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Modeling Awareness as the Crux in Solar Energy Adoption Intention through Unified Theory of Acceptance and Use of Technology

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Abstract: Non-renewable energy depletion has prompted stakeholders to advocate alternatives, such as solar energy to pursue sustainability. However, the acquisition rate of solar service is unconvincing despite various initiatives; thus, we are seeking for a more focused remedy. This study is therefore motivated to investigate elements influencing the intention to adopt solar energy, underpinned by a unified theory of acceptance and use of technology. A self-administered questionnaire through a purposive sampling method was employed, targeting working adults who own a home or intend to purchase one in the future. Homeowners residing in condominiums, apartments, or any shared building or property were excluded. Partial least squares structural equation modelling was used for data analyses. Findings reveal that awareness positively influences performance expectancy, effort expectancy, and facilitating condition. Additionally, performance expectancy and facilitating conditions foster an intention to adopt solar energy. This research contributes pivotal insights into solar energy purveyors to invoke awareness amongst Malaysia's society while reiterating performance expectancy, effort expectancy, and facilitating conditions towards solar energy adoption.

Keywords: awareness; intention to adopt; solar services; sustainability; UTAUT; PLS-SEM

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1. Introduction

The sustainable use of energy has been a key challenge amongst many countries. Malaysia's rampant usage of scarce viable energy, such as coal, crude oil, natural gas, and fossil fuel, has led to resource exhaustion, which could lead to further detrimental implications if not addressed immediately. An extensive dependence on fossil fuels has triggered

global shifts towards other forms of renewable energy, particularly solar. Each country has different renewable energy sources owing to geographical location. Consequently, many initiatives have been drafted by governments to encourage consumers to adopt renewable energy sources with solar energy adoption positioned as key to sustaining the Earth. These initiatives were also formalised in the year 2015 by 193 member countries, hence the birth of United Nation's 2030 Agenda for Sustainability Development comprising 17 goals, where Goal seven pertains to affordable and clean energy [1–3]. Subsequent initiatives, namely the Green Deal, Horizon Europe, and the European Urban Agenda, have mooted sustainable and livable futures where clean energy transition and sustainable area transition must be fair, inclusive, and abandons nobody [4].

Malaysia, a member of United Nations, is located in Southeast Asia and encompasses Sabah, Sarawak, and Peninsular Malaysia. The country's total area is approximately 330,000 km^2 and blessed with a tropical climate. Particularly, the country enjoys tropical weather throughout the year because of its proximity to the equator. Although Malaysia benefits from sunshine throughout the year, the use of solar energy as an alternative form of energy remains low in the country as compared to European countries who are governed by four seasons, yet able to enhance sustainability efforts through renewable energy [2,3]. In fact, technology advancement, especially the Internet of Things (IOT), which promotes smart cities by connecting various devices such as power plants and residential houses is seen to lay a strong opportunity for solar energy adoption [5] but in Malaysian soil, despite embracing technological advancement and smart cities, solar energy adoption remains inconsequential. Therefore, this calls for further investigations on solar energy adoption intention.

Prior studies that have examined solar energy adoption in Malaysia remain inconclusive. Practitioners have often cited that such issues as minimal government incentives, weak demand, limited public–private partnerships, and poor consumer acceptance prevent the extensive use of solar energy. However, academicians have suggested that solar energy can be a viable substitute, thus performance expectancy (PE), effort expectancy (EE), and awareness could influence its adoption [6,7]. In fact, solar energy adoption would be a precursor to internalizing renewable energy especially in the electric car, a key to curb CO_2 emission where charging stations could be powered up with solar energy. To achieve this, the Malaysian society must be aware of solar technology and its benefits. A literature survey on renewable energy (Appendix B) was conducted. It a nutshell, it has revealed the benefits of renewable solar energy, thus awareness programmes are to be the uppermost ingredient to kick start understanding of the benefits of solar energy.

The present study is set on [8], as bases to examine the elements that impact adoption of solar energy amongst consumers in Malaysia. Particularly, elements such as awareness, performance expectancy (PE), effort expectancy (EE), facilitating condition (FC), and social influence (SI) are examined in relation to solar energy adoption intention amongst Malaysians.

2. Materials and Methods

Solar energy has been recognised as a potential alternative energy source [6,7]. Traditional energy sources are seen as detrimental to environmental sustainability, thereby severely impacting the Earth owing to the expanding energy demand [9–11]. Solar remains as the prime source for unlimited and free energy [12] specifically in Malaysia, which is at a full advantage because of its location near the equator, where sun rays are nearly present throughout the year. Despite the advantages, embracing solar energy is exigent and clouded with high initial challenges coupled with the switching costs from conventional fossil fuel to solar power. Nevertheless, this situation promises various long-term benefits energy [12].

A major factor that prevents solar energy from being used extensively in Malaysia is the awareness that this energy source is a viable substitute for traditional sources; thus, lack of awareness could further hinder behavioural intentions. As such, green awareness

is considered a vital component of successful green initiatives [13,14]. The literature has suggested that the possibilities of green adoption are high when appropriate awareness is administered towards such initiatives [10].

Studies have reiterated that, amongst recent theories acquainted to behavioural intention, UTAUT has the strongest predictive and explanatory power that is applaudable for its resiliency being operationalised across multifold fields. Ref. [15] developed the Unified Theory of Acceptance and Use of Technology (UATUT) by condensing and merging eight technology acceptance and use models [8,16], that conceived four core factors, namely, PE, EE, SI, and FC, in predicting intention.

Intention to adopt refers to people's subjective probability that they will perform a behaviour [17]. Thus, UTAUT has been accepted irrefutably for its abundance of merits amongst behavioural intention studies. Although the first decade of UTAUT's inception attracted related studies on information technology and systems [13,18] other disciplines subsequently gained traction [8,19,20].

UTAUT has also been used in the context of examining the adoption of green initiatives [21–23]. Studies have likewise used UTAUT in examining solar energy adoption [10,24]. Ref. [25] conveyed three broad types of integration/extension in fortifying UTAUT's generalisability, among which is the inclusion of exogenous predictors to UTAUT predictors.

The present study takes a cue from the preceding and subsequent propositions of [8], in which various exogenous, endogenous, and intervening variables are to be incorporated to add to UTAUT's radius, and examines the significance of awareness towards PE, EE, and FC in the context of solar power adoption. Consequently, these variables, in addition to SI, are tested towards rendering impact on the intention to adopt solar energy. Four items were operationalised to measure the intention to adopt, of which, three were adapted from [10] and one from [17]. The overall research framework is depicted in Figure 1.

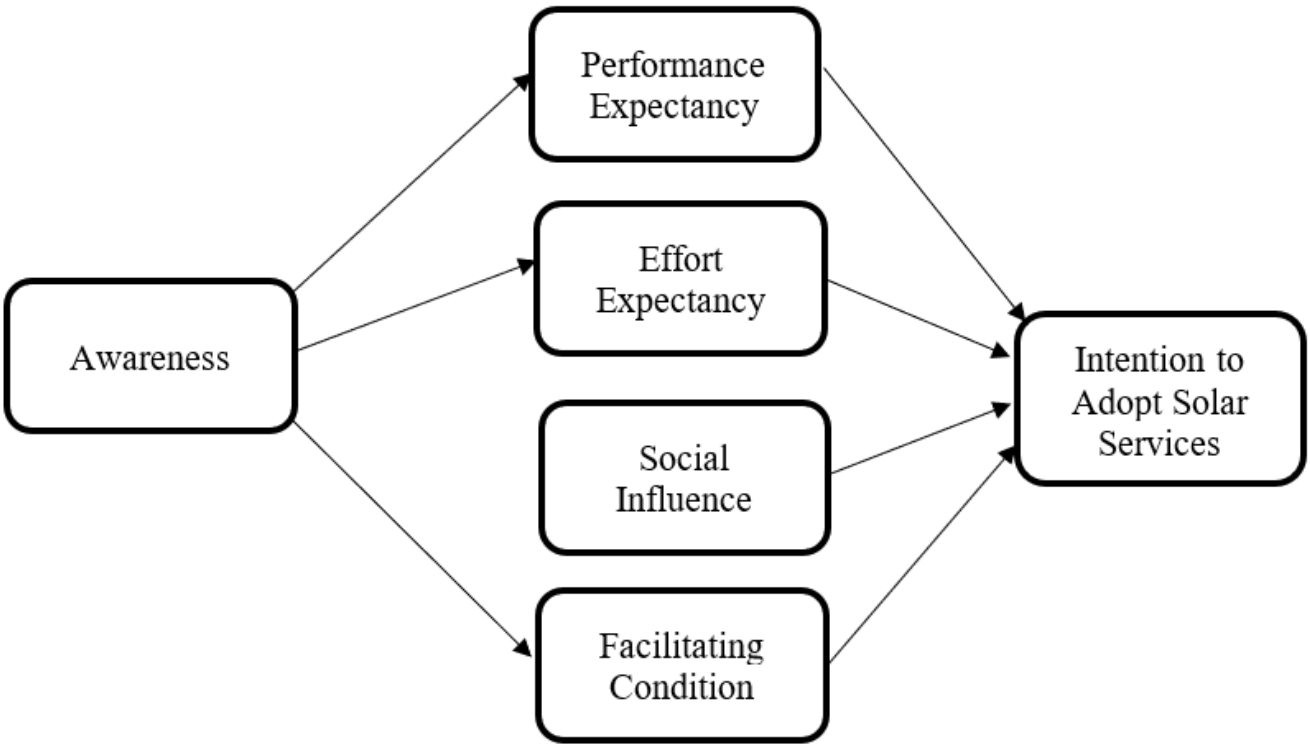

Figure 1. Schematic diagram of research model and its exogenous and endogenous variables.

2.1. Awareness

Generally, awareness relates to the state of being informed and alert [26]. In this context, green awareness is defined as a concern for environmental issues that influences

people's decision-making and behavioural intentions [27]. Similarly, ref. [10] defined awareness in relation to technology adoption as the users' magnitude of consciousness towards new technology, its benefits, drawbacks, and use.

Awareness can also be termed as a personal ability to recognise and focus on the existence of certain phenomenon, objects, products, or services in addition to being the omnipresent knowledge from continuous contact [9,11]. Ref. [7] conducted research involving undergraduate university students in Pakistan and reported awareness as an important element in green behaviour [10]. Ref. [28] study did obtain similar findings whereas [29] used UTAUT in the mobile banking environment of Saudi Arabia to investigate the role of awareness as antecedent to PE and EE. Their findings suggested its significance towards PE and EE. In the case of Malaysia, ref. [30] Ramayah et al. (2012) used the Theory of Planned Behaviour (TPB) and found that awareness plays a vital role in adopting recycling behaviour amongst university students.

Ref. [31] revealed the scarcity of research on solar energy adoption amongst developing countries. In Malaysia's context, the low acquisition of solar energy, despite various initiatives by the government calls for investigations on green awareness towards building expectations, invokes intentions to adopt solar energy, which is the best predictor of actual behaviour [11]. Therefore, the present study adopts green awareness from [10], of which four items are operationalised to measure green awareness towards rendering its impact on three variables of UTAUT in the context of solar energy adoption.

H1. *Awareness has a positive effect on PE.*

H2. *Awareness has a positive effect on EE.*

H3. *Awareness has a positive effect on FC.*

2.2. Performance Expectancy (PE)

PE did initially explain the magnitude of beliefs among individuals with regards to employing a system and its corresponding gains [15]. This definition has received global reception for having the flavour of gains from performance, which is a central element to organisations and individuals. Therefore, observing PE as widely operationalised across various studies and contexts through adaptations is no longer surprising. Ref. [32] skewed PE's definition towards the scale, a system that will assist users in uplifting their job performance. PE is also defined as the magnitude of individual perception about how a particular technology will enhance work output [8,16,25]. Ref. [33] operationalised UTAUT in a solar water heater system (SWHS) amongst Libyan households by matching the reduced electricity bills as benefits whilst striving for use of natural resources.

Ref. [24] propose that PE is a yardstick about beliefs households have towards user-friendliness and safety of rooftop solar usage. Other studies have also remarkably proven PE's role towards behavioural intention [19,34,35]. PE is seen to stamp its mark further on behavioural studies when [36] propagated PE as the most powerful force in acquiring user adoption; numerous studies have confirmed this notion [37–39]. The present study adopts the PE definition of [25] and four items from [32] towards measuring PE. Thus, the following hypothesis is formulated:

H4. *PE has a positive effect on intention to adopt solar services.*

2.3. Effort Expectancy (EE)

EE relates to the degree of simplicity accompanying with the use of technology [8,25,32]. Ref. [24] operationalised EE in measuring the extent by which individuals feel comfortable in using the system. Ref. [22] argued the existence of EE to be closely related to ease of use, being part of the Technology Acceptance Model whereas from a marketing perspective, EE is seen to express views on customers concern towards simplicity of using certain services. Meanwhile, in the renewable energy segment such as solar energy, EE can be viewed as how

easy/effortless solar energy can be used. After PE, EE is observed as one of the strongest influencers towards behaviour intention.

This observation has been confirmed through a series of research on EE's relationship towards intention, which would reiterate EE's position. Ref. [40] studied location-based service amongst smartphone users and found that EE recorded a B-value of 0.3 next to PE, which had a B-value of 0.42. A similar pattern was observed among other research outcomes [25,35,39]. Ref. [41] conducted research on users of Phablet, which is a hybrid product that combines PC and a smartphone's functionality and found that EE occasionally overpowers PE. The aforementioned study showed that EE has the highest positive value, thereby playing a dominant role in causal networks relative to other UTAUT variables; namely habits, hedonics, and price values, being operationalised. EE has also been consistently leading to behaviour intention when tested in various industries [42,43]. The present study adopts the definition of [25] and operationalises five items to measure EE: four adapted from [32] and one from [24]. Thus, the following hypothesis is presented:

H5. *EE has a positive effect on intention to adopt solar services.*

2.4. Social Influence (SI)

SI depicts the magnitude of consumer's perception about close family and contacts' belief that he/she should utilise a specific technology [25], thereby suggesting that society or social network have an impact on individuals. Ref. [32] operationalised 'similar definition in usage of new system.' Ref. [37] conducted research tailored to a social networking application (app) and suggested that consumers have the tendency to embrace similar apps with a reference group to be in contact and communicate. Thus, SI could play a vital role in relation to technology adoption.

SI is operationalised by numerous UTAUT researchers, thereby expanding its boundaries to diverse cultures and industries. These studies include [43] in the Internet banking of Fiji, ref. [19] in the mobile learning segment of Saudi Arabia followed by [34] in the smartphone industry of India.

SI has been vital in the renewable energy sector, particularly in influencing the significant impact to behavioural intention [21,22,24]. The choices people make are generally influenced by another human being, thereby demonstrating and affirming the significance of SI in the UTAUT model. Therefore, the current study operationalises the definition of [25] and adapts five items, i.e., four from [32] and one from [24] hence leading to the following hypothesis:

H6. *Social Influence has a positive effect on intention to adopt solar services.*

2.5. Facilitating Condition (FC)

FC primarily refers to support and assistance available towards a system/technology from the perspective of end-users. Numerous studies have examined FC and revealed some interesting discoveries. Ref. [20] argued that FC is in actual fact similar to perceived behavioural control in TPB and may not necessarily lead to actual usage. Ref. [25] explained FC as the perception consumers have towards support and resources in order to exhibit a behaviour, which relates to the actual usage of system/technology and stressed that FC may render its influence on intention and usage.

Ref. [19] investigated mobile learning systems amongst university students and found that FC contributes significantly towards intention. In the same study, availability of resources, which had a similar definition to FC, has a significant relationship with actual usage. Despite the contrary and colourful nature of FC, numerous studies have successfully operationalised FC in the behavioural intention context by defining it as the degree of belief in overall infrastructure, ranging from organisational to technical infrastructure towards fostering system usage [32,35]. The current research operationalises the definition of [25] and measures FC using five items, three of which were adapted from [32] and two from [44]. Thus, the following hypothesis is developed:

H7. *FC has a positive effect on intention to adopt solar services.*

2.6. Methods

Present research developed a questionnaire from validated studies. PE, EE, FC, and SI were adopted from the combined research of [24,32,44] and awareness was adopted from [10]. Intention items were adopted from [10,17] (refer to Appendix A). A self-administered questionnaire was developed as well. Cooperation was solicited through a purposive sampling method because the study investigated the intention to adopt solar services. The target group comprises working adults in Malaysia who own a home or intend to purchase one soon. Homeowners residing in condominium, apartments, or any shared building or property were excluded from this survey. A total of 400 respondents were approached, out of which 273 responses were received; nevertheless, only 272 responses were used for the final data analysis owing to missing values in one response.

The profile of the respondents showed that approximately 60% were females, 70% were aged 35 and above, and the majority hold at least a bachelor's degree. A total of 76% were working full time, while the remainder were contract workers or self-employed. The majority were earning approximately RM 3000–RM 5000, 37% of whom were earning above RM 5000. The profile of our sample is representative of the population of the Malaysian population as according to the census report of the Department of Statistics Malaysia (DOSM), in terms of gender it is about a 50-50 split followed by age with 69.8% of working age and similar percentage for the working group (15–64 years). For income level it differs from city to city, the mean household income was RM 7901 in 2019 with a median of RM 5873, the income of a majority of the respondents in our sample is about RM 3000–RM 9000 a month [45].

3. Data Analysis and Results

Data analysis was done through variance based SmartPLS 3.3.6 [46], which is a second-generation analytical tool. The threat of method bias due to single source data collection was addressed in this study using the suggestion of [47] by testing the full collinearity. All the variables were regressed against a common variable. Single source data have no bias if VIF $\leq$ 3.3. The analysis yielded a VIF of below 3.3, refer Table 1, hence there was no threat of single source bias in this study.

Table 1. Full Collinearity.

	Awareness	Effort Expectancy	Facilitating Condition	Intention	Performance Expectancy	Social Influence
VIF	1.830	2.151	2.766	1.676	1.929	1.809

3.1. Measurement Model

The two main criteria used for testing the goodness of measures are validity and reliability. Reliability is a test of how consistently a measuring instrument measures whatever concept it is measuring, whereas validity is a test of how well an instrument that is developed measures the particular concept it is intended to measure. This research tested the convergent validity, refer Table 2, which is the degree to which multiple items that measure the same concept are in agreement. As suggested by Hair et al. [48], factor loadings, composite reliability, and average variance extracted were assessed for convergence validity. The loadings for all items exceeded the recommended value of 0.6. Composite reliability is a test of how consistently a measuring instrument measures whatever concept it is measuring; all exceeded the recommended value of 0.7. The average variance extracted, were all greater than 0.5.

Table 2. Measurement Model: Convergent validity.

Construct	Items	Loadings	Cronbach	rhoA	CR	AVE
Awareness	AW1	0.862	0.909	0.911	0.936	0.786
	AW2	0.926				
	AW3	0.884				
	AW4	0.873				
Effort Expectancy (EE)	EE1	0.809	0.894	0.898	0.923	0.708
	EE2	0.874				
	EE3	0.903				
	EE4	0.909				
	EE5	0.693				
Facilitating Condition (FC)	FC1	0.663	0.819	0.839	0.873	0.580
	FC2	0.816				
	FC3	0.787				
	FC4	0.796				
	FC5	0.734				
Intention to Adopt	ITA1	0.895	0.905	0.905	0.933	0.778
	ITA2	0.875				
	ITA3	0.914				
	ITA4	0.843				
Performance Expectancy (PE)	PE1	0.894	0.866	0.881	0.910	0.717
	PE2	0.879				
	PE3	0.885				
	PE4	0.717				
Social Influence (SI)	SI1	0.824	0.805	0.810	0.867	0.570
	SI2	0.863				
	SI3	0.780				
	SI4	0.616				
	SI5	0.660				

Next, analysis proceeded to test the discriminant validity. The discriminant validity of the measures (the degree to which items differentiate among constructs or measure distinct concepts) was assessed by [49] using the HTMT ratio. Table 3 shows that all HTMT ratios were less than the $HTMT_{0.85}$ criterion, thereby confirming that the measures were distinct. Both assessments show that the measures used in this study are both valid and reliable.

Table 3. Measurement Model: Discriminant Validity (HTMT Ratio).

	1	2	3	4	5	6
Awareness	-					
Effort Expectancy	0.636	-				
Facilitating Condition	0.684	0.732	-			
Intention	0.544	0.532	0.636	-		
Performance Expectancy	0.445	0.663	0.731	0.588	-	
Social Influence	0.491	0.646	0.784	0.520	0.590	

3.2. Structural Model

The assessment of normality was done using WebPower's multivariate normality [50]. Mardia's multivariate skewness was 4.776 (z = 216.497, $p < 0.01$) and kurtosis was 60.632 (z = 10.632, $p < 0.01$), thereby indicating that the data were not multivariate normal. Thus, the researchers conducted bootstrapping with 5000 re-samples [48] to generate t- and *p*-values. Upon checking for multicollinearity, the results were 1.948 (EE), 2.379 (FC), 1.817 (PE) and 1.795 (SI). Thus, indicating that multicollinearity was not a serious issue in this study.

The values of R^2 were 0.161 (Q^2 = 0.111) for PE, 0.331 (Q^2 = 0.228) for EE, and 0.377 (Q^2 = 0.282) for intention to adopt solar services. Awareness was positively related to PE (β = 0.401, $p < 0.01$), EE (β = 0.575, $p < 0.01$), and FC (β = 0.606, $p < 0.01$), with the effect strongest for FC (refer Table 4). Thus, H1, H2, and H3 are supported.

Table 4. Structural Model.

Hypothesis	Relationship	Std Beta	Std Error	*t*-Value	*p*-Value	BCI LL	BCI UL	f^2
H1	Awareness → PE	0.401	0.061	6.529	0.000	0.300	0.492	0.192
H2	Awareness → EE	0.575	0.045	12.829	0.000	0.495	0.645	0.494
H3	Awareness → FC	0.606	0.040	15.274	0.000	0.532	0.659	0.582
H4	PE → Intention	0.238	0.083	2.869	0.002	0.102	0.364	0.050
H5	EE → Intention	0.116	0.082	1.426	0.077	−0.041	0.232	0.011
H6	SI → Intention	0.088	0.070	1.256	0.105	−0.009	0.213	0.007
H7	FC → Intention	0.281	0.081	3.479	0.000	0.130	0.402	0.053

This research proceeded to assess the effect of the four predictors on the intention to adopt solar services. PE (β = 0.238, $p < 0.01$) and FC (β = 0.281, $p < 0.01$) were significant predictions of adoption. EE and SI were insignificant. H4 and H7 were supported, whereas H5 and H6 were not supported.

Given that PLS is a prediction-oriented analytical tool, the out-of-sample prediction was assessed using PLS-Predict. The 10-fold and 10-repetition cross-validation procedure was used. Table 5 presents the results. Firstly, the assessment of Q^2 for the latent variable prediction of intention to adopt; Q^2 was 0.252, which was higher than 0 [51]. Thus, this research proceeded to assess the prediction of measurement items. Given that all PLS-LM values were negative, the model has high predictive power.

Table 5. PLS Predict.

	PLS		LM		PLS-LM		
	RMSE	MAE	RMSE	MAE	RMSE	MAE	Q^2_Predict
ITA1	0.842	0.669	0.853	0.682	−0.011	−0.013	0.180
ITA2	0.893	0.688	0.897	0.714	−0.004	−0.026	0.225
ITA3	0.838	0.676	0.841	0.687	−0.003	−0.011	0.224
ITA4	0.954	0.755	0.974	0.785	−0.020	−0.030	0.153

4. Discussion

The research findings show that awareness plays a vital role in fostering PE, EE, and FC. Given the nature of previous UTAUT research, which recorded a similar enthusiasm on awareness, most of these studies were relatively skewed to a non-green domain [29,36]. As such, the use of UTAUT to examine individual's adoption intentions in green domains is seen as relevant. Thus, the outcome of the present research would be a guiding principle to green researchers, particularly amongst researchers employing UTAUT in solar energy. Research on UTAUT, currently, is largely confined to technology adoption, mainly, e.g., e-wallet, digital platforms, and even contact tracing applications. Limited work has been done in the area of solar technology. Awareness proved its mettle again in the green context, thereby rendering a significant effect towards intention in the renewable energy segment [10,17] and recycling behaviour [30], as well as impressing its position on green research despite the scarcity of studies on PE, EE, FC, and awareness. Our findings suggest awareness of a particular technology, is a natural precursor to its final adoption.

Awareness is unprecedented for its ability to foster PE, EE, and FC, as documented in the current study, and to catalyse behavioural change [7] that is extremely tenable towards behavioural intention and the adoption of green technology [11]. Moreover, awareness resiliency, which is tested across many disciplines, and its agility, which is refined to various dimensions [36], reflect the fundamental essence of awareness. Therefore, awareness should

be the core in inculcating green intention/behaviour. The reason is that the benefits of going green and sustainability can be exceptionally ingrained with awareness at the centre stage.

PE also revealed significant influence on the intention to adopt solar technology. A similar outcome was observed in [24] research on solar technology amongst households in Bangalore and Delhi, India. This outcome was also echoed correspondingly in the research of [52] on the Internet of Things-based smart metre intention amongst households in two important cities of Malaysia (Malacca and Putrajaya). By contrast, ref. [32] concluded that PE is not significant towards the intention to adopt in a small private online class amongst undergraduate accounting students in Indonesia. Nevertheless, PE is expected to persevere in the green context. Thus, a significant impact is expected to resurface amongst developing countries, bearing fruits from recent initiatives done towards inculcating green behaviour. Ref. [21] studied the intention to adopt green information systems in Malaysia and divided PE into two dimensions (human infrastructure and administrative policies). This research found that both dimensions were significant in rendering its effect on intention, thereby reflecting strongly about the role of PE. Moreover, PE is known to have a tenable impact on the intention for scoring the highest beta value observed across multiple studies in various fields [16,17,29]. Therefore, data in the current study imply that using solar technology will improve performance, particularly for its usefulness, which is depicted by the high indicator reliability of 0.894.

As mentioned, EE relates to the degree of simplicity accompanying the use of technology [8,25,32]. EE does not lead to the intention to adopt in the current study. The unexpected outcome stands in stark contrast with retrospectively documented empirical research and is relatively startling, specifically when EE has strong predictive power [41]. EE rendered on many occasions generates significant impact towards behavioural intention, particularly on recent studies conducted after 2017, in the green context [21,24,52] or non-green field [34,37,43]. There could be two possibilities in our view that explains this finding. One could argue that EE is tightly coupled with awareness. In our case, it is suggested that the non-significant nature of EE was also occasionally observed such as in [32] in an online learning setting, and this pattern may prevail in Malaysia due to a limited affinity with solar technology amongst Malaysian households, thereby impacting their ability to gauge solar-related technologies. Therefore, the government and private businesses should collaborate and strategise plans to provide hands-on experience to consumers to familiarise themselves with solar technology services. Consumers with such experience will have a different mindset on solar technology usage, which could contribute positively to the adoption process. On the other hand, in relation to a model that predicts adoption intentions of any form of technology, EE is often related to the notion of the effort required to use a particular technology. Effort in the context of using solar, could be a trivial matter, or even non-consequential given post installation seamless use, perceived by potential users.

H6 is not supported. SI did not influence intention to adopt. This unexpected verdict from a green viewpoint stands in stark contrast with other documented empirical outcomes, as seen in [24], where SI rendered significant impact on intention to adopt solar technology among Indian households. A similar outcome was observed in [21] where SI, which is termed as institutional pressure, was seen to significantly influence green IS diffusion. Thus, the non-significant outcome in the present study could be caused by the urbanites' behaviour in the Malaysian Klang Valley. Households have great inclination to be independent regarding decision-making matters and are not lured away by those who are close and important in their circle of contact; such households are similar to Indonesian undergraduate accounting students that belong to Generation Y's age cohort, who are fundamentally independent and maintain individualism [32].

FC, which gravitates along with support and assistance towards a technology, is significant in rendering its influence on solar technology intention. The outcome is expected, particularly when solar services remain in the infant stage in Malaysia. Thus, prospective users would probably need the necessary support and aid. A similar outcome was seen in [35] research on crowdfunding intention, apart from [21] which divided FC into two

dimensions (IS infrastructure and knowledge accessibility) of which both dimensions were found to be significant towards green IS diffusion intention. Although the existence of PE and EE may dilute FC's influence on the intention to adopt, present research would partially concur with this notion after realising FC's significance despite experiencing PE's significance, backdropped by EE's insignificance. Numerous studies have differed and remained steadfast, thereby achieving significant PE, EE, and FC [18,35,43]. The existence of insignificant FC is underscored by the insignificant PE and EE [32], thereby intensifying the existing juxtaposition surrounding FC. Such a scenario may prevail, possibly owing to the position of FC, which was occasionally tested to intention and, in many instances, tested towards actual usage [16,34,39,43]. Therefore, FC is an important factor to be maintained in the UTAUT model, which is reiterated by [44] conceptual research on Malaysian SMEs. Ref. [44] exploratory factor analysis diluted and removed EE but not FC, which was maintained in the modified UTAUT model. Conditions that facilitate the adoption of technology is again a natural precursor to an intention–predictive model, as proven in this study as well.

5. Conclusions

The present research provides impetus on the intention to adopt solar technology whilst enriching UTAUT's body of knowledge. It also declares the crux of behavioural intention in considerable means and affix awareness, which should be internalised as the pillar towards solar technology adoption, thereby enforcing its role to accelerate the dissemination of solar technology's benefits to the core. This conclusion was imperatively arrived upon seeing awareness rendering its significant impact to PE, EE, and FC. PE and FC's positions are further fortified in responding to the incumbent researchers, who had mixed and inconclusive outings on reflecting UTAUT's exogenous variables towards fostering the adoption of solar technology.

The current research could also lay a strong foundation for solar technology proponents and act as a guiding principle to Malaysian policymakers. The Ministry of Education could embed green/solar awareness in the curriculum and attain cognitive consciousness, emulating successful countries, such as Sweden, Germany, Indonesia, and Portugal, which have mandated renewable energy as part of their educational systems. Moreover, the Malaysian Ministry of Science, Technology, and Innovation together with relevant departments and agencies, could cohesively present cutting-edge opportunities to enhance participation amongst green ecosystem members. Such an effort would increase additional demand and create green entrepreneurs, particularly in solar technology fraternity and contributes enormously towards achieving affordable and clean energy as stipulated in the United Nation's Sustainable Development Goal Number Seven, thus investing in solar and accomplishing equitable energy productivity while corroborate access to unwavering, reasonable, sustainable, and modern energy to mankind.

The current study was conducted in Klang Valley's Kuala Lumpur and Selangor. These two urbanised cities may not reflect the perceptions of other households, particularly from the rural setting. Correspondingly, 50% of the respondents were degree holders, which may not represent the actual composition of the Malaysian educated lot. Thus, future studies may include households from other states of Malaysia, in addition to corporations. Moreover, the awareness inclusion in UTAUT theory may be extended by incorporating perceived cost as the moderator towards the intention to adopt solar technology in organisations, specifically post COVID-19 pandemic, when business communities have to bear the brunt of business impediments.

Earth's sustainability has been given utmost attention lately. The reception is disheartening at the Malaysian front because of the low renewable energy usage of 2% compared with the targeted 20% usage by 2025, which is a tall order for Malaysians. Thus, this research would aid in achieving the intended outcome, commencing with the intention towards the quest to eventually achieve usage.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Questionnaire

Construct	Item	Source
Awareness	1. I am sufficiently knowledgeable about solar energy source. 2. I am familiar with technology elated to solar energy. 3. I know the necessities of using solar technology at my residential. 4. I can easily identify solar energy source and related technology.	[10]
Performance Expectancy	1. Solar technology will be useful in my daily routine. 2. Using solar technology will allow me to complete tasks faster. 3. Using solar technology will improve my productivity. 4. Using solar technology will improve y electricity consumption.	[32]
Effort Expectancy	1. I understand how to use solar technology. 2. Being skilled in using solar technology will be easy for me. 3. I would find solar technology easy to use. 4. I think that learning to operate solar technology would be easy for me. 5. Maintaining a solar panel will be easy for me	[24,32]
Social Influence	1. The person who influence my behaviour thinks that I should use solar technology. 2. People who are important to me think that I should use solar technology. 3. My peers and family encourage me to use solar technology. 4. The government supports the use of solar technology in our daily life. 5. I consistently ask a friend about his/her experience with a new product/technology before I buy.	[24,32]
Facilitating Condition	1. I have the resources needed to use solar technology. 2. I have the necessary knowledge to use solar technology. 3. A special person could help me if I have trouble using solar technology. 4. Using solar technology will fit into my lifestyle. 5. I intend to receive necessary training to use solar technology.	[32]
Intention to adopt	1. I will attempt to use solar technology at my home in the future. 2. I strongly recommend others to use solar technology. 3. I intend to use solar technology in my home to supply a part of my required energy. 4. I intend to purchase a solar technology storage system for my household in three to five years.	[10,17,44]

Appendix B. Literature Survey

No	Authors	Country	Key Takeaways/Findings
1	Factors driving Indian consumer's purchase intention of rooftop solar.	India	Environmental concern, social beliefs, hedonic motivation, performance expectancy, price value, self-efficacy, and effort expectancy
2	Solar energy adoption in rural China: A sequential decision approach.	China	Awareness on subsidy policy, awareness on solar technology
3	Factors influencing Malaysian consumers' intention to purchase green energy: The case of solar panel.	Malaysia	Perceived cost and maintenance, product knowledge and experience, social influence, and product benefits
4	How we did it. The founder of UBI group on leading a transition to renewable energy in Africa.	Africa	Climate, experts, awareness, expensive in short run but more sensible, cheaper in the long run
5	Analysis on the current situation of solar energy in Shannan area of Tibet and suggestion for popularization.	Tibet	Solar power generation to play leading role in the energy sector by the end 21st century. Lack of broad social recognition, lack of professionals, and analytics.
6	Energy audit on solar energy switching.	India	Solar energy can save monthly electricity bills up to 33%
7	Solar dried traditional African vegetables in rural Tanzania: Awareness, perceptions and factors affecting purchase decision.	Tanzania	Most households resort to open sun-dried food due to lack of awareness on solar dried traditional African vegetables.
8	Public willingness assessment in utilising solar energy in Malaysia: A household perspective.	Malaysia	Awareness of solar energy, self- effectiveness, environment, neighbours, and energy benefits.
9	Public acceptance of solar energy: A perspective of households in Malaysia.	Malaysia	Aware about solar but did not practice it hence initiatives and awareness need to realign.
10	Optimal utilization of electrical energy of solar photovoltaic system using internet of things.	India	Solar power utilization reduces usage of fossil fuel-based power
11	Solar charger for electric vehicle.	India	Solar power as the power source to charge electric vehicle's battery.
12	Willingness to utilise solar energy in Malaysia: A case of Gen Z	Malaysia	Policy makers to strengthen the initiatives to increase awareness.
13	A novel solar-powered milk cooling refrigeration unit with cold thermal energy storage for rural application.	India	Solar energy with thermal energy storage is effective for operating the milk chilling unit for two seasons: winter and summer. For monsoon season, the system requires additional source of power. Solar milk chiller resulted in 91.15% lesser CO_2 emission.
14	Prioritization of renewable solar energy to prevent energy insecurity: An Integrated role.	Pakistan	Mass, money supply and ratio are important. Two districts are more suitable (Barkhan & Baluchistan). Solar energy provides cheaper electricity.
15	Effect of climate change to solar energy potential: a case study in the Eastern Anatolia region of Turkey	Turkey	New fossil-fired power plant should not be built. The number of existing ones should be reduced. Renewable energy projects should be budgeted and encouraged.

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