THE INTERNATIONAL JOURNAL OF HUMANITIES & SOCIAL STUDIES

Income Level Effect of Rural Electrification on the Household Well-Being of Proprietors of Micro and Small Enterprises in Kenya

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Abstract:
The Kenyan Medium Term Plan 2008-2013 targeted an Energy Access Scale-up Program through which a million households were to be connected with reliable and affordable energy by 2013. Poverty rates in rural parts of Kenya have endlessly remained high indicating that household well-being has equally remained low. Given this scenario, an explanation necessitates studying income level effect of rural electrification on the household well-being in Kenya. The study adopted descriptive survey design, which ensured ease in understanding the insight about the problem under study. The target population for this study comprised of 914,243 proprietors of micro and small enterprises registered in Kenya by 2015. Primary data from proprietors of rural micro and small enterprises in eight counties namely; Kakamega, Bungoma, Nakuru, Busia, Bomet, Siaya, Kericho and Kirinyaga forming a sample size of 418 and a response rate of 73.4% (307 respondents) was used. Pearson correlation analysis showed that there was a general moderate positive relationship between income level effects of rural electrification and household well-being of proprietors of micro and small enterprises. Combined multiple regression analysis revealed that there was a significant positive relationship between income level effect and household well-being of proprietors of micro and small enterprises. It was concluded that income level effects have an influence on household well-being of proprietors of micro and small enterprises in Kenya. It was recommended that the Kenyan government should come up with a policy framework to include micro and small enterprises as priority areas for electrification in addition to health centers and schools.

Keywords: *Income level effects, household well-being, rural electrification, proprietors of MSEs*

1. Background to the Study

Well-being is a state of satisfaction of basic human needs and rights and a crucial pre-requisite before people can flourish and live well (Tinkler & Hicks, 2013). In 2014, 1.06 billion people still lived without access to electricity - approximately 15 percent of the global population and almost 3.04 billion people still relied on traditional biomass and kerosene for cooking and heating (IEA, 2017). The electricity access shortfall is overwhelmingly concentrated in sub-Saharan Africa (62.5 percent). In sub-Saharan Africa, 6 out of 10 people lack access to electricity (World Bank, 2017). The miserable energy access picture in sub-Saharan Africa is sadly highlighted in Table 1 which presents the regional totals of global electricity access proportions in 2014.

Region	Pop. without Electricity (Millions)	Electrification Rate (%)	Urban electrification Rate (%)	Rural electrification Rate (%)
Africa	634	45	71	28
North Africa	1	99	100	99
Sub-Saharan Africa	632	35	63	19
Developing Asia	512	86	96	79
China	0	100	100	100
India	244	81	96	74
Latin America	22	95	98	85
WORLD	1,186	84	95	71

Table 1: Global Electricity Access Rates in 2014
Source: (IEA, 2016)

Income opportunities following electrification process comprises openings for households to earn wages, salaries, profits, interest payments, rents, and other forms of earnings received in a given period of time (Grogan & Sadanand, 2013). Ahmed & Fausat (2012) indicated that following electrification, most households were involved in income diversification activities such as petty trading, mat making and tailoring. They suggest that to enhance income diversification it is important to improve rural infrastructure in terms of the provision of electricity and improving access to markets. Non-farm income provide self-insurance against likely shocks, overcome farm credit constraints and enhance farm investment, absorb labor surplus, and ultimately improve the financial well-being of households through increased total income (Hoang, Pham & Ulubasoglu, 2014).

Government of Kenya (2004a) confers that and Small Medium Enterprises (MSE) sector accounted for 30% of the GDP and for over 90% (about 500,000) of new jobs created outside agriculture in 2003. In view of this, start-up and growth of MSEs for income generation and enhanced household well-being is a key and explicit assumption of virtually every rural electrification program on the continent. A review of the Mpeketoni Electricity Project, a community-based diesel-powered micro-grid in rural Kenya, found that the use of electricity and equipment improved the productivity and incomes of local small and micro-enterprises, contributed to the mechanization of agriculture, and supported improved village infrastructure such as schools, markets and water pumps (World Bank, 2017). Rural areas remain to be the home to the bulk of Kenya's population and similarly the hub of micro and small enterprises. To seize this opportunity, Kenya has developed a national policy aimed at building the capacities of micro and small enterprises through the rural electrification projects (Abdullah & Markandyab, 2012). According to Khandker, Hussain, Rubaba and Douglas (2012), the role and intent of electrification programs is not only to provide access to electricity but also to improve the overall well-being of people.

1.1. Statement of the Problem

The average annual electricity consumption in 2014 for Kenya and United States was 167 and 12,987 kWh per capita respectively which translates to about 1.3% of U.S. per capita consumption (IEA, 2014). In Kenya, households are willing and able to pay, on average, about Ksh. 37 per kWh (US$0.53 per kWh) for improved energy services based on renewable energy resources including biomass (Kirubi *et al*., 2009). Many of the previous studies on household well-being particularly focused on individual household members such as children (Di Tommaso, 2007) or women (Waswa & Mudi, 2018; Mudi & Waswa, 2018; Mudi, Waswa & Nabwayo, 2018) or on the macro-level (Krishnakumar, 2007). Other studies on household well-being concentrated on health (Keese & Schmitz, 2014), electricity access (Khandker *et al*., 2009; Kirubi *et al*., 2009). Despite these studies and their recommendations, household well-being remains a challenge, indicating that there is still more that needs to be done. Relatively, there is limited research on the income level effects of rural electrification on household well-being of proprietors of micro and small enterprises in Kenya. This study seeks to fill this knowledge gap.

1.1.1. Objective of the Study

To examine income level effect of rural electrification on the household well-being of proprietors of micro and small enterprises in Kenya.

1.2. Research Hypothesis

There is no significant relationship between income level effect of rural electrification and the household well-being of proprietors of micro and small enterprises in Kenya.

2. Literature Review

2.1. Sustainable Livelihoods Approach

The origin of sustainable livelihood as a concept is widely attributed to Chambers and Conway (1992) in their efforts to respond to diverse realities of most rural life. Chambers and Conway presented the Sustainable Livelihood Approach (SLA) as a link of the three existing concepts of capability, equity and sustainability. The heart of sustainable livelihood in all agencies has been a link between asset - livelihood strategies - livelihood outcomes (Small, 2007).

The Sustainable Livelihoods Approach (SLA) can be used to examine the well-being of people and communities through measuring of capitals (e.g. financial, social, human, natural, and physical) and explore how their capitals relate to sustainable practices of living (Flora & Flora, 2013). Physical capital comprises the basic infrastructure such as transportation, shelter, water, energy, sanitation, communication, technology and tools (equipment) for production in which community or people are able to hunt their livelihood (Carney, 1998). To have secure livelihoods, households or individuals need to have secure access and ownership of resources such as electricity supply and income earning activities such as reserves and assets, to balance risks, alleviate shocks and meet contingencies (Franken berger & McCaston, 1998).

This study assumes that rural electrification has a high influence on rural household's ability to pursue meaningful Livelihood Strategies, to access other assets and consequently to attain well-being (Lee *et al.,* 2014). In that view the study puts electricity at the core of livelihood assets, and assumes that income level effect of rural electrification has varied influences on the pursuit of Livelihood Strategies and the ultimate achievement of well-being.

2.1.1. Income Levels and Household Well-Being

There are numerous ways in which rural electrification might affect income of newly connected households spanning from direct effects through home business activities to better job prospects in newly connected enterprises in the locality (Torero, 2015). A considerable number of research suggests that household access to electrification enhances household well-being through providing income generation opportunities, alleviating poverty, improving children's health, reducing instances of child labor, and improving status of women and girls (Grogan& Sadanand, 2013). Reliance on generators for electricity during outages can be expected to increase the cost of electricity, and the effect on cost-competitiveness is related to the proportion of total costs accounted for by electricity leading to reduced firm income (Scott, Darko, Lemma & Rud, 2014).Firms created after electrification, amongst them some highly dependent on electricity for their operations, exhibited profits that are considerably higher than non-connected firms (Peters, Vance, & Harsdorff, 2011).

Some empirical studies (Khandker *et al*. 2012; Khandker *et al.* 2013) show that electricity access boosted household employment, or income, or both, but they do not identify the actual productive activities that generated these results.
A study conducted in Bhutan by the Asian Development Bank (2010) found positive effects of electrification on non-farm income but not on farm income. Non-farm incomes of electrified households were found to be 50-72 % higher than those of non-electrified households, but these accounted for only 21-29 % of household income. Grimm, Lange, & Lay, (2011) found that tailors in Burkina Faso with access to electricity have revenues 51% higher with an improved household well-being than tailors without electricity, and attribute this to the use of electric sewing machines and longer working hours.

In Bangladesh, incomes of households in electrified areas are 12.2% higher than those of comparable households in non-electrified areas, positive effects on both farm and non-farm incomes (Khandker, 2009b). Ahmed, Buckley and Mabe (2012) showed that most households connected to electricity were involved in income diversification activities such as petty trading, mat making and tailoring. Material disadvantage, such as poor housing quality, unaffordability of a one-week holiday, and difficulty in making ends meet, is strongly associated with low household well-being (Watson, Pichler & Wallace, 2010).

In a study by Scott *et al*. (2014), data analysis in regard to costs focused on the effects of electricity insecurity on unit costs of production, as an indicator of competitiveness and firm income. World Bank Enterprise Survey datasets, which included data on total sales and costs, were analyzed to determine whether firms with different characteristics had higher unit costs when exposed to outages. The country enterprise surveys included in this analysis were for Bangladesh, Nepal, Nigeria, Pakistan, Tanzania and Uganda. The statistical analyses found that MSEs experiencing outages do not necessarily have higher unit costs of production. This finding holds for the duration as well as the number of outages, it holds when using the log of total costs, and it holds when using the ratio of total costs to (fixed) capital as the indicator of competitiveness and firm income.

Bose, Uddin & Mondal (2013) conducted a study targeting at evaluating the impact of electricity availability on the operation and productivity of MSEs in the rural areas of Bangladesh. The results were based on a study from a survey carried out in two electrified villages in Paikgacha, Khulna. The study identified favorable changes on the production costs, profit margin, development and modernization of business, women empowerment, quality of life, and human development due to the electrification.

Lipscomb *et al*. (2013) investigated the long-run effects of the expansion of electricity network in Brazil on economic development at the County level during 1960 – 2000 period. Similar to Dinkelman (2011), they both use an exogenous program placement instrument to identify the impacts. The studies found significant effects on the Counties' Human Development Index and average housing value as a proxy for enhancements in living and working conditions. They identified positive effects of electricity access on employment and income as well as literacy and school enrolment. Khandker *et al*. (2012) used a large cross-sectional household survey in Bangladesh to study effects of electricity access on income, expenditures and investments into education. They observed quite a substantial increase in income and expenditures as well as completed schooling years for both girls and boys.

3. Research Methodology

Descriptive survey design was used in this study. Descriptive survey studies are those studies which are concerned with describing the characteristics of a particular individual or groups for instance households (Kothari & Garg, 2014). This design is appropriate for this study since Zikmund (2003) note that descriptive survey research is intended to produce statistical information about the aspects of the research issue (in this case rural electrification) that may interest policy makers and MSE entrepreneurs. The target population for this study was 914,243 rural registered micro and small enterprises in Kenya. According to Kenya National Statistics Survey Report 2016, there are 1,549,576 micro and small enterprises registered in Kenya out of which 59 percent are located in rural areas (Republic of Kenya, 2016).

Systematic sampling was used to arrive at the choice of the counties based on the Contribution to National Poverty and County Ranking as shown in Table 2. Marsabit and Tana River counties ranked position 35 and 40 respectively were deliberately avoided due to perceived insecurity in the counties.

County	Total Population	Contribution (%)	Rank (Highest to lowest)
Kakamega	1,644,328	4.77	1
Bungoma	1,359,983	3.79	5
Nakuru	1,562,625	3.08	10
Busia	735,294	2.61	15
Bomet	721,873	2.18	20
Siaya	833,230	1.87	25
Kericho	737,942	1.71	30
Kirinyaga	520,585	0.79	45

Table 2: Contribution to National Poverty by County
Source: Republic of Kenya (2014)

This study therefore used a sample population of 418 respondents for data collection. This sample is most likely to be well informed about income level effect of rural electrification on the household well-being of proprietors of micro and small enterprises in Kenya. Questionnaires were administered in various counties based on the proportionate number of registered rural micro and small enterprises as shown in Table 3

County	Total Reg. MEs. (rural)	Total Reg. SEs. (rural)	Sample of MEs.	Sample of SEs.	Total
Kakamega	28,956	2,001	64	5	69
Bungoma	9,418	700	27	3	30
Nakuru	64,577	4,603	143	10	153
Busia	16,123	248	36	1	37
Bomet	7,921	339	28	2	30
Siaya	8,143	184	28	2	30
Kericho	10,035	1,483	26	4	30
Kirinyaga	17,323	500	38	1	39
Total	162,496	10,058	390	28	418

Table 3: Sample Population per County

4. Results of Diagnostic Tests

4.1. Reliability Test Results

Scale	No. Items	Cronbach's alpha	Conclusion (Reliable/Unreliable)
Income Levels	10	.855	Reliable
Household Well-Being	8	.865	Reliable

Table 4: Internal Consistency: Cronbach's Alpha Results for the Questionnaire
Source: Author (2018)

Table 4 which shows the Cronbach's alpha for all the subscales reveals that the instruments had adequate reliability for the study. Deleting any of the items would not cause improvement in the internal consistency. All the subscales had Cronbach's alpha of greater than 0.7, which is adequate (Mugenda & Mugenda, 2003).

4.1.1. Validity Test Results

Although pilot study was done to improve external validity of the instruments, internal validity of the constructs was tested by subjecting the survey data to suitability tests using the Kaiser-Meyer-Oklin measure of sampling adequacy (KMO Index) and the Bartlett's Test of Sphericity. This is a prerequisite condition for a factor analysis. Before the extraction of factors, the suitability of the questionnaire data set for factor analysis was assessed for each sub-scale and the results was summarized as in Table 5.

Subscale	Kaiser-Meyer-Olkin (KMO index)	Bartlett's Test for Sphericity		
		Approx. Chi-Square	df	Sig.
Income Levels	.878	1128.777	45	.000
Household Wellbeing	.899	910.693	28	.000

Table 5: KMO and Bartlett's Test
Source: Survey Data (2018), SPSS Analysis

The results of the Kaiser-Meyer-Oklin measure of sampling adequacy (KMO Index) and the Bartlett's Test for Spheri city for each subscale of the questionnaire are presented in Table 5. Kaiser (1974) asserts that the Kaiser-Meyer-Oklin measure of sampling adequacy index ranging > 0.6 is of adequate internal validity and is considered suitable for factor analysis. Creswell (2014) observes that Bartlett's Test of Sphericity test statistic should be less than 0.05. In the current study, the value of Bartlett's test for Sphericity is significant ($p<0.001$, $p=0.000$) for all the subscales of the questionnaire. In addition, the Kaiser-Meyer-hold Olkin indexes are all > .6 which is a threshold for sufficient for internal validity. Thus, based on the results, it was appropriate to proceed with Factor Analysis on assumption of adequate internal validity, which is an indication that all the subscales had suitable data.

4.1.2. Normality Test Results

Normality of the data were tested through the use of formal test using Kolmogorov-Smirnov and Shapiro-Wilk tests, as shown in Table 6

	Kolmogorov-Smirnov			**Shapiro-Wilk**		
	Statistic	Df	Sig.	Statistic	df	Sig.
Income Levels	.152	307	.068	.765	307	.057
Household Wellbeing	.271	307	.134	.841	307	.116

Table 6: Tests of Normality
**. This Is a Lower Bound of the True Significance*
a. Lilliefors Significance Correction

Initial tests on the variables indicate violation of normality; hence all the independent variables had to be transformed first to remove moderate skewness that was observed in the original data. Normality tests in Table 6 shows the results after transformation. Garson (2012) recommends that Shapiro-Wilk's test should be used for small and medium samples up to n = 2000. Shapiro-Wilk is comparable to the correlation between a given data and its corresponding normal scores, with S-W = 1 when their correlation is perfectly normal. This means that a significantly ($p<.05$) smaller S-W than 1 imply that the normality is not met. Hence, the data is normal when Shapiro-Wilk (S-W) >.05. It is evident from Table 6 that the variables follow normal distribution given that there were no statistical significant differences noted between the variables with their corresponding normal scores.

4.1.3. Factor Analysis Results for Household Well-being

To find out the items with greater significance to Household well-being and to examine their dimensionality on the variable. Factor Analysis using Principal Components Method (PCM) approach helped the researcher to cluster the common factors and to retain a small number of factors which had the highest influence, as explained by Oso and Onen (2009). The extraction of the factors followed the Kaiser Criterion where an eigenvalue of 1 or more indicates a unique factor. All the eight household wellbeing indicators were subjected to factor analysis which was conducted using Principal Components Method (PCM) approach. The results were presented on Table 7.

Component .	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**		
	Total.	Variance. (%)	Cumulative. (%)	Total.	Variance. (%)	Cumulative (%)
Item 1	4.181	52.264	52.264	4.181	52.264	52.264
Item 2	.762	9.528	61.792			
Item 3	.643	8.039	69.832			
Item 4	.592	7.394	77.226			
Item 5	.569	7.106	84.332			
Item 6	.483	6.034	90.366			
Item 7	.406	5.081	95.447			
Item 8	.364	4.553	100.000			
Extraction Method: Principal Component Analysis						

Table 7: Total Variance Explained for Household Well-being

Table 7 lists the eigenvalues associated with each linear component (factor) before extraction, after extraction and after rotation. Before extraction, SPSS had identified eight linear components within the data set. The eigenvalues associated with each factor represents the variance explained by that particular linear component and it is displayed in terms of percentage of variance explained. The eight measures of household well-being were subjected to factor analysis and seven (7) factors attracted coefficients of more than 0.4. Therefore, the seven (7) statements were retained for analysis. According to Rahn (2010) a factor loading equal to or greater than 0.4 is considered adequate. Further the results showed that there was only one critical factor influencing household well-being which accumulated to 52.264% of the total variance in this construct. Therefore, the component identified to have the highest influence is enhanced business income due to electrification leads to improved nutrition for households.

	Component	Communalities
Statement	1	
Enhanced business income due to electrification leads to improved nutrition for households.	.751	.565
Part of the business profit as a result of electricity use is used to improve household housing.	.744	.553
Longer opening hours in health facilities due to electricity supply enhances the level of healthcare.	.676	.457
Some of the business income gained owing to electricity use is used to buy clothing for members of the household.	.741	.549
Income from businesses enhanced as a result of electricity use helps pay school fees for members of households.	.735	.540
Income from business enhanced as a result of electrification enables proprietors to gain membership of social groups.	.694	.482
Improved profit levels due to electricity supply leads to ownership of valuable assets.	.736	.542
Improved income status provides confidence to members of a household to participate in community decision making process	.702	.493

Table 8: Rotated Component Household Well-Being Measures
Extraction Method: Principal Component Analysis
a. 1 Components Extracted

From the rotation matrix in Table 7, there was one major factor which deemed to be influencing household well-being. This factor had eight items with very high loadings and significance namely improved nutrition at 0.751, improve household housing at 0.744, enhanced healthcare at 0.676, better clothing at 0.741 and ease of school fees payment at 0.735 while gain in membership of social groups was at 0.694, ownership of valuable assets was at 0.736 and finally participating in community decision making process at 0.731. Using the factors, a scale was created using the average means of each construct. A scale of 1-5 was created and all the means of all the items in each component were analyzed. Any factor not included in this group was not included in further analysis because it was deemed to have a low mean and as such much of its influence could be explained by the other factors.

4.1.4. Factor Analysis for Income Levels

Factor Analysis was used to investigate items with greater significant to income levels and to explore their dimensionality on the variable. Principal Components Method (PCM) approach used as a method of Factor Analysis enabled the researcher to identify the common factors and to retain a small number of factors which had the highest influence. Kennedy (2010) points out that analysis of Principle Components describes interdependencies among the items of a variable with an aim of identifying few factors which explains most of the information on the variable construct. The extraction of the factors followed the Kaiser Criterion where an Eigenvalue of 1 or more indicates a unique factor. All the 10 items describing to Income Levels were put on factor analysis. The results were presented on Table 9.

Component	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**			**Rotation Sums of Squared Loadings**		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Item 1	3.198	45.680	45.680	3.198	45.680	45.680	2.482	35.460	35.460
Item 2	1.193	17.041	62.721	1.193	17.041	62.721	1.908	27.261	62.721
Item 3	.728	10.398	73.119						
Item 4	.545	7.789	80.908						
Item 5	.533	7.615	88.524						
Item 6	.417	5.959	94.482						
Item 7	.386	5.518	100.000						
Extraction Method: Principal Component Analysis									

Table 9: Total Variance Explained for Income Levels

Table 9 indicates the eigenvalues associated with each linear component (factor) before extraction, after extraction and after rotation. Before extraction, SPSS identified seven linear components within the data set. The eigenvalues associated with each factor represents the variance explained by that particular linear component and it is presented in terms of percentage of variance explained. The seven measures of income level effects were subjected to factor analysis and six (6) factors attracted coefficients of more than 0.4. Therefore, the six (6) statements were retained for analysis. According to Rahn (2010) a factor loading equal to or greater than 0.4 is considered adequate. Using factor analysis, only two factors were identified to have a significant influence on explaining characteristics of income levels with

cumulative variance of 62.721%. Only these items had an Eigen value greater than one (1) and had the significant influence on income levels characteristics, explaining 45.680% and 17.041% totaling to about 62.721% of variance on the variable as shown in Table 9. Hence, the components identified to have the highest influence are; use of electricity leads to reduction of business operation costs, and use of electricity enhances economies of scale due to enhanced use of machines.

	Component		Communalities
Statement	1	2	
• Use of electricity leads to reduction of business operation costs.	-.019	.837	.701
• Use of electricity-dependent machines and computers reduces the wage bill	.273	.795	.706
• Reliable electricity supply reduces the cost of energy.	.398	.671	.609
• Use of machines produces improved quality products and services that enhance demand.	.716	.132	.529
• Electrification leads to diversification of businesses that enhances income for households.	.754	.211	.613
• Electrification attracts more people in rural areas leading to increased demand for goods and services.	.746	.239	.613
• Availability of electricity enables value addition of agricultural products that enhances profitability.	.782	.078	.618

Table 10: Rotated Component Income Levels Measures
Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
Rotation Converged In 3 Iterations

From the rotation matrix in Table 10, there were two major factors which were believed to be influencing income levels. Factor one had four items with very high loadings and significance including value addition of agricultural products with 0.782 and increased demand for goods and services at 0.754. This factor was named Business Revenue. Factor two had high loadings on reduction of business operation costs at 0.837, and reducing wage bill with 0.795. This factor was named Business Costs. Using the factors, a scale was created using the average means of each construct. A scale of 1-5 was created and all the means of all the items in each component were analyzed. Any factor not included in this group was not included in further analysis because it was believed to have a low mean and as such much of its influence could be explained by the other factors.

4.1.5. Correlation Analysis for Income Levels and Household Well-being

To investigate whether there was any statistical significant relationship between income level effects of rural electrification and the household well-being of proprietors of micro and small enterprises in Kenya. The null hypothesis that "there is no significant relationship between income level effects of rural electrification and the household well-being of proprietors of micro and small enterprises in Kenya." was tested. The correlation analysis result was shown in SPSS output, as indicated in Table 11.

		Household Well-being
Income Levels	Pearson Correlation	.576**
	Sig. (2-tailed)	.000
	N	307

Table 11: Relationship between Income Levels Effects of Rural Electrification and Household Well-Being
***. Correlation Is Significant at the 0.01 Level (2-Tailed)*

It is evident that there was a moderate positive (r=.576, n=307, p<.05) correlation between income level effects of rural electrification and household well-being of proprietors of micro and small enterprises. The relationship was statistically significant; therefore, the hypothesis that, "*There is no significant relationship between income level effects of rural electrification and household well-being of proprietors of micro and small enterprises*" was rejected. It was therefore concluded that there is statistical significant relationship between income level effects of rural electrification and household well-being of proprietors of micro and small enterprises, with increase in income level effects of rural electrification causing an improvement in household well-being of proprietors of micro and small enterprises and vice-versa.

This finding concur with Grogan and Sadanand (2013) who posits that household access to electrification enhances household well-being through provision of income generation opportunities, alleviating poverty, improving children's health, reducing incidences of child labor, and enhancing status of the women and girls.

4.1.6. Regression Analysis of Income Level and Household Well-being

To estimate the level of influence of income level effects of rural electrification on household well-being of proprietors of micro and small enterprises, a coefficient of determination (R Square) was computed. This was done using regression analysis and the results are tabulated in Table 12.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.576[a]	.332	.330	.46088

Table 12: Model Summary on Regression Analysis of Influence of Income Levels on Household Well-Being of Proprietors of Micro and Small Enterprises
a. Predictors: (Constant), Income Levels

The model shows that income level effects of rural electrification accounted for 33.2% (R^2 = .332) of the variation in overall household well-being of proprietors of micro and small enterprises, which was a fairly large effect. However, to determine whether income level effects of rural electrification was a significant predictor of household well-being of proprietors of micro and small enterprises, Analysis of Variance (ANOVA) was computed as shown in Table 13.

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	32.180	1	32.180	151.499	.000[b]
	Residual	64.785	305	.212		
	Total	96.964	306			

Table 13: ANOVA –Influence of Income Level Effects of Rural Electrification on Household Well-Being of Proprietors of Micro and Small Enterprises
a. Dependent Variable: Household Well-Being
b. Predictors: (Constant), Income Levels

From Table 13, it can be seen that income level effects of rural electrification was a significant predictor of household well-being of proprietors of micro and small enterprises [F (1, 305) = 151.499, p < .05)]. This implies that income level effects of rural electrification were a significant predictor of household well-being of proprietors of micro and small enterprises.

4.1.7. Regression Coefficients of Income Level and Household Well-being

Analysis of the regression model coefficients is shown in table 4.11. From the table there is a positive beta co-efficient of 0.353 and 0.299 as indicated by the co-efficient matrix with a P-value = 0.000 < 0.05 and a constant of 0.692 with a p-value = 0.000 < 0.05. Therefore, the variables Business Revenue and Business Costcontribute significantly to the model. Consequently, the model can provide the information needed to predict household well-being from income level effects. The regression equation is presented as follows: $Y = 0.692 + 0.353X_1 + 0.299X_2 + \varepsilon$; Where Y = Household well-being, X_1 is Business Revenue, X_2 is Business Costand ε is the error term.

Coefficients					t	Sig.
Model		Unstandardized Coefficients		Standardized Coefficients		
1		B	Std. Error	Beta		
	(Constant)	.692	.100		6.940	.000
	Business Revenue	.353	.052	.340	6.735	.000
	Business Costs	.299	.039	.384	7.611	.000

Table 14: Regression Coefficients of Income Level and Household Well-Being
a. Dependent Variable: Household Well-Being
Model: Y = 0.692 + 0.353X1 + 0.299X2

5. Summary of Major Findings

The main objective of this study was to investigate income level effect of rural electrification on the household well-being of proprietors of micro and small enterprises in Kenya. Descriptive statistics revealed that rural electrification enhances their income levels, reduces cost of production, and reduces business operation costs. The findings of the survey also show that use of information communication technology such as computers reduces the wage bill of MSEs, enhances economies of scale and improves quality products and services. It also emerged that rural electrification lead to diversification of businesses, enabled value addition of agricultural products and attracted more people in rural areas leading to increased demand for goods and services in rural areas whose combined efforts increased the level of household well-being of proprietors of MSEs.

Pearson correlation analysis disclosed that there was a moderate positive (r=.576, n=307, p<.05) correlation between income level effects of rural electrification and household well-being of proprietors of micro and small enterprises. It was therefore concluded that there is statistical significant relationship between income level effect of rural

electrification and household well-being of proprietors of micro and small enterprises, with increase in income level effect of rural electrification causing an improvement in household well-being of proprietors of micro and small enterprises and vice-versa. Regression model shows that income level effect of rural electrification accounted for 33.2% (R^2 = .332) of the variation in overall household well-being of proprietors of micro and small enterprises, which was a fairly large effect. Analysis of Variance indicated that income level effects of rural electrification was a significant predictor of household well-being of proprietors of micro and small enterprises [F (1, 305) = 151.499, p < .05)]. This implies that income level effects of rural electrification were a significant predictor of household well-being of proprietors of micro and small enterprises.

6. Conclusion

Pearson correlation analysis disclosed that there was a moderate positive correlation between income level effects of rural electrification and household well-being of proprietors of micro and small enterprises. It was therefore concluded that there is statistical significant relationship between income level effects of rural electrification and household well-being of proprietors of micro and small enterprises, with increase in income level effects of rural electrification causing an improvement in household well-being of proprietors of micro and small enterprises. Regression analysis reveal that income level effects of rural electrification was a significant predictor of household well-being of proprietors of micro and small enterprises. This implies that income level effects of rural electrification were a significant predictor of household well-being of proprietors of micro and small enterprises.

7. Recommendations

Electrification strategies should ensure a sustainable and affordable supply, and plan for enhancing access to electricity by all micro and small scale enterprises in rural areas. To maximize socioeconomic benefits, there should be a policy framework to include micro and small enterprises as priority areas for electrification in addition to health centers and schools.

Proprietors of micro and small scale enterprises should make use of rural electrification to embrace use of ICT equipment and services such as computers, online advertisement and purchasing among others to reduce the cost of production and enhance income levels. Proprietors of micro and small enterprises should also take advantage of rural electrification to add value to their farm produce and introduce non-farm businesses to increase their income.

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