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MODEL DEVELOPMENT AND VALIDATION OF PUBLIC PARTICIPATION TOWARDS RENEWABLE ENERGY DEVELOPMENT (PPRED) IN MALAYSIA: AN EXPLORATORY FACTOR ANALYSIS (EFA) AND CONFIRMATORY FACTOR ANALYSIS (CFA) STUDIES.

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Abstract

Due to the absence of specific instrument in measuring public participation of renewable energy in Malaysia, this research paper has been conducted to develop and validate the instruments of Public Participation towards Renewable Energy Development (PPRED) model using validation study. The instruments of PPRED model includes the public willingness to pay (WTP) for energy generated from RE, public awareness on RE (ARE), degree of knowledge on RE (KRE), willingness to adopt RE technology (WTA), environmental concern (EC) and attitude towards RE usage (AURE). The PPRED model is used to measure the public willingness to pay (WTP) for energy generated from RE sources and the factors that influenced the public WTP. Based on usable questionnaire of 172 respondents, an exploratory factor analysis (EFA) is used to assess the factors structures. A confirmatory factor analysis (CFA) with 154 usable questionnaires is used to test the unidimensionality of measurement model. The items' discriminant and convergence are measured using correlation. Finally, Cronbach's Alpha is used to measure the internal consistency between items. Using EFA, six variables were extracted while the model unidimensionality, discriminant and convergence validity and internal consistency of reliability for PPRED model were validated using CFA. Thus, these results provided evidence that the PPRED instruments are reliable and valid instruments to be used in final data collection. Since the items for six variables that are estimated by EFA may seen as relatively small, future studies with more items for each of the variables could be constructed to enhance the usability of the instrument.

Keywords*: Willingness to pay, Renewable Energy, Exploratory Factor Analysis, Confirmatory Factor Analysis.*

I. Introduction

Unanticipated economic growth caused by the technology revolution and globalization has led to market-driven growth in consumption pattern for the emerging economies [I]. Variation in consumption patterns has led to overconsumption or unsustainable consumption and over-exploitation of resources. Energy as a basic necessity is important to enhance the quality of people's lives and increase a nation growth [XL]. Therefore, a country development usually grows together with its energy consumption [XLI]. One of the possible solutions on these issues are by focusing on alternative energy source, particularly renewable energy (RE), such as solar, hydropower, biomass, wind and geothermal [XXII], [XLIX]. These alternative energy choices come in the form of energy that will not be exhausted over time, can be regenerated efficiently and is friendly to the environment [XVIII]. Although Malaysia is known to have a relatively high carbon dioxide emission compared to other Southeast Asian countries. It has made a positive start to

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reduce its carbon footprint by establishing carbon-mitigating projects, adopting several renewable energy and implementing energy efficiency initiatives. In year 2000, the Government of Malaysia had announced in the Eighth Malaysia Plan that RE resources as the fifth energy source of the nation after petroleum. Concerns over environmental downturn, reduction of environmental impact and sustainable development has become among a notable research issues being debated by academicians, industrial entities and practitioners. Environment pollution such as burning of fossil fuels to generate energy sources and exhaust fumes from vehicles is at an alarming state. Thus the society and government need to plan for improvement in environmental sustainability [XXI], [VIII], [XXXIV], [XXX]. Moreover, for upcoming years, usage of non-RE such as fossil fuels and natural gas focusing to generate electricity will eventually be limited. This serves as a substantially major issue for society since electricity relies heavily on it [XXIII].

To strengthen the initiative of promoting alternative energy resources, the Government of Malaysia in the Tenth Malaysia Plan has embarked on various strategies to reduce carbon footprint to reaffirm their commitment to address the climate change issue. Therefore, the nation has no option but to encourage the society to accept the RE as part of the diversification of fuel sources. Although the Malaysian Government has various policies to encourage the development of cleaner energy sources, the country is still facing a serious challenge on how to upsurge the contribution of RE in the energy mix. One of the possible reason may be due to the absence of specific instrument in measuring public participation of renewable energy in Malaysia. Hence, this research paper has been conducted to develop and validate the instruments of Public Participation towards Renewable Energy Development (PPRED) model using validation study. To improve the RE development, there is a need to assess social acceptance and concern towards the environment in terms of their understanding of RE technology usage and climate change issues [XXXIII], [IV], [XXXII], [XXXI], [XXXVIII]. This paper is organized as follows. In section two, the paper discusses the aim of the study, while section three reviews on the literature. Research methodology is presented in section four, follows by analysis of the result in the fifth section. The last section provides the conclusion of the study.

II. Aim of Study

In this study, public participation or consumer participation is recognized as the process by which an organization consults with interested or affected individuals, organizations or government entities before making a decision. This process is an opportunity for participants to share their facts, experience, knowledge, ideas, preferences, opinions, and values. In summary, such communications and collaborative efforts can be used to solve problems and achieve better and more acceptable decisions [II]. The participation is being measured using WTP since it denotes a maximum price that a consumer is willing to pay for a particular development and its influences on their choice of behavior [XLVII]. Thus, WTP is proposed as a measure of the social value [XIV] and is also used to derive value from the public communities in different ways to treat the same problem. Therefore, this paper aims to develop and validate the instruments of Public Participation towards the Renewable Energy Development (PPRED) model using validation study. The instruments of PPRED model includes the public willingness to pay (WTP) for energy generated from RE, public awareness on RE (ARE), degree of knowledge on RE (KRE), willingness to adopt RE technology (WTA), environmental concern (EC) and attitude towards RE usage (AURE). The PPRED model is used to measure the public willingness to pay (WTP) for energy generated from RE sources and the factors that influenced the public WTP.

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III. Literature Review

Malaysia has an abundant diversity of natural resources that come from both non-RE and RE. The non-RE is any source of energy that comes from natural resources but is limited, scarce and takes billions of years to be formed. For example fossil fuels such as coal and natural gases. They are known to be relatively cheap and readily available. However, heavy dependence on them could cause significant drawbacks such as carbon monoxide pollution, global warming, and climate change. Therefore, RE can be considered as a possible alternative energy to meet the growing energy demand either locally or globally. The RE is any source of energy that is produced from natural resources and can constantly being replaced and never run out. The most widely used RE technology comes from hydroelectric power, solar energy, and biomass energy. Among the benefit of RE are they produce little or no harmful waste products such as carbon dioxide, they require less maintenance and they are useful for diversification of power sources. The primary energy consumption in Malaysia has risen from 861.98kg of oil equivalent per capita in 1980 to 2967.54kg of oil equivalent per capita in 2014. This is due to most of Malaysia's economic growth depends on fossil fuel energy sources and causing continuous rise in carbon dioxide (CO2) emissions. As a result, CO2 emissions have increased from 2.03 metric tons per capita in 1980 to 8.03 metric tons per capita in 2014. This phenomena contribute towards global climate change leading to more negative impacts such as health problems, destruction of nature, landscapes, biodiversity, and energy security. Under the 8th Malaysian Plan, RE was introduced as one of the energy mix in Fifth Fuel Policy. In the past, Malaysia's former energy mix mostly relied on fossil fuels. The National Petroleum Policy guarantees the oil and gas resources being used optimally to improve the growth of the country's social, economic and environment. However, the 1973 and 1978 global oil crises had adversely affected the Malaysia economy due to high oil dependency in the energy mix.

Therefore, in 1979 the National Energy Policy was introduced to provide a balanced energy mix between both fossil and renewable sources [XXIV]. In a study by [XXXVII], they find RE resources including solar, biomass, biogas, wind and hydropower have sufficient potential to develop a sustainable electricity system in Malaysia. Based on their analytic hierarchy process (AHP), the result revealed solar is the most favorable RE resource followed by biomass, hydropower, and wind. Hence, in the long run, RE seems to be a secure option. This is because of its distinctive features as cleaner sources of energy that is inexhaustible to energy security issues. In the last thirty years, various energy policies have been implemented by the Malaysian government including the 'Four Fuel Diversification Policy', 'Fifth Fuel Diversification Policy' and the 'Renewable Energy Act 2011'. These policies aim to ensure energy security, generate energy from RE sources and improve the share of renewable sources in electricity production, respectively. Then, the Feed-in-Tariff (FiT) was established under the RE Act in order to establish and implement a special tariff system to facilitates the generation of RE [XX]. In the 11th Malaysia Plan, the country aims to reduce 33% of the greenhouse gas emissions intensity of GDP and target to achieve 2080MW or 11% of electricity being produced by RE sources by 2020 (Eleventh Malaysia Plan 2015). While at a conference of Parties in Copenhagen, Malaysia promised to decrease by 40% carbon emission by the year 2020 from the base year 2005 [IX]. However, as of 2014 only 1% of the total installed capacity in Peninsular Malaysia and Sabah are from RE source while only 1% of the total energy mix being renewable [XXXIX], [XLVI]. This could be due to the fact RE production is more expensive than fossil fuel energy and continuous increase in RE supply would increase the production costs for most RE sources. Hence, the global investment in RE

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technologies has increased to more than 270 billion US$ in 2014 with an increment of 21% from 2013 (214 billion US$ in year 2013) [XII].

A National Renewable Energy Policy and Action Plan developed in 2009 is used as part of the commitment by the Government of Malaysia to accelerate the growth of RE in the future. This is a part of their commitment to accelerate the growth of RE in the future. Currently, the portion of RE sources used to produce electricity had increased. To maintain this growth, the government needs to consider increasing the electricity price, for instance, by two to five percent hike in electricity price. However, any increment in price will normally caused public objection. Therefore, the public including households and businesses are accountable to share the RE cost burden. Currently, 1.6% surcharges are imposed on domestic consumers who consume more than 300kWh of electricity per month. The revenues from this 1.6% price increase will be used to finance the tariff payment for RE producers under the national Feed-in Tariff (FiT) (Jacobs, 2010). Therefore, one of the ways for the cost to be shared is using consumption-based burden method. In this method, the ones who consume more electricity need to contribute higher into the RE funds. The goal of RE development is hard to achieve with a low level of social acceptance [XXXVI]. Thus, advancement in RE development as an alternative energy source inclusive of green product consumption depends on their tendency to pay the green price premium. The present study tries to analyze the potential factors influencing public intention to pay the energy generated from RE or green price and their participation in RE development. On the other hand, many studies have been embarked to identify the factors that influence the WTP level. Since RE is a relatively new energy source that is promoted, the benefits, existence and the options for adoption of this energy may not be aware by the public. Moreover, according to a finding [XXV], knowledge of specific renewable technologies varies among the public.

Therefore, it has been identified that individuals who are aware of and acknowledge these different kinds of energy resources, could increase their understanding and WTP levels on energy generated from RE sources [XLVIII]. Furthermore, one of the predictors of actions and behavioral intentions is also known as attitude. For example, those who seem the negative impacts of electricity generation using non-RE to the environment were found to be willing to pay more for RE as compared to those who perceived otherwise [XXVII]. In terms of instrument used in the measurement of public awareness of RE, various instruments have been developed to measure public awareness in the energy industry, but so far there is no specific instrument has been developed to obtain public opinion regarding PPRED in Malaysia. Thus, for this study, several previous studies have been referred to construct the questionnaire [XXVI], [XVI], [XLV], [XXXV], [XVII], [V], [XLIV]. There are 61 items under six variables has been constructed to complete the questionnaire. The instruments of the PPRED model is consist of the following variables, WTP, ARE, KRE, WTA, EC, and AURE. Hence, the study aims is to develop and validate these instruments using validation study.

IV. Methodology

Instrumentation

1) Demographic measures

The survey questions comprised of three sections that aim to evaluate the public participation by measuring the WTP for electricity generated using RE and its factors that affect the WTP level. Section one consists of six questions to measure the demographic background of the respondents including gender, marital

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status, age, education, occupation, and income. However, all items asked in this section are rated using nominal and ordinal scale. Therefore, these variables are not included in the factor analysis.

2) Public willingness to pay on RE (denotes as WTP).

In the second section, it comprised a set of items that show the extent of respondents' willingness to pay for RE development in Malaysia. There are six items [LII] and four items [XXVI], [LII] that are adopted to measure the WTP level. The response format consisted of a 5-point Likert Scales type, where 1 indicates the "definitely not willing to pay" to 5 which indicates "definitely willing to pay". However, previously [XXVI], [LIV] validated and checked the reliability of the items and shown that acceptable with Cronbach's Alpha 0.846.

3) Public awareness and knowledge on RE (denote as ARE and KRE).

The following section is subdivided into five constructs. The first construct determines the level of public awareness on RE. It consists of thirteen items [XVII], [LII] that are adopted and adapted. The awareness of energy is defined as the state or condition of being aware, having knowledge and consciousness. Thus, the set of items are shown to which extent the respondents aware of RE in Malaysia. Meanwhile, the second construct relates to the respondent's perspective and to examine the knowledge of respondents toward RE. Ten items adapted and adopted from previous literature [XXXV], [XLIV], [LII]. The scale for both constructs are measured using a 5-point Likert Scale response format where 1 indicates the "very disagree" to 5 indicates "very agree". A higher score indicated a greater degree of engagement on strategies to increase awareness and knowledge respectively.

4) Willingness to adopt RE technology (denotes as WTA).

This construct consists of a set of items that relate to the respondent's perspective on RE technology. These technologies have been proposed to address global warming and environmental impact. The questions were asked in the event that the respondents were responsible for designing a plan to address environmental impact. They need to choose which technologies they would be using. The respondents need to show the degree to which level they are willing to adopt the RE technology development in Malaysia. All nine items were adopted and adapted [XLV], [LIV]. The scale for this construct was estimated using a 5-point Likert Scale response format where 1 indicates the "definitely not willing to use" to 5 indicates "definitely willing to use".

5) Environmental concern and Attitude towards RE usage (denotes as EC and AURE).

Environmental concern defined as an evaluation of, or an attitude towards facts, one's behavior, or others' behavior with consequences for the environment. It seems as if environmental concern may refer to both specific attitudes directly determining intentions or more broadly to a general attitude or value orientation [XXVIII],[LIV]. Therefore, the fourth construct consists of a set of items that relay to respondents' point of view towards environmental concern. Every items show to which level the respondent's concern towards the environment in Malaysia. The ten selected items were adopted. Besides, the last construct gauged the level of respondents' attitude which was adopted [V] as well. The attitude is defined as an individual's evaluative state, associated with psychological feelings of distress or worries regarding the usage of electricity generated using RE and may be accompanied by supporting behavior [X], [LII]. Subsequently, the respondents were asked to which extent their attitude towards the usage of RE. The scale for the fourth

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and the fifth construct consisted of 9 items were weighed using a 5-point Likert Scale response format ranging from 1 “very disagree” to 5 “very agree”.

Data Analysis

This study has employed two methods of factor analysis. An Exploratory Factor Analysis (EFA) was used in developing the instrument and scale for this research. The EFA has acted as exploratory data technique to determine the appropriate number of common factors, and to ascertain which measured variables are reasonable indicators of the various latent dimensions. Pre and post-testing of EFA and reliability were conducted [XV], [XLII], [LI], [LII], [LIII], [LIV], [LVI].

Table 1: Summary Result on EFA

		Factor Suitability		**Factor Extraction**				**Rotation**
Variables	**Constructs**	**Bartlet Test (p<0.05)**	**Kaiser-Mayer-Olkin (KMO> 0.6)**	**Eigenvalues**		**Variance Explained (%)**	**Scree Plot**	**Direct Oblimin/ excluded**
Dependent Variable	Willingness to pay (WTP)	.000	0.884	Factor 1 Factor 2	5.500 1.301	55.001 13.005	Two Factors	Question 1, 2,7,8 & 9
Independent Variables	Awareness on RE (ARE)	.000	0.903	Factor 1 Factor 2	6.963 1.523	53.561 11.713	Two Factors	Question 1,3,5,6,7 & 9
	Knowledge on RE (KRE)	.000	0.723	Factor 1 Factor 2 Factor 3	3.699 1.838 1.274	36.986 18.377 12.743	Three Factors	Question 1,2,3,4 & 5
	Willingness to adopt RET (WTA)	.000	0.864	Factor 1 Factor 2	4.951 1.411	55.009 15.679	Two Factors	Question 6,7 & 8
	Environmental Concern (EC)	.000	0.903	Factor 1 Factor 2	3.671 1.235	57.025 14.265	Two Factors	Question 3,4,6,8, & 9
	Attitude towards RE usage (AURE)	.000	0.789	Factor 1 Factor 2	3.617 1.234	40.193 13.716	Two Factors	Question 1,2,8 & 9

The Confirmatory Factor Analysis (CFA) is used in the later phases when the underlying structure has been established on prior empirical and theoretical grounds. Using CFA, this study specifies the number of factors and the pattern of indicator-factor loadings based on results from the first step of EFA analysis as well as based on other parameters such as those bearing on the independence or covariance of the factors

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and indicator unique variances. Those pre-specified factor solution is evaluated in terms of how well it reproduces the sample covariance matrix of the
measured ***variables. Measurement model, convergence and discriminant testing are conducted under CFA analysis [XXIX], [XLIII]***, [LI], [LII], [LIII], [LIV], [LV], [LVI].

Respondents and Data Collection

An urban residential area for population frame in this study are chosen from the respondents who are residing in Klang Valley, Peninsular Malaysia (Kuala Lumpur, Selangor, and Negeri Sembilan). This study was conducted by acquiring the information through emails to workers in private and government sectors in Peninsular Malaysia. For size sample consideration, the sample size calculation was based on a stable factor structure model, which requires a minimum of 100 and 200 respondents and a respondent variable ratio of at least 2:1 to reduce the standards error of the correlations to negligible proportions [III]. A systematic random sampling method was used to ensure a certain degree of generalization can be acquired to the population [L], [XIII], [LV]. The researcher has constructed a continuous list from 1500 population frame and for this study, the 5th item was picked as the first item. The first sample for EFA was comprised of 172 prospective respondents. From 300 selected respondents from the first population frame, the return rate was more than 50%. Hence, 172 samples selected for the present study is sufficient to generalize the findings to the population and appropriate for the application of explanatory factor analysis (EFA) [III], [LV]. Whereas for the second sample for CFA analysis, the number of respondents in this study was 154 usable based on 300 respondents acquired from the second population frame.

V Result Analysis

Exploratory Factor Analysis (EFA)

(1) Factor Suitability, Factor Extraction, and Rotation

Factor suitability for all variables results in Table 1 shows that for WTP (Bartlet Test - .000; Kaiser Mayor Olkin (KMO) – 0.884), ARE (Bartlet Test - .000; Kaiser Mayor Olkin (KMO) – 0.903), KRE (Bartlet Test - .000; Kaiser Mayor Olkin (KMO) – 0.723), WTA (Bartlet Test - .000; Kaiser Mayor Olkin (KMO) – 0.864), EC (Bartlet Test - .000; Kaiser Mayor Olkin (KMO) – 0.903), and AURE (Bartlet Test - .000; Kaiser Mayor Olkin (KMO) – 0.789). Thus results of the Kaiser-Mayer-Olkin (KMO>.60) and Bartlett Test (p<.000) for all variables were supported by the use of the Principle Components Analysis (PCA) for examining the factor structure of the 61 items of PPRED model instruments in this study.

Under factor extraction, results of Kaiser's Criterion obtained show that Eigenvalue (> 1.0) produces several components for each variable and only major components were included in analysis. The component under WTP is with two factors, ARE is with two factors, KRE is with three factors, WTA is with two factors, EC is with two factors and AURE is with two factors. The scree plot was employed to re-confirm the factor for every variable. Based on Table 1, the scree plot analysis has confirmed the result obtained based on eigenvalue analysis. For more clear interpretation, all variables with more than one component have been rotated. A direct oblimin method was used under the rotation process based on literature review. Results from the pattern matrix table shows that WTP for all items under component one were more related to WTP, while, second component with less item and not related were excluded. The same assessment method was applied for the rest of the instruments. Refer to Table 1, three instruments, ARE, WTA, AURE and EC obtained two components, KRE obtained three components, thus second and third components

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were excluded for respective variables.

(2) Facture Structure of Instrument

Specifically, the items under six left variables obtained from the pattern matrix table under the rotation process were similar to the original instrument adapted from literature and only item with factor loading more than 0.3 were retained. Six variables (groups) retained as per literature are WTP, ARE, KRE, WTA, EC, and AURE. Based on Tables 2, the retained (final) items for WTP are five items, ARE with seven items, KRE with five items, WTA with six items, EC with five items, and AURE with five items. To re-check the retained components, post-hoc analysis of EFA was run (refer Table 3). Post EFA test produces all variables with one component and which is conformed to the result from earlier EFA operation.

Table 2: Factor Structure of PPRED model

Variable	Awareness on RE	Knowled-ge on RE	Willingness to Adopt RE Technology	Environ-mental Concern	Attitude Towards RE Usage	Willingess to Pay
Awareness on Renewable Energy (ARE)						
I strongly support the use of renewable energy resources.	.877					
I believe that media has a great responsibility in emphasizing the importance of using renewable energy resources.	.827					
I believe that it is necessary to focus and create awareness on the importance of energy resources and energy saving within educational programs.	.803					
The expression of renewable energy makes me nervous because I am not used to it.	.773					
Using renewable energy resources would remove the negative effects of the greenhouse gasses.	.744					
I am not interested in whether the energy resources are renewable or not.	.719					
Renewable energy and its resources are subjects that I have no idea about.	.697					

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Knowledge on Renewable Energy (KRE)						
I think that I know about hydro electric and the way it is used to produce electricity.		.849				
I think that I know about natural gas and the way it is use to produce electricity.		.818				
I think that I know about biomass and the way it is used to produce electricity.		.781				
I think that I know about solar power and the way it is used to produce electricity.		.748				
I think that I know about fossil fuel and the way it is use to produce electricity.		.717				
Willingness to Adopt RE Technology (WTA)						
Energy efficient (EE) appliances: Producing appliances that use less energy to accomplish the same tasks.			.853			
Solar energy: Using the energy from the sun for heating or electricity production. E.g: Solar Panel.			.835			
Energy efficient cars: Producing cars that use less energy to drive the same distance. E.g: Hybrid and solar car.			.781			
Carbon sequestration: Using trees to absorb carbon dioxide from the atmosphere.			.771			
Wind energy: Producing electricity from the wind, traditionally in a windmill.			.718			
Bio-energy/biomass: Producing energy from trees or agricultural wastes such as paddy and palm trees residue.			.716			

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Environmental Concern (EC)						
If things continue on their current situation, we will soon experience a major environmental disaster.				.631		
By choosing environmentally friendly products, I signal to manufacturers the types of products they should be producing.				.589		
When it comes to purchasing products, I consider how my use of them will affect the environment.				.584		
The most effective way to overcome global climate change is reduce energy consumption.				.575		
We are consuming energy much more than what we really need.				.573		
Attitude towards RE Usage (AURE)						
Appearance of renewable energy products such as solar panel is acceptable.					.801	
Installation of renewable energy product such as solar panel is added value to the house.					.790	
Installation of renewable energy such as solar panel is compatible with modern living style.					.783	
Renewable energy products are safer than existing energy system.					.755	
Renewable energy can contribute to conservation of energy.					.615	

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Willingness to Pay (WTP)						
To pay 10% more in your monthly electric bill for renewable.						.857
To pay more now in exchange for possibly lower electric rates in the future.						.854
To pay more for your electric bill if you knew the cost paid for environmentally safe electricity.						.846
To support a fuel adjustment clause in your electric bill to subsidize the cost of developing RE-powered energy.						.810
To support the government's policy if the government makes a policy to generate 10% of your electricity supply from renewable energy.						.762

Table 3: Summary of Eigenvalue

Variables	**Before item-deletion**		**After item-deletion**	
	Eigenvalues	**% of Variance explained**	**Eigenvalues**	**% of Variance explained**
WTP	5.500	55.001	3.961	66.015
	1.301	13.005		
ARE	6.963	53.561	6.296	62.959
	1.523	11.713		
KRE	3.699	36.986		
	1.838	18.377	3.382	56.374
	1.274	12.743		
WTA	4.951	55.009	4.027	67.115
	1.411	15.679		
EC	3.671	57.025	3.502	57.025
	1.235	14.265		
AURE	3.617	40.193	3.431	49.020
	1.234	13.716		

(3) Reliability of instruments

Again reliability of instruments were re-checked. The result of Cronbach's Alpha before and after conducting EFA shows that all variables are well above .70. The reliability test after the item-deletion process in Table 4 shows that the reliability coefficients for each of the six construction of public participation after item-deletion process under EFA are as follows; WTP (.897), ARE (.932), KRE (.833), WTA (.901), EC (.914) and AURE (.826).

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Table 4: Summary of Reliability Statistic

Variables	Before item-deletion		After item-deletion	
	Number of items	Cronbach's Alpha	Number of items	Cronbach's Alpha
WTP	10	0.908	5	0.897
ARE	13	0.923	7	0.932
KRE	10	0.774	5	0.833
WTA	9	0.890	6	0.901
EC	10	0.914	5	0.914
AURE	9	0.790	5	0.826

Confirmatory Factor Analysis (CFA)

In the next phase of instrument development, Confirmatory Factor Analysis (CFA) was employed as a multivariate statistical technique used to measure the factor structure of a set of observed variables. The purpose is to test the developed relationship between observed variables and their underlying latent constructs exists. In other words, it is employed to test whether the measure of the construct is consistent with the nature of the construct [XIX], [LV], [LVI]. The unidimensionality of the six constructs was tested and all items were examined simultaneously using AMOS. Figure 1 illustrates the model fit had been achieved based on seven fitness indexes through several deletion processes and re-test of model fit. Results of the CFA operation on the measurement model that consists of six variables shown that all items had factor loadings exceeded the cut-off point of .60 [III]. Table 5 and 6 show two further tests have been conducted.

(1) Convergence validity

Convergent validity is achieved when all items in a measurement model are statistically significant [L]. Convergence validity was tested and confirmed by obtaining Average Variance Extracted (AVE) which is highly correlated between two instruments and statistically significant [XIX], [VII], [LVI]. The value of AVE should be 0.5 or higher to achieve the Convergent Validity [XLIV], [LVI]. The value of AVE less than 0.50 indicate that variance explained by construct is smaller than the variance explained by measurement error. Result from Tables 5 shows that all variables have AVE value exceeding .50

(2) Discriminant validity

Discriminant is achieved when the measurement model is free from redundant items [XXVI], [XXXV],

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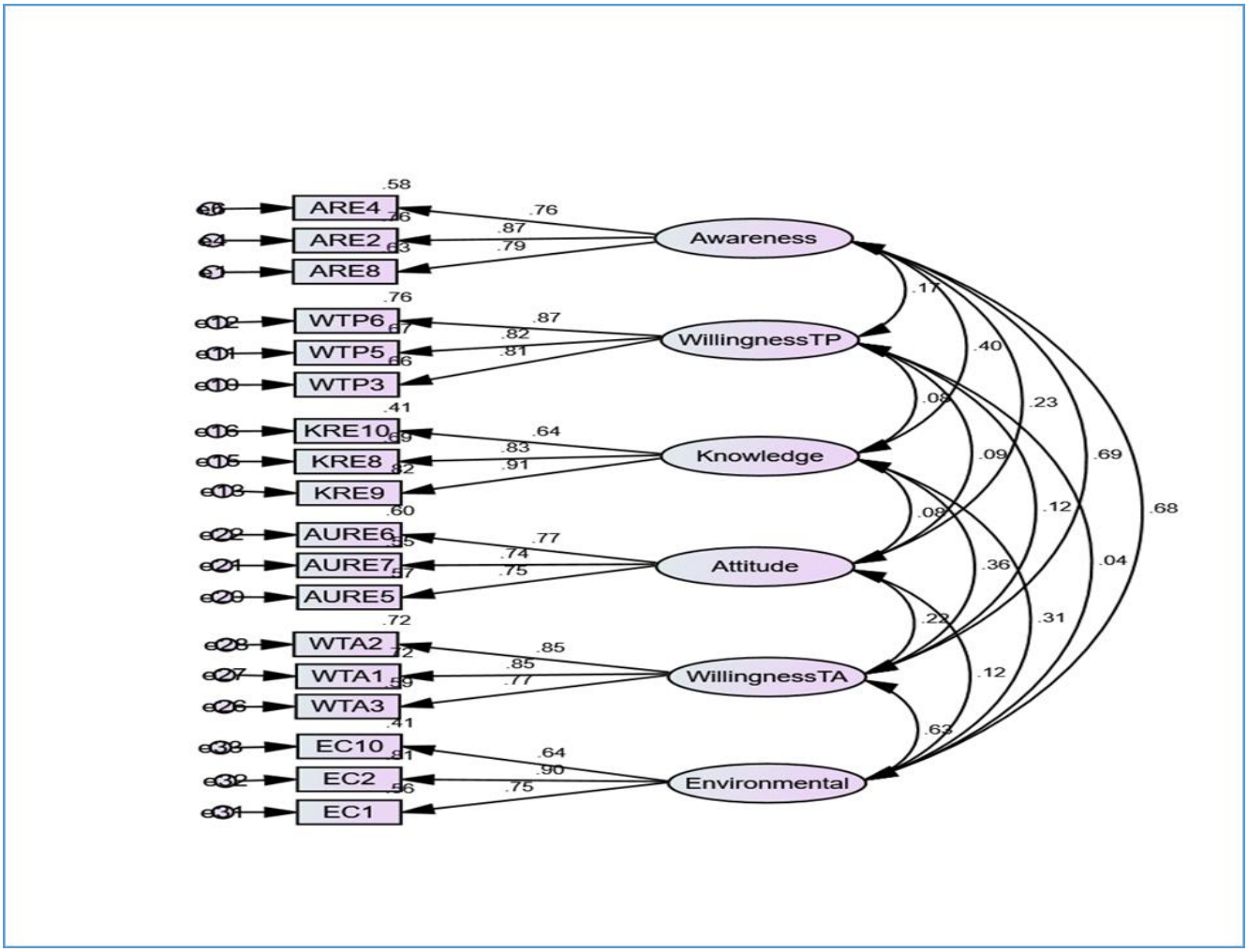
[LVI]. AMOS identifies which of the pair item is redundant in the system in terms of high Modification

Figure 1: CFA Result of Measurement Model on Public Participation towards Renewable Energy Development (PPRED)



Indices (MI). Discriminant validity can be achieved when Average Variance Extracted (AVE) exceeded

the shared variance estimate (square of correlation). Table 6 shows that all variables have achieved the discriminant validity where the square root AVE (diagonal value in bold) is higher than the value in the row and column. Thus, those results have shown that all latent variables, WTP, ARE, KRE, WTA, EC, and AURE in the measurement model are different from each other or in other words all latent variables can be discriminated against each other. In other word, this result validate and confirm the six variables proposed in this study. While, under the reliability test, the result of Cronbach's Alpha for all variables shows that all variables were greater than 0.70 and composite reliability results for all variables also exceed cut off point which is above 0.60.

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(3) Facture structure of PPRED

Based on the result in Table 5, several final items were retained. The six components obtained from EFA are further analyzed for CFA. As the results, the items for WTP were WTP3, WTP5, WTP6, the items for ARE were ARE2, ARE4, ARE8, the items for KRE were KRE8, KRE9, KRE10, the items for WTA were WTA1, WTA2, WTA3, the items for EC were EC1, EC2, EC10), the items for AURE were AURE5, AURE6, and AURE7.

Fitness Indexes
1. ChiSq=161.918
2. df=120
3. GFI=.908
4. CFI=.972
5. TLI=.964
6. IFI=.973
7. RMSEA=.045

Table 5: Summary Result of CFA of Measurement Model on PPRED

Construct	**Item**	**Factor Loading**	**Cronbach' Alpha** (Above 0.70)	**Composite Reliability** (Above 0.6)	**Average Variance Extracted** (Above 0.50	**Square-root of Average Variance Extracted**
Awareness on RE	ARE4	.76				
	ARE2	.87				
	ARE8	.79	.92	.85	.65	.80
Knowledge on RE	KRE10	.64				
	KRE8	.83				
	KRE9	.91	.85	.84	.64	.80
Willingness to Adopt RE Technology	WTA2	.85				
	WTA1	.85				
	WTA3	.77	.90	.86	.68	.82
Environmental Concern	EC10	.64				
	EC2	.90				
	EC1	.75	.83	.81	.59	.77
	AURE6	.77				

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Attitude towards RE Usage	AURE7	.74				
	AURE5	.75	.81	.80	.57	.76
Willingness to Pay	WTP6	.87				
	WTP5	.82				
	WTP3	.81	.90	.87	.70	.83

Note: Formula of Composite Reliability CR = $(\Sigma\lambda)^2/ [\Sigma(\lambda)^2 + (\Sigma 1- \lambda^2]$ (Where, λ is factor loading), while, formula for Average Variance Extracted (AVE) = $\Sigma(\lambda)^2/n$ (Where, λ is factor loading, n = number of items in a model).

Table 6: The Discriminant Validity Index Summary of PPRED model

Construct	Awareness on RE	Knowledge on RE	Willingness to Adopt RE Technology	Environmental Concern	Attitude towards RE Usage	Willingness to Pay
Awareness on RE	**0.80**					
Knowledge on RE	*0.40*	**0.80**				
Willingness to Adopt RE Technology	*0.69*	*0.36*	**0.82**			
Environmental Concern	*0.68*	*0.31*	*0.63*	**0.77**		
Attitude towards RE Usage	*.23*	*.08*	*.22*	*.12*	**0.75**	
Willingness to Pay	*.17*	*.08*	*.12*	*.04*	*.09*	**.84**

Results Discussion

This study aims to develop and validate the factor structure and dimensionality of the instruments in PPRED model. Hence, the development of instruments had followed standard procedures including an extensive literature review of existing questionnaires and further statistical testing using available statistical tools. Using EFA testing, the retained items for WTP were five items, ARE were seven items, KRE were five items, WTA were six items, EC were five items and AURE with five items. Likewise, based on the next CFA testing, the result showed that the underlying factor structure of PPRED model is equivalent to the original instruments. As illustrated in Figure 1, all factor loadings for each item were above .60 and the appropriate level of fitness indexes were achieved. Discriminant, convergent validity and internal consistency based on Cronbach's Alpha of the factor structure in the questionnaire were also tested. The result showed that six constructs have greater AVE value than 0.50, which indicates a good convergent validity. Meanwhile, for discriminant validity, results from this study indicate a square root of AVE for all six constructs were greater than shared variance [VI]. This result implies that there is a significant difference between each latent variables in the model. Finally, the study checked on the internal consistency of six

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variables. The result shows that all variables have acceptable value which is above .70. Based on the results from EFA and CFA, it is shown that instruments of PPRED model are reliable and valid to be used for data collection for research in RE development in Malaysia.

VI Conclusion and Recommendations

Although several initiatives and action plans have been developed to improve RE development, in general, they are not directly linked with public participation. Hence, it is the purpose of this paper to develop and validate the instruments of PPRED model using validation study. The results show the validated instruments of PPRED model which consists of WTP, ARE, KRE, WTA, EC, and AURE as variables are reliable and valid measurements based on Malaysian respondents. This means reliable and valid instruments are crucial in implementation and conducting this research to create greater awareness in society on the development of RE in Malaysia. In summary, this study has provided sufficient preliminary conclusions on the instruments that are useful to validate the instruments of the PPRED model. In particular, the awareness and knowledge of Malaysians on RE can further be improved through public education formulation and well-targeted campaign that focused on educating the young generation who seem to be interested towards RE development [XIII] Other mass media channels, such as newspaper, television and radio can be useful to disseminate information on RE. The other factors that will be a great influence on rapid improvement in RE development are appropriate legislation and incentives [XL]. These include incentives for purchasing of RE products such as exemption of tax on hybrid cars.

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