and has economic potential (Ahmed et al., 2022). This study aims to examine the factors affecting rooftop solar PV system adoption, and it would be important to build the policymaker’s understanding on the factors that significantly influence consumer’s adoption of solar PV systems, so that they can develop a policy instrument for scaling- up the adoption among both adopters and non-adopters.

Motivating Factors

The commonly identified motivating factors through reviewing literature were financial, energy, environmental and knowledge & awareness. Kemp and Schot (1999) categorized the motivating factors for technology adoption into three distinct areas: the system of information transfer, the economic and technical characteristics of the technology, and the characteristics of the adopter environment. The latter group of characteristics was further broken down into factors such as environmental policy, price/cost structure, availability and complementary technique costs, age of existing consumer goods, competitiveness, environmental awareness and attitude, social pressure, financial resources availability, and resistance to change and acceptance. Nkundabanyanga et al. (2020) studied socio-political, community, and market receptiveness to renewable energy, considering factors such as technological characteristics, environmental advantages, and the intricate value. Vasseur and Kemp (2015) identified factors such as capability to save on electricity bills, increased cost-efficiency, autonomy, a reduced environmental impact, system's quality, and easy installation as reasons for people to adopt solar PV systems. All above factors highlighted by scholars can be categories in to four main motivations; financial, energy, environmental and knowledge & awareness that affect the rooftop solar PV system adoption intention. Accordingly, following hypotheses were developed.

H1: Financial motivation positively affects rooftop solar photovoltaic system adoption intention.

H2: Energy motivation positively affects rooftop solar photovoltaic system adoption intention.

H3: Environmental motivation positively affects rooftop solar photovoltaic system adoption intention.

H4: Knowledge and awareness positively affects rooftop solar photovoltaic system adoption intention.

Barriers

The commonly identified barriers through reviewing literature were financial barriers, technical barriers and knowable and institutional barriers. Abdullahi et al. (2021) analysed the effects of four key impediments to the adoption of renewable energy: technological (R&D, technical capacity), financial (economic utilization, financial investments in solar energy projects), political (political commitment, legislation), and social (knowledge and awareness). Besides, a scarcity of maintenance and operations skills, research and development initiatives, energy storage, and a lack of standards are all substantial technological challenges to the expansive utilization of renewable energy (Sovacool et al., 2011; Yaqoot et al., 2016; Wyllie et al., 2018). Owusu-Manu and Mankata (2021) have identified twelve barriers classified into three main areas: economic (lack of industry knowledge, costs incurred and payback period), commercial (absence of government policies, inefficient pricing strategies, local energy situation) and regulatory (incorrect regulatory framework, limited corporate bond markets). All above factors highlighted by scholars can be categories in to three main barriers; financial barriers, technical barriers and knowable and institutional barriers that affect the rooftop solar PV system adoption intention. Accordingly, following hypotheses were developed.

H5: Financial barriers negatively affect rooftop solar photovoltaic system adoption intention.

H6: Technical barriers negatively affect rooftop solar photovoltaic system adoption intention.

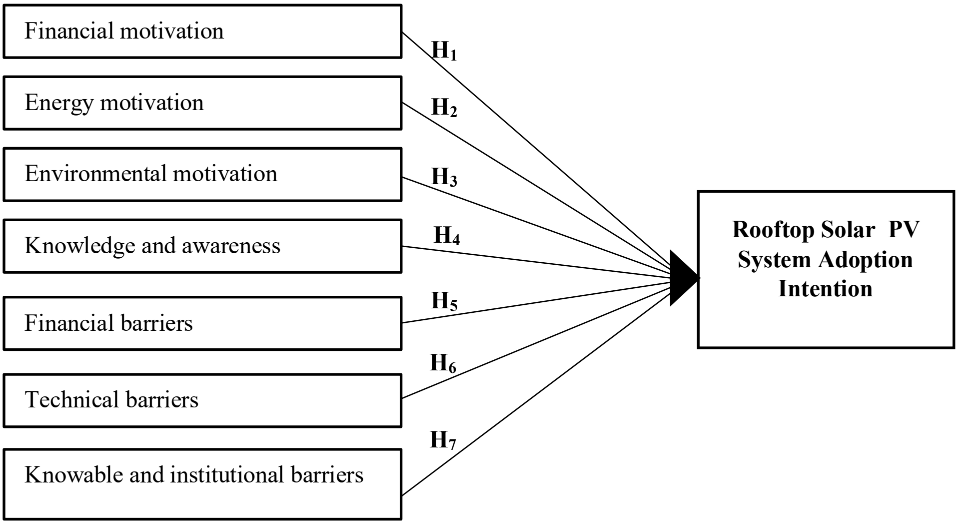
H7: Knowable and Institutional barriers negatively affect rooftop solar photovoltaic system adoption intention.

METHODS

Study Design

This research is aimed at exploring the factors that affect the intention of middle-income households in Sri Lanka to adopt rooftop solar PV systems. It is hypothesised that there is a strong correlation between the motivating factors and factors that act as barriers and the adoption intention. The factors identified in the reviewing literature are used to develop the conceptual model shown in Figure 2. The dependent variable is rooftop solar PV system adoption intention and the independent variables are the four motivating factors and three barriers.

Figure 2: Conceptual Model of the Study



Source: Authors (2022)

Case Study Area

As the statistics of Asian Development Bank report (2019) disclosed, the highest share of electricity sales (37%) was done to households. Further, when looking at the statistics of income share by households published by the Department of Census and Statistics – Sri Lanka (2016), 60% of households fall into the middle-income category of LKR 56,079 – 196,289 as per the range of defined by the Ministry of Economic Policies and Plan Implementation – Sri Lanka in the year 2019. In addition, those statistics reveal that Kaduwela is the second highest populated city in Colombo district. It is a suburb of Colombo in Colombo districts, western province in Sri Lanka, located about 16km from Colombo city center. Kaduwela consists with area of 87.7 km² (33.9 sq mi). According to the 2020 census data, there are 266,211 population and there are 75,245 households in the area (Department of Census and Statistics – Sri Lanka, 2020). Hence, this study focused on the middle-income households in Kaduwela area to get a significantly applicable findings with higher rate of potential for generalisability.

Population, Sample and Data Collection

The study population consisted of middle-income residential households in Sri Lanka. The data was collected through a structured questionnaire targeting 75 middle-income residents in Kaduwela area selected using simple random sampling technique. For the data collection, both primary and secondary sources were used. Secondary data collection was done through reviewing journal articles, reports, web articles, blogs, etc. The main data collection tool for the primary data of this study was the structured questionnaire survey. More than 100 questionnaires were randomly distributed among middle income households in Kaduwela area and the responses received with income levels which were not within considered middle-income range were disregarded.

Survey Instrument

A structured questionnaire survey was conducted with Likert scale questions to collect the required data from the middle-income households. This method has been used by many previous scholars and have proved its suitability for this type of study. The first part of the questionnaire included the demographic details of the respondents such as gender, age, education level, occupation, income, and household size. The second part focused on house and roof type. The third section of the questionnaire was allocated for the determinants of rooftop solar PV system adoption. 5-point Likert Scale questions (1= strongly dissatisfied, 2= dissatisfied, 3= neutral, 4= satisfied, 5= strongly satisfied) were used to obtain data on their perception on the factors that act as motivators (financial motivation, energy motivation, environmental motivation and knowledge and awareness) and barriers (financial barriers, technical barriers and knowable and Institutional barriers) in adopting rooftop solar PV systems. Table 2 shows the variables, sub-variables and items used to measure the determinants and behavioural intention.

Table 2: Variable, Sub-variables and Items used to Measure Determinants and Behavioural Intention

Variables	Items	Measures	Source
Financial motivation (FM)			
Sub-variables	FM 1	Price of the normal solar grid is affordable enough	Parsad et al. (2020)
	FM 2	The government encourage the use of solar energy for houses via financial support	Selvin et al. (2021)
	FM 3	Solar PV can reduce electricity bills	Bekti (2021)
Energy motivation (ENM)			
Sub-variables	ENM 1	I am highly motivated in the adoption of solar panels due to energy reliability	Parsad et al. (2020)
	ENM 2	I am highly motivated in the adoption of solar panels due to energy independence	Parsad et al. (2020)
Environmental motivation (EVM)			
Sub-variables	EVM 1	Solar PV can help to improve the environment	Selvin et al. (2021)
	EVM 2	I like to use environmentally friendly technologies	Bekti (2021)
Knowledge and awareness (KM)			
Sub-variables	KM 1	Enough information is available on solar energy and its technologies	Selvin et al. (2021)
	KM 2	It is easy to understand how solar panels work on household appliances in my resident	Selvin et al. (2021)
Financial barriers (FB)			
Sub-variables	FB 1	Renewable energy is too costly for me to consider for my home	Selvin et al. (2021)
	FB 2	There is a price variation in the same solar panels from different suppliers	Parsad et al. (2020)

Technical barriers (FB)			
Sub-variables	TB 1	Roof mounting can damage the client's roof and cause leaks into the house	Parsad et al. (2020)
	TB 2	Homeowners think that solar PV systems make their house look ugly	Parsad et al. (2020)
Knowable and institutional barriers (KB)			
Sub-variables	KB 1	Lack of knowledge on proper maintenance	Parsad et al. (2020)
	KB 2	Lack of knowledge companies for consulting/installation	Parsad et al. (2020)
	KB 3	Scarcity of attractive offers, promotions provided to potential buyers	Parsad et al. (2020)
	KB 4	Lack of access to quality material or installation practices	Parsad et al. (2020)
	KB 5	Hard to find information on how to interpret the benefits of excess energy sold back to the grid based on law	Parsad et al. (2020)
Behavioral intention (BI)			
Sub-variables	BI 1	I am willing to installation of solar PV system	Verma and Chandra (2018)
	BI 2	I plan to use solar panel technology	Verma and Chandra (2018)
	BI 3	I will make an effort to using solar panels	Verma and Chandra (2018)

Data Analysis Procedure

The IBM Statistical Package for Social Sciences (SPSS) version 26 was used to conduct both descriptive and inferential statistical analysis of the data. Descriptive statistics such as the mean and standard deviation were used to measure adoption intention of rooftop solar PV systems. This allowed the data to be displayed clearly and simply analyzed (Garth, 2018). Furthermore, Pearson Correlation was used to investigate the relationship between identified factors and adoption intention of rooftop solar systems

(Samuels, 2014). Regression analysis was then used to identify the impact of the identified factors on the adoption intention of rooftop solar PV systems.

Reliability of Data

Cronbach's alpha is a common measure used to test factor reliability (Nunnally, 1978). It was used to check the reliability of data of both independent and dependent variables. As shown in Table 3, all values were above 0.7 which is the minimum acceptable level to ensure the internal consistency of the data set (Hair et al., 2014).

Table 3: Reliability of the Data

Factor	Cronbach's Alpha	No. of Items
Financial motivation (FM)	0.732	3
Energy motivation (ENM)	0.888	2
Environmental motivation (EVM)	0.837	2
Knowledge and awareness (KM)	0.908	2
Financial barriers (FB)	0.731	2
Technical barriers (TB)	0.731	2
Knowable & institutional barriers (KB)	0.918	5
Behavioral intention (BI)	0.997	3

Source: Field Survey (2022)

RESULTS AND DISCUSSION

Demographic Profile of Respondents

The demographic data in Table 4 show that the majority of respondents were males (53%) between the age of 45-54 years (31%). The majority were having either ordinary level (36%) or bachelor’s degree (37%) level education and were employed in the private sector (48%). Moreover, most respondents’ monthly income ranges from LKR 55,000 to LKR 100,000 (71%). The common household sizes are 1-3 (52%) and 4-5 (48%).

Table 4: Respondents' Profile

		N	%
Gender	Male	40	53
	Female	35	47
	Total	**75**	**100**
Age	18-24	16	21%
	25-34	12	16%
	35-44	11	15%
	45-54	23	31%
	Above 55	13	17%
	Total	**75**	**100%**
Education level	Ordinary Level	27	36%
	Advanced Level	14	19%
	Diploma	3	4%
	Bachelor's degree	28	37%
	Postgraduate (Master or PhD)	3	4%
	Total	**75**	**100%**
Occupation	Employed (Government sector)	24	32%
	Employed (Private sector)	36	48%
	Self-employed	9	12%
	Retired	6	8%
	Total	**75**	**100%**
Income	LKR 55,000 – 100,000	53	71%
	LKR 100,001 – 150,000	18	24%
	LKR 150,001 –200,000	4	5%
	Total	**75**	**100%**
Household size	1-3 persons	39	52%
	4-5 persons	36	48%
	7-10 persons	0	0%
	More than 10	0	0%
	Total	**75**	**100%**

Source: Survey Data (2022)

Type of Residence and Roof

As shown in Table 5, the common resident type of the sample was detached houses (59%). The common types of roof were either asbestos roof (52%) or calicut tiled roofs (35%).

Table 5: Type of Residence and Roof

		N	%
Residence type	Apartment	0	0%
	Detached house	44	59%
	Villa	0	0%
	Townhouse (attached units)	31	41%
	Others	0	0%
	Total	75	100%
Roof type	Asbestos	39	52%
	Calicut Tile	26	35%
	Concrete slab	6	8%
	Other	4	5%
	Total	75	100%

Source: Survey Data (2022)

Factors affecting rooftop solar PV system adoption intention

The mean comparisons describe a contrast between the average of one or more continuous variables and one or more categorical variables. It is an all-encompassing phrase that can be used to describe a wide range of various research objectives and study methodologies. One can, for instance, compare the average from a single sample of data to a fictitious population value, the means from many independent groups for a single variable, or the average for a single variable from a single sample over various measurement intervals. Table 6 shows the mean values of the variables.

Table 6: Mean Distribution of the Factors affecting Adoption Intention of Rooftop Solar PV Systems

Variables	Items	Mean	Standard Deviation
Financial motivation (FM)	FM 1	4.19	.64
	FM 2	4.08	.95
	FM 3	3.27	.92
Energy motivation (ENM)	ENM 1	3.69	.84
	ENM 2	3.64	.75
Environmental motivation (EVM)	EVM 1	1.91	.74
	EVM 2	1.48	.84

Knowledge and awareness (KM)	KM 1	3.87	.81
	KM 2	4.04	.89
Financial barriers (FB)	FB 1	2.41	.90
	FB 2	2.47	.78
Technical barriers (FB)	TB 1	3.27	.74
	TB 2	3.96	.76
Knowable and institutional barriers (KB)	KB 1	2.28	.88
	KB 2	2.13	1.04
	KB 3	2.11	.94
	KB 4	2.43	.99
	KB 5	2.63	.87
Behavioral intention (BI)	BI 1	3.80	.79
	BI 2	3.71	.78
	BI 3	3.99	.79

Source: Survey Data (2022)

On a 5- point Likert scale, mean scores higher than 3.0 indicate that the perception of respondents is towards agreeing to statements. Considering the mean values of the factors obtained from the mean comparison, motivating factors and barriers were ranked. As shown in Table 7, out of four motivating factors financial motivation has ranked number one having 3.84 mean value. Second was energy motivation having 3.67 mean value while environmental motivation was not found as an indicator of behavioural intention of solar system adoption.

Out of four barriers, mean values revealed that knowledge and awareness barrier is the number one indicator and second was the technical barrier. Their mean values were 3.96 and 3.62 respectively. Other two factors were not found as barriers in solar system adoption intention as their mean values were below 3.

Table 7: Ranking of Factors based on Mean Values

	Mean	Rank
Motivating Factors		
Financial motivation (FM)	3.84	1
Energy motivation (ENM)	3.67	2
Environmental motivation (EVM)	1.70	-

Barriers		
Knowledge and awareness (KM)	3.96	1
Technical barriers (FB)	3.62	2
Financial barriers (FB)	2.44	-
Knowable and institutional barriers (KB)	2.32	-

Source: Survey Data (2022)

Relationship between the Motivating Factors and Barriers and Adoption Intention of Rooftop Solar PV Systems

Table 8 shows the output of correlation analysis. According to those statistics, financial motivation, energy motivation and knowledge and awareness have statistically correlated with behavioural intention or solar system adoption intention since their sig values are below 0.05. Further, it was revealed that the environmental motivation and behavioural intention are not correlated as its sig value was .455 above 0.05. Accordingly, H1a, H1b and H1d were supported and the H1c was not supported. When looking at barriers, negative correlations were evident between all three barriers and behavioural intention (sig value<0.05). Consequently, H2a, H2b and H2c were supported.

Table 8: Correlation between the Motivating Factors and Barriers and Adoption Intention of Rooftop Solar PV Systems

Variables	**Behavioural intention (BI)**	
	Pearson Correlation	**Sig. (2-tailed)**
Motivating Factors		
Financial motivation (FM)	.398**	.000
Energy motivation (ENM)	.299*	.030
Environmental motivation (EVM)	.027	.455
Knowledge and awareness (KM)	.343*	.010
Barriers		
Financial barriers (FB)	-.462**	.000
Technical barriers (FB)	-.242*	.036
Knowable and institutional barriers (KB)	-.045*	.020

Source: Survey Data (2022)

Impact of Motivating Factors and Barriers on Adoption Intention of Rooftop Solar PV Systems

First, the researchers examined if any multicollinearity issue can be detected. According to Sekaran and Bougie (2016), the common cutoff value is a tolerance value of 0.10, which corresponds to a Variance Inflation Factor (VIF) of 10. The test outputs of the current study showed that there is no multicollinearity between independent variables because, the VIF factor is far below the cutoff 10 and there is a higher tolerance value of 0.10.

The data in Table 9 shows the results of a regression analysis that evaluates the effect of Motivating Factors and Barriers on the Intention to Adopt Rooftop Solar PV Systems. The p-value's, which must be lower than 0.05 to be considered statistically significant, indicate the level of significance. The standardized regression coefficient (ß) gives an idea of the magnitude of the influence of the Motivating Factors and Barriers on the Adoption Intention of Rooftop Solar PV Systems. The higher the ß value, the greater the impact.

Table 9: Regression Analysis Results

Variables		**Standard Coefficient (Beta Value)**	**P-value**
Behavioural intention (BI)	**Motivating Factors**		
	Financial motivation (FM)	.544	.001
	Energy motivation (ENM)	.309	.033
	Environmental motivation (EVM)	.049	.003
	Knowledge and awareness (KM)	.143	.210
	Barriers		
	Financial barriers (FB)	-.377	.000
	Technical barriers (FB)	-.242	.036
	Knowable & institutional barriers (KB)	-.045	.177

Source: Survey Data (2022)

The results of this regression test show that out of motivating factors, financial motivation had a significant positive impact on behavioural intention, with a beta coefficient of .544 and a p-value of .001. Energy motivation had a moderate positive impact, with a beta coefficient of .309 and a p-value of .033. Environmental motivation had a weak positive impact, with a beta coefficient of .049 and a p-value of .003. Finally, knowledge and awareness did not show any evidence of having any impact on solar adoption intention due to its p-value being .21. When moving to barriers, financial barriers and technical barriers had significant negative impact on behavioural intention. Their beta coefficient and p-values are .337, .242 and .000, .036 respectively. Knowable and institutional barriers did not show any impact, as its impact on solar adoption intention was insignificant (P-value was .117).

A summary of hypothesis testing of the current study is given in Table 10. The researcher proposed seven hypotheses altogether and five hypotheses were supported.

Table 10: Summary of hypothesis testing

Variable	Standard Coefficient	P-value	Decision
Motivating Factors			
Financial motivation (FM)	.544	.001	Supported
Energy motivation (ENM)	.309	.033	Supported
Environmental motivation (EVM)	.049	.003	Supported
Knowledge and awareness (KM)	.143	.210	Not supported
Barriers			
Financial barriers (FB)	-.377	.000	Supported
Technical barriers (FB)	-.242	.036	Supported
Knowable and institutional barriers (KB)	-.045	.177	Not supported

Source: Survey Data (2022)

CONCLUSION

The aim of the current study was to determine the factors influencing rooftop solar PV system adoption intention of middle-income households in Sri Lanka. Accordingly, this study explored the factors motivating rooftop solar PV system adoption intention and factors acting as barriers in rooftop solar PV system adoption intention. Based on reviewed literature, the study adopted four variables as motivating factors; Financial Motivation, Energy Motivation, Environmental Motivation and Knowledge & Awareness Motivation. The identified three barriers through literature review were Financial Barriers, Technical Barriers, and Knowable & Institutional Barriers.

As the highest share of electricity sales was done to households in Sri Lanka and 60% of households fall into the middle-income category, Kaduwela being the second highest populated city in Colombo district was selected as the case study area. Accordingly, this study was done focusing on the middle-income households in Kaduwela area. The data was collected through a structured questionnaire from 75 middle-income residents in Kaduwela area selected using simple random sampling technique. For the data collection, both primary and secondary sources were used. Secondary data collection was done through reviewing journal articles, reports, web articles, blogs, etc. The main data collection tool for the primary data of this study was the structured questionnaire survey. The respondent showed a combination of different age, gender, education, and income groups attached to different occupations.

The Pearson correlation and regression analysis were performed and the study hypotheses were got confirmed revealing that the identified motivating factors and barriers affect the rooftop solar PV system adoption intention of middle-income households in Sri Lanka. These findings are consistent with the findings of studies done by previous scholars such as Parsad at el. (2020); Ahmed et al. (2022); Schulte et al. (2022). However, the study also exposed that not all identified factors affect the adoption intention in the same way. According to study findings, financial motivation, energy motivation and knowledge and awareness have statistically correlated with behavioural intention or solar system adoption intention while the environmental motivation and behavioural intention are not correlated. When looking at barriers negative correlations were evident between all three barriers and behavioural intention.

The results of this regression test show that out of motivating factors, financial motivation had a significant positive impact on behavioural intention. Energy motivation had a moderate positive impact while environmental motivation had a weak positive impact. Finally, knowledge and awareness did not show any evidence of having any impact on solar adoption intention. The test outputs of barriers show that financial barriers and technical barriers had significant negative impact on behavioural intention while knowable and institutional barriers did not show any impact. As an overall finding, the financial aspect is a major concern in both motivators and barriers. These findings have implications on a policy that connects to the capital investment in solar energy generation and evaluating motivating factors and barriers to find relevant interventions and policy instruments to scale up the motivating aspects more while mitigating the barriers. A study focusing on providing deeper understanding on strategies to mitigate financial barriers and encourage motivating factors and thereby increase the level of rooftop solar PV system adoption is suggested to strengthen the research on renewable energy usage, as immense number of benefits can be gained from adopting rooftop solar PV systems to the country.

ACKNOWLEDGEMENT

The authors acknowledge the Center for Real Estate Studies (CRES), Department of Estate Management and Valuation, University of Sri Jayewardenepura, Sri Lanka.

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