ENHANCING RURAL ECONOMIC PERFORMANCE THROUGH RURAL ELECTRIFICATION: A CASE STUDY OF ELECTRICITY COOPERATIVES IN LAGOS STATE

ADEBOSIN, GBADEBO WALID
Department of Cooperative Economics and Management, Lagos State Cooperative College, Oko-Oba, Agege, Lagos State
ddwalid3@gmail.com, 08060720987

SALAMI, LATEEF ABIODUN
Department of Economics, Halmark University, Itele, Ogun State
salamysalamy124@gmail.com, 08038025681

ADESINA, AKINNIFESI
Department of Cooperative Economics and Management, Lagos State Cooperative College, Oko-Oba, Agege, Lagos State
adesinaakinnifesi@gmail.com, 08107778766

OJOMU, QUADRI TUNDE
Department of General Studies, Lagos State Cooperative College, Oko-Oba, Agege, Lagos State
ojomutunde1@gmail.com, 09055811966

ABSTRACT
Electrification plays a crucial role in modern life and is central to sustainable development, particularly in rural areas of developing countries. Despite international and national commitments to achieving universal electricity access, progress has been slow, especially in sub-Saharan Africa, where few of rural populations have access to electricity. This study focuses on rural electrification in Lagos State, Nigeria, assessing the role of electric cooperatives in accelerating economic performance. Through a cross-sectional quantitative survey of rural households in two towns in Lagos State, the study investigates how rural electrification influences job and business creation, while addressing challenges such as infrastructure limitations and financial constraints. The findings indicate that while access to electricity has a marginal effect on job creation, government support emerges as a significant factor, positively impacting job opportunities. The study concludes that targeted government interventions, alongside addressing infrastructure bottlenecks, are critical for fostering sustainable job creation and economic development in rural electrification efforts.
JEL Codes: L94, O18, O55
Keywords: Economic performance, electric cooperatives, electricity access, rural electrification

1. INTRODUCTION
Access to electricity is a fundamental aspect of contemporary existence, and the objective of achieving universal access has garnered substantial backing at both national and international levels. The efficacy of electrification initiatives has been inconsistent, leading to sluggish progress in electrification (Cook 2011; Barnes 2010; Doll & Pachauri, 2010), with over 1.2 billion individuals remaining devoid of this fundamental infrastructure as of 2013. Economic causes and the distribution of rural settlements are sometimes referenced as reasons for this sluggish advancement; yet, there is scant data about the fundamental patterns defining electrification. Dynamic economic expansion results in heightened demand for physical infrastructure, which supports higher economic activity and generates greater demand for services from a population with escalating income. An interconnected channel indicates that

when national revenue rises, a nation's financial capacity to address the aforementioned concerns also expands. Aggressive rural electrification initiatives have predominantly depended on financial resources, aiming to promote social and economic advancement.

Rural electrification is a crucial sustainable development objective for developing nations, because access to power in isolated and impoverished rural areas is generally restricted. Robust data indicates that rural electrification yields several economic, social, environmental, and health advantages (Vernet et al., 2019). Rural electrification in Nigeria continues to pose a significant challenge, with development hindered by issues such as inequality, inefficiency, insufficient investment, and mismanagement (Almeshqab & Ustun, 2019). The World Bank Global Electrification Database indicates that merely 28.7% of the rural populace in sub-Saharan Africa has access to electricity. Due to the sluggish rate of advancement, only a limited number of African nations are poised to achieve the universal energy access objective by 2030 (Simone & Bazilian, 2019). The necessity for a viable and sustained rural electrification solution in Nigeria is urgent.

Rural electrification is a crucial factor in facilitating the social and economic advancement of disadvantaged rural communities (Palit & Chaurey, 2011). A substantial number of individuals globally lack access to electricity, the bulk of whom reside in rural regions. The international community has long underscored the necessity of expanding modern energy services to the inhabitants of developing nations, given the critical significance of electricity in alleviating poverty and addressing many economic, social, and environmental challenges. Governments worldwide prioritise ensuring electrical access for their citizens. Notwithstanding the persistent endeavours of the worldwide community and global governments, the rate of rural electrification in numerous developing nations remains quite sluggish (Paul, 2012).

Rural electrification often presents greater obstacles regarding policy, funding, and institutional frameworks due to its unique characteristics. Rural electrification is more challenging than urban electrification due to several factors, including a reduced number of connections per km of line, minimal consumption levels, absence of industrial demand, diverse topography, and insufficient incentives for private investors. Notwithstanding these limitations, several developing nations have demonstrated greater efficacy in supplying power to their rural demographics (Barnes, 2007). Despite the importance of the relationship between rural electrification and economic performance, there have been only a limited number of research on rural electrification in Nigeria. This report gives a case study on rural electrification in Lagos State to address this issue. Rural electrification in Lagos State is a governmental priority and has experienced strategic transformation following years of policy failures linked to the privatisation of power. This study seeks to investigate methods for improving economic performance in Lagos State by utilising electric cooperatives to expedite access to energy from an economic standpoint.

2. LITERATURE REVIEW

The cooperative principles serve as a foundation that enhances the cooperative's efforts in promoting development within its community. Numerous studies have consistently demonstrated that cooperatives can thrive in environments and circumstances where other businesses might falter, positioning them as a solution to market failures (Webb & Cheney, 2014). Some have even suggested that many businesses in their respective communities would have failed if they had not been established as cooperatives (Cheney et al., 2014). Cooperatives fill a distinct role, enabling them to function as place-based contributors and bridge-builders of social capital.

The principles guiding cooperatives provide a critical framework that bolsters their capacity to foster development within their communities. A body of research has repeatedly shown that cooperatives possess the resilience to succeed in contexts where other businesses are likely to

struggle, making them an effective response to market failures (Bhuyan & Leistritz, 2000). Furthermore, it has been argued that without their cooperative structure, many businesses would have failed in the communities they serve (Zeuli & Deller, 2007). Cooperatives occupy a distinctive position, allowing them to act as place-based agents and facilitators of social capital. Through both their core operations and external economic development efforts, cooperatives foster networking and interaction within communities. As a result, cooperatives in general and electric cooperatives in particular can serve as key facilitators of bridging social capital. Electric cooperatives hold a vital role in ensuring high service quality, not only for their residential member-owners but also in appealing to external industries, which often assess the reliability of the electric provider before investing in an area. These cooperatives bear significant responsibility in enhancing community attractiveness by maintaining service reliability, ultimately acting as a conduit for social capital that can elevate the local quality of life through job creation, financial investments, and increased tax revenues (Majee & Hoyt, 2011).

Yadoo and Cruickshank (2010) examined the role of cooperatives in rural electrification in developing countries. It explores how cooperative models can provide efficient and effective electricity services to rural communities, with a focus on increasing access to electricity for the rural poor in a sustainable manner. The study reviews various rural electrification delivery models, including concessionary approaches, dealership models, and small energy businesses, using studies from countries such as the USA, Bangladesh, and Nepal. It provides a detailed case study of a Nepali rural electric cooperative to explore the effectiveness of cooperatives as a delivery mechanism for rural electrification. The methodology involves both qualitative assessments and lessons drawn from these country-specific. The study found that cooperatives, when provided with appropriate financial and institutional support, can be a viable, efficient, and socially-oriented means of extending rural electrification. Cooperatives in countries like Bangladesh and Nepal have proven to reduce electricity theft, improve service delivery, and enhance community participation and ownership. However, challenges such as financial sustainability and potential vulnerability to political pressures were also highlighted.

Barnes (2011) identified effective solutions to rural electrification in developing countries and examined the successful programmes and institutional frameworks needed to support these initiatives. The study emphasised the challenges of expanding electricity access, particularly in rural areas, explored grid-to-grid and non-grid electrification approaches, and synthesised lessons from the success of rural electrification programmes from several countries using the review approach. The results show that the combination of grid and non-grid solutions is important for effective access to electricity supply, as well as the importance of financing strategies such as subsidies and long-term loans for a sustainable and affordable electrification

Cook (2011) focused on the relationship between infrastructure, particularly rural electrification, and economic development. It assesses various approaches and experiences in developing countries, examining both grid-based and off-grid electrification efforts and draws on a wide array of previous studies, project reports, and country-specific data, using both quantitative and qualitative evidence to analyze the effects of rural electrification on poverty reduction, income generation, and business development. The result revealed that rural electrification plays a significant role in economic growth and poverty alleviation, but the impact is often limited due to infrastructure challenges, low incomes, and difficulties in cost recovery.

Jimenez (2016) analyses three intrinsic variables influencing rural electricity service provision: household income, household location, and a nation's relative wealth as indicated by per capita income. A cross-sectional analysis of nationally representative household surveys from sixteen Latin American countries offers a contemporary overview of electricity access in the region. The findings reveal that, despite recent advancements in rural electrification, low-income

countries continue to encounter substantial obstacles. In certain LAC countries, rural electricity coverage is as low as 55% for the poorest income group, with approximately 90% of the total access deficit concentrated among the poorest households in rural low-income areas. While location predominantly accounts for the lack of access, income also serves as a significant impediment to electrification in low-income nations.

Kalisa and Thomas (2021) assessed the effects of rural electrification on the economic growth of small and medium enterprises (SMEs) in Bugesera District, Rwanda. The study adopted a descriptive design, utilizing both quantitative and qualitative approaches. Data were collected from 183 SMEs in Bugesera District, with a response rate of 74.86%. The study used surveys to gather primary data and employed regression analysis to examine the relationship between rural electrification and economic growth. The study showed that multiplication of SMEs had a statistically significant effect on economic growth, contributing to employment creation and increased industrial production. New services by SMEs also had a significant impact, promoting employment and boosting industrial output and enhanced production efficiency in SMEs was found to significantly improve employment rates and industrial production, highlighting the role of electricity in expanding business operations.

Del-Río-Carazo et al. (2022) examine the primary components (i.e., governance, technology, and business models) of management frameworks in universal energy access initiatives and their effects on several dimensions of sustainability (i.e., social, environmental, and economic). The paper subsequently includes three case studies of rural electrification projects with varying management model configurations, emphasising the distinctions in the business model and analysing their outcomes from a sustainability viewpoint. The examination of the three case studies indicates that the selection of the business model is crucial for achieving sustainability, with fee-for-service models yielding the most favourable outcomes. The analysis underscores the significance of collaboration and community involvement in initiatives that engage various stakeholders with diverse roles.

Alwanga et al. (2023) assess the impact of governance reforms in the electricity energy subsector on rural electrification, employing a survey design with a sample size of 384 selected from rural households in Kakamega, Uasin Gishu, and Nyandarua counties. Data were gathered through questionnaires and processed using descriptive and multiple logistic regression techniques. Research indicates that improved accountability and decentralisation within the power sub-sector positively influence electricity access in rural Kenya. Nonetheless, stakeholder involvement exerts no influence on rural electrification. Furthermore, there exists a minimal degree of citizen engagement in the rural participation initiatives.

The literature on rural electricity in Nigeria is scarce. Several studies conducted have mostly concentrated on the issues influencing electricity connectivity rather than examining how electric cooperatives improve economic performance. Consequently, we aim to bridge this information gap by utilising survey data from rural regions in two towns within Lagos State.

3. RESEARCH METHOD

The research surveyed 250 households using a basic random sampling method. To participate in the study, individuals must be at least 18 years old, possess healthy mental faculties, and reside in the rural areas of Odo-Ayandelu and Odo-Onosa in Lagos State. The settlements possess a cumulative population of 5,976 and a single transformer. These towns are centres of agricultural farming activity for commercial cultivation. Data were acquired via the administration of questionnaires and evaluated using both descriptive and inferential statistics.

The Probit model is of the form:

(i) $$Prob(Y_t = 1) = \emptyset(\beta_1 Er_t + \beta_2 X_t + \varepsilon_t)$$

(ii) $$Prob(Er_t = 1) = \emptyset(\alpha_1 Z_t + \varepsilon_t)$$

Where is the Y_t depedent variable; Er_t is an endogenous regressor; X_t is an endogenous regressor; Z_t is the instrument in the model; ε_t is the error term α_1, β_{1-2} are the parameters; $\emptyset$ is the Probit stardard normal distributive function. This study expands equation (i) to include the control variables and therefore allows the model to accommodate the factors that affect business and job creation. Such that:

Model 1: Job creation or employment model

(iii) $$Prob(jb = 1) = \vartheta_o + \omega_1 ate + \omega_2 lte + \omega_3 roe + \omega_4 ic + \omega_5 fc + \omega_6 gs + \omega_7 ci + \varepsilon_t$$

Model 2: Business creation model

(iv) $$Prob(bc = 1) = \vartheta_o + \omega_1 ate + \omega_2 lte + \omega_3 roe + \omega_4 ic + \omega_5 fc + \omega_6 gs + \omega_7 ci + \varepsilon_t$$

Where jb is the job creation or employment; bc is the business creation; ate is the access to electricity; lte is the length of time with electricity; roe is the reliability of electricity; ic is the infrastructure challenges; fc is the financial challenges; gs is the government support; ci is the community involvement.

Description of Variables

Dependent variables

Job creation (jb) refers to the generation of employment opportunities in rural areas as a direct or indirect result of electrification project such as jobs in businesses that emerge or expand due to improved electricity access.

Business creation (bc) refers to the establishment of new enterprises, particularly in sectors that rely on electrical power, made possible by reliable access to electricity.

Independent variables

Access to electricity (ate) is the ability of rural households and businesses to connect to and use electricity, transforming their livelihoods and local economies.

Length of time with electricity (lte) refers to the number of hours per day that rural households and businesses have consistent access to electricity.

Reliability of electricity (roe) is the consistency and stability of electricity supply in rural areas, indicating the frequency and duration of power outages.

Infrastructure challenges (ic) refer to the physical and logistical barriers, such as lack of transmission lines, remote locations, or outdated equipment, that impede the delivery of electricity to rural areas.

Financial challenges (fc) means the difficulties in securing the funds necessary to develop, expand, or sustain rural electrification projects, as well as the affordability of electricity for rural consumers.

Government support (gs) are policies, subsidies, and initiatives implemented by the government to promote and fund electrification projects in rural areas.

Community involvement (ci) is the participation of local communities in the planning, implementation, and maintenance of electrification projects, as well as their role in supporting businesses and social initiatives powered by electricity.

A *priori* Expectations

We expect that all the coefficients for all the variables would have positive relation to job creation except infrastructure and financial challenges. Therefore, $^{jb}/_{ate} > 0$; $^{jb}/_{lte} > 0$; $^{jb}/_{roe} > 0$; $^{jb}/_{ic} > 0$; $^{jb}/_{fc} > 0$; $^{jb}/_{gs} > 0$; $^{jb}/_{ci} > 0$. Also, we expect that all the coefficients for all the variables would have positive relation to business creation except infrastructure and financial challenges. Hence, $^{bc}/_{ate} > 0$; $^{bc}/_{lte} > 0$; $^{bc}/_{roe} > 0$; $^{bc}/_{ic} > 0$; $^{bc}/_{fc} > 0$; $^{bc}/_{gs} > 0$; $^{bc}/_{ci} > 0$.

4. RESULTS AND DISCUSSION

Out of 250 questionnaires, all were filled in and returned. This response rate was considered enough for data analyses *and* drawing of conclusions.

Table 1, *Profile of the Respondents*

Variable	Obs	Mean	Std. Dev	Min	Max
Age	250	0.67	0.47	0	1
Gender	250	0.53	0.50	0	1
Education	250	0.80	0.40	0	1
Occupation	250	0.30	0.46	0	1
Employment	250	0.60	0.49	0	1

Source: Field Survey, 2024

The mean suggests that 67.2% of respondents are involved in job creation. This is relatively high, indicating a strong involvement in generating employment, either through self-employment or creating jobs for others. About 53.6% of respondents are involved in business creation, indicating a slightly lower level of entrepreneurial activity compared to job creation. The high standard deviation (almost 0.5) shows a greater spread around the mean**.** The mean suggests that 80% of the respondents fall into the 18-44 years age group, while only 20% are aged 45 years or older. This indicates a younger sample, which may have implications for how age impacts job and business creation. Younger individuals tend to be more active in entrepreneurship and employment, as they might be at the beginning of their careers or more willing to take risks.

The mean indicates that only 30% of respondents are male, suggesting that the majority (70%) are female. This skewed gender distribution could have implications for understanding gender roles in job and business creation. If women dominate the sample, this could reflect a higher representation of women in entrepreneurship or informal employment sectors in this study. The mean indicates that 60% of the sample is learned, while 40% are not learned. This educational attainment distribution is critical because education is often correlated with job and business creation opportunities. Those with higher educational levels may be more likely to engage in entrepreneurship or secure employment.

With only 30% indicating they have an occupation, this suggests a high rate of unemployment or underemployment among the sample, which could align with the relatively high levels of job and business creation seen earlier. Individuals who cannot find formal employment might turn to entrepreneurship as a solution. The mean suggests that 60% of the respondents are employed, while 40% are unemployed. This relatively balanced employment status distribution may help explain the levels of job and business creation in the sample. Those

who are unemployed might be more likely to engage in business creation as a means of securing income, while those who are employed may also participate in entrepreneurial activities as secondary sources of income.

Correlation Analysis

The inclusion of two or more highly correlated variables in a regression model would lead to problem of multicollinearity, which leads to unstable and biased parameter estimates. To avoid such, the study conducts the correlation analysis through the correlation matrix to ascertain the level of the variables employed.

Table 2, Correlation matrix

	jc	*bc*	*ate*	*lte*	*roe*	*ic*	*fc*	*gs*	ci
jc	1.000								
bc	-0.069	1.000							
Ate	0.079	-0.101	1.000						
lte	-0.049	-0.068	-0.126**	1.000					
roe	-0.028	-0.064	0.028	0.522**	1.0000				
ic	0.043	0.107	-0.022	-0.254**	-0.147**	1.000			
fc	-0.051	-0.098	-0.003	0.138**	0.183**	-0.120	1.000		
gs	0.165**	-0.060	0.000	0.169**	0.111	-0.074	-0.080	1.000	
Ci	0.067	-0.037	0.178**	-0.285**	0.101	0.080	0.022	-0.032	1.000

Note: ** represents P < 0.05

Source: Field Survey, 2024

The correlation analysis revealed that there is absence of correlation coefficients that exceed the 0.70 rule of thumb (Mukaka, 2012). Job creation shows a positive and significant correlation with government support indicating that job creation tends to be higher in areas where there is strong government support while weak correlations with other variables like access to electricity and length of time with electricity suggest that job creation might not be directly influenced by these factors. On the other hand, business creation exhibits weak negative correlations with most variables, such as access to electricity and length of time with electricity implying that business creation might face challenges in areas with poor electricity access or shorter durations of supply. The relationship between business creation and reliability of electricity is also weak and negative, suggesting that reliable electricity might not directly influence business creation. Infrastructure challenges exhibits weak positive correlation with business creation suggests a minimal but positive link between infrastructure challenges and business activity, potentially indicating that businesses are still being created despite infrastructural issues. Government support also exhibits positive and significant correlations with job creation indicating that government intervention plays a vital role in supporting employment.

Table 3, *Logistic Regression Coefficients (Business Creation Equation)*

Variable	Coefficient	Std. Err	Z	Prob
Access to electricity	-0.2459	0.1642	-1.50	0.134
Length of time with electricity	-0.1308	0.2154	-0.61	0.544
Reliability of electricity	0.0074	0.2762	0.03	0.979

Infrastructure challenges	0.3353	0.2775	1.21	0.227
Financial challenges	-0.2432	0.1869	-1.36	0.174
Government support	-0.1583	0.1898	-0.83	-0.404
Community involvement	-0.2420	0.4019	-0.60	0.547
Constant	0.5725	0.4208	1.36	0.174
Number of observations	250			

Note: Dependent variable - Business creation

Source: Author, 2024

The relationship between access to electricity and business creation is negative, it is not statistically significant which suggests that simply having access to electricity may not directly promote business creation. The duration for which electricity has been available seems to have a negligible and non-significant effect on business creation. This implies that merely increasing the time with access to electricity might not encourage more business creation without addressing the quality or reliability of the service. Reliability appears to have no meaningful impact on business creation. The close-to-zero coefficient suggests that businesses might be adapting to poor reliability.

Infrastructure challenges have a positive coefficient, meaning that as these challenges increase, business creation might increase possibly due to entrepreneurial responses to fill gaps in infrastructure. However, the result is not statistically significant. Financial challenges negatively impact business creation, but the result is not statistically significant. Access to financial resources might play an important role in business creation. Contrary to expectations, the relationship between government support and business creation is negative, but the result is not significant. This could suggest that government support is either ineffective or that businesses are unable to capitalise on it. Community involvement does not significantly contribute to business creation which indicates that businesses do not rely heavily on community networks for creation or that community support mechanisms are underdeveloped.

Table 4, *Logistic Regression Coefficients (Job Creation Equation)*

Variable	Coefficient	Std. Err	Z	Prob
Access to electricity	0.1736	0.1705	1.02	0.309
Length of time with electricity	-0.0703	0.2229	-0.32	0.752
Reliability of electricity	-0.1003	0.2871	-0.35	0.727
Infrastructure challenges	0.1887	0.2920	0.65	0.518
Financial challenges	-0.0604	0.1940	-0.31	0.755
Government support	0.5670***	0.2094	2.71	-0.007
Community involvement	0.2930	0.4112	0.71	0.476
Constant	-0.0075	0.4304	-0.02	0.986
Number of observations	250			

Note: Dependent variable - Job creation; *** represents P < 0.01

Source: Author, 2024

In terms of magnitude, the marginal effect of access to electricity is 0.1736. Therefore, a percentage point increase in access to electricity will increase the likelihood of job creation in the study area. This implies that electricity may not directly translate into more job creation or opportunities because this relationship is not significant at the 5 per cent level of significance. Also, the marginal effect of length of time with electricity is -0.070. Hence, a one percent increase in length of time with electricity will reduce the likelihood of job creation by 7 per cent. The insignificance of this variable suggests that the duration of electricity access may not be enough to influence job opportunities.

The marginal effect of reliability of electricity is -0.100 which implies that reliability of electricity have 10 per cent points less to perform in the job creation. Thus, infrastructural challenge has a marginal effect of 0.189. Thus, infrastructural challenges have a 18.9 per cent higher probability of creating job. The lack of significance indicates that overcoming infrastructure barriers may not have an immediate effect on employment generation. Also, financial challenges is not significant with a marginal effect of -0.060, financial challenges are 6 percentage points less likely to create job. The result of government support is otherwise. At 1 per cent level of significance, government support is 56.7 percentage points more likely to create job opportunities implying that government initiatives and policies designed to support employment are crucial drivers of job creation in form of electricity investments which can significantly boost employment by lowering costs for businesses and encouraging investment. Further, the marginal effect of community involvement is 0.293. Thus, a unit increase in community involvement will result in a 29.3 percent likelihood of increase in job opportunities. Its lack of significance suggests that community-driven efforts may not be enough to create large-scale employment in the study area.

5. CONCLUSION

This study highlights the critical role rural electrification plays in fostering economic performance in two towns in Lagos State, Nigeria. While access to electricity is essential for improving living standards and driving economic performance, challenges such as infrastructure limitations, financial constraints, and unreliable electricity services hinder progress. The results indicate that electric cooperatives can be an effective model for addressing these challenges by promoting community involvement, reducing theft, and enhancing service delivery. However, further investment, government support, and policy reforms are necessary to scale up electricity access, reduce inequalities, and stimulate sustainable economic growth in rural areas. The findings show the importance of a holistic approach that combines electricity access with supportive policies and infrastructure development to unlock the full economic potential of rural electrification efforts.

REFERENCES

Almeshqab, F., & Ustun, T. S. (2019). Lessons learned from rural electrification initiatives in developing countries: Insights for technical, social, financial and public policy aspects. *Renewable and Sustainable Energy Reviews*, 102, 35–53. doi:10.1016/j.rser.2018.11.035

Alwanga, M. W, Mwaura, F. O & Mukulu, E. (2023). Has Kenya's Governance Reforms in the Energy Sector Enhanced Access to Electricity in Rural Areas? *Journal of Energy Technologies and Policy*. 13(1), 2023.

Barnes, D.F., (2010). The Challenge of Rural Electrification: Strategies for Developing Countries. Resource for the Future

Bauwens, T. (2013). What roles for energy cooperatives in the diffusion of distributed generation technologies? *Available at SSRN 2382596*.

Bhuyan, S., & Leistritz, F. L. (2000). Cooperatives in non-agricultural sectors: examining a potential community development tool. *Community Development Society Journal*, 31(1), 89–111. doi:10.1080/15575330009489734

Cheney, G., Santa Cruz, I., Peredo, A. M., & Nazareno, E. (2014). Worker cooperatives as an organizational alternative: Challenges, achievements and promise in business governance and ownership. *Organization*, *21*(5), 591-603.

Cook, P. (2011). Infrastructure, rural electrification and development. *Energy for Sustainable Development*, *15*(3), 304-313.

Del-Río-Carazo, L.; Acquila-Natale, E.; Iglesias-Pradas, S.; Hernández-García, Á. (2022). Sustainable rural electrification project management: An analysis of three case studies. *Energies*, 15, 1203. https://doi.org/10.3390/en15031203

Doll, C. N., & Pachauri, S. (2010). Estimating rural populations without access to electricity in developing countries through night-time light satellite imagery. *Energy Policy*, *38*(10), 5661-5670.

Duvall, W. P. (2016). The evolving role of electric cooperatives in economic development: a case study of Owen electric cooperative and Jackson energy cooperative.

Jasiński, J., Kozakiewicz, M., & Sołtysik, M. (2021). Determinants of energy cooperatives' development in rural Areas—Evidence from Poland. *Energies*, 14, 319.

Jimenez R. (2016). Rural Electricity Access Penalty in Latin America: Income and Location. *Policy Brief.* IDB-PB-253.

Kalisa, R. & Thomas, T. (2021). Effect of Rural Electrification on Economic Growth for Small and Medium Enterprises in Bugesera District; Rwanda. *International Journal of Thesis Projects and Dissertations (IJTPD).* https://api.semanticscholar.org/CorpusID:248238084

Labarca, J. T. (2016). Cooperativas como política pública: Electrificación rural en Chile, 1940-1970. *European Review of Latin American and Caribbean Studies/Revista Europea de Estudios Latinoamericanos y del Caribe*, 27-46.

Majee, W., & Hoyt, A. (2011). Cooperatives and Community Development: A Perspective on the Use of Cooperatives in Development. *Journal of Community Practice*, 19(1), 48–61. https://doi.org/10.1080/10705422.2011.550260

Mukaka, M.M. (2012). A guide to appropriate use of correlation in medical research. *Malawi Medical Journal*, 24(3), 69.

Palit, D., & Chaurey, A. (2011). Off-grid rural electrification experiences from South Asia: Status and best practices. *Energy for Sustainable Development*, *15*(3), 266-276.

Simone, T., & Bazilian, M. (2019). The role of international institutions in fostering sub-Saharan Africa's electrification. *The Electricity Journal*, 32(2), 13–20. doi:10.1016/j.tej.2019.01.016

Vernet, A., Khayesi, J. N.O., George, V, George, G & Bahaj, A. S (2019). How does energy matter? Rural electrification, entrepreneurship, and community development in Kenya. *Energy Policy*. 126(3), 88-98

Verwers, J. L., & Sovers, J. R. (2000). Challenges of supplying electric power to a large industrial customer in rural areas. *IEEE Transactions on Industry Applications*, *36*(4), 972-977.

Webb, T., & Cheney, G. (2014). Worker-owned-and-governed co-operatives and the wider co-operative movement: challenges and opportunities within and beyond the global economic crisis. *The Routledge Companion to Alternative Organization*, 64-88.

Yadoo, A., & Cruickshank, H. (2010). The value of cooperatives in rural electrification. *Energy policy*, *38*(6), 2941-294.

Zeuli, K., & Deller, S. (2007). Measuring local economic impact of Co-operatives. *Journal of Rural Co-operation*, 35(1), 1–17.