The Influence of Socio-cultural Factors on the Adoption rates of Sustainable Energy Technologies in Kakuma Refugee Camps

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DOI: 10.29322/IJSRP.10.06.2020.p10212
http://dx.doi.org/10.29322/IJSRP.10.06.2020.p10212

Abstract

The situation that continues to persist with most Africans is that despite the impact of the eurocentric influence, evidence suggests that the inner motivation to their way of life overwhelmingly remains their African culture. Adoption of sustainable energy technologies in Africa will continue to be influenced by cultural practices. Adoption rates are likely to be low especially in resource constrained African communities like those hosting refugees. The purpose of this study was to investigate the influence of socio-cultural factors on the adoption rates of sustainable energy technologies in Kakuma refugee camps. The study adopted concurrent descriptive cross sectional and correlation research designs. Both simple random and purposive sampling methods were used to sample respondents A quantitative tool was administered on 286 refugee respondents, two focus group discussions were held, 29 key informant interviews were conducted while 10 observations were made. Data was analyzed using Statistical Package for Social Science by applying both descriptive and inferential statistical procedures. The study findings revealed that the predictor variables identified as socio-cultural factors, had a significant positive influence on adoption rates of sustainable technology. The study concludes that socio-cultural factors have a role on adoption rates of sustainable energy technologies as indicated by the values $\beta 1 = 0.612$, $t = 4.383$, $p<0.05$; $\beta 2 = 0.499$, $t = 3.782$, $p<0.05$; for culture and social factors respectively. Humanitarian agencies needs to develop a database on SE demand in camps that is based on socio-cultural factors to guide planning and management of humanitarian energy aid among others.

Keywords: *Adoption rate, socio-cultural factors, sustainable energy technologies, Kakuma refugee camp, cooking, lighting.*

Introduction

Throughout the world, there has been mounting pressure to adopt sustainable energy technologies. It has been argued that renewable energy offers possibilities for generating local environmental and health benefits along with the facilitation access to energy for cooking and lighting as well increasing employment opportunities. However, a qualitative research outcome by Energy for Impact (2017) revealed that socio-cultural factors and family set-ups could be dictating decisions on which fuel type is appropriate for cooking. Socio-cultural practices, particularly in Africa are therefore acting as key determinants of what energy sources families need to adopt. This influence is likely to be seen in resource constrained communities and where African culture still enjoys an overwhelming following.

Social Cultural Determinants

Socio-cultural determinants can be looked as aspects that affect people's way of life. They consist of conditions that people live in that is likely to have deep roots in the people's traditional cultures. Several reviewed studies have shown that cultural beliefs affect integration of sustainable energy technologies. Urmee (2016) reviewed

renewable energy programs around the world and highlighted that the reason for the failure of many such programs might be that none have considered local culture and social background in the target areas. Culture affects and is about cooking practices and choices. The positive reputation in terms of compatibility with the cooking culture of a community increases the use of improved cook stoves (ICS). Cooking practices and taste/dietary preference related to the local culture are involved in decision making about ICS adoption. In particular, some studies have found that attachment to the particular taste of food cooked on traditional stoves may act as a barrier to the adoption of LPG stoves, highlighting that it is not possible to prepare certain traditional dishes with ICS.

Social cultural determinants can include circumstances like religion, customs, gender, family, physical status, education level, economic status, marital status, environment and political systems (Eseonu and Egbue, 2014). Culture and customs in societies provide guidelines for conduct and raise a standard to be upheld in communities. In the social-cultural context, norms and traditions may dictate decisions on where cooking takes place; whether in a hut in the evening or in a kitchen shelter during the day or out there in the open when the sun is out and hot (Rosenbaum, et al., 2015). Socio-cultural factors would therefore have a strong bearing on the adoption of clean energy in refugee camps.

In Kakuma, varying attitudes, concerns and apprehensions among refugee families regarding suitability of solar cookers to prepare food for a family were noted. Social norms, security, education level, family size and beneficiaries' involvement were considered to have a great deal of issue on uptake of renewable energy technologies. Socio-cultural benefits are gaining prominence as a key driver for renewable energy deployment in Sub-Saharan Africa (Caird, Willness, Steel & Scialfa, 2008). However, analytical work and empirical evidence on these topics remains relatively limited.

Barriers and Gaps

In a study on renewable energy policies and barriers by Beck and Martinot (2010), some socio-cultural barriers that exist in a community can prevent uptake of renewable energy projects. A study by Owen (2002) established that the taste of food is different depending on the type of stove used to cook. It is however not clear how the type of stove used determines what taste the food will take. While one of the key social barriers to adoption of renewable technologies is mostly financial as well as some practical issues regarding installation and general levels of knowledge, it is not clear that even if the costs were reduced and information made more available, the adoption levels would increase. Neither is it clear that if an increase in adoption were to occur that it would lead to reductions in carbon emissions due to the effect known as the 'Rebound' effect (Caird et al., 2008).

A study by Lay et al (2012) found that income and education influence adoption rate of sustainable energy technologies, however, the researchers considered only social determinants as the only factor influencing adoption rates of sustainable energy technologies. In many cases, energy projects are treated as gender neutral based on the assumption that energy bottlenecks and solutions impact men and women in similar ways. The failure to look at the distinct situation of women and men in relation to energy use patterns can also result in people losing faith in renewable energy technologies (Stern, 2007). More broadly, women are often excluded from discussions about energy plans and policies across scales, despite being primary household-energy managers, which limits their entry into the energy industry (UNHCR, 2017) and results in gender-blind energy project planning, financing, execution and implementation (Glemarec, Bayat-Renoux, & Waissbein, 2016).

Despite extensive research in the area of sustainable energy, majority of these studies have been carried out by humanitarian agencies whose findings are based on an insider's eye in line with donor funding opportunities. A study by Mamuye, Lemma, Woldeamanuel, (2018) focused on gender aspect influence on adoption of improved cooking stoves which was narrow in scope since it studied a single aspect of wider renewable energy

drivers. Further the study was carried in an Ethiopian and not a Kenyan context. In addition, studies were done in Pakistan and Mexico which are completely different setting distinctive from Kakuma refugee camp in Kenya.

A survey by Lahn and Grafham, (2016) on the influence of aesthetics on adoption of solar power targeted home owners who are endowed with resources unlike refugees who rely on humanitarian aid. Majority of literature also employed only qualitative methods to draw findings and conclusions. This has limitations. This study adopted a more informative concurrent descriptive cross sectional and correlation research designs. For culture, there is virtually little study found to focus on culture and its role on SE integration. Despite an increase in the number of energy-related activities in recent years, there appears to have been limited literature of their impacts on the refugee setup.

While access to modern energy is a basic human need that displaced and disadvantaged people are entitled to, a better comprehension of their socio-cultural situation is needed to better address this need. The goal of this study was therefore to investigate the influence of socio-cultural factors on the adoption rates of sustainable energy technologies in Kakuma refugee camps

Research Design

This research adopted concurrent descriptive cross sectional and correlation research designs. The choice of this research method was primarily to collect qualitative data to illustrate quantitative findings. This enabled the researcher to collect both quantitative and qualitative data that focused on generating detailed information regarding the key aspects.

Study Population

According to UNHCR (2019), as of August, 2019 Kakuma refugee camps had 191,500 refugees. 1000 of them who were trained by SNV on sustainable energy in Kakuma formed the study population. Further, the population included zonal leaders in the camps, lead persons drawn from UNCHR implementing agencies and sustainable energy market organizations.

Sampling Strategy and Sample Size

The current study employed simple random sampling technique to sample refugees in Kakuma refugee camps. Purposive sampling was used to select UNHCR implementing partners. In choosing the sample for FGDs, and observation, census was used. The Slovins statistical formula was employed to obtain the study sample size as follows.

$$n = \frac{N}{1 + N(e)^2}$$

Where; n= sample size, N=Population, e = level of precision

n=1000 / (1+1000 $(0.05)^2$) = 286 respondents

For focus group discussions, census technique was used since the population of interest was smaller. However for interview, 29 lead persons drawn from 42 implementing partners operating in Kakuma were selected. This represents 69 % of the population.

Data Collection Instruments and Procedure

A quantitative tool with structured questionnaires was applied to 286 refugee respondents, two focus group discussions were held, 29 key informant interviews were conducted while 10 observations were made. Findings revealed that most of the predictor variables identified as socio-cultural factors, had a significant positive influence on adoption rates of sustainable technology.

Primary data was collected using questionnaires, interview, focus group discussion guide and observation checklist which were administered by the researcher with the help of research assistants. Quantitative data was collected by use of a structured questionnaire. This enabled the respondents to remain anonymous and be honest in their responses (Cooper & Schindler, 2008). It also helped to gather responses in a standardized and more objective manner.

Questionnaires were constructed with closed and open-ended set of questions with a five-point Likert scale ranging from 'strongly agree' to 'strongly disagree'. The research instruments were pilot tested in a study involving 30 refugees who were drawn from camps that were not part of the sampled population. It served to gain feedback on clarity and validity of the instruments to be used and time taken by respondents to answer to question items.

For open-ended questionnaires the respondents were required to use their own words to answer questions, whereas in closed-ended questionnaires pre-written response categories were provided. The questionnaires were administered using ‘drop-and-pick’ method. This provided convenience and efficiency in the process of data gathering.

For key informant interviews, purposive sampling was used to identify respondents through consultation with SNVs in the camps. Only the UNHCR implementing partners whose role were within the interest of the study were chosen for the interview. An interview schedule was used, and before the interview, the interviewer gained a rapport with the respondent.The respondents answered identical questions at individual level to maintain confidentiality and to control bias among the respondents.

Focus Group Discussions (FGD) were used to explore their ideas on ownership and adoption of new cooking and lighting technologies. The topics for discussion were modeled from the research questions, questionnaires and interview schedule. Two FGD were carried out comprising 7 and 6 zonal leaders respectively.

Observation was used to explore the SE technologies in the Kakuma market place. The SE market organization list was provided by the SNV, which is in charge of the energy cluster in Kakuma camps. All the organizations were visited, observation on their technologies made and photographs taken.

Secondary data was used to supplement the primary data collected and identify critical grey areas the study sought to fill. The sources of data reviewed included journals, publications, online reports and statistics from the government ministries such as energy and donor agencies working in Kakuma refugee camp. The secondary data was useful in corroboration of the study findings.

The quantitative tool employed was a structured questionnaires and applied to 286 refugee respondents. The qualitative tools employed were interview and FGD guides and an observation check list. The instruments were pre-tested in a pilot study in Kalobeyi due to similarity with camps to check for their reliability and validity.

Data analysis

Data was analyzed using Statistical Package for Social Science (version 25) by applying both descriptive and inferential statistical procedures. Descriptive results were presented in tables and charts. Quantitative information was analyzed through statistical procedures. Pearson's correlation analyses was used to explore the association among determinants of adoption rates of SET and SET adoption rates. The regression model was tested on how well it fits the data. Fischer distribution test was applied. It was used to test the significance of the overall model at a 5 percent confidence level. The p-value for the F-statistic was applied in determining the robustness of the model. The conclusion was based on the basis of p-value. The statistical significance of the coefficients were determined using the t-statistic. The t-test was used to establish if the correlation coefficient were significantly different from zero, and, hence whether there is evidence of relationship between the two variables.

The statistical package for social sciences, SPSS (version 25.0) was used for data analysis.

The regression model used was as follows:

$Y=\alpha + \beta_1 X_1 + \beta_2 X_2 + e$ Equation 3.0.1

Where:

Y is weight for adoption rates of SET

α is regression constant

β_1- β_2 are regression coefficients

X_1 is weight for socio factors

X_2 is weight for cultural factors

e is stochastic term

Hypothesis were tested at 95% confidence level ($\alpha = 0.05$). A two tailed test were carried out.

Results and Discussion

Descriptive Analysis of Socio-Cultural Factors

Influence of Social Factors

The mean and standard deviation of social factors on adoption rates of sustainable energy technologies are shown in table 1.

Table 1: Social factors

	Mean	SD
	Statistic	Statistic
More women are able to adopt sustainable energy solution as compared to men	4.56	1.255
I prefer to use sustainable energy solutions because I have attained basic education and I know their benefits	4.47	.886

My current level of income informs me the sustainable energy solution to adopt	4.39	1.123
I received information on the benefits of sustainable energy technologies from my church leader	2.35	1.199
Women groups within the refugee camp have influenced me to adopt sustainable energy technologies	2.96	1.388
Cost of sustainable energy has forced me to adopt alternative energy technologies	4.04	.959

Gender, education and income

More women are able to adopt sustainable energy solution as compared to men as indicated by a mean of 4.56 (SD = 1.255). Respondents prefer to use sustainable energy solutions due to their education level and knowledge of the benefits of SE and their current level of income as indicated by a mean of 4.47 (SD = 0.886) and 4.39 (SD = 1.123) respectively. The study findings agree with Lay, Ondraczek & Stoever, (2012) who found that income and education influence adoption of solar home systems. Similarly, the findings concurs with the results of a study carried out in Kenya in 2013 by Lay et al., (2013) which found out that factors affecting the choice of lighting fuel in Kenyan households include education level and income bracket of the household heads, the average household expenditure, ownership of the dwelling, potential grid access, rural/urban setting of the household and the prevalence of solar home systems in the area. The alarming level of illiteracy found in the Kakuma refugee camp despite the camp having high provision of education facilities has the potential for affecting the adoption of sustainable energy technologies.

Church leaders, women groups and alternative energy costs

Whether respondents received information on the benefits of sustainable energy technologies from their church leader or from women groups, the results showed religious and peer influence from women groups was minimal as shown by a mean of 2.35 (SD = 1.199) and 2.96 (SD = 1.388) respectively. According to Candland, (2005) many social scientists see in religious conviction an eclipse of reason, and in religious motivation a constraint of enlightened social behaviour. Faith organizations are often seen as 'safe spaces', either literally, such as in sanctuary provision or disaster relief, or as a refuge from being judged or marginalized (Jaworsky, 2010; Reale, 2010; Fiddian-Qasmiyeh and Ager, 2013; Refugee Studies Centre, 2012). Governments have frequently sought to involve Faith organizations both in the support of refugees, and in the provision of welfare services generally (Dinham, 2013). However, in the case of sustainable energy integration the Faith organizations have either deliberately shunned the subject as a whole or have feigned ignorance.

The cost of sustainable energy has forced respondents to adopt alternative energy technologies as shown by a mean of 4.04 (SD = 0.959). This implies that the cost of firewood and kerosene is less compared to renewable energy technologies and thus alternative energy costs do influence uptake of sustainable energy technologies. One key informant for instance admitted:

> *Not just anyone can afford renewable energy technologies in this camp. The costs of acquisition are prohibitive and this motivates the camp refugees to turn to alternative sources of energy which are cheaper such as firewood and gasoline stoves.*

The observation made on prices in the market place corroborate the finding that cost is a limiting factor to adoption of SET for most of the refugee who only depend on aid. It was suggested that the only way to improve

uptake of sustainable energy is by assisting the refugees with initial payment of solar systems and pay as you go.

Influence of Cultural Factors

The mean and standard deviation of cultural factors on adoption rates of sustainable energy technologies are shown in table 2.

Table 2. Cultural factors

	Mean	SD
	Statistic	Statistic
I consider the source of fuel before making adoption decision	4.40	1.388
Some fuels affect expected food taste and texture and this influences adoption of such fuels	4.04	.959
The ability of the sustainable energy solution to be used multi-purposely affects the degree of its adoption	4.56	1.255
The cooking habits determines the level of sustainable energy integration	4.47	.886
The use of sustainable energy solutions like LPG requires extra care and thus not safe to use	4.19	1.072
I prefer to access humanitarian energy aid which is free rather than purchasing sustainable energy solutions which have to be purchased	4.86	1.008

Source of fuel, food taste and texture

The source of fuel was a consideration before making a decision to adoption of SET as indicated by a mean of 4.40 (SD = 1.388). The findings imply that the refugees' cultural backgrounds are primary drivers influencing ease of adoption of sustainable energy technologies. The expected food taste and texture using certain fuels had influences on adoption of such fuels as shown by a mean of 4.04 (SD = 0.959). One FGD discussant pointed out that her customers at a local food kiosk prefer food cooked using charcoal due to its taste. She would not compromise her business by using any other cooking fuel rather than charcoal. Many implementing partners interviewed concurred with this opinion that there are traditional foods which can only be cooked using firewood and charcoal and this makes it an uphill task to convince refugees to abandon charcoal and firewood for renewable energy technologies.

Multipurpose use and cooking habits

The ability of the sustainable energy solution to be used multi-purposely affects the degree of its adoption as indicated by a mean of 4.56 (SD = 1.255). Equally cooking habits determines the level of adoption of sustainable energy integration as shown by a mean of 4.47 (SD = 0.886). This implies that with concerted and unified efforts to change the behavior of refugees, the renewable energy technologies can be adopted easily. Donor agencies should therefore invest in sensitization programs in order to change the refugees' view on renewable energy. Prior research suggests that consumer adoption of innovations is affected by consumer characteristics and values (Gatignon and Robertson, 2006) as well as social context (Fisher & Prices, 2005).

Safety and donor dependency

Safety concerns of fuels like LPG that require extra care and thus not safe to use limits its adoption as indicated by a mean of 4.19 (SD = 1.072). This implies that refugees approach LPG adoption with caution due to its propensity to explode and cause harm and even death to the households. A high donor dependency on humanitarian energy aid as shown by a mean of 4.19 (SD = 1.088) shows that provision of free firewood by the humanitarian organizations inhibits refugees' ability to transition to sustainable energy solutions. A female respondent explained the dilemma of refugees preferring charcoal over firewood, but that they use the latter because it is free:

> *Most people in camps live as dependents, and their income as well as food supply is dependent on humanitarian aid and remittances. …In many cultures it is very shameful to have pots that are blackened by soot.*

Multivariate Analyses

Relationship between socio-cultural factors and adoption rates of SET

Table 3. presents Pearson's correlation of socio-cultural factors and adoption rates of sustainable energy technologies.

Table 3: Relationship between socio-cultural factors and adoption rates of SET

		Socio factors	Cultural factors	Adoption rates of SET
Socio factors	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	274		
Cultural factors	Pearson Correlation	.302**	1	
	Sig. (2-tailed)	.000		
	N	274	274	
Adoption rates of SET	Pearson Correlation	.669**	.529**	1
	Sig. (2-tailed)	.000	.000	
	N	274	274	274

**. Correlation is significant at the 0.01 level (2-tailed).

In the Pearson correlation analysis conducted, the social factors and cultural factors was found to have a weak positive correlation (r=0.302, P<0.001). The social factors are positively correlated to adoption rates of sustainable energy technology (r=0.669, P<0.001). This implies that an increase in social factors will increase the sustainable energy adoption rate in refugee camps. The study findings agree with the Karytsas S, and Theodoropoulou, E. (2014) who found that the socio-cultural factors influence public's adoption of the different forms of renewable energy sources.

The relationship between culture and adoption rates of sustainable energy technology was supported (r=0.529, P<0.001). This implies that an increase in culture change will increase the adoption rates of sustainable energy technology in refugee camps.

Model Summary

Table 4. Socio Cultural Factors and Adoption Rates of SET Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.860[a]	.739	.718	.899

a. Predictors: (Constant), Socio cultural factors

In the regression analysis conducted shown in table 4, the goodness of fit for the regression between socio-cultural factors and adoption rates of SET was significant, $F(2,272)=386.688$, $P<0.001$, $R^2=0.739$. R^2 of 0.739. This indicates that 73.9% of the variations in adoption rates of sustainable energy technologies in refugee camps are explained by the variations in socio-cultural factors of refugees.

ANOVA

Table 5: Socio-cultural factors and adoption rates of SET model validity

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	873.914	1	436.957	386.688	.000[b]
	Residual	307.335	273	1.130		
	Total	1181.249	274			

a. Dependent Variable: Adoption rates of SET

b. Predictors: (Constant), Socio cultural factors

The ANOVA test conducted as presented in table 5 showed that the overall model was significant indicated by an F statistic of 386.688 at $P<0.001$.

Significance of coefficients

Table 6: Socio cultural factors and adoption rates of SET regression weights

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.181	.823		4.470	.000
	Social factors	.522	.212	.499	3.782	.000
	Cultural factors	.628	.032	.612	4.383	.000

a. Dependent Variable: Adoption Rates of SET

Regression analysis (table 6) on the social and cultural coefficients show that social and cultural factors uniquely contributes significantly to adoption rates of sustainable energy technologies ($P<0.001$). This imply that one positive unit change in a social factor would lead to a change in adoption rate of SET at the rate of 0.522. Likewise, one positive unit change in culture would lead to a change in adoption rate of SET at the rate of 0.628. The fitted equation is as shown below;

$$Y= 2.181 + 0.522X_1 + 0.628X_{2+} \varepsilon$$

These finding are illustrated by qualitative data from the refugee camps that recognized that the most significant factor in the adoption of sustainable energy in the camp was income level, gender of the refugee and level of education. Refugees ability to purchase sustainable energy technologies and sustain them was a key factor in determining the success or failure of intervention programs to stimulate SE integration in refugee camps. This

is supported by Lay et al (2012) whose study established that income and education influence adoption of solar home systems. It was observed that many refugees prefer to use traditional firewood cooking methods since most refugee population perceive that use of firewood makes the food to retain its natural taste unlike cooking with LPG and solar cookers.

Conclusion

This study has found conclusive evidence that social and cultural factors contributes significantly to adoption rates of sustainable energy technologies. This imply that one positive unit change in a social factor would lead to a change in adoption rate of sustainable energy technology. Likewise, one positive unit change in culture would lead to a change in adoption rate of sustainable energy technologies. This implies that with concerted and unified efforts to change the behavior of refugees, the renewable energy technologies can be adopted easily especially when the intervening consumer characteristics, values and social contexts are identified. Donors and humanitarian agencies should therefore invest in sensitization programs in order to change the refugees' view on sustainable energy technologies.

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