A STUDY ON CUSTOMER PERCEPTION ON THE ADOPTION OF RENEWABLE ENERGY RESOURCES AMONG HOUSEHOLDS

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Abstract
The world energy demand is expected to increase by 35 percent by 2030 from2005 levels. This increase in demand is driven predominantly by growingpopulation and economic growth in developing countries, even with substantialefficiency gains in all regions.The potential of renewable energy sources is enormous as they can in principle meetmany times the world's energy demand. Renewable energy sources such as biomass, wind, solar, hydropower, and geothermal can provide sustainable energy services, based on the use of routinely available, indigenous resources (Antonia V. Herzog). TAM, a widely used model in management of information systems The goal of TAM was to offer a parsimonious explanation of the determinants of adoption that would be general enough for application to usage behavior across a wide range of technology innovations (Davis, Bagozzi, &Warshaw, 1989)These factors are identified through previous research and each one measured based on 5-point interval scale. Using primary data collection method, 90 questionnaires were distributed to respondances who have adopted renewable energy resources among households. The study made use of measures and these measures were factor analyzed into 2 constructs such as Perceived Usefulness and Perceived Ease of Use on adoption. A Regression model was formed by taking degree of adoption of renewable energy resources as dependent variable and Perceived Usefulness and Perceived Ease of Use as independent variables. It is found from the analysis that the degree of adoption significantly depends on the factors influencing the adoption of Renewable Energy Resources..

Key words:Degree of Adoption of RER, Perceived Usefulness, Perceived Ease of Use.

Introduction
Booming economic growth, rapid industrialization and high standard of living of the global population demand more and more energy in different forms. since the quality of available energy from conventional resources is depleting day by day development of newer or renewable energy technologies become necessary to meet the energy demand in the future.. There is a need to think globally but act locally. **"**Renewable energy refers to energy generated from naturally replenishable energy sources. The main types of RERs include hydro- power, bioenergy (biomass and biofuels), solar, wind, geothermal and ocean energy" (ESMAP, 2007; REN 21, 2010).Using renewable energy is betterfor the humanity, because they produce few pollutants, if any. These resources are alsocalled 'clean' or 'green' as it does not produce any pollutant harmful to the environment.These sources derive their energy from the nature, either directly or indirectly and areexpected to be capable of supplying humanity energy for almost another one billion years.

"Renewable energy sources currently supply somewhere between 15 percent and 20 percent of world's total energy demand.. New renewable energy sources (solar energy, wind energy, modern bio-energy, geothermal energy, and small hydropower) are currently contributing about two percent(Kammen) .

To evaluate the various factors that influence the adoption of renewable energy resources based on the framework suggested in the TAM theory.TAM theorized that an individual's behavioral intention to adopt a particular piece of technology is determined by the person's attitude toward the use of the technology. Attitude, inturn, is determined by two beliefs: perceived usefulness and perceived ease of use. (Davis, Bagozzi, &Warshaw, 1989).

Perceived usefulness is defined as the extent to which persons believe that technology will enhance their productivity or job performance (Davis, Bagozzi, &Warshaw, 1989).. A significant body of TAM research has shown that perceived useful- ness is a strong determinant of user acceptance, adoption, and usage behavior (Davis,1989;Mathieson,1991;Taylor & Todd,1995).In TAM,perceived ease of use is defined as the extent to

which a person believes that using a technology will be simple (Davis, Bagozzi, &Warshaw, 1989).It is a construct tied to an individual's assessment of the effort involved in learning and using a technology.

Objectives
1. To evaluate the various factors that influence the adoption of renewable energyresources based on the framework suggested in the TAM theory.
2. To analyse the impact of TAM variables on the degree of adoption of renewable energy resources.

Hypothesis
Ho: The degree of adoption does not depend on Perceived Usefulness and Perceived Ease of Use

Methodology
The study was based on both primary and secondary data. The secondary data used in the study were collected from journals, books, magazines, websites and other publications. In order to collect primary data, direct interview method was used. Interviews were conducted using a structured Interview Schedule. Ninety households were selected using convenient sampling method from the towns of Kottayam district viz., Kanjirapally, Ponkunam, Pala, Kanjikuzhy, Changanasserry. The theoretical scope of the study aims at analyzing the adoption of renewable energy resources in terms of the following attributes: Perceived Usefulness, Perceived Ease of Use. The data collected were analyzed using appropriate statistical and mathematical tools like mean, standard deviation, and Regression using SPSS.

Results and Discussion: The classification of the respondents in terms of Gender, Age, Education level and Occupation are given in Table 1.

Table 1: Profile of the Respondents

Variables	Classification	No.of respondents	Percentage
Age	Upto 30	18	20.0%
	30-50	46	51.1%
	50 above	26	28.9%
Gender	Male	58	64.4%
	Female	32	35.6%
Qualification	High school	3	3.3%
	Pre-degree or +2	26	28.9%
	Degree	25	27.8%
	P.G	20	22.2%
	Others	16	17.8%
Occupation	Planter	12	13.3%
	Salaried Employee	26	28.9%
	Business	18	20.0%
	Self-Employee	6	6.7%
	Others	28	31.3%

Source : Primary Data

Table 1 shows that 64.4% of the respondents are Males and 35.6% of the respondents are Females. 20% of the respondents belong to the age group upto 30. 51.1% of the respondents belong to the age group of 30-50. The rest of the respondents 28.9% fall in the age group of 50 above respectively.28.9% of the respondents have Pre-Degree education level. 27.8% of them have Degreequalification. 22.2% of the respondents have P.G education level. 17.8% and 3.3% fall in the category of Others and High School respectively.31.3% of the respondents belong to the group Others. 28.9% of the respondents are Salaried Employees.20.0% of the respondents fall in the category of Business.13.3% of the respondents belong to the group Farmer/ Planter. 6.7% of the repondents are Self- employed.

Source Of Renewable Energy Resource: There are different sources of renewable energy resources such as hydro power, solar ,biogas and geothermal that are commonly used and practiced in the households of Kottayam. Table 2 shows the respondents sources of renewable energy resources.

Table 2: Adoption of Renewable Energy Resources

Sl.No	Sources	Frequency	Percentage
1.	Hydro power	Nil	Nil
2.	Solar	76	84.4%
3.	Biogas	14	15.6%
4.	Geothermal	Nil	Nil

84.4% of the respondents use Solar and 15.6% of the respondents have adopted Biogas. None of the respondents have adopted Hydropower and Geothermal. Therefore the prominent renewable energy resources adopted are Solar power and Biogas.

Factors Influencing The Adoption Of Renewable Energy Resources
The study measured the various factors influencing the adoption of renewable energy resources primarily drawing ideas from Technology Acceptance Model. The data were collected from ninety respondents and were analyzed using appropriate statistical tools like Mean and t- test.

Percieved Usefulness
Perceived usefulness is defined as the extent to which persons believe that technology will enhance their productivity or job performance (Davis, Bagozzi, & Warshaw, 1989). To determine the perceived usefulness 7 variables were considered. Following are factors based on which customers perceived usefulness is measured:

Table 3: Perceived Usefulness

Variable Code	Description	Mean	SD
PU1.	RER's makes works easier	3.96	.748
PU2.	RER's are more efficient than non-RER's	3.93	.897
PU3.	RER's are useful	4.03	.741
PU4.	RER's improves performance of household activities	3.76	.852
PU5.	RER's increases convenience and productivity	3.79	.757
PU6.	RER's improves the quality of work	3.51	.890
PU7.	RER's gives greater control over work	3.74	.931

Table 3 shows the mean and standard deviation of factors influencing the adoption of RER's for perceived usefulness. The highest mean score is 4.03 for RER's are useful. The next highest mean score is 3.96 for RER's makes works easier followed by a score of 3.93 for RER's are more efficient than non-RER's. The lowest mean score is 3.51 for RER's improves the quality of work.

Percieved Ease Of Use
In TAM,perceived ease of use is defined **as** the extent to which a person believes that using a technology will be simple (Davis,Bagozzi,& Warshaw,1989).There were total of 9 variables. Based on the pilot survey 3 items were removed and the rest where retained. Following factors determine the customers perceived ease of use:

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Table4: Perceived Ease of Use

Variable Code	Description	Mean	SD
PEU1.	RER's makes me skillful	3.79	.814
PEU2.	RER's are easy to learn	3.92	.877
PEU4.	RER's saves energy	4.01	.930
PEU5.	RER's are user friendly	4.13	.889
PEU7.	RER's are easy to remember	3.58	.936
PEU9	RER's are easy to use	3.74	.829

Table 4 shows the mean and standard deviation of factors influencing the adoption of RER's in Perceived Ease of Use. The highest mean score is 4.13 for RER's are user friendly. The second highest mean score is 4.01 for RER's saves energy followed by a score of 3.92 for RER's are easy to learn. The lowest mean score is 3.58 for RER's are easy to remember.

Reliability

In order to measure perceived usefulness, perceived ease of use, and barriers, the researcher has developed a measurement scale based on the reference from literature review and discussion with experts in the field. Table 5 shows the reliability values calculated using Cronbach's Alpha.

Table 5: Reliability Statistics of The Measurement Scale

Sl.No	Variables	No.of items	Alpha
1.	Perceived usefulness	7	.750
2.	Perceived ease of use	6	.781
3.	Barriers	9	.730

Source: Primary Data

The coefficient of reliability is used as a measure of the internal consistency or reliability of a psychometric test score. A value greater than .7 is widely considered as a good score (Nunnally, 1978). Of the four constructs measured, all aspects have got a value beyond this threshold limit indicating a higher reliability of the measurement scales adopted for the study.

Regression analysis

Regression analysis was conducted to reveal how different factors- Perceived Usefulness and Perceived Ease of Use affect the degree of adoption of Renewable Energy Resources among households. The main objective of regression analysis is to explain the variation in one variable based on the variation in one or more other variable. If multiple independent variables are used to explain the variation in dependent variable, it is called multiple regression models. The output of multiple regression analysis was used to test the following hypothesis. The degree of adoption of RER's is taken as the dependent variable and factors influencing the adoption of RER's are taken as the predicted variables.

Table 6: Degree of Adoption and Factors influencing the adoption of RER's – Regression Model Summary

Model Summary				ANOVA[b]				
Model 1	R	R square	Adjusted R square		Sum of squares	Df	f	P value
	.328a	.107	.087	Regression Residual Total	1.194 9.929 11.122	2 87 89	3.229	.007a

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1. **Predictors(constant): Perceived Usefulness, Perceived Ease of Use**
2. **Dependent variable: Degree of adoption**

Model 1 shows that degree of adoption significantly depends on the factors influencing the adoption of Renewable Energy Resources that is Perceived Usefulness and Perceived Ease of Use. 8.7 percent of the variation in the degree of adoption is explained by Perceived Usefulness and Perceived Ease of Use.

R square is the percent of the variance in the dependent explained uniquely or jointly by the independence the R square and adjusted R square will be close when used for the case of little independence. Table 6 shows that R square and adjusted R square is very close. Guajarati (2006) recommends that it is a good practice to find the adjusted R square value because it explicitly takes in to account the number of variables included in the model hence the adjusted R square value is used for interpreting the result.

Table 7: Degree of Adoption and Factors influencing the adoption of RER's – Regression Coefficients

Model 1	Unstandardized coefficient		Standardized coefficient	F	P value
	B	Std.Error	Beta		
(constant)	.955	.297		3.212	.002
Perceived Usefulness	.081	.073	.121	1.113	.269
Perceived Ease of Use	.153	.063	.263	2.410	.018

a.Dependent variable: Degree of adoption

The two independent variables viz., Perceived usefulness (p= .269), Perceived Ease of Use (.018) are statistically significant at 5 percent significance level. The Beta coefficient gives a measure of the contribution of each variable to the model. Higher the Beta value, the greater is the effect of independent variable on the dependent variable. Perceived Ease of Use has the highest Beta coefficient (.153) and therefore it has greater effect in the adoption of RER's followed by Perceived Usefulness (.081).

Findings
1. The prominent aspect of Perceived Usefulness shows a mean score mean score of 4.03 for RER's are useful.
2. The prominent aspect of Perceived Ease of Use shows a mean score of 4.13 for RER's are user friendly.
3. The major barrier that the adopters face while using RER's were 'lack of information' regarding renewable energy resources (m= 3.70, SD=0.905) . The next major barriers are 'high transaction costs' (m=3.47, SD=0.622), 'difficulty in changing existing systems' (m=3.42, SD=0.793) 'high initial start- up cost' (m=3.27, SD= 0.909) and 'inadequate work force' (m=3.19, SD=0.886).
4. Regression analysis brought out two significant predictors of adoption of RER's viz., Perceived Usefulness and Perceived Ease of Use. The result shows that the degree of adoption significantly depends on the factors influencing the adoption of Renewable Energy Resources. 8.7 percent of the variation in the degree of adoption is explained by Perceived Usefulness and Perceived Ease of Use.
5. Regression Coefficient analysis shows thatthe two independent variables viz., Perceived usefulness (p= .269), Perceived Ease of Use (.018) are statistically significant at 5 percent significance level. The Beta coefficient gives a measure of the contribution of each variable to the model. Perceived Ease of Use has the highest Beta coefficient (.153) and therefore it has greater effect in the adoption of RER's followed by Perceived Usefulness (.081).

Conclusion

In the study brought down interesting findings relating to the aspects of different sources of information information, factors influencing, barriers and degree of adoption of Renewable Energy Resources. We identified that finding, encouraging and motivating consumers of the renewable energy resources is not an easy proposition. But there is a wide scope for the adoption of RER's in Kottayam district of Kerala for the public. Those respondents who adopt these resources completely understand the uses and benefits of these resources and also accept the changes that are required in the in today's world but often most consumers forget to accept these changes because of the lack of information regarding RER's. The future research may test and verify the findings of this study through a largescale analysis. The investigation on the potential consumers of these resources who have already adopted these resources may provide further useful insights

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