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Solar energy technology: Knowledge, awareness, and acceptance of B40 households in one district of Malaysia towards government initiatives

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ABSTRACT

Various initiatives have been planned and implemented by the Government of Malaysia to increase the lower 40% household income known as "B40". Among these was the solar photovoltaic (PV) project publicly known as "MySuria," which was presented by the 6th Prime Minister of Malaysia in Budget 2017. As classified by the Department of Statistic Malaysia (DSoM), B40 is a household group that earns a monthly income of RM3,855 and below. It is a group of people who have low wealth and non-financial asset ownership and desperately needed governmental and non-governmental organizations (NGOs) assistance to survive and very vulnerable to economic shocks. This study was conducted to identify the B40 households' level of basic science knowledge, awareness, and acceptance to use solar photovoltaic (PV) energy technology to generate extra income. A set of questionnaires comprises demographic information, awareness, and acceptance to utilizing solar PV technology, as well as a short test about the basic science of solar energy, were distributed to selected respondents. The respondent was composed of one hundred B40 working individuals in the public and private sectors around the Tanjong Malim district. Since this research is intentionally done to identify the specific group interests with no intention to generalized the data, the group population was purposefully sampled to achieve the research's objective. It was found that 43% of respondents have a tertiary education (diploma or degree), 70% were married, and 90% were youth (under 40 years old). The findings of this study also revealed that although 80% of respondents have basic knowledge of science, their level of awareness about solar energy technology and its use was at the average score. However, the respondents showed their high level of acceptance towards the government's initiative in using solar energy technology to increase their household incomes. Additionally, the study also discovered that the B40 group in Tanjung Malim district is highly engaged in the changes brought by the new technology product to their society that would benefit them. On top of that, the respondents gave a full-fledged commitment to use, promote, and educate their families in solar energy technology.

1. Introduction

In today's world, regularly growing technology has become an essential part of our lives. It has changed our lives drastically as a result of new technology introduces to us. Technology has simplified people's work and made life very comfortable according to their needs and requirements. Nowadays, society is subsequently well intertwined and reliant on technology. Technology improves almost every sector, such as telecommunications, transportations, health, energy, and education. A society that has grown up with technology have multitasking skills [1] for retrieving information. Technology is continuously changing and evolving with the way people adapt to these technological advances. Modern science and technology have exaggerated society in numerous ways, not only in changing our lifestyles but also in generating incomes. One of the newly and progressively involved in the energy sector is renewable energy, and one of its candidates is solar photovoltaic (PV) technology.

The solar PV panels installed on the houses' rooftop have given such opportunities, especially in the rural and semi-urban societies, to gain extra incomes by selling back the solar-generated electrical energy to a licensed utility company. To support lessening climate change since solar energy is environmentally friendly, in 2011, the Government of Malaysia has introduced a Feed-in Tariff (FiT) law scheme for its citizen to generate extra monthly income by the solar PV panels. Malaysia's FiT

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system obliges Distribution Licensees (DLs) to buy from Feed-in Approval Holders (FiAHs) the electricity generated from renewable resources and set the FiT rate.

In general, Malaysian are categorized into three different monthly income groups: Top 20% (T20), Middle 40% (M40), and Bottom 40% (B40). The T20 group is defined as the median household income of at least RM13,148, while the M40 and B40 groups' median household incomes are RM6,275 and RM3,000, respectively [2]. Over the years, the bar for each group's income level has increased. This is one of the indicators of economic growth, according to the latest Household Income and Basic Amenities Survey 2019 research findings by the Department of Statistics Malaysia (DoSM) for the year 2016.

Household Income Survey (HIS) was carried out by the Malaysian government to obtain information on the status of income and poverty in Malaysia. HIS conducted by the Department of Statistics Malaysia (DoSM) twice every five years. The data used as input for monitoring, planning, and policy formulation and program development, particularly in preparing the country's Five-Year Plan. Report on Household Income and Basic Amenities Survey (HIS & KA) 2014, published by the DoSM, showed progress in terms of income inequality state [2]. According to the report, 50% of Malaysian households earned RM4,585 and above per month, increasing 11.7% per year since 2012. Overall, the Gini coefficient declined from 0.431 in 2012 to 0.401 in 2014. According to DoSM, a household is considered poor if its monthly income is less than RM2,293. The implication is that more than 20% of households or 1.3 million is still below the relative poverty line in 2014.

During the Tenth Malaysia Plan (10th MP), 2011–2015, an inclusive approach to development is a key strategy designed and implemented to achieve a prosperous and fair society without bias, gender, ethnicity, socioeconomic status, or geographical location [3]. This intelligent approach provides equal opportunity for Malaysians to get involved and benefit from the economy. The focus has been given to address pockets of poverty and socioeconomic inequalities, particularly among households earning the lowest 40% (B40).

In the Eleventh Malaysia Plan (11th MP), 2016–2020: Direction to Increase Household Income and Wealth B40 [4], improving the B40 household income was continued and intensified. It aims to improve rural and urban households' living standards to increase participation in the economy through income-generating activities, human capital development, and support programs for micro-enterprises. Data released by the Economic Planning Unit [5] showed that business ownership opportunities were provided by Amanah Ikhtiar Malaysia (AIM) in rural areas, with 225,867 participants have increased their income by more than RM2,000 a month. In the city, a total of 8580 participants were involved in entrepreneurship training.

The 11th Malaysia Plan set a target to double the average monthly household income of the lowest income group from RM2,537 in 2014 to RM5,270 in 2020 and the median monthly income of RM2,629 to RM5,701. One of the three strategies designed by the government was to increase the household income and wealth by enlarging the size of the middle class. A variety of initiatives have been undertaken by the government to help the B40 group to increase their income, such as BR1M, MySuria, Agropreneur, mobilpreneur, taxi 'ride-sharing' (e.g., Uber, Grabcar) and entrepreneurship as presented by the Prime Minister of Malaysia in the Budget 2017 [6].

From the literature, similar initiatives on applying new technology to society are also being implemented in other parts of the globe. Similar and related researches on the household adoption of solar PV technology were carried out in various countries. A study carried out in Lahore, Pakistan, to determine the households' decisions to solar PV adoption found that the solar PV system's cost appeared to be the most significant factor in the household reluctant to adopt the solar PV system [7]. Another similar study in rural Ethiopia found that the household head's level of education and monetary incentives by the government increase the adoption of energy technologies [8].

Research into electricity generation conducted in Uttar Pradesh, India, reported a high satisfaction among rural low-income households with distributed solar PV [9]. The income benefit and level of household education were found to be the influencing factors to procure an additional solar PV system. Lee et al. [10] investigated the Korean government's sustainable energy policy's effectiveness in providing solar photovoltaic (PV) systems for low-income households living in public rental apartments in Seoul Metropolitan. The program was successful implemented with a reduction in the electricity bill, which benefited the lower-income group. Electricity bill reduction and government funding for the system were found to be the most important motivations for installing solar PVs in their apartment verandas. However, they also found that the participants' satisfaction level had then dropped due to the actual system's energy capacity and energy bill reductions. Again, money was found to be the most significant concerning factor for the low-income household group.

Another similar research conducted in England and Wales to study the participant's motivation to install solar PV panels found the changes in motivations over time. In 2011, the financial benefit presented by the feed-in tariff (FiT) was the primary reason. However, over time, environmental considerations have become more assertive, although rising electricity price is the primary reason for rent-a-roof users [11]. The more vital environmental consideration could be because England and Wales are developed countries with high household incomes and educational levels compared to undeveloped and developing countries.

As can be seen, similar and different determinants were observed in several other parts of the world on the household's adoption of solar PV technology in their houses. Hence this paper sought to disseminate some critical findings on the Malaysian low-income household group (B40) in aspects such as solar energy, awareness, and technology acceptance on the solar PV FiT scheme formulated by the Malaysia Sustainable Energy Development Agency (SEDA). This research was conducted concerning the "MySuria" program, which employed the FiT scheme to raise additional financial income for B40 households through solar photovoltaic (PV) technology. This study's primary research aim was to identify the level of basic science knowledge, awareness, and acceptance of the B40 households on solar PV technology to generate extra monthly income. The research findings and its interpreted potential data's meaning are summarised in the result and discussion section.

2. Theoretical background

2.1. Solar energy

Different regions of the world receive different amounts of sunlight. One of the factors is the sunlight that reaches the Earth's surface is highly dependent on the latitude and the weather. Fig. 1 illustrates the annual average solar irradiance of the sunlight for regions of Malaysia [12]. As can be seen, Malaysia received between 1300 and 1600 kWh/m^2 annually.

The radiant power along the vertical (directly overhead) of sunlight that reaches the Earth's surface, at the equatorial region, is estimated at 1366 W per square meter (W/m^2) [13]. However, factors such as latitude, season, and weather will usually reduce solar radiation's power at ground level. Atmospheric conditions will reduce the amount of sunlight that reaches the Earth's surface through the light scattering direction and variation of the spectrum. When moving across the atmospheric, almost 6% of the sun rays reflected toward the Earth while a further 16% is absorbed. This phenomenon will produce maximum radiation at the equator is about 1000 W/m^2. Cloudy atmospheric conditions, dust, or air pollution turn further reduces power by almost 20% through reflection and 3% through absorption. However, as the Sun gives its energy free of charge and uninterrupted supply (except for the evening), energy from sunlight is very beneficial in the long run.

The term solar energy used in this study is defined as energy from the Sun converted into electrical energy by solar photovoltaic panels/modules. Photovoltaic solar panels are usually placed on the rooftop of

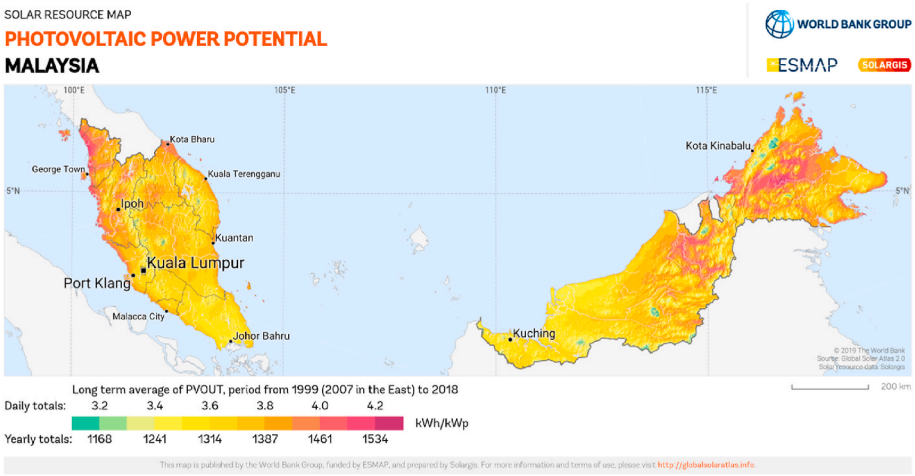

Fig. 1. Solar resource map of Malaysia (source: Solargis [12]).

the house or building. The advantages of using solar energy are that it is free, renewable, and clean. With the use of solar energy, the world will be safer for living by reducing the burning of fossil-based resources such as oil and gas, which is a significant cause of greenhouse gas emissions. Scientists have agreed that the increase in greenhouse gases, especially carbon dioxide (CO_2), contributes to global warming [14].

2.2. Feed-in tariff (FiT)

In the MP10 (2011–2015), the Government of Malaysia aimed to achieve a renewable energy (RE) target of 985 MW by 2015, or 5.5% of Malaysia's total electricity generation mix [15] with the target of 25% of the country's electricity generation by 2050. Sustainable Energy Development Authority (SEDA) was established to promote sustainable energy as a part of the solution to achieve energy security and autonomy. One method of promoting a sustainable energy scheme introduced by SEDA is a feed-in tariff (FiT) to the holder of a secured quota generation of electricity using photovoltaic solar panels [16].

Through the Sustainable Energy Development Authority (SEDA) under the former Ministry of Energy, Green Technology, and Water, the Government of Malaysia has established a FiT policy to encourage consumers and investors to adopt solar technologies to generate income by selling back electricity energy to the national utility company. This policy has been mandated under the Energy Act new (TBB). Under this act, there are five (5) renewable resources that have been identified and met the criteria for implementation and benefits of the FiT mechanism, namely biomass, biogas, small hydropower, solar photovoltaic (PV), and geothermal. The host with FiT quota (approval holder) can sell the excess electricity generated by the solar panels to the electricity provider company and earn some money through this scheme. It is strongly believed that this project will help the B40 group to increase their monthly household income for such a long period of 21 years.

Fig. 2 shows an overview of domestic wiring for the FiT scheme that uses two electricity energy meters. A FiT meter is a device that measures the electricity generated by photovoltaic solar panels at home and sells to utility companies such as Tenaga Nasional Berhad (TNB). Through this scheme, the landlord is an individual electricity generator and paid each month by TNB for every unit of energy purchased.

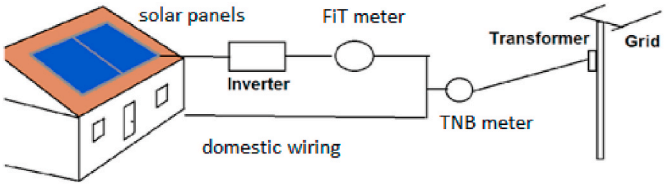

Fig. 2. Domestic wiring for Feed-in Tariff meter connections.

The electricity generated is measured in kilowatt-hours (kWh). As a common practice, and also depends on the insolation of sunlight in a given area, solar PV panel of 1 W peak ($1W_P$) can generate 1 to 2 kWh of electricity per year. This energy is a large multiple of more than 1000 times in the generation of electricity from sunlight source. Malaysia is a country that receives average daily solar radiation of 4 kWh/m^2 [17] and more than ten sunshine hours a day throughout the year. Therefore, the application of the solar system is suitable for generating electricity, a system of 4 kWp power capable of generating enough electricity to power a medium-sized house.

It is estimated that a minimum payback period for a solar PV system on Malaysia's roof façade is six years [18]. Given the lifetime of the photovoltaic solar panels with the latest technology can achieve 30 years or more, investments in this sector are very profitable, especially in tropical countries such as Malaysia. Table 1 shows the Feed-in tariff (FiT) rate for solar photovoltaic panels produced by SEDA with effect from 1st January 2017.

This rate is for 21 years from the start of electrical energy generated by photovoltaic solar panels. In addition to the use of sustainable energy, bonuses will be given to encourage the use of local materials. For example, if the average radiation of sunlight per day is 5 h, for solar panels of 4 kW (RM 0.7424/kWh) that are installed on the roof of the house (RM 0.1395/kWh), using local solar panels (RM 0.050/kWh) and local inverter (RM 0.050/kWh), the average return per month is approximately RM 500.00. In the year 2020, the country is projected to generate more than 3 GW of new renewable installed, in which 1250 MW will be coming from Solar PV.

In the UK, a similar FiT scheme introduced in 2010 was the most

Table 1
The feed-in tariff (FiT) for solar photovoltaic (individual).

Description of Qualifying Renewable Energy Installation	FiT Rates (RM per kWh)
(a) Basic FiT rates having installed capacity of:	01-JAN-2017
(i) up to and including 4 kW	0.7424
(ii) above 4 kW and up to and including 12 kW	0.7243
(b) Bonus FiT rates having the following criteria (one or more):	
(i) use as an installation in buildings or building structures	+0.1395
(ii) use as building materials	+0.1060
(iii) use of locally manufactured or assembled solar PV modules	+0.0500
(iv) use of locally manufactured or assembled solar inverters	+0.0500

frequently installed with 634,421 PV installations, with 96% of which are under 4 kW registered in the Microgeneration Certificate Scheme (MCS) the end of 2014 [19]. By 2020, the UK Government estimates that the FiT will produce 7.5 GW of PV energy.

2.3. Technology Acceptance Model (TAM)

The conceptual framework used to support this study was adapted from the Technology Acceptance Model (TAM) developed by Davis [20]. TAM is originally a theoretical model of an information system used to determine the level of acceptance and use of new technologies by users. Acceptance has been viewed as a function of user participation in systems development. Fig. 3 depicts the original TAM model, which comprises two primary constructs: Perceived usefulness (PU) and Perceived ease of use (PEU) [21].

PU and PEU are the two cognitive beliefs in TAM. Davis defines PU as a stage where a person trusts certain technologies that will improve their work performance. External variables are defined as variables that affect PU, PEU, and attitude towards using new technology. Behavioural Intention (or Treatment Intention) is determined by the user attitude towards the use of technology. This model states that when a user is introduced to new technology, several factors influence their decision to use it. It provides a basis with which the users trace how external variables influence their belief, attitude, and intention to use the new technology introduced to them. TAM suggests that the usefulness and ease of use are essential factors in determining consumer attitudes toward adopting new technology [22].

According to TAM, one's actual use of new technology is influenced either directly or indirectly by the user's behavioural intentions, attitude, PU, and PEU of the technology. TAM also proposes that external factors affect intention and actual use through mediated effects on PU and PEU. TAM utilizes entirely cognitive predictors, relating the adoption and actual behaviour of new attitudes to technology, beliefs, and perceptions [23]. Although TAM is used initially to describe the use of technology in the organization, constructs of the model have been widely adopted for general use and universal [24–27].

3. Research methods

The research methodology combines methods, techniques, or procedures in designing, developing, and administering the study to collect and analyze data and information. The selection of appropriate research methodology is crucial that the findings were able to answer the research questions. This research is a quantitative survey method where three variables, the basic knowledge of science, awareness, and acceptance of the B40 group towards using solar energy, were measured.

3.1. Research instrument

A set of questionnaires was used to obtain data and information based on the objective of the study. The questionnaires contain four constructs (or parts). Part 1 concerns the respondent demographics and socioeconomic. Besides, there are also items on projected household income by the year 2020. These data would allow researchers to predict the result of the study if it were to be held in 2020 in which Malaysia aspires to become a high-income developed nation. Part 2 is the test questions concerning basic scientific knowledge of the Sun, the Earth, and geography. Parts 3 and 4 are respectively dedicated to the respondents' level of awareness and their acceptance of solar energy and its usage. The short test questions and questionnaires were built by the researcher and reviewed by social science experts.

The questionnaire was designed in Malay and, if required, translated in English, which is a commonly understood language. It comprised of closed-ended quantitative questions with a provision, where applicable, to capture elaborated responses. The quantitative dataset was transformed into numerical data to use variables in the statistical model. Such data are new, and by way of example, there is no public database of B40 households awareness and acceptance to use the newly introduced Feed-in Tariff (FiT) scheme of solar PV in the district of Tanjong Malim.

Before data collection, the suitability and clarity of the questionnaire set items that will be used to obtain the respondents' feedback are also done. The 5-point Likert scale questionnaire: strongly disagree (1) to strongly agree (5), was used to extract the respondents' perception of the awareness and acceptance of solar energy use. The collected data were then scaled into 3-score levels to identify their level of score tendency, as shown in Table 2.

The management of questionnaires was conducted and administered by a research assistant who is also a PhD student. The benefit of self-management is that the researcher can explain the question's purpose if the respondent requires any clarification. The survey questionnaires were distributed to respondents of the public and private sectors who work in Tanjong Malim district. Respondents answered all the questionnaires independently according to their best knowledge and perception without influence by anyone or by a research assistant's clarification support. Before data collection, the questions for items

Table 2
Level of perception scale.

Score	Score Level
1.00–2.33	Low
2.34–3.66	Moderate
3.67–5.00	High

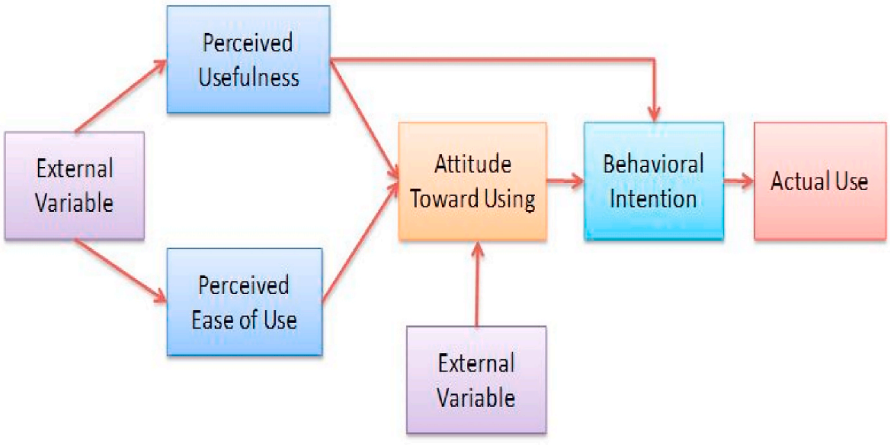

Fig. 3. Technology acceptance model (TAM).

"Level of Awareness" and "Level of Acceptance" were tested for their reliability using a Cronbach Alfa index. It was found that both constructs have a highly reliable index with Cronbach Alfa of 0.948 and 0.981, respectively.

3.2. Sampling and data analysis

Since this study is specific to the scope indicated in advance, a purposive sampling technique was used. The purposive sampling aimed to emphasize the specific characteristics of a population of interest [28]. The respondents' selection is based on the fact that they must be the person who falls under the B40 group and responsible for the household decision regarding solar PV adoption. The survey was conducted in one district of Perak state in Malaysia, Tanjong Malim, situated 100 km north of Kuala Lumpur in Peninsular Malaysia. The Tanjung Malim town is well connected to Malaysia's city with road highway and train facilities. The district was selected based on its semi-urban area, which located Malaysia's oldest university of education (Universiti Pendidikan Sultan Idris) and Malaysia national car factory plant, Proton. These two iconic institutions are synonymous with the higher education and technology sector in Malaysia. A total number of one hundred employees of the B40 group working in public and private sectors in Tanjong Malim was purposively selected as respondents. The data for each item and constructs were derived and analyzed using Microsoft Excel spreadsheet software. Data were analyzed using descriptive methods in the form of frequency (f), percentage (%), mean (m), and standard deviation (sd). Descriptive statistics were used because the researcher, at this stage, did not intend to generalize the findings to the population [29] of B40 throughout Malaysia.

The analysis was done on the primary data obtained from questionnaires distributed to respondents. The data were converted to statistics value according to the weight. Next, the data that have been analyzed were presented in the form of a table. Ordinal data from each item and constructs were translated into 3-range scale intervals. With this methodology, the researcher can determine the respondents' level of the tendency for each studied item and constructs.

4. Results and discussion

4.1. Demographic

Table 3 provides details of respondent demographics in surveying households. As can be seen, the sex ratio of male and female employees is approximately 60:40, and 90% are youth (under 40 years). Almost 70% of the respondents are married. More than 70% work in the public sector and the rest were in the private sector. Approximately half of the respondents are knowledgeable, having completed tertiary education at either high school, diploma, or degree level.

A total of 97 respondents was found to be in the B40 group by reviewing household income data. If the household income remains at RM3,855.00, then in 2020, it is projected that only 18 people managed to move out of the B40 group, an increase of 15% from the year under review. This finding showed a tremendous dependence on sources of employment for the B40 group. Another finding shows that approximately 77% of respondents live in terrace houses, and 42% of respondents own their own homes, which is suitable for panel-roof mounted solar panels. However, on the other hand, 41% of the respondents do not have their own house, making it pretty hard for them to participate in the FiT program. This could be another big hinder to the government initiative regarding elevating the B40 poverty through solar PV technology.

4.2. Basic science knowledge

The study was conducted to determine the extent to which the respondents know about the basic science of solar energy. Tables 4 and 5 show the study results, in which more than 70% of respondents knew about the existence of solar energy and solar panel technologies. It was also found that more than 80% of respondents were able to answer basic science questions about the Sun and the Earth. About 88% of the respondents knew that sunlight could be converted into electrical energy. These findings are quite reasonable since almost 90% of respondents have gone through their schooling education (school/diploma/bachelor

Table 3
Respondent demographic information.

Variables (n = 100)	Frequency (*f*)	Percentage (%)
Gender		
Male	62	62.0
Female	38	38.0
Age		
30 years and below	45	45.0
31–40 years	45	45.0
41–50 years	9	9.0
51–60 years	1	1.0
Marital status		
Single	30	30.0
Married	69	69.0
Single mother	1	1.0
Occupation		
Government	73	73.0
Private	27	27.0
Highest qualification		
Bachelor/Diploma	43	43.0
Higher School Certificate	5	5.0
Middle School Certificate	46	46.0
Lower School Certificate	6	6.0
Total monthly household income (including spouses)		
RM2 499 and below	75	75.0
RM2 500-RM3 999	22	22.0
RM4 000 and above	3	3.0
Total household income in the year 2020 (estimation)		
RM2 499 and below	40	40.0
RM2 500-RM3 999	42	42.0
RM4 000 and above	18	18.0
Residence status		
Rental	41	41.0
Owner	42	42.0
Living with parent	17	17.0
Type of residence		
Terrace	77	77.0
Village	22	22.0
Flat	1	1.0

Table 4
Solar energy.

Items (n = 100)	Frequency (*f*)	Percentage (%)
1. Have you heard about solar energy?		
Yes	78	78.0
No	22	22.0
2. Have you seen a solar panel?		
Yes	73	73.0
No	27	27.0

Table 5
Basic science knowledge.

Items (n = 100)		Wright	Wrong	Not sure	No answer
3.	The Earth rotates around the Sun following its orbit	93	2	5	0
4.	The Sun is always above the equator	53	14	31	2
5.	Geographically, Malaysia is located along the equator	83	11	5	1
6.	Sunlight can be converted into electrical energy	88	2	9	1

degree). It could therefore be said that even though Malaysia is still a developing country, its education system has been well established since independence from the British about 60 years ago.

4.3. Solar energy awareness

The third part of the study was focused on the level of awareness of solar energy and its related technology. The data obtained are as organized in Table 6. The highest scoring item in this category was item no.12 (m = 3.68, sd = 0.92), a 'high' score on the 3-range scale. The respondents have confidence that Solar PV panels can generate electric currents. This outcome presented that the respondents were familiar with the solar PV panel and its usefulness. However, all other items were judged moderate. Overall, the level of awareness of solar energy is moderate.

A simple test was performed to check their knowledge in the basic science of solar energy and found that over 80% of respondents knew the basics of solar science related to the Earth and the Sun. In contrast, the study on the level of awareness regarding solar energy and its use in generating monthly income was modest. An earlier study by Ref. [30] found that lack of knowledge has led to a low awareness level on the adoption of solar energy among Malaysians. This phenomenon is possibly due to solar energy technology is relatively new in Malaysia. The importance of its use has not been widely spread yet to the lower-income society. Globally, lack of knowledge and awareness of RE technologies are among the significant challenges encountered which hinder its usage amongst the society [31] in developing nations. Thus, there is a need to create awareness of RE among low-income societies in developing countries, and their socio-cultural practices are required.

4.4. Acceptance to use solar energy

The fourth part of the study was set to find the respondents' level of acceptance to use solar energy for monthly income generating. Table 7 shows the mean (m) data and its standard deviation (sd). The overall acceptance was high. All of the items surveyed received high ratings except for item no. 16, which is at a moderate level. As given by this study, the impression showed that the respondents fully supported the government's initiative to increase B40 household incomes through solar energy technology. This evidence is visible through item no. 22, which is the highest mean (m = 3.99) obtained in this study. The results also showed that the respondents gave a high commitment to care for the Earth and the environment by agreeing to adopt and promote solar panels in Tanjong Malim district. This result is in line with previous research in user acceptance of renewable energy technology in Peninsular Malaysia, which found that PU and PEU are essential factors in influencing the intention to use renewable energy [32].

A work published by Ref. [33] on awareness of engineering students on green technologies in one of the public universities in Malaysia recommended that green values and thinking to be inculcated among the young generation through education. A similar concluding remark was given by Ref. [8] on the vital role of education in enhancing awareness, adoption, and use of households' renewable energy technology in a rural area in Ethiopia to improved socioeconomic and environmental well-being. Another similar finding of solar technology adoption at the household level in Kiambu County in Kenya concluded that the higher the education, the more commitment to adopt to solar energy [34].

Table 6
Level of awareness.

	Items (n = 100)	Mean	SD
7.	Green technology	3.48	0.90
8.	Renewable energy	3.50	0.87
9.	Solar energy	3.53	0.90
10.	Greenhouse gas emission	3.24	0.93
11.	Global warming	3.59	1.00
12.	Solar PV panel can generate electric current	3.68	0.92
13.	Malaysia is suitable for the generation of electric energy from sunlight	3.61	0.96
14.	Solar PV panel can generate extra monthly income	3.35	1.01
15.	The use of solar PV panels do not give any bad health/side effect	3.29	1.04
Average		**3.47**	**0.95**

Table 7
Level of acceptance to use solar energy.

	Items (n = 100)	Mean	SD
16.	Believe of solar PV panels can generate monthly income	3.23	1.08
17.	Support the use of solar PV panels in a residential area in Tanjong Malim and its vicinity	3.79	0.98
18.	Agreed to place the solar PV panels on the rooftop of your house	3.77	1.01
19.	Encourage relatives and friends to install solar panels on their roofs	3.74	0.95
20.	Keeping Earth space safe by reducing the release of Greenhouse Gases'	3.74	1.08
21.	Educating children and families in the use of environmentally friendly technologies	3.87	0.93
22.	Support the government's intention to increase the income of low-income (B40) with the installation of solar PV panels on the roof of their house	3.99	1.02
Average		**3.73**	**1.01**

5. Conclusion

This study was motivated by MySuria project, which was presented by the 6th Prime Minister of Malaysia during the Budget 2017 tabling in Parliament. MySuria is one of the latest initiative projects by the government to improve group B40 household income. The 2015/2016 Economic Report released by the Ministry of Finance defined B40 as households with a monthly income of less than RM3,855. B40 is a group of workers who desperately need governmental and non-governmental organizations (NGOs) to help to survive. As has been stressed by the economist, the payroll factor alone will not remove this group from the poverty line. The government and the NGOs are making various initiatives towards achieving zero poverty in the country.

This research was conducted in a town named Tanjung Malim, about 100 km north of Kuala Lumpur, which housed the oldest education university in Malaysia (Universiti Pendidikan Sultan Idris) and Malaysia's Proton car maker largest factory plant known as Proton city. The study found that 90% of respondents were youth and 43% had a tertiary education (diploma/degree). Through the employment income projection data, it was found that 82% of respondents will remain in this group in the year 2020. This finding is a clear sign of the need for additional monthly income to get them out of the B40 "income-trap."

The study also revealed that the respondents showed a strong acceptance level (m = 3.74, sd = 1.01) in supporting the government's initiative to increase the B40 household's income through solar energy technology. On top of that, the respondents also showed a high commitment to use, promote, and educate their families in solar energy technology (m = 3.97, sd = 0.93). The findings also exposed that the B40 group in Tanjung Malim is always ready to support the government initiative to increase their household's income by utilizing solar PV energy technology (m = 3.99, sd = 1.02). This data is the highest mean result of all the items conducted in this research.

This study discovered that the societal level of acceptance of the new technology introduces to them is highly dependent on their level of education. From a socio-technical perspective, the Feed-in Tariff (FiT) scheme of solar power self-generation is sought to be employed as a viable alternative to address existing challenges in the lowest income group. It will be easier for the government to introduce new technology to the educated households than to less educated one. These findings are similar to the research results in other developing countries, as discussed

in the introduction section. Monetary and level of education had played a vital role in persuading the low-income society in developing countries adopting solar PV technology.

Nevertheless, future studies are recommended for larger samples over long-term perspectives to gather more data and a more in-depth understanding of current and future B40 households in adopting new technology that could be generalized among all Malaysian B40. More research is needed, but the body of evidence reviewed here makes it clear that for both developed and developing countries, besides the monetary factor, the perceived use of new technology depends on the education level and can have a dramatic impact on society. Thus, it is suggested that the high-level education systems to educate the people is a must for every undeveloped and developing country to move forward in the era of the fourth industrial revolution (IR 4.0) quickly.

CRediT authorship contribution statement

Syed A. Malik: Conceptualization, Methodology, Investigation, Validation, Formal analysis, Data curation, Writing - original draft. **Abdul Rahman Ayop:** Funding acquisition, Writing - review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.techsoc.2020.101416.

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