Adoption of Liquefied Petroleum Gas among Refugees and Host Communities in Uganda: A Behavioral Perspective

Joseph Elasu[1], Orobia A. Laura[2], Vincent Bagire[3] and Nkuutu Geofrey[4]

Abstract

Uganda hosts over 1.55 million refugees, many of whom lack access to clean and reliable energy for cooking. The Uganda's Third National Development Plan (NDP III) together with the Ministry of Energy and Mineral Development recognize that reliable energy is critical for poverty reduction and society's social and cultural transformation yet millions of refugees in Uganda have inadequate access to safe and reliable energy mostly for cooking. Humanitarian agencies have attempted on several occasions to promote the use of Liquefied Petroleum Gas (LPG) among refugee and host communities but these attempts have not yielded much. With literature suggesting that behavioral intention can affect the adoption of technologies like LPG, this study aimed at investigating the influence of behavioral intentions on the adoption and use of LPG among refugees and host communities in Uganda.

Guided by the Unified Theory of Acceptance and Use of Technology (UTAUT), this study investigates the behavioral factors influencing LPG adoption among refugees and host communities. A cross-sectional design and quantitative approach were used to collect data from 383 households in Adjumani refugee settlement in Adjumani district in northern Uganda. The findings reveal that performance expectancy and effort expectancy significantly influence behavioral intention to adopt LPG, while social influence had no significant effect on behavioral intention to adopt LPG. Packaging size also moderates the relationship between facilitating conditions and adoption. The study concludes that behavioral intentions are key drivers of LPG adoption, and improving infrastructure, affordability, and awareness can enhance uptake. These findings have important policy implications for designing context-sensitive clean cooking interventions targeting both refugee and host populations in Uganda.

Keywords: Refugees, Adoption, Host community, UTAUT, Behavioral perspective

Introduction

Uganda hosts over 1.55 million refugees, ranking among the largest refugee-hosting countries in Africa. Most refugees originate from South Sudan, the Democratic Republic of Congo, and Somalia (Barasa et al., 2022; Gianvenuti et al., 2022). Access to modern energy is widely recognised as a key enabler of sustainable development, supporting essential household needs such as cooking, lighting, heating, and access to clean water. Uganda's Third National Development Plan (NDP III) identifies reliable energy supply as central to poverty reduction and

[1] Makerere University Business School, Uganda
Email: jelasu@mubs.ac.ug
[2] Makerere University Business School, Uganda
[3] Makerere University Business School, Uganda
[4] Makerere University Business School, Uganda

socio-economic transformation. In response, the Ministry of Energy and Mineral Development developed the Sustainable Energy Response Plan for Refugees and Host Communities (SERP) to expand access to affordable, reliable, and clean energy in refugee-hosting areas (USAID, 2023). Despite these commitments, access to safe and reliable cooking energy remains limited among refugee and host community households (USAID, 2023). Refugee settlement is frequently associated with increased environmental pressure, particularly land degradation and forest depletion driven by rising demand for firewood and timber (World Bank & FAO, 2018). Although deforestation and forest degradation in Uganda predate recent refugee inflows, settlement patterns have intensified pressure on forest ecosystems and increased competition over natural resources between refugees and host communities. Deforestation refers to the permanent conversion of forest land or sustained reduction in tree canopy cover below 10 percent, while forest degradation denotes declines in forest quality or biomass (World Bank & FAO, 2018). Forest resources remain central to livelihoods in Uganda, particularly for household energy, with over 94 percent of households relying on biomass fuels mainly firewood and charcoal for cooking (UBOS-UNHS, 2020).

Expanding access to clean cooking energy offers substantial social, health, and economic benefits, including reduced exposure to household air pollution, improved safety, lower time burdens associated with fuel collection, reduced risks of gender-based violence, and increased income-generating opportunities, particularly for women in the energy value chain (USAID, 2023). While clean energy access has increasingly been incorporated into humanitarian programming, significant barriers continue to constrain the uptake and sustained use of clean cooking technologies such as Liquefied Petroleum Gas (LPG) among refugees and host communities (Barasa et al., 2022; Gianvenuti et al., 2022). Although LPG is derived from fossil sources, it is widely classified as a relatively clean cooking fuel due to its low black carbon emissions and substantially lower concentrations of fine particulate matter (PM2.5) compared to traditional biomass fuels (Health Effects Institute, 2019; Khanwilkar et al., 2021). Transitioning from biomass to LPG can significantly reduce exposure to harmful pollutants while generating environmental and climate co-benefits (Health Effects Institute, 2019; Shupler et al., 2021). Globally, approximately 2.5 billion people use LPG for cooking, with adoption highest in Latin America, India, and Indonesia (Chen et al., 2021).

In Uganda, LPG promotion initiatives among refugees and host communities include subsidised programmes such as the Raising Gabdho Foundation's pilot, which offered a 50 percent subsidy. Nakivale refugee settlement is the only settlement reporting measurable LPG use, yet most refugee households continue to rely on increasingly scarce firewood. Despite financial assistance from humanitarian agencies including UNHCR, WFP, UNICEF, DRC, and NRC dependence on biomass fuels persists, indicating that economic constraints alone do not fully explain cooking fuel choices. Guided by the Unified Theory of Acceptance and Use of Technology (UTAUT), behavioural intention is a key determinant of technology adoption, shaped by performance expectations, effort expectations, social influence, and facilitating conditions. In refugee settings, continued reliance on firewood may reflect perceptions of affordability, accessibility, and compatibility with prevailing cooking practices, particularly given the upfront investment and recurrent refill costs associated with LPG (Halford et al., 2022). While UTAUT has been widely applied to clean energy adoption, it does not explicitly account for technology-specific attributes such as LPG cylinder packaging size. Existing studies focus mainly on facilitating conditions and user characteristics (Kudiwa, 2024), leaving limited empirical evidence on how physical

attributes of LPG interact with behavioural factors to influence adoption. This study addresses this gap by extending UTAUT to examine the moderating role of LPG cylinder size in shaping LPG adoption among refugee and host community households in Uganda.

Theoretical Framework

UTAUT, developed by Venkatesh et al. (2003), provides a comprehensive framework for understanding how users accept and adopt new technologies. It synthesises insights from earlier technology acceptance models and proposes that adoption is influenced by four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions, which together explain behavioural intention and actual use across diverse contexts (Venkatesh et al., 2003). UTAUT has been widely applied in studies examining the adoption of improved cookstoves and clean cooking technologies (Osiolo, 2021; Kar & Zerriffi, 2018). However, most of these studies have focused on stable, non-humanitarian settings. Empirical applications within humanitarian contexts, particularly among refugee and host communities characterised by economic vulnerability, institutional dependence, and constrained choice, remain limited. This gap suggests the need to reassess UTAUT where conventional market and infrastructure assumptions may not hold.

Prior to UTAUT, several theoretical models explained technology adoption, including the Technology Acceptance Model (TAM), Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Innovation Diffusion Theory (IDT), Social Cognitive Theory (SCT), Motivational Model, Personal Computer Usage Model, and hybrid models such as TAM–TPB. UTAUT integrates key elements from these frameworks, providing stronger explanatory power (Venkatesh et al., 2003). Within UTAUT, performance expectancy refers to perceived benefits of technology use, effort expectancy reflects perceived ease of use, social influence captures normative pressures, and facilitating conditions relate to resource availability and institutional support. Demographic and contextual variables such as gender, age, experience, and voluntariness act as moderators, while the four constructs remain primary determinants, with facilitating conditions theorised to directly affect actual use (Venkatesh et al., 2003). Empirical evidence on their relative importance is mixed; for example, effort expectancy was insignificant in Afonso et al. (2012) but significant in Dönmez-Turan and Kir (2019), while Kim et al. (2016) emphasised performance expectancy.

Building on these insights, this study extends UTAUT by introducing LPG packaging size as a moderating variable in the relationship between facilitating conditions and LPG adoption, which is particularly relevant in refugee and host community settings, where access, affordability, and infrastructure constraints may interact with packaging options to influence adoption outcomes (Figure 1).

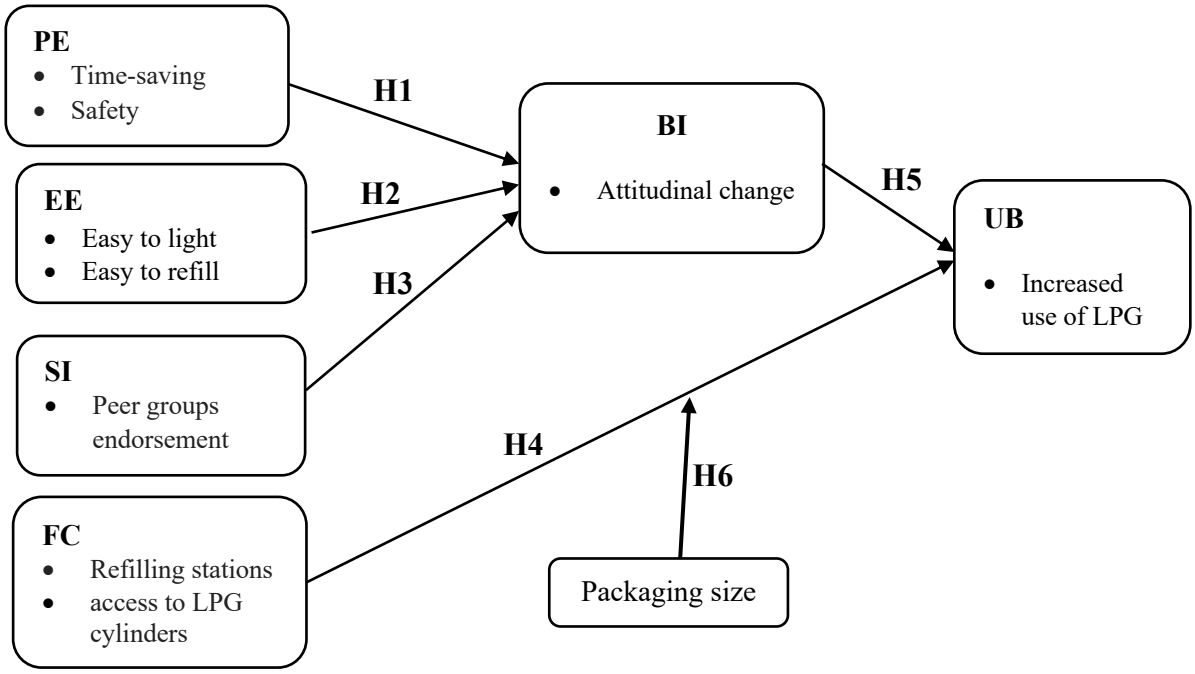

Figure.1: Theoretical model
Source: Adapted from Venkatesh et al (2003) and modified to include packaging size as a moderator

Empirical Review

Performance Expectancy and Behavioural Intention to Adopt and Use LPG

Performance expectancy refers to the extent to which an individual believes that using a particular technology will enhance task performance or lead to improved outcomes (Venkatesh et al., 2003; Venkatesh & Davis, 2000; Zhou et al., 2010). The construct draws on several earlier theoretical perspectives, including the TAM, TAM2, the Combined TAM and Theory of Planned Behavior (CTAM–TPB), Innovation Diffusion Theory (IDT), and Social Cognitive Theory (SCT), all of which emphasise perceived usefulness and outcome expectations as key drivers of technology adoption (Venkatesh et al., 2003; Venkatesh & Davis, 2000; Zhou et al., 2010). Empirical studies consistently identify performance expectancy as a critical determinant of users' intention to adopt new technologies. Venkatesh et al. (2016) demonstrate that performance expectancy is often the strongest predictor of behavioural intention across a range of technological contexts. Similarly, Lu et al. (2009) report that its influence persists in both voluntary and mandatory usage settings, as well as among users with limited prior experience. Earlier work by Venkatesh et al. (2003), however, suggests that the strength of this relationship may vary across demographic groups, particularly by gender and age. In the context of the present study, performance expectancy is conceptualized as refugees' and host community members' belief that LPG offers tangible advantages over traditional cooking fuels. These perceived benefits include faster cooking times, improved fuel efficiency, reduced household pollution, enhanced cleanliness, and greater safety and convenience. In addition, the time saved through LPG use may enable households especially women to engage in other productive or income-generating activities (Osiolo, 2021). Given these anticipated benefits, it is expected that higher levels of performance expectancy will be associated with stronger intentions to adopt LPG among refugee and host community households.

H1: Performance expectancy has a positive effect on behavioural intention to adopt LPG.

Effort Expectancy and Behavioural Intention to Adopt and Use LPG

Effort expectancy describes the extent to which an individual perceives a technology as easy to learn and use (Venkatesh et al., 2003). The construct originates from the concept of perceived ease of use within the TAM, which emphasises the role of simplicity and reduced effort in shaping technology adoption decisions (Davis, 1989). Perceived ease of use reflects an individual's belief that engaging with a particular technology requires minimal physical or cognitive effort and can simplify task performance (McCard, 2007). Beyond the benefits derived from a technology, the perceived ease associated with its use significantly influences users' willingness to adopt and continue using it (Rizkalla et al., 2023). In this regard, effort expectancy captures users' confidence that a technology can be used efficiently without extensive training or complexity. Within the context of LPG adoption, effort expectancy relates to the perceived characteristics of LPG that make it easier and more convenient to use compared to traditional cooking fuels. Empirical studies indicate that LPG use is associated with reduced cooking time, improved convenience, and cleaner cooking environments relative to biomass-based technologies (UNHCR, 2023; Hsu et al., 2021; WLPGA, 2018). These attributes may lower the physical and time burdens associated with cooking, thereby enhancing the attractiveness of LPG among refugee and host community households. Based on this evidence, it is anticipated that higher perceptions of ease of use will strengthen users' intentions to adopt LPG.

H2: Effort expectancy has a positive influence on behavioural intention to adopt LPG.

Social Influence and Behavioural Intention to Adopt and Use LPG

Social influence refers to the extent to which an individual perceives that important others such as family members, peers, or authority figures believe they should adopt a new technology (Venkatesh et al., 2003). This construct is conceptually similar to subjective norms in the Theory of Reasoned Action and the image construct in TAM2, which emphasise that individuals' behaviours are often shaped by the expectations and perceptions of others (Ajzen, 1991; Venkatesh et al., 2003). Essentially, social influence captures the effect of external opinions on users' adoption decisions, including guidance or pressure from influential actors such as friends, colleagues, or hierarchical superiors (Afonso et al., 2012). In the context of LPG adoption among refugees and host communities, social influence manifests through the advice, approval, or endorsement of peers and community leaders. For example, recommendations from camp leaders, respected community members, or fellow refugees may encourage households to adopt LPG, while negative opinions or scepticism could hinder uptake. These social dynamics can therefore play a significant role in shaping behavioural intention toward LPG use.

H3: Social influence has a positive effect on behavioural intention to adopt LPG.

Facilitating Conditions and Adoption and Use of LPG

Facilitating conditions refer to the extent to which an individual perceives that the necessary technical, organizational, and physical resources exist to support the use of a technology (Venkatesh et al., 2003). This construct emphasizes the availability of infrastructure, tools, and institutional support that enable users to adopt and effectively utilize a given technology. Unlike performance expectancy or effort expectancy, facilitating conditions can have a direct influence on actual technology use rather than solely shaping behavioural intention (Venkatesh et al., 2003).

It also encompasses users' perceptions of the adequacy of support, guidance, and resources that ensure smooth and sustained technology adoption (Karanja & Gasparatos, 2019). In the context of LPG adoption, facilitating conditions may include the presence of fuel refill infrastructure and distribution networks (Bisu et al., 2016), government or organizational subsidy programs to reduce costs (Pattanayak et al., 2019), and the provision of credit or financing options to support purchase of stoves and cylinders (Karanja & Gasparatos, 2020). These enabling factors are likely to increase households' confidence in their ability to use LPG and therefore promote adoption and continued usage.

H4: Facilitating conditions have a positive effect on the adoption and use of LPG.

Behavioural Intention and Adoption and Use of LPG

Behavioural intention refers to an individual's stated willingness or plan to perform a specific behaviour, which in turn significantly influences actual technology use (Venkatesh et al., 2003). In most technology acceptance frameworks, including UTAUT, the effects of core constructs performance expectancy, effort expectancy, and social influence on actual technology use are typically mediated by behavioural intention (Lai, 2017; Venkatesh et al., 2016; Venkatesh & Davis, 2000). In the context of LPG adoption among refugee and host community households, understanding behavioural intention is critical. Positive intentions toward using LPG are expected to translate into higher rates of adoption and sustained use, as households are more likely to engage with the technology when they perceive it as desirable and beneficial.

H5: Behavioural intention positively influences the adoption and use of LPG.

The Moderating Role of Packaging Size on the Relationship Between Facilitating Conditions and Adoption of LPG

The size of an LPG cylinder plays a crucial role in shaping user preferences, accessibility, and overall adoption of the technology. Cylinder size can influence convenience, affordability, and practicality for households with differing energy needs (Puzzolo et al., 2020). Smaller cylinders are often more portable and easier to handle, which is advantageous for households in rural or peri-urban areas where transportation and storage may be challenging. Conversely, larger cylinders are typically more cost-efficient over time and suitable for households with higher fuel consumption, though the higher upfront cost may limit access for lower-income users (Karanja & Gasparatos, 2020; WLPGA, 2015). Safety and storage considerations also shape cylinder preferences. Households with limited space or safety concerns may favour smaller cylinders, which are easier to store and perceived as less risky in congested or informal living environments (Ochieng et al., 2020; Gupta et al., 2019). In contrast, larger cylinders, while more efficient, are sometimes viewed as hazardous and harder to manage in such conditions (Gupta et al., 2019). Given these dynamics, LPG packaging size is hypothesized to interact with facilitating conditions, affecting the likelihood of adoption. Specifically, the availability of appropriate cylinder sizes may enhance the effect of supportive infrastructure, subsidies, or financing mechanisms on households' adoption of LPG.

H6: Packaging size of LPG cylinders moderates the relationship between facilitating conditions and adoption of LPG.

Methodology, Research Design and Approach

This study used a cross-sectional, explanatory design to examine LPG adoption among refugee and host-community households in Uganda. Quantitative data were collected at a single point in time to analyze behavioral, technological, and contextual factors influencing adoption (Broadhurst et al., 2012; Creswell, 2014). A sample of 383 households, determined using the Krejcie and Morgan (1970) formula, was selected via simple random sampling from a comprehensive household frame, ensuring equal selection probability, representativeness, and minimal bias. There eleven (11) refugee settlement camps across the country however this study targets only four settlements where LPG has been piloted. The areas where the LPG has been piloted include**;** Bidibidi Refugee Settlement, Rwamwanja Refugee Settlement, Nakivale Refugee Settlement, Adjumani settlement and Kyaka II Refugee Settlement. However, this study considered only Adjumani Refugee Settlement (see Table 1). This is because Adjumani receives refugees continuously more than any other settlement in Uganda due to unending unrests in Democratic Republic of Congo, Somalia and South Sudan. Continuous refugee arrivals increase pressure on existing energy resources, particularly forest energy resource. Data were collected from 383 respondents determined using Krejcie and Morgan table (Krejcie et al., 1970). The data were collected using a self-administered questionnaire.

Table 1: Target population

	Adjumani Refugee Settlement
Refugee households	244,374
Natives	237,400
Total	**481,774**

Source: Achola et al., (2024)

Estimation strategy

Ordinary Least Square (OLS) regression is widely used due to its simplicity and optmality under the classical liner regression assumptions, more so that the error terms are normaly distributed with constatnt variance. However, OLS is highly sensitive to outliers because it minimises the sum of squared residuals (Farahani et al., 2010). To address this problem in the data collected, the study adopted Huber regression which is a roburst regression method developed by peter Huber in 1964. The model blesnds loss of OLS with the absolute L1 regression thus producing a model that is both efficient and robust (Weisberg, 1992). The Huber regression model is specified in equation 1.

$$\rho_\delta(r) = \begin{cases} \frac{1}{2}r^2 & \text{if} |r| \leq \delta \\ \delta.(|r| - \frac{1}{2}\delta & \text{if} |r| > \delta \end{cases} \quad (1)$$

Where $r = y_i - x_i^T\beta$ is the residual of *i.*

δ is a positive constatnt that determines the threshold between treating an error as a small or large. When the residual r is small (within $\pm\delta$), the loss is quadratic just like in OLS, and when the is large (i.e., outlier) the loss becomes linear thus limiting the influence of the outlier on the loss fuction.

Model specification

Following equation 1 above, the following models were specified;

Model 1

Behavioral intention = f [Performance expectancy (PE), Effort expectancy (EE), Social influence (SI), Experience (Exp), Education level (Educ)].

$$BI = \propto 0 + \beta_1 PE + \beta_2 EE + \beta_3 SI + \beta_4 Exp + \beta_5 Educ + \epsilon \quad (2)$$

Model 2

LPG adoption = f [Facilitating conditions (FC), Packaging size (PS), Experience (Exp), Education level (Educ)].

$$BI = \propto 0 + \beta_1 FC + \beta_2 PS + \beta_3 Exp + \beta_4 Educ + \epsilon \quad (3)$$

Model 3

LPG adoption = f [Facilitating conditions (FC), Interaction term ($FC * PK$), Experience (Exp) and Education level (Educ)].

$$BI = \propto 0 + \beta_1 FC + \beta_2 FC * PK + \beta_3 Exp + \beta_4 Educ + \epsilon \quad (4)$$

Scale Reliability & Validity

The reliability and validity of instrument was tested using Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). The findings are included in Table 2. Cronbach's alpha values ranged from 0.72 to 0.95, indicating acceptable internal consistency across all constructs. Composite Reliability values ranged from 0.81 to 0.99, further confirming strong reliability when accounting for factor loadings. Convergent validity, assessed using AVE, was satisfactory for all constructs, with values between 0.56 and 0.95, exceeding the recommended threshold of 0.50.

Table 2: Reliability and validity test results

Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Performance expectancy	0.95	0.99	0.95
Effort expectancy	0.91	0.98	0.87
Social influence	0.92	0.96	0.81
Facilitating condition	0.95	0.97	0.85
Behavioral intention	0.93	0.97	0.85
Cylinder size	0.72	0.81	0.56
Adoption	0.8	0.94	0.76

Source: Primary data (2025)

Findings

Descriptive statistics

This section presents findings on the characteristics of the respondents. Specifically, the study inquired on the size of the households, experience with LPG and the country of origin of the respondents. Figure 2 shows that most respondents are natives (67.5%), followed by refugees (31.9%), with asylum seekers representing a minimal proportion (0.5%). This indicates that the study primarily reflects the perspectives of local residents and the substantial refugee population in the area.

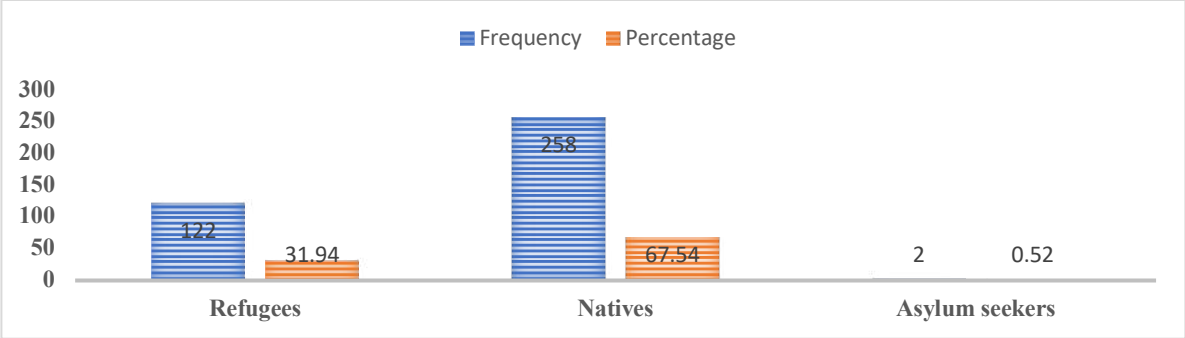

Figure 2: Resident status of the respondents
Source: Primary data (2025)

The study also inquired from the respondents, if they have ever used or owned an LPG cylinder. The findings presented in Figure 3 show that a majority of respondents have used or owned LPG as indicated by a higher percentage compared to those who have not. The findings also show a significant portion of respondents have never used LPG. The higher number of respondents with LPG experience suggests increasing adoption and use of LPG as a cooking fuel among the refugees and host communities. On the other hand, presence of a notable group who have never used or owned LPG suggests that barriers to adoption still exist that need to be addressed.

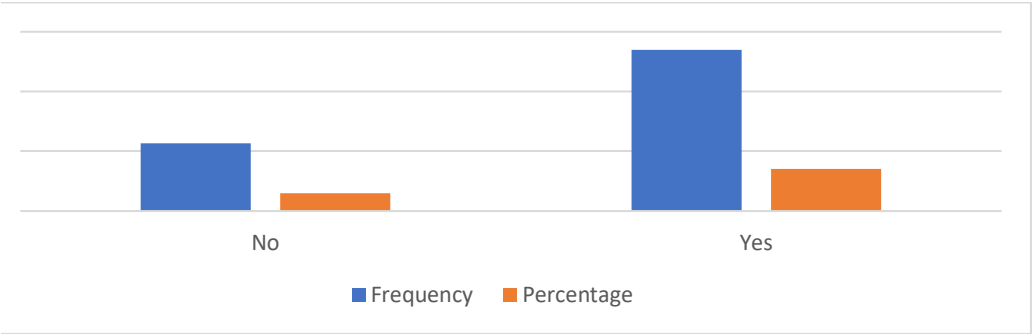

Figure 3: experience with LPG
Source: Primary data (2025)

Statistical tests
Shapiro-Wilk test
Normality assumption is important when making accurate statistical inferences and constructing confidence interval estimation. Violation of normality assumption may lead to biased standard errors regression errors subsequently leading to incorrect conclusions about the significance of the predictors (Mishra et al., 2019). In this study, the Shapiro-Wilk test was used to test for normality of the data using the following hypothesis:

H_0: The data follows a normal distribution.
H_1: The data does not follow a normal distribution.

Table 3 presents the results of the normality tests for the study variables. The findings indicate that gender, education level, and experience are normally distributed ($p > 0.05$), whereas age, household size, behavioral intention, LPG packaging, adoption, effort expectancy, performance expectancy, and social influence significantly deviate from normality ($p < 0.05$). The rule of

thumb is that W statistic should be as closer to 1 as possible since it provides a measure of the data's conformity to normal distribution (Mishra et al., 2019). However, the W statistic alone may not be sufficient, instead in this study P-values calculated based on the W statistic are also considered since they are crucial in determining if the null hypothesis of normality should be rejected. A p-value greater than 0.05 significance level means that there is not enough evidence to reject the null hypothesis. On the other hand, a p-value less than the significance set suggest that the data significantly deviates from the normal distribution leading to the rejection of the null hypothesis.

Table 3: Normality test results

Variable	W	p-value	Interpretation
Gender	0.99438	0.17659	Normally distributed
Education level	0.99471	0.21179	Normally distributed
Age	0.99031	0.01264	Not normal
Household size	0.98856	0.00432	Not normal
Behavioral intention	0.94666	0.00000	Not normal
LPG Packaging	0.98525	0.00061	Not normal
Experience	0.99554	0.34681	Normally distributed
Adoption	0.91035	0.00000	Not normal
Effort expectancy	0.94408	0.00000	Not normal
Performance expectancy	0.91148	0.00000	Not normal
Social influence	0.92779	0.00000	Not normal

Source: Primary data (2025)

Correlation matrix

To ensure reliable coefficient estimates, the independent variables should not be highly correlated with each other. A correlation matrix was used to test for multicollinearity among variables in this study and the findings are presented in Table 4. The correlation results indicate that the correlation values ranged between 0.56 or ($0.0 \leq |r| \leq 0.55$). This implies weak between the independent variables thus ruling out multicollinearity.

Table 4: Multicollinearity test results

	1	2	3	4	5	6	7	8	9
1. LPG. packaging	1.000								
2. Social influence	0.457	1.000							
3. Effort expectancy	0.437	0.214	1.000						
4.Performance expectancy	0.473	0.177	0.811	1.000					
5. Gender	-0.244	-0.097	-0.063	-0.046	1.000				
6. Age	-0.223	-0.137	-0.409	-0.353	0.094	1.000			
7. Education level	0.558	0.371	0.377	0.399	-0.225	-0.274	1.000		
8. Household size	-0.387	-0.272	-0.318	-0.334	0.109	0.571	-0.309	1.000	

9. Experience	-0.479	-0.364	-0.385	-0.348	0.154	0.181	-0.611	0.274	1.000

Source: Primary data 2025

Breusch-Pagan test

It is important to check if the variance of the error terms in a regression model is constant across all the levels of the independent variables. Ordinary Least Squares (OLS) regression assumes that the variance (ε_i) is = δ^2 (Constant). Once this assumption is violated, means that heteroscedasticity exists. In this study, Breusch-Pagan test is used to test for the presence of heteroscedasticity using the following hypothesis:

H_0: The error terms have constant variance (homoscedasticity).
H_1: The error terms do not have constant variance (Heteroscedasticity).

Table 5 presents the results of the Breusch–Pagan test for heteroscedasticity. The test yields a chi-square statistic of 25.13 with a p< 0.0001 (Prob > Chi^2 = 0.0000), which is below the 0.05 significance level. This indicates that the assumption of homoscedasticity is violated, implying the presence of heteroscedasticity in the regression model. Therefore, the null hypothesis of constant error variance is rejected.

Table 5: Breusch-Pagan test results

Test statistic	Degrees of freedom	Chi-squared (x^2)	p-value
1	25.13		0.0000

Source: Primary data 2025

Regression results

To establish the effect of the regressors on the outcome variables, a Huber regression model was used. The presence of heteroskedasticity and the violation of normality assumption requires the use of a robust regression model that can reduce the impact of outliers and heteroskedasticity.

Table 6: Huber regression results

Variable	**Coefficient**	**Std. err.**	**t-value**
Performance expectancy	0.3431**	0.032	10.57
Effort expectancy	0.610**	0.029	21.00
Social influence	-0.020	0.015	-1.29
Education level	-0.110	0.071	-1.56
Experience	-0.203	0.165	-1.23
Cons	1.466	0.540	2.71
Prob > F = 0.0219; F (6, 373) = 0.1408			

Source: Primary data 2025

Results in Table 6 indicate that performance expectancy (β = 0.343, p < 0.01) and effort expectancy (β = 0.610, p < 0.01) positively and significantly influence behavioral intention to adopt LPG for cooking. In contrast, social influence, education level, and experience with LPG were not significant predictors. These findings suggest that perceptions of LPG's usefulness and ease of use drive adoption intentions among refugee and host households in Northern Uganda, whereas social pressures and prior experience have minimal impact. Table 7 presents the findings

regarding the effect of behavioral intention and facilitating conditions on the adoption of LPG for cooking among the refugees and host communities in Northern Uganda.

Table 7: Huber regression results

Variable	Coefficient	Std. err.	t-value
Behavioral intention	0.1072 **	0.004	21.62
Facilitating conditions	-0.02678**	0.005	-4.92
Packaging size	0.0578**	0.007	7.81
Education level	0.0221	0.021	1.02
Experience	-0.0074	0.052	-0.14
Size	-0.0575**	0.020	-2.81
Cons	0.6208	0.163	3.79
Prob > F = 0.000; F (6, 373) = 154.97			

Source: Primary data 2025

The findings reveal that behavioral intention exerts a positive and statistically significant effect on LPG adoption (β = 0.1072, SE = 0.004). This indicates that as individuals' willingness and readiness to use LPG increase, their likelihood of actual adoption also rises. Unexpectedly, facilitating conditions show a negative and significant effect on LPG adoption (β = -0.02678, SE = 0.005). This suggests that despite the presence of supportive conditions such as access to refill stations or infrastructure adoption may remain constrained by other structural or contextual barriers. By contrast, packaging size has a positive and significant association with LPG adoption (β = 0.0578, SE = 0.007, t = 7.81, $p < 0.05$). This implies that favorable packaging formats, such as smaller and more affordable LPG cylinders, facilitate adoption among low-income and resource-constrained households. The model is statistically significant (Prob > F = 0.000; F(6, 373) = 154.97), confirming the joint explanatory power of the included predictors. These findings collectively suggest that while behavioral intention is the strongest determinant of LPG adoption, product characteristics (packaging size) and household economic realities (size and affordability constraints) also play crucial roles in shaping the clean energy transition among vulnerable populations.

Table 8 presents the results of two regression models examining the influence of behavioral intention and facilitating conditions on LPG adoption, and the moderating effect of packaging size in this relationship among refugees and host communities in Northern Uganda. In Model 1, behavioral intention shows a positive and statistically significant effect on LPG adoption (β = 0.1762, SE = 0.018, $p < 0.05$). This implies that as individuals' intentions and willingness to adopt LPG increase, their likelihood of actual adoption also rises. In Model 2, the inclusion of facilitating conditions, packaging size, and their interaction term (FC × PS) enhances the explanatory power of the model. The coefficient for facilitating conditions (β = 0.236, SE = 0.039, $p < 0.05$) indicates a significant positive influence. This suggests that improved accessibility, affordability, and availability of LPG infrastructure promote adoption. Similarly, packaging size demonstrates a strong positive effect (β = 0.523, SE = 0.054, $p < 0.05$), showing that favorable packaging such as smaller and more manageable LPG cylinders encourages uptake, particularly among low-income or transient households. Importantly, the interaction term between facilitating conditions and packaging size (FC × PS) is also positive and significant (β = 0.014, SE = 0.002, $p < 0.05$), confirming a moderating effect. This means that the influence of facilitating conditions on LPG adoption becomes stronger when packaging is more suitable and user-friendly. In

practical terms, even when enabling infrastructure exists, adoption is more likely when LPG products are offered in sizes and formats that align with consumers' financial and practical needs.

Table 8: Behavioral intention and facilitating conditions (with packaging moderation) on LPG adoption

	Model 1		**Model 2**	
	Adoption		**Adoption with moderation**	
Variable	**Coef.**	**SE**	**Coef.**	**SE**
Behavioral intention	0.1762**	.018272		
Facilitating conditions			0.236**	0.039
Packaging (moderator)			0.523**	0.054
Interaction Term (FC × PS)			0.014**	0.002
Constant	9.000	0.282		

Notes: FC X PS = facilitating conditions X packaging size

Source: Primary data 2025

Discussion of Findings

Performance expectancy, as defined in the UTAUT, refers to an individual's belief that using a technology will improve their performance outcomes (Venkatesh et al., 2016). In this study, performance expectancy was examined to determine its influence on refugees' and host-community households' decisions to adopt LPG for cooking. The results indicated a positive and statistically significant relationship, suggesting that households perceiving greater benefits from LPG such as faster cooking, fuel efficiency, convenience, and safety were more likely to intend to adopt it. These findings align with the UTAUT model, which identifies performance expectancy as a critical determinant of behavioural intention. Similar patterns have been observed in energy-related technology studies, where users tend to weigh potential advantages over existing alternatives before adoption (Lu et al., 2009; Zhou et al., 2010). Empirical studies in other domains, including AI adoption in education (Bouteraa et al., 2024) and clean cooking technologies (Apfel & Herbes, 2021), similarly demonstrate that higher perceived performance benefits correspond to increased adoption likelihood.

Effort expectancy refers to the perceived ease of using a technology, capturing users' confidence that the system is simple, convenient, and requires minimal effort to operate (Venkatesh et al., 2003; Fedorko et al., 2021). In the context of LPG, this reflects households' perception that using LPG is easier and more manageable than traditional fuels like firewood. The study results confirmed a positive and significant effect of effort expectancy on behavioural intention, indicating that households who perceived LPG as easy to use were more inclined to adopt it. This observation is consistent with previous research demonstrating that perceived ease of use is an important driver of technology adoption across contexts, including mobile health applications (Utomo et al., 2021) and other clean energy solutions (Rizkalla et al., 2023). The findings support the theoretical assumption that users are more likely to adopt technologies that reduce physical or cognitive effort, consistent with both UTAUT and TAM models (Lai, 2017; Venkatesh & Davis, 2000).

Contrary to performance and effort expectancy, social influence did not significantly affect behavioural intention in this study. This result is in line with UTAUT theory, which posits that

social influence exerts stronger effects under mandatory adoption conditions (Venkatesh et al., 2003). Since LPG adoption in the refugee and host-community context is voluntary, household decisions were primarily guided by perceived benefits and ease of use rather than peer or authority pressures. Similar findings have been reported in mobile banking adoption (Hassan & Wood, 2020) and e-government studies, where social norms exerted limited influence in non-compulsory settings.

Behavioural intention emerged as a strong predictor of actual LPG adoption. Households with higher intention to use LPG were significantly more likely to adopt the technology, confirming that intention mediates the effects of performance and effort expectancy on behaviour. This supports prior findings in clean energy adoption in Kenya and Tanzania (Mutua et al., 2020; Kulindwa et al., 2018) and aligns with Ajzen's (1991) argument that intentions guide human actions. The results highlight the importance of strategies that cultivate positive behavioural intentions, such as targeted behaviour change campaigns, demonstration of LPG benefits, and social marketing interventions. The study found a positive and significant relationship between facilitating conditions and LPG adoption. Facilitating conditions such as accessible fuel refill points, affordability mechanisms, and supportive infrastructure directly influence households' ability to adopt and sustain use of LPG (Venkatesh et al., 2003; Puzzolo et al., 2024). These findings align with prior research in low-resource settings, which emphasizes that practical support systems are crucial for adoption of clean cooking technologies (Mulyana et al., 2020). Interestingly, the analysis also highlighted that facilitating conditions alone are insufficient if households do not perceive LPG as beneficial or easy to use. Ownership or access without perceived value may not translate into adoption, suggesting that facilitating conditions operate most effectively when coupled with positive performance and effort expectancy perceptions.

Packaging size emerged as a significant moderating factor in the relationship between facilitating conditions and LPG adoption. Smaller, more affordable cylinder options improved accessibility, enhanced perceived feasibility, and strengthened the effect of available infrastructure on adoption. Empirical evidence from Mexico and sub-Saharan Africa demonstrates that mini-cylinder programs increase uptake among low-income or peri-urban households (Troncoso et al., 2019; Clean Cooking Alliance, 2023). The interaction term (facilitating conditions × packaging size) was statistically significant, indicating that the positive influence of supporting infrastructure is amplified when cylinder size aligns with household needs and constraints. This finding extends the UTAUT framework by demonstrating that product design features can enhance the effectiveness of facilitating conditions, making infrastructure more usable and adoption more likely (Gould & Urpelainen, 2018).

Conclusions

The main objective of this study was to examine the influence of behavioral factors on the adoption of LPG among refugees and host communities in Uganda. UTAUT was used a guiding framework for the study. based on the results of the study, the following conclusions are drawn: The study found that behavioral factors significantly shape LPG adoption among refugees and host communities in Uganda. Performance and effort expectancy positively influence adoption, as LPG is seen as efficient, smoke-free, and easy to use. Facilitating conditions, including infrastructure and technical support, also enhance adoption, while social influence has little effect. Cylinder size further moderates adoption, with smaller cylinders offering portability and larger ones providing longer refill intervals.

Theoretical implications

The study contributes to the existing body of knowledge in several important ways: First, it successfully extends the UTAUT to a humanitarian and displacement context. Previous applications of UTAUT have largely been confined to stable, market-driven environments; this study demonstrates the model's applicability in fragile settings. Furthermore, while UTAUT stresses core constructs like performance expectancy and facilitating conditions, the current study highlights that local, context-specific factors such as product packaging size must be integrated to capture the full range of influences on adoption behavior. Second, the introduction of packaging size (cylinder size) as a moderating variable between facilitating conditions and use behavior enriches the UTAUT framework. It highlights that product design and physical usability factors can significantly impact technology adoption. Thirdly, the critical role of facilitating conditions reinforces the view that behavioral intentions, while important, are insufficient on their own. Successful adoption depends heavily on external enabling infrastructure and resources, especially in marginalized settings.

Policy implications

In order to foster increased adoption and use of LPG among refugee and host communities in Uganda, the following policy recommendations are proposed: Government agencies, humanitarian organizations, and private sector actors should invest in expanding LPG infrastructure, including establishing additional refilling stations within and near refugee settlements. Comprehensive communication campaigns should be launched to highlight the health, environmental, and economic benefits of LPG relative to traditional fuels. These campaigns should leverage community influencers, including religious and local leaders, to improve credibility and reach. LPG suppliers should ensure that a variety of cylinder sizes are available, particularly smaller cylinders (e.g., 3 kg, 6 kg) that are easier to purchase, transport, and store. Additionally, flexible payment models such as pay-as-you-go (PAYG) should be explored. LPG access should be mainstreamed into core humanitarian support activities, including food aid, livelihoods development, and shelter programs, rather than treated as a peripheral intervention.

Recommendations

Based on the study findings, several practical steps are recommended for development practitioners, humanitarian organizations, and policymakers:

- Design comprehensive LPG programs that integrate behavior change strategies, financing mechanisms, infrastructure development, and ongoing support services rather than focusing solely on product distribution.
- Deploy Community LPG Ambassadors by training influential individuals within refugee and host communities to demonstrate safe usage practices, conduct peer training sessions, and provide testimonials.
- Establish LPG Micro-enterprises by promoting entrepreneurship among refugees and host communities to operate small-scale LPG distribution outlets, refilling stations, and maintenance services.

References

Achola, R., Atuyambe, L., Nabiwemba, E., Fredrick, M., & Orach, C. G. (2024). Factors associated with family planning use among refugee and host populations in Adjumani

district, West Nile, Uganda: a comparative study. *BMC Public Health*, *24*(1), 1–11. https://doi.org/10.1186/s12889-024-18103-x

Afonso, C. M., Roldán, J. L., Sánchez-Franco, M., & O, M. De. (2012). The moderator role of Gender in the Unified Theory of Acceptance and Use of Technology (UTAUT): A study on users of Electronic Document Management Systems. *7th International Conference on Partial Least Squares and Related Methods*, *June*, 1–8.

Ajzen, I. (1991). Theory of Planned Behaviour. In *Disability, CBR and Inclusive Development* (Vol. 33, Issue 1, pp. 52–68). https://doi.org/10.47985/dcidj.475

Apfel, D., & Herbes, C. (2021). What drives senegalese SMEs to adopt renewable energy technologies? Applying an extended UTAUT2 model to a developing economy. *Sustainability (Switzerland)*, *13*(16). https://doi.org/10.3390/su13169332

Barasa, B., Turyabanawe, L., Akello, G., Gudoyi, P. M., Nabatta, C., Mulabbi, A., & Bellucci, S. (2022). The Energy Potential of Harvested Wood Fuel by Refugees in Northern Uganda. *Scientific World Journal*, *2022*. https://doi.org/10.1155/2022/1569960

Bisu, D. Y., Kuhe, A., & Iortyer, H. A. (2016). Urban household cooking energy choice: an example of Bauchi metropolis, Nigeria. *Energy, Sustainability and Society*, *6*(1), 1–12. https://doi.org/10.1186/s13705-016-0080-1

Bouteraa, M., Bin-Nashwan, S. A., Al-Daihani, M., Dirie, K. A., Benlahcene, A., Sadallah, M., Zaki, H. O., Lada, S., Ansar, R., Fook, L. M., & Chekima, B. (2024). Understanding the diffusion of AI-generative (ChatGPT) in higher education: Does students' integrity matter? *Computers in Human Behavior Reports*, *14*(December 2023), 100402. https://doi.org/10.1016/j.chbr.2024.100402

Broadhurst, K., Holt, K., & Doherty, P. (2012). Accomplishing parental engagement in child protection practice?: A qualitative analysis of parent-professional interaction in pre-proceedings work under the Public Law Outline. *Qualitative Social Work*, *11*(5), 517–534. https://doi.org/10.1177/1473325011401471

Chen, K. C., Leach, M., Black, M. J., Tesfamichael, M., Kemausuor, F., Littlewood, P., Marker, T., Mwabonje, O., Mulugetta, Y., Murphy, R. J., Diaz-Chavez, R., Hauge, J., Saleeby, D., Evans, A. W., & Puzzolo, E. (2021). Biolpg for clean cooking in sub-saharan africa: Present and future feasibility of technologies, feedstocks, enabling conditions and financing. *Energies*, *14*(13). https://doi.org/10.3390/en14133916

Creswell, J. W. (2014). *Research Design Qualitative, Quantitative and Mixed Approaches* (Fourth edi).

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *Management Information Systems Research Center, University of Minnesota*, *13*(3), 319–340. https://doi.org/10.5962/bhl.title.33621

Dönmez-Turan, A., & Kir, M. (2019). User anxiety as an external variable of technology acceptance model: A meta-analytic study. *Procedia Computer Science*, *158*, 715–724. https://doi.org/10.1016/j.procs.2019.09.107

Farahani, H. A., Rahiminezhad, A., Same, L., & Immannezhad, K. (2010). A comparison of Partial Least Squares (PLS) and Ordinary Least Squares (OLS) regressions in predicting of couples mental health based on their communicational patterns. *Procedia - Social and Behavioral Sciences*, *5*, 1459–1463. https://doi.org/10.1016/j.sbspro.2010.07.308

Fedorko, I., Bacik, R., & Gavurova, B. (2021). Effort expectancy and social influence factors as main determinants of performance expectancy using electronic banking. *Banks and Bank Systems*, *16*(2), 27–37. https://doi.org/10.21511/bbs.16(2).2021.03

Gianvenuti, A., Bedijo, N. G., Jalal, R., Hitimana, L., Walter, S., Linhares-Juvenal, T., & Xia, Z.

(2022). Woodfuel Consumption in Refugee Hosting Areas and Its Impact on the Surrounding Forests—The Case of Uganda. *Forests*, *13*(10). https://doi.org/10.3390/f13101676

Gould, C. F., & Urpelainen, J. (2018). LPG as a clean cooking fuel: Adoption, use, and impact in rural India. *Energy Policy*, *122*(July), 395–408. https://doi.org/10.1016/j.enpol.2018.07.042

Gupta, A., Vyas, S., Hathi, P., Khalid, N., Srivastav, N., & Spears, D. (2019). *Persistence of solid fuel use despite increases in LPG ownership : New survey evidence from rural north India*. *55*(3). https://riceinstitute.org/research/persistence-of-solid-fuel-use-despite-increases-in-lpg-ownership-new-survey-evidence-from-rural-north-india/

Halford, A., Gaura, E., Bhargava, K., Verba, N., Brusey, J., & Nixon, J. (2022). Off the boil? The challenges of monitoring cooking behaviour in refugee settlements. *Energy Research and Social Science*, *90*(April), 102603. https://doi.org/10.1016/j.erss.2022.102603

Hassan, H. E., & Wood, V. R. (2020). Does country culture influence consumers' perceptions toward mobile banking? A comparison between Egypt and the United States. *Telematics and Informatics*, *46*(November 2019), 101312. https://doi.org/10.1016/j.tele.2019.101312

Health Effects Institute. (2019). State of Global Air 2019. *Health Effects Institute.*, 24. https://doi.org/https://www.stateofglobalair.org/sites/default/files/soga_2019_report.pdf

Hsu, E., Forougi, N., Gan, M., Muchiri, E., Pope, D., & Puzzolo, E. (2021). Microfinance for clean cooking : What lessons can be learned for scaling up LPG adoption in Kenya through managed loans ? *Energy Policy*, *154*(April), 112263. https://doi.org/10.1016/j.enpol.2021.112263

Kar, A., & Zerriffi, H. (2018). From cookstove acquisition to cooking transition: Framing the behavioural aspects of cookstove interventions. *Energy Research and Social Science*, *42*(February), 23–33. https://doi.org/10.1016/j.erss.2018.02.015

Karanja, A., & Gasparatos, A. (2019). Adoption and impacts of clean bioenergy cookstoves in Kenya. *Renewable and Sustainable Energy Reviews*, *102*(June 2018), 285–306. https://doi.org/10.1016/j.rser.2018.12.006

Karanja, A., & Gasparatos, A. (2020). Adoption of improved biomass stoves in Kenya: A transect-based approach in Kiambu and Muranga counties. *Environmental Research Letters*, *15*(2). https://doi.org/10.1088/1748-9326/ab63e2

Khanwilkar, S., Gould, C. F., DeFries, R., Habib, B., & Urpelainen, J. (2021). Firewood, forests, and fringe populations: Exploring the inequitable socioeconomic dimensions of Liquified Petroleum Gas (LPG) adoption in India. *Energy Research & Social Science*, *75*, 102012. https://doi.org/10.1016/J.ERSS.2021.102012

Krejcie, R., V.Morgan, & W., D. (1970). "Determining sample Size for Research Activities", Educational and Psychological Measurement. *International Journal of Employment Studies*, *18*(1), 89–123.

Kudiwa, A. E. (2024). Technology Adoption by Rural Women: A Unified Theory of Acceptance and Use of Technology (UTAUT2) Analysis. *Texila International Journal of Academic Research*, *11*(2). https://doi.org/10.21522/tijar.2014.11.02.art016

Lai, P. (2017). the Literature Review of Technology Adoption Models and Theories for the Novelty Technology. *Journal of Information Systems and Technology Management*, *14*(1), 21–38. https://doi.org/10.4301/s1807-17752017000100002

Lu, Y., Zhou, T., & Wang, B. (2009). Exploring Chinese users' acceptance of instant messaging

using the theory of planned behavior, the technology acceptance model, and the flow theory. *Computers in Human Behavior*, *25*(1), 29–39. https://doi.org/10.1016/j.chb.2008.06.002

McCord, M. (2007). Technology acceptance model. *Handbook of Research on Electronic Surveys and Measurements*, 306–308. https://doi.org/10.4018/978-1-59140-792-8.ch038

Mishra, P., Pandey, C. M., Singh, U., Gupta, A., Sahu, C., & Keshri, A. (2019). Descriptive statistics and normality tests for statistical data. *Annals of Cardiac Anaesthesia*, *22*(1), 67–72. https://doi.org/10.4103/aca.ACA_157_18

Ochieng, C. A., Zhang, Y., Nyabwa, J. K., Otieno, D. I., & Spillane, C. (2020). Household perspectives on cookstove and fuel stacking: A qualitative study in urban and rural Kenya. *Energy for Sustainable Development*, *59*, 151–159. https://doi.org/10.1016/j.esd.2020.10.002

Osiolo, H. H. (2021). Cook stove technology adoption: Evidence from Kenya. *Energy for Sustainable Development*, *63*, 133–144. https://doi.org/10.1016/j.esd.2021.06.004

Pattanayak, S. K., Jeuland, M., Lewis, J. J., Usmani, F., Brooks, N., Bhojvaid, V., Kar, A., Lipinski, L., Morrison, L., Patange, O., Ramanathan, N., Rehman, I. H., Thadani, R., Vora, M., & Ramanathan, V. (2019). Experimental evidence on promotion of electric and improved biomass cookstoves. *Proceedings of the National Academy of Sciences of the United States of America*, *116*(27), 13282–13287. https://doi.org/10.1073/pnas.1808827116

Puzzolo, E., Cloke, J., Parikh, J., Evans, A., & Pope, D. (2020). National scaling up of LPG to achieve SDG7: Implications for Policy, Implementation, Public Health and Environment. In *MECS Modern Energy Cooking Services* (Vol. 20, Issue 1).

Puzzolo, E., Fleeman, N., Lorenzetti, F., Rubinstein, F., Li, Y., Xing, R., Shen, G., Nix, E., Maden, M., Bresnahan, R., Duarte, R., Abebe, L., Lewis, J., Williams, K. N., Adahir-Rohani, H., & Pope, D. (2024). Estimated health effects from domestic use of gaseous fuels for cooking and heating in high-income, middle-income, and low-income countries: a systematic review and meta-analyses. *The Lancet Respiratory Medicine*, *12*(4), 281–293. https://doi.org/10.1016/S2213-2600(23)00427-7

Rizkalla, N., Tannady, H., & Bernando, R. (2023). Analysis of the influence of performance expectancy, effort expectancy, social influence, and attitude toward behavior on intention to adopt live.on. *Multidisciplinary Reviews*, *6*(Special Issue). https://doi.org/10.31893/multirev.2023spe017

Shupler, M., O'Keefe, M., Puzzolo, E., Nix, E., Anderson de Cuevas, R., Mwitari, J., Gohole, A., Sang, E., Čukić, I., Menya, D., & Pope, D. (2021). Pay-as-you-go liquefied petroleum gas supports sustainable clean cooking in Kenyan informal urban settlement during COVID-19 lockdown. *Applied Energy*, *292*(November 2020). https://doi.org/10.1016/j.apenergy.2021.116769

Troncoso, K., Segurado, P., Aguilar, M., & Soares, A. (2019). Adoption of LPG for cooking in two rural communities of Chiapas , Mexico. *Energy Policy*, *133*(December 2018), 110925. https://doi.org/10.1016/j.enpol.2019.110925

UBOS-UNHS. (2020). *Uganda National Survey Report 2019/2020 Released – Uganda Bureau of Statistics*. https://www.ubos.org/uganda-national-survey-report-2019-2020-released/

UNHCR. (2023). *Assessment report on Pressure Cooker Use and LPG Refill Cycle Adjustment* (Issue April).

USAID. (2023). *Energy for Household Uses in Refugee Settlements in Uganda*. https://ulearn-uganda.org/wp-content/uploads/2024/01/HUE-Desk-review-final-v3_compressed.pdf

Utomo, P., Kurniasari, F., & Purnamaningsih, P. (2021). The Effects of Performance Expectancy, Effort Expectancy, Facilitating Condition, and Habit on Behavior Intention in Using Mobile Healthcare Application. *International Journal of Community Service & Engagement*, *2*(4), 183–197. https://doi.org/10.47747/ijcse.v2i4.529

Venkatesh, V., & Davis, F. D. (2000). Theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. *Management Science*, *46*(2), 186–204. https://doi.org/10.1287/mnsc.46.2.186.11926

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information: Towar a Unified View. *MIS Quarterly*, *27*(3), 425–478. https://www.jstor.org/stable/30036540

Venkatesh, V., Thong, J. Y. L., & Xu, X. (2016). Unified theory of acceptance and use of technology: A synthesis and the road ahead. *Journal of the Association for Information Systems*, *17*(5), 328–376. https://doi.org/10.17705/1jais.00428

Weisberg, J. F. S. (1992). Robust Regression (ROBUST). In *Mathematical Algorithms for Linear Regression* (pp. 193–206). https://doi.org/10.1016/b978-0-12-656460-0.50009-4

WLPGA. (2015). *Cooking with gas : How children in the developing world benefit from switching to LPG* (Issue September).

WLPGA. (2017). Guidelines for Good Industry Practices LPG Cylinder Filling. In *Neuilly-sur-Seine, France* (Vol. 1, Issue 7). https://www.wlpga.org

WLPGA. (2018). *The Socioeconomic Impact of Switching To Lpg for Cooking*.

World Bank, & FAO. (2020). *Assessment of Forest Resource Degradation and Intervention Options in Refugee-Hosting Areas of Western and Southwestern Uganda*. *February*, 92.

Zhou, T., Lu, Y., & Wang, B. (2010). Integrating TTF and UTAUT to explain mobile banking user adoption. *Computers in Human Behavior*, *26*(4), 760–767. https://doi.org/10.1016/j.chb.2010.01.013