Human Behavior, Development and Society
E-ISSN 2651-1762, Vol 23 No 2, August 2022

Acceptance of Rooftop Solar Technology in Kenya: A Solar Adoption Model for the Main Electricity Grid

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Date Received: 4 August 2021 Revised: 12 October 2021 Accepted: 14 October 2021

Abstract

Amongst renewable technologies, solar power has the highest potential as a substitute energy generation option to fossil fuels. However, adoption of rooftop solar technology is still comparatively low. Thus, this paper examined acceptance of rooftop solar technology in Kenya using the Technology Acceptance Model 3 framework. A survey was conducted (N = 402) in two regions of the Kenyan coast, which receive more than 2,000 peak sunlight hours annually. Using Structural Equation Modelling, the analysis revealed self-efficacy, anxiety, occupational relevance, perception of external control, and perceived enjoyment positively influenced perceived ease of use and perceived usefulness. These factors also influenced behavioural intentions and indirectly influenced the actual adoption of rooftop solar technology. The study showed a significant impact of perceived ease of use and perceived usefulness on behavioural intentions towards adoption, which guarantees a reliable energy source and income generation. A majority of respondents (67%) planned to adopt the technology due to its perceived benefits. Solar companies could use these factors to target new niche markets.

Keywords: *Renewable energy, rooftop solar, usefulness, behavioural intention*

Background

Energy plays a major role in development and improvement of both social and economic activity. However, much of the energy produced and consumed is done in ways that cannot be sustained, let alone be increased (Bilgen et al., 2008). The harmful nature and unsustainability of energy generation using fossil fuels is well known (Ahmad et al., 2017). The Intergovernmental Panel on Climate Change (IPCC) recommended the use of renewable fuels for electricity generation to alleviate these problems currently experienced by reliance on fossil fuel (IPCC, 2011). This will ensure the world uses clean energy for electricity production and fulfils the growing demand for energy consumption (Von Borgstede et al., 2013). The use of photovoltaics (PV) is an attractive option due to its environmentally friendly technology. It represents a system that allows homeowners to produce, consume, and distribute electricity in a cost-efficient way involving less pollution, thereby reducing climate change effects. The only requirement is sunlight (Macias & Ponce, 2006). Kenya has a rich market for commercial PV solar, having an installed capacity of around 16 megawatts (Ondraczek, 2014). This represents around 320,000 rural households, or 4.4% of the rural population who were connected to solar systems in 2010 (Lay et al., 2013). Renewable solar PV energy has existed in Kenya since the 1970s. This paper focuses on finding the causes of low-level of adoption of Feed-in Tariff (FiT) rooftop solar PV technology, a source of clean electricity and an economic empowerment tool for the people.

Research Objectives

This study's objectives were first, to explore the impact of social influence (subjective norms and image) and cognitive instrumental factors (occupational relevance, result demonstrability, and output quality) on perceived usefulness. Second, to examine the impact of cognitive (self-efficacy, anxiety, perception of external control) and adjustment factors (perceived enjoyment, objective usefulness) on perceived ease of use. And third, to investigate how perceived usefulness (PU) and perceived ease of use (PEOU) influence behavioural intentions towards adopting rooftop solar technology.

Literature Review

Renewable energy technology is a broad subject that fits different contexts, including wind energy, geothermal energy, hydropower, solar energy, and biogas. This study investigated rooftop

solar PV electricity that permits the use of a renewable energy resource at a low level, but is not limited to this use. The technology enables consumers to produce, store, and distribute excess energy for economic benefit. With proper policy structures and goodwill from the government, such technologies can aid professional consumers to become more cost effective and major industry players. Solar PV is a technology with high environmental friendliness and sustainability. In recent years, research has shown a significant increase from kilowatts to megawatts of electricity produced by PV systems. This indicates the viability of the technology as a reliable power generation source (Ahmad et al., 2017). A developed country like Germany offers a good example of the reliability of solar PV technology, as 4% of total electricity demand (32 gigawatts) came from the solar PV technology in 2013 (International Energy Agency, 2013). Kenya, like many other developing countries in Africa, faces an ever-increasing challenge of upgrading and expanding the electricity generation capacity and grids to support the growing connectivity demands and development of the economy. Solar energy, according to the IPPC, has enormous potential and can even match major energy sources like wind generation by the year 2050 (Edenhofer et al., 2011).

Relationship of Relevant Variables and Hypotheses

Davis et al. (1989) developed the Technology Acceptance Model (TAM) theory with the intention of determining the factors that influenced users to adopt a technology. The TAM model has two main variable factors—perceived usefulness and perceived ease of use. Due to limitations of the initial TAM model, Davis and Venkatesh (2000) developed the TAM2 model, which included perceived usefulness and usage intentions as the main factors in social influence and cognitive instrumental processes. Eventually this model presented further limitations, which led to the introduction of TAM3 by Venkatesh and Bala (2008). The TAM3 provides a robust structure used to explore a model's constructs when determining users' intended adoption of different technologies.

The conceptual framework for this study is shown on the following page in Figure 1.

Social Influence and Perceived Usefulness

The social influence processes in TAM3 are represented by the perceived usefulness construct, subjective norms, and image determinants. Shin (2010) found subjective norms to have a strong significance on perceived usefulness. Subjective norms and image constructs posit a positive influence on perceived usefulness through the processes of internalization and identification respectively (Venkatesh & Bala, 2008). Subjective norms, in the context of this study, is the extent to which individuals perceive that people in their circle of influence consider or reject the use of FiT rooftop solar technology. This study also defines image as the way people perceive that the usage of FiT solar technology will enhance their status in their social circles. The following hypotheses were tested.

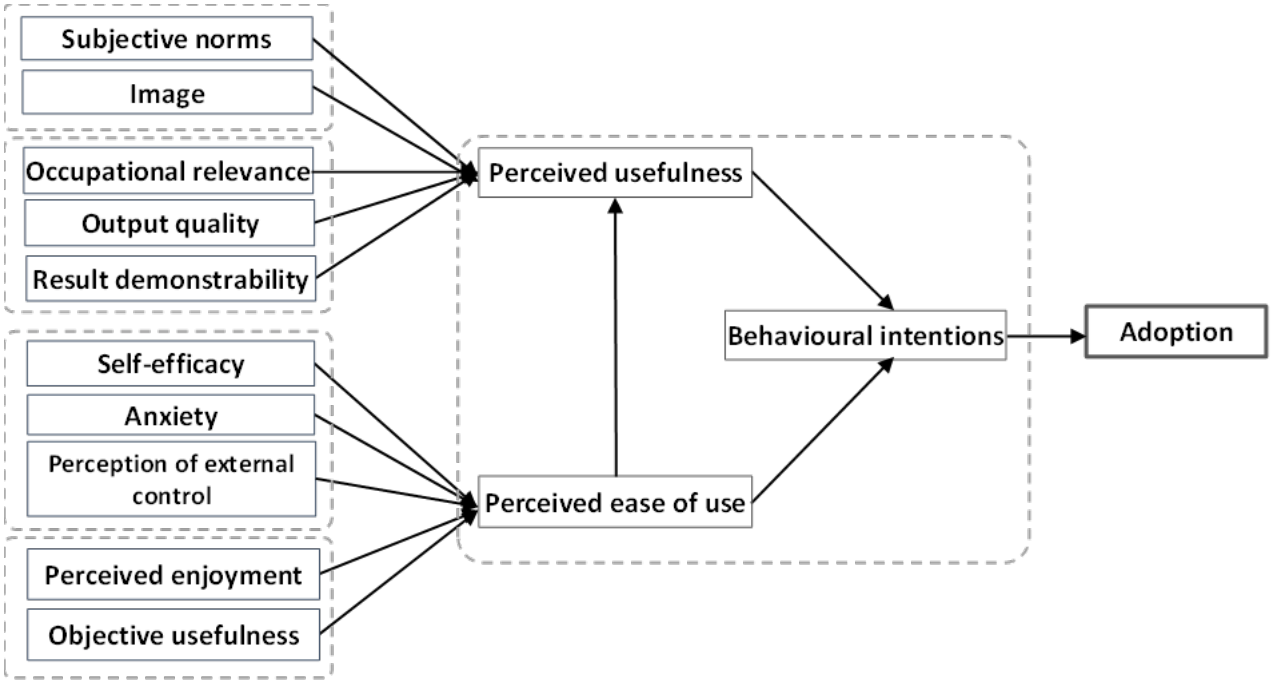
H_1: Subjective norms will have a positive influence on perceived usefulness.
H_2: Image will have a direct positive influence on perceived usefulness.

Cognitive Process and Perceived Usefulness

Users "form judgment in part by cognitively comparing what a system is capable of doing with what they need" (Venkatesh & Davis, 2000). Perceived ease of use and result demonstrability would have a positive direct influence on perceived usefulness. Job relevance and output quality will have a moderating effect on perceived usefulness, such that the higher the output quality, the stronger the effect that job relevance will have on perceived usefulness (Venkatesh & Davis, 2000). Occupational relevance in this study is the extent to which FiT rooftop solar technology can be looked at as a work opportunity or a business activity. Output quality in the context of this research is the extent to which people believe that the FiT rooftop solar technology will be able to perform its required tasks well at their homes. Based on the FiT rooftop solar technology, result demonstrability is the point where a person believes the effects of using the technology are tangible, observable, and communicable. The following hypotheses were tested.

H_3: Occupational relevance will have a direct positive influence on perceived usefulness.
H_4: Output quality will have a direct positive influence on perceived usefulness.
H_5: Result demonstrability will have a direct positive influence on perceived usefulness.

Figure 1 *Conceptual Framework*



Source. Adapted from Technology Acceptance Model 3 (TAM3) (Venkatesh & Bala, 2008)

Cognitive Process and Perceived Ease of Use

Venkatesh (2000) debated that individuals will form early perceptions of perceived ease of use of a system based on self-efficacy, computer anxiety, and perceptions of external control regarding computers and computer use. Increasing levels of control by an individual are through accessibility to relevant resources and knowledge (Barranis, 2011). A computer usage study by Compeau and Higgins (1995) theorised that computer anxiety strongly influenced perceived ease of use of that technology. To contextualise self-efficacy to this study, it is the extent to which a person controls beliefs about personal ability to use FiT rooftop solar technology. Anxiety in this research is an individual's extent of nervousness when faced with use of FiT rooftop solar technology for the first time. Perception of external control is the extent to which a person believes that organizational and technical resources exist to support the use of FiT rooftop solar technology. Hence, it was hypothesised that:

H_6: Self-efficacy has a positive influence on the perceived ease of use.
H_7: Anxiety has a positive influence on the perceived ease of use.
H_8: Perception of external control has a positive influence on the perceived ease of use.

Related Adjustments on Perceived Ease of Use

The factors of related adjustments—perceived enjoyment and objective usability—were considered by Venkatesh (2000) to play a role in determining perceived ease of use after a user gains experience with the new system. The significance of perceived ease of use involving other technologies is relevant, and several examples will be given. Teo et al. (1999) perceived that enjoyment was an important factor affecting Internet usage; this was due to the perceived ease of use construct, which was the most important motivator. Moon and Kim (2001) included playfulness into the TAM regarding Internet use, which theorized the positive influence of perceived ease of use on playfulness. Perceived enjoyment in the context of this study is the extent to which a user expresses gratification associated with using FiT rooftop solar technology. Objective usefulness in this research

is defined as a comparison of FiT rooftop solar technology with other energy technology sources based on the actual level of effort required to accomplish tasks. It was hypothesised that:

H_9: Perceived enjoyment has a positive influence on the perceived ease of use.
H_{10}: Objective usefulness has a positive influence on the perceived ease of use.

Perceived Ease of Use and Perceived Usefulness

Perceived ease of use influenced perceived usefulness in a mobile-based application adoption study in Germany (Gurtner et al., 2014). A study on healthcare information systems in Taiwan by Pai and Huang (2011) established the influence of perceived ease of use on perceived usefulness. Lederer et al. (2000) studied the effects of PU and PEU on behavioural intentions and found a positive effect on PU. Perceived ease of use in this study is the straightforwardness with which FiT rooftop solar technology is usable or integrated into daily tasks. It was hypothesised that:

H_{11}: Perceived ease of use will have a positive effect on perceived usefulness.

Perceived Ease of Use and Behavioural Intentions

Empirical studies by Agarwal and Karahanna (2000) and Shen and Chiou (2010) showed that PEOU was a predominant determinant of intention to adopt. PEOU also influenced behavioural intentions for those with previous experience in e-commerce settings (Sun et al., 2010). However, in some studies, perceived ease of use did not influence intent (Halilovic & Cicic, 2015). In the original extended TAM model by Davis et al. (1989), PEOU did not directly influence adoption intention. In this research it was hypothesised that:

H_{12}: Perceived ease of use will have a positive effect on behavioural intentions.

Perceived Usefulness on Behavioural Intentions

Davis et al. (1989) theorised that perceived usefulness of information technology played a significant role in understanding the motivation in accepting or rejecting a technology. Perceived usefulness influenced the intention to use mobile Internet on smartphones by doctors (Park & Chen 2007). Perceived usefulness also influenced a positive attitude towards mobile banking in Sudan (Mansour et al., 2016). In the context of this study, it refers to the extent of apparent applicability or practical worthiness of the FiT rooftop solar technology to the user. It was hypothesised that:

H_{13}: Perceived usefulness will have a positive effect on behavioural intentions.

Behavioural Intentions and Adoption

Davis et al. (1989) found that behavioural intention to adopt a system had a positive and significant effect on actual usage. Turner et al. (2010) analysed 79 empirical studies and found that intention is a significant determinant of actual adoption compared to the other TAM constructs. Actual use was represented by intention to use when a technology was still in the developmental stage and when the research objective was to predict future use (Williams et al., 2014). The behavioural intention construct in this research was defined as the likelihood of a person to install/use or not install/use solar FiT technology. It was thus hypothesised that:

H_{14}: Intention will have a direct positive influence on adoption.

Methodology

In this research, a structured questionnaire was adapted and further developed to collect data using face-to-face interviews. The questionnaire consisted of three sections. The first section was an introduction to the research, followed by demographic questions, and the final part contained 40 items aimed to measure each construct of the study's thirteen variables. The questions were answered using a seven-point Likert scale ranging from 1-*Strongly Disagree* to, 7-*Strongly Agree*. The questionnaire was revised using Item-Objective Congruence assessment for content validity according to expert opinion. A pilot survey was then conducted on 30 respondents and the questionnaire was refined using Cronbach's Alpha reliability analysis for internal consistency and Exploratory Factor

Analysis for validity. A random sampling method was used for data collection (*N* = 450). Questionnaires were given to homeowners in the Kilifi and Mombasa regions of Kenya for the main study. There was an 89% response rate. A descriptive analysis was performed to give respondents' demographic information and a reliability test of the scale items was completed to measure all variables. Then a descriptive analysis of the questionnaire was undertaken using Confirmatory Factor Analysis (CFA) for discriminant validity and convergent validity in the model measurements (Hair et al., 2010). Finally, structural equation modelling (SEM) analysis was used to test the relationships among the variables.

Results and Analysis

Males accounted for 57% of respondents, and the remainder were females. In terms of location, 52% were from Kilifi and 48% from Mombasa. Respondents aged between 35 and 44 years were the largest group (*n* = 122), while the smallest group (24) were those 65 years and older. For expenses on energy consumption, the monthly expenditure group of Kenyan Shilling 1,000 and below was the largest with 57% of total participants. In terms of solar usage, 22% of households had installed solar in their homes, while the remainder had not. A total of 156 respondents indicated a desire to have the technology and to sell the energy generated. In terms of priorities to consider when adopting solar technology, 54% of respondents factored cost of the technology as their first option, followed by the stakeholders involved, and neighbours were least in their list of priorities. Trust was the top priority of 20% of the population studied, followed by the cost of the technology and then their neighbours.

Before applying SEM, the reliability and validity of all variables was checked using Cronbach Alpha, composite reliability (CR), and AVE (Table 1). All items included in the current measurement model showed acceptable factor loadings. Furthermore, the Cronbach Alpha and CR values against all these variables were > .70. Hair et al. (2019) theorised that a value greater than .60 could be regarded as a satisfactory level for internal consistency, even though a value of .70 was preferred. This means that both of these indicators met these thresholds. Hence, all variables included in the study showed excellent reliability. Besides reliability, the validity of each variable was checked to determine its internal consistency. The AVE values against all variables of the study were > .50; this showed the convergent validity of each variable. The above values indicate high convergent validity for all constructs (Zaltman & Burger, 1975).

Confirmatory Factor Analysis

Confirmatory factor analysis was completed on the data. Information was categorized according to perceived usefulness, perceived ease of use, and behavioural intention (refer to Figure 1). Table 1 below shows the analysis results. All indicators of model fitness met their respective threshold in the TAM3 model. The χ^2/df for the current model was < 5, *p* is < .05, CFI was > .90, GFI was also > .90, and RMSEA was < .08. All these indicators were showing excellent values meaning that the current measurement model displayed excellent fitness. Previous studies (Baumgartner & Homburg 1996; Doll et al. 1994; Hu & Bentler 1999; MacCallum et al. 1996; and Savci & Griffiths 2019) suggested that the accepted values for these indices are: χ^2/df is < 5; the value of GFI is > .90, and RMSEA < .05, and acceptable up to .08 as a good fit, which corresponds with previous research (Hair et al., 1998). GFI Values of just above .80 are acceptable for goodness of fit, as supported by (Doll et al., 1994).

Table 1 *Model of Fit Indices*

Measurement Models	χ^2/df	***p***	**Chi-Square (χ^2)**	**CFI**	**GFI**	**RMSEA**	***df***
Criteria	≤ 5	< .05	≤ 1	≥ .90	≥ .90	≤ .08	
PU Model	1.569	.003	98.847	.987	.968	.038	63
PEOU Model	2.311	.000	201.087	.973	.939	.057	87
BU Model	2.608	.000	146.067	.973	.950	.063	56
SEM Model	2.352	.000	1458.041	. 915	. 852	.058	620

Note. GFI = Goodness-of-Fit Index; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; χ2/*df* = Chi-Square; *df* = degree of freedom

Hypotheses Testing

The critical ratios of individual hypotheses should exceed the cut off level of 1.96, with a *p*-value at levels < .05 as well. This is standard practice for statistical significance testing (Chin, 1998). Results obtained in the analysis supported eleven hypotheses (H_3, H_6, H_7, H_8, H_9, H_{11}, H_{12}, and H_{13}, H_{14}) and are shown in Table 2.

Table 2 *Summary of Testing of Hypotheses*

Hypothesis	Path			Estimate	*SE*	CR	*p*	Decision
H_1	Subjective norms	→	Perceived usefulness	.132	.089	1.485	.137	Rejected
H_2	Image	→	Perceived usefulness	.041	.047	0.871	.384	Rejected
H_3	Occupational relevance	→	Perceived usefulness	.132	.049	2.673	.008	Accepted
H_4	Output quality	→	Perceived usefulness	.102	.069	1.473	.141	Rejected
H_5	Result demonstrability	→	Perceived usefulness	.193	.105	1.841	.066	Rejected
H_6	Self-efficacy	→	Perceived ease of use	.085	.041	2.062	.039*	Accepted
H_7	Anxiety	→	Perceived ease of use	.08	.036	2.219	.027*	Accepted
H_8	Perception of external control	→	Perceived ease of use	.478	.069	6.698	***	Accepted
H_9	Perceived enjoyment	→	Perceived ease of use	.133	.053	2.487	.013*	Accepted
H_{10}	Objective usefulness	→	Perceived ease of use	.151	.084	1.793	.073	Rejected
H_{11}	Perceived ease of use	→	Perceived usefulness	.293	.041	7.206	***	Accepted
H_{12}	Perceived ease of use	→	Behavioural intentions	.413	.068	6.114	***	Accepted
H_{13}	Perceived usefulness	→	Behavioural intentions	.528	.107	4.924	***	Accepted
H_{14}	Behavioural intention	→	Adoption	.272	.039	6.913	***	Accepted

Note. * = *p*-value < .05, ** *p*-value < .01, *** *p*-value < .001; *SE* = Standard coefficient; CR = Critical ratio

Discussion

The correlational study aimed to determine the influence of factors involved in the adoption of rooftop solar PV technology in Kenya (Jaradat & Al-Mashaqba, 2014). The results are analysed below; the hypotheses that were supported are discussed first.

H_3: Occupational relevance will have a direct positive influence on perceived usefulness.

As previously suggested (Venkatesh & Davis, 2000), the formation of mental calculations of the match between important work goals and the consequences of performing job tasks when using a system helps in creating the perception of usefulness in the adoption of a technology. It is important to note that more than a third of the respondents prioritised the sale of energy first when deciding to adopt it. An affordable price and understanding of stakeholders' motivation will create occupational relevance for a technology (Huang, & Kao, 2012).

H_6: Self-efficacy has a positive influence on the perceived ease of use.

A study by Venkatesh (2000) showed that self-efficacy had a positive and significant effect on perceived ease of use, but users relaxed these judgments after increasing their experience with the new system. Self-efficacy had a significant direct effect on the perceived ease of use to adopt rooftop solar PV technology according to the study results. Participants believed they had control regarding their personal ability to operate the rooftop solar PV technology. They also perceived it as a technology that was easy to use (Huang, & Kao, 2012; Yang, 2010). With a youthful population of 25 to 44 years

(54% of all respondents), the data indicated that an energetic youthful population was enthusiastic about trying new ideas and technologies.

$H_{7:}$ Anxiety has a positive influence on the perceived ease of use.

Elasmar and Carter (1996) theorised that computer anxiety would have a strong influence on the perceived ease of use of this new technology, which agrees with the results of the present study which showed a positive impact of anxiety on PEOU. This increased their probability of adopting the technology as theorised in previous research (Jaradat & Al-Mashaqba, 2014). The positive influence of anxiety on the perceived ease of use of the technology was possibly because a large number of respondents were between the ages of 25 and 44, and had a positive perception of external control on the perceived ease of use of the rooftop solar technology.

$H_{8:}$ Perception of external control has a positive influence on the perceived ease of use.

External control is an individual's awareness of the availability of resources and knowledge that is necessary for the performance of a specific task (Ajzen & Fishbein, 1980). Hence, increasing levels of control by an individual are through accessibility to certain relevant resources and knowledge, as hypothesised by Barranis (2011). The perception of external control showed a significant and direct effect on the perceived ease of use to adopt the rooftop solar technology. On account of the dense population and urbanisation, companies have opened branches closer to the people. This has boosted their confidence in terms of availability of resources to implement the technology in their homes.

$H_{9:}$ Perceived enjoyment has a positive influence on the perceived ease of use.

Perceived enjoyment had a positive influence on perceived ease of use. The research did not find evidence for the direct impact of the analysed constructs regarding perceived enjoyment with perceived ease of use. This result implied that individuals not only think that enjoyment did not represent the core motivation associated with using rooftop solar, but also they perceived it as easy to operate. Research by Mills et al. (2011) suggested that "in several developing countries with limited resources, enjoyment is unlikely to be a priority." This was true, since 78% of respondents had no solar in their homes, and 39% wanted to adopt solar for the purpose of selling energy. This gives supports to Mills' research, which theorised the unlikelihood of enjoyment being a priority.

H_{11}, H_{12} and H_{13}: The impact of PEOU on PU, PEOU on behavioural intentions, and PU on BI.

PEOU was shown to influence PU in a mobile-based application adoption study in Germany (Gurtner et al., 2014). Another study in Iran on acceptance of a localized operating system found that a positive relationship existed between PEOU and PU (Saghafi et al., 2017). The results of the present study supported these findings by showing a strong influence of PEOU on PU. A high number of respondents were of a youthful age, between 25 and 44, and a bigger percentage of these youths preferred to adopt solar for selling the energy. This resulted in a positive influence of the occupational relevance variable on PU. When this is coupled with the positive self-efficacy and anxiety they have on the perceived ease of use of the technology, this contributed immensely to the positive significance PEOU had on PU of the technology. Research by Agarwal and Karahanna (2000) and Shen and Chiou (2010) indicated that PEOU is a major determinant of intention to adopt a technology. The results of the present study were aligned with this finding, as PEOU had a positive impact on behavioural intention. With the promise of business establishment from the adoption of this technology, and respondent self-efficacy positively influencing their PEOU of the technology, the PEOU variable greatly influenced participants' behavioural intentions to adopt. Previous research showed PU influenced intention to use in a study investigating the mobile Internet use of smartphones by doctors (Park & Chen, 2007). Our study results aligned with this previous research. The occupational relevance on the technology's PU indirectly influenced PU on behavioural intentions in a major way. The PEOU variable significantly and directly influenced the behavioural intentions to use, and indirectly influenced actual adoption. Moreover, it had a significant and indirect effect on both behavioural intentions to use and actual adoption through perceived usefulness. It also had a significant positive and direct effect on

perceived usefulness of the rooftop solar technology. This implies that those who consider rooftop solar to be useful, improve performance, increase productivity, and enhance effectiveness also perceive it to be easy to use. “Easy to use means, it is clear and understandable and does not require a lot of mental effort to operate and use, without much effort and easy to use procedure;” this is consistent with previous research by Schierz et al. (2010) and Yang (2010).

$H_{14:}$ Behavioural intention will have a direct positive influence on adoption.

Behavioural intentions had a significant effect on actual adoption. This means that an individual’s behavioural intentions constitute an important determinant of technology adoption, which agrees with previous research (Shin, 2010). Studies have suggested that behavioural intention is a reasonable indicator of future system usage (Jackson et al., 1997). Davis et al. (1989) also found that behavioural intention has a positive significant effect on actual usage. Perceived ease of use significantly and directly influenced the behavioural intentions to use, and indirectly influenced actual adoption. Moreover, it had a significant and indirect effect on both behavioural intentions to use and actual adoption, through perceived usefulness of the rooftop solar technology.

Hypotheses that Were Not Supported

H_1: Subjective norm will have a positive influence on perceived usefulness.

The above hypothesis was rejected. This differs from a study conducted by Venkatesh and Bala (2008), which found that subjective norms had a positive influence on perceived usefulness. In our study, 156 respondents desired to adopt the technology in order to sell energy, which showed that a majority were purpose driven in their decision-making. It was noted that 54% of respondents prioritised cost of setup and stakeholders’ trust, while they valued their neighbours the least in arriving at their decision for adoption. Companies need to understand the psychological perspective of their marketing in order to influence adoption of rooftop solar PV technology.

H_2: Image will have a direct positive influence on perceived usefulness.

In a study by Nadri et al. (2018), the social influence construct, of which image is a part, was not a significant factor in influencing the acceptance of mobile health among students. This was similar to the results of this study, which showed that image had no significant effect on the perceived usefulness to adopt and use rooftop solar PV technology. Since 78% of respondents did not have solar, the mind-set of individuals made them believe that rooftop solar technology had no prestige. Image played no significant role in the present study, possibly due to the high percentage of participants who were in the youthful age group of between 25 and 44.

H_4 and H_5: Output quality and result demonstrability will have a direct positive influence on perceived usefulness.

In this study, both output quality and result demonstrability had no significant effect on the perceived usefulness to adopt rooftop solar technology, which was not in alignment with previous studies by Venkatesh and Davis (2000). Few respondents understood the output quality and result demonstrability of the solar technology, which made it hard to understand its usefulness, since the technology was not yet in operation in the study area.

H_{10}: Objective usefulness has a positive influence on the perceived ease of use.

The above hypothesis was rejected. This was at variance with Venkatesh’s (2000) conclusion. This author defined objective usefulness as a comparison of systems based on the actual level of effort required to complete a task. This means that individuals need to have two systems in operation to enable an actual comparison. With 78% of respondents not having solar, this greatly contributed to the negative outcome of objective usefulness towards perceived ease of use.

Conclusions

This study focused on using the TAM3 model to explore the factors that influenced acceptance of rooftop solar technology in Kenya. This study created an interest in study participants, especially regarding the possibility of the technology being an income generator. It was shown that 39% of participants were willing to adopt the technology as a business activity. This information will be valuable to energy companies in the country, such as Equator Energy, to better structure their marketing approach to customers with the view of creating business opportunities. The results will also help inform government and private sector partners of the need for creating or improving regulations and policies to push for an increase in the adoption of affordable solar energy in Kenya.

Theoretical Contributions

This research extends the application of the TAM3 model. The study indicates that both PEOU and PU have significance in technology adoption in Kenya, which supports the study of Venkatesh et al. (2003). These researchers found PU to be a very important factor in technology adoption. The present findings suggest that further research be done to establish more evidence on the significance of the variables on other technologies in Kenya. Previous research studies in Kenya have focussed on generation of renewable electricity using other sources like wind and geothermal power (Kiplagat et al., 2011; Lay et al., 2013). In the present study, 39% of participants intended to adopt the technology for selling energy as a business. Certain aspects were crucial in adoption, particularly the trust of stakeholders such as policymakers, relevant government ministries, and market players. Their needs must be considered in order to increase users' confidence in adopting this technology.

Managerial Implications

As technology marketers, managers might emphasise the usefulness and ease of use of technology to their customers more extensively through organising training sessions for their customers to increase awareness. Developing a positive occupational relevance regarding usefulness of a technology as a source of income generation would be helpful in informing the decision-making process of potential customers. Companies can capitalise on this by selling technology for applications other than home use. This can be actualised by investing in training their employees about customer service and in helping to re-educate their customers. The statistics of households without solar (78%) should be good news to solar companies. There is a large potential market for their businesses if they can change their market penetration tactics. This might be done by investing more in media advertising, which guarantees a wider and personal reach. To increase customers' confidence, adoption intentions, and reduce their perception of external control, companies can set up regional and local area offices to bring company support closer to their customers. They can also create mechanisms for customer feedback and involvement through suggestion boxes or writing reviews. With the growing level of interest in prosperity generation enterprises, and with 39% of respondents willing to adopt the solar technology for business purposes, the study results suggest that solar companies can be important players in the country's economic growth. They can market this idea to the government, as manufacturing and housing needs are important factors on their agenda. Companies can position themselves to be big players in the push for both economic growth and increases in the electrification rate through a rooftop solar connection that enhances and creates more private and government sector partnerships. Conducting public seminars and participating in corporate social responsibilities are good ways of encouraging these partnerships.

Limitations and Recommendations

First, the economic aspects of the technology were not included. Future studies focussing on the consumption rate in comparison to the amount of electricity generated may reflect the economic viability of the technology. Second, the research had a limited scope, for it focused on individual households, and not companies and organisations. The latter are big consumers in the market and can provide a different angle regarding outcomes following adoption. Third, future studies may compare

the impact at various regional locations receiving different sunlight hours to give a wider perspective. Finally, in future research, investigations should use a longitudinal study to obtain results that are more comprehensive with other factors, including such factors as security, cost, and trust.

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