

Influence of Last Mile Infrastructure Maintenance Cost on the Financial Performance of Kenya Power and Lighting Company, Kenya

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Abstract

The study sought to determine the influence of last-mile power connectivity infrastructure maintenance costs on the financial performance of Kenya Power and Lighting Company. The Last Mile Connectivity Program (LMCP) aims to support the government's initiative of ensuring increased electricity access to Kenyans. However, the extent to which the last mile connectivity program has influenced the financial performance of Kenya Power Limited Company has not been explored. The study was anchored on economies of scale theory. The target population was employees directly involved in the last mile projects, who were 242. The study employed a census where all the employees were taken as the study respondents. Structured questionnaires with close-ended questions were used for data collection. Data was analysed using inferential and descriptive statistics. The study established that maintenance cost had a positive significant relationship with the Kenya Power Limited Company's financial performance. Regression analysis demonstrated that maintenance costs had a significant influence in determining the KPLC's financial performance. It was concluded that maintenance costs have a significant influence on the financial performance of KPLC. The study recommended that Kenya Power undertake a financial sustainability evaluation of its projects in order to ensure that they are able to generate the projected revenues from its projects.

Key terms: Financial Performance, Infrastructure, Kenya Power, Last Mile Connectivity, Maintenance Costs.

INTRODUCTION

Electricity connectivity levels in any given country are intertwined with the social and economic development of such a country. Electricity connectivity has been correlated to the Gross domestic product (GDP) in a country (Nicolas et al., 2019; Onuonga, 2020). In this context, Enoma and Marcus (2017) posit that the electricity supply and consumption contribute to the GDP by determining the economic output of a given country. This is achieved through the electricity supply and consumption having a significant influence on the industrialisation and the industry output of goods and services to the economy. Abbasi et al. (2021) particularly lay emphasis on the role of a steady supply of electricity to industries, especially in the manufacturing sector, being critical to their productivity in the manufacturing of their goods.

Numerous scholars, such as Shirota et al. (2018), Guefano et al. (2020), and Stevanovic et al. (2018), have linked access to electricity with poverty reduction and the attainment of the country's sustainable development goals. In this regard, Zhang et al. (2019) note that access to electricity enables the functioning of diverse utility functions such as healthcare and schooling, amongst others. Zhang et al. (2019) further note the importance of electricity supply improving the social welfare of citizens through household utilisation in various activities such as cooking, lighting and the use of various electricity appliances.

The access to electricity and utilisation of electricity is linked to Sustainable Development Goals number seven (SDG 7) (Minh & Son, 2021; Ha-Duong & Son, 2021). SDG 7 is associated with access to clean and cheap energy sources for diverse utilisation. This is what access to electricity enables: access to cheap and reliable sources of energy (Minh & Son, 2021). Access to electricity has been linked to the stimulation of diverse small businesses in both informal settlements and rural setups, further leading to poverty reduction aspects (Anderson et al., 2021; Sabo & Lekan, 2019). Anderson et al. (2021) assert in this regard that access to electricity stimulates the growth and development of Small and Medium Enterprises (SMEs) through an increase in the scope of business activities and the

introduction of operational efficiency in their businesses.

Despite the importance of electricity in social and economic development, access to sustainable electricity remains a big challenge across the world. According to the United Nations Development Program (2020), over 800 million people across the world lack access to electricity, including 50 percent within sub-Saharan Africa. United Nations Development Programme (2020) further noted that another 2.8 billion people lack access to reliable and sustainable electricity to secure their livelihoods. According to the World Bank (2020c), access to electricity in sub-Saharan countries has continued to be a challenge as population growth has largely increased beyond the electricity connectivity rates. World Bank (2021a) further notes that in Sub-Saharan countries, over 910 million people have no access to clean cooking energy due to a lack of access to electricity or inadequate access to reliable and sustainable electricity. Sub-Saharan Africa also has a large number of countries in the energy deficient countries, including the Democratic Republic of the Congo, Tanzania, Ethiopia, Mozambique, Niger, Uganda, and Madagascar had an equal to 5 per cent or less of their populations with access to clean cooking (World Bank, 2021a).

Due to the benefits of access to electricity and inadequate access to electricity hindering the realisation of these potential benefits, diverse governments and development partners have initiated electricity-power connectivity projects and policies across the globe. Electricity power connectivity refers to a series of activities with a definite start and end time with the purpose of improving access to electricity. Such activities may target different geographical contexts, such as rural areas (Domenech et al., 2019; Duran & Sahinyazan, 2020; López et al., 2018; Van Gevelt et al., 2020) and slum areas (Dave et al., 2019; De Bercegol et al., 2018; Muhia, 2019; Songa, 2020) amongst others areas. World Bank (2019a) argues that the challenges of access to electricity are also present in urban areas. Both the World Bank (2019a) and the World Bank (2019c) noted that the modern challenge of access to electricity is increasingly becoming a challenge to electricity

demand as opposed to the traditional challenges of electricity generation and supply challenges.

The power connectivity projects are undertaken with the view of overcoming constraints in the provision and access of electricity in a given location, as well as capitalising on existing structures to improve access to electricity. Amongst the constraints that are noted in electricity connectivity include low uptake and utilisation of electricity in some areas due to poverty challenges, high connectivity charges acting as a barrier to access to electricity, stringent and rigid connectivity processes and requirements (Blimpo & Cosgrove-Davies, 2019). Other challenges that constrain access to electricity include affordability challenges of potential consumers and irregularity of household income (World Bank, 2019c). World Bank (2019c) further asserts that other challenges undermining electricity connectivity include regular power outages, high electricity tariffs, complex and costly grid connections, and inadequate policies or practices. The power connectivity projects are thus meant to address the access to electricity hindrances with a view of increasing access to electricity to households (World Bank, 2019f; World Bank, 2018b), connection of the financially vulnerable to the electricity grid (World Bank, 2019d), improvement of electricity supply reliability (World Bank, 2020a).

Despite the enormous benefits of power connectivity to the citizens, the financial performance of the power utility firms involved in electricity access projects has increasingly become under sharp focus (Blimpo & Cosgrove-Davies, 2019; World Bank, 2019c). Augustine et al. (2018) view financial performance as an organisation's financial viability or the extent to which the organisation is able to meet its financial obligations. Uvaneswaran, Zemen, and Muhammed (2019) further viewed financial performance as the measurement of the organisational output in monetary terms or the organisational financial health aspects. The views by Uvaneswaran et al. (2019) with those of Baah and Jin (2019) in terms of the organisation's financial performance being in terms of the financial health of the organisation. Several scholars, including Sarker et al. (2020), Peters et al. (2019), Rout et al. (2021), and Rafique and Bahaidarah (2019) have raised the financial performance and

viability of diverse power connectivity projects and programs.

The inability of the power connectivity beneficiaries to pay for the electricity consumption has been seen to undermine the financial viability and performance of electrification projects (Colombelli, 2019; Rafique & Bahaidarah, 2019; Williams et al., 2018). In this context, Makol et al. (2020) posit that the inability of the power connectivity beneficiaries, especially in rural areas, to pay for the electricity consumption reduces the electricity demand and, hence, low revenue collection for the electricity supply firm. Within the context of slum power connectivity, Appiah-Kubi and Amoako (2020) further raised the customers' challenges in raising the lump sum amount required for electricity connectivity amongst slum dwellers and the inability of the connected customers to pay their electricity bills in a sustainable manner leading to electricity disconnection. The payment challenges amongst the slum dwellers are associated with high poverty levels in those slum areas. Yadav et al. (2019) detail the diverse factors that undermine the capacity of some of the power connectivity beneficiaries to make payments for electricity consumption. In this context, Yadav et al. (2019) note high cases of households in rural setups having low-income levels that undermine their capacity to make payments. The inability to make payments undermines the revenue model of the electricity supply firms.

Other challenges that were found to influence the revenue model of the electricity supply firms include infrastructural challenges limiting the reliability of power supply (Yadav et al., 2019; Akhator et al., 2019), high transmission losses (Akpojedje & Mormah, 2019; Irechukwu & Mushi, 2021; Nasir et al., 2020), poor revenue collection strategies (Mupwaya, 2020; Sergi et al., 2018; Yekinni et al., 2011), and illegal connections power pilferage Das (2020) that serve to undermine the financial performance of electricity supply firms. Due to the above challenges the electricity supply firms often face diverse financial performance challenges characterised by financial losses (Ghosh et al., 2021; Bhardwaj & Sharma, 2020), debt accumulation (Chege & Kinoti, 2019; Mutinda & Ali, 2018), costs escalations in connectivity projects (Ntshangase & Tuan, 2019), and state bailouts to the electricity supply firms (Bowman, 2020; Jacquot et al.,

2019) amongst other financial performance challenges.

The last mile power connectivity project, amongst other objectives, was expected to strengthen the financial capacity of Kenya Power. According to the Office of the Auditor General (2021), the last mile project utilised 11.7 billion shillings up to June 2020 and connected 87 per cent of the total number of customers targeted, which is 195,483 members. World Bank (2019b) noted that Kenya has substantively enhanced electricity access compared to other countries in sub-Saharan Africa, in which it had doubled the electricity connectivity in the 2013-2018 period to 6.7 million consumers as of June 2018. However, despite the enhanced electricity connectivity aspects in Kenya, Kenya Power faces diverse financial-related challenges. Kenya Power (2021), in commenting on its 2020 financial performance, noted that the company recorded a reduction in income growth by 3.5% due to a reduction in electricity consumption. The company further made higher provisions for credit losses, leading to increases in the costs of transmission and distribution of Ksh 47,834 million shillings in the financial year ending 30th of June 2020, which was a 16.5% increase from the previous financial year (Kenya Power, 2021).

The company further declared a reduced operating income of 13.9% in the financial year under examination from the previous financial year. The Company recorded a loss before tax of Kshs 7,042 million, a decline from the previous year's profit before tax of Kshs 334 million (Kenya Power., 2021). With this foregoing, there is doubt in regard to the power projects the company has been undertaking in terms of their viability to the company. This study sought to examine the link between the last-mile connectivity project and the financial performance of Kenya Power. The study will be premised on the observations of Blimpo and Cosgrove-Davies (2019) World Bank (2019c), who noted that despite the enormous benefits of power connectivity to the citizens, the financial performance of the power utility firms involved in electricity access projects has increasingly become under sharp focus. This study will thus explore whether the last-mile electricity connections, Mile infrastructure maintenance cost, and capacity building have impacted the financial

performance of Kenya Power and Lighting Company. The moderating effect of the Last Mile Electricity economies of scale on the relationship between the Last Mile Power connectivity project and the financial performance of Kenya Power and Lighting Company.

LITERATURE REVIEW

The economies of scale theory was proposed and devised by Stigler in 1958. In the realm of microeconomics, the concept of economies of scale holds a pivotal position. It represents the cost advantages that enterprises can harness as a result of their scale of operation, often measured by the quantity of output produced. In simple terms, as a business grows and its production output increases, the cost per unit of output tends to decrease. This fundamental economic principle, commonly known as economies of scale, has far-reaching implications across various industries and economic activities (Spierdijka & Zaourasa, 2018).

At its core, the term "economies" refers to cost savings, while "scale" denotes the quantity or scale of production. This concept has been well-documented and understood in the field of economics for a considerable period (Highfield et al., 2019). Scale economies play a key role in enhancing profitability, and they encompass various aspects of business operations, from mass production processes to standard product lines and input efficiency (Klotzki et al., 2018). The application of economies of scale is multifaceted, impacting organisations at different levels, including individual business units, manufacturing facilities, plants, or even entire enterprises. It becomes evident when the average costs of production start to decrease as the level of output increases. In simpler terms, it signifies that as a company produces more, the cost of production per unit decreases. A key indicator of economies of scale is when a firm's marginal cost of producing a good or service falls below its average cost of producing that same good or service (Chen, 2017).

Several sources contribute to economies of scale, some of which have a physical or engineering basis. These include the capital cost of manufacturing facilities and the reduction of friction losses in transportation and industrial equipment. However, another significant source of scale economies lies in

the opportunity to procure inputs at a lower per-unit cost when purchasing them in larger quantities. The concept of economies of scale has a rich historical background, dating back to the ideas of Adam Smith and the advantages of division of labour in achieving larger production returns (Malhotra et al., 2018).

In essence, economies of scale are a means to optimise production efficiency and reduce costs. Achieving such economies is a goal for many businesses and industries as it can lead to increased profitability and competitive advantages. Conversely, the opposite of economies of scale is known as diseconomies of scale, which occur when the average cost per unit of production increases as the scale of operation expands. In this scenario, the cost-efficiency gains that come with increased production may be offset by various factors, resulting in higher costs. Economies of scale are not confined to traditional business operations but extend their significance to various sectors, including infrastructure development projects such as power connectivity initiatives.

These projects aim to improve access to electricity, especially in underserved and financially disadvantaged areas, and scale economies play a crucial role in their success. Researchers and scholars have emphasised the necessity of achieving economies of scale in power connectivity projects worldwide. Examples from countries like Indonesia (Legino et al., 2019), Rwanda (Agutu, 2020), Ethiopia (Tarekegne, 2020), and Spain, among others, underscore the importance of cost-efficiency in expanding access to electricity. In the context of Kenya's Power operations and connectivity projects, several scholars have recognised the critical role of economies of scale. Ouma (2020) and Koech (2020), among others, have highlighted the significance of these cost-efficiency gains in enhancing access to electricity services.

Economies of scale in power connectivity projects manifest in various ways: Efficient deployment of labour resources is essential to achieve economies of scale. By optimising labour use, projects can reduce costs and expedite the expansion of electricity access. Economies of scale can be realised by effectively utilising equipment and infrastructure. Efficient power generating, transmission, and distribution equipment

use can lead to substantial cost savings. Building a skilled workforce is crucial in achieving cost efficiencies. A well-trained workforce can contribute to smoother project implementation and long-term operational cost reductions. Leveraging existing infrastructure and networks can significantly reduce the capital investment required for expanding power connectivity. This approach aligns with the principles of economies of scale.

The Rural Electrification Kenya - Last Mile Connectivity Program (2017) serves as a notable example of the application of economies of scale in the power sector. This initiative recognised that access to electricity in Kenya lagged behind other African countries, with only 12% of rural areas having access. To address this gap, the Government of Kenya launched the Last Mile Connectivity Program in 2015, aiming for universal access to electricity by 2020.

This ambitious program was designed based on international best practices and experiences, with a focus on achieving large economies of scale. By expanding access to electricity to underserved communities and optimising the use of existing infrastructure, the program aimed to drive down the cost per unit of electricity delivered. The Last Mile Connectivity Program exemplifies how economies of scale can be harnessed to achieve significant progress in power connectivity and electrification projects.

In conclusion, economies of scale represent a fundamental concept in microeconomics with far-reaching implications for various industries and economic activities. In the context of power connectivity projects, achieving economies of scale is paramount for expanding access to electricity, reducing costs, and promoting inclusive development. Scholars and practitioners alike recognise the importance of cost-efficiency gains in achieving universal access to electricity and improving the quality of life for millions of people around the world. As we keep on navigating the complex challenges of infrastructure development, economies of scale remain a powerful tool for shaping a brighter, more electrified future.

According to Liu and Yi (2021), maintenance costs refer to the expenses incurred as a result of repairs and the preventive maintenance aspects. This view is

consistent with that of (Percic et al., 2020; Pinello et al., 2018) with respect to the meaning of maintenance costs. In a study based in Brazil, Valer et al. (2017) noted that the location of most rural electrification projects and the scattered nature of the households within the rural setup area led to an increase in the maintenance costs of the electricity transmission infrastructure. This challenge was particularly acute after the finalisation of the funding period from the donors. The study also raised the challenges of the sourcing of the technical expertise of the maintenance works and the costs associated with the same. In Brazil, Valer et al. (2017) found that the maintenance costs of the isolated electricity infrastructure are three times more compared to those maintenance costs associated with the electricity infrastructure in a localised area. This was attributed to the additional costs being attributed to the frequency of the technical visits, organisational dynamics and insufficiency of the technical skills of the local staff in those rural areas. The study recommended stronger maintenance measures with a view to mitigating the frequency of failure rates, hence reducing the frequency of maintenance costs.

In a study based in Peru, Holguin et al. (2019) raised the challenges of the maintenance costs of rural electrification projects. In particular, the study raised the issue of travelling distances for the electrical technicians for the maintenance works. Amongst the aspects having an influence on the cost factor include distance to the maintenance area, presence and quality of access roads, nature of the maintenance works and other support infrastructure required in maintenance works. These aspects were associated with the presentation of indirect costs in the maintenance works of the rural electrification projects. The challenges of the remoteness of power electricity to remote areas of rural areas and the various cost implications, including maintenance costs, have been raised by (Dugoua et al., 2017; Watson & Rao, 2018; Radanielina, 2018; Lhazom & Thanarak, 2019) other scholars.

Maintenance cost, as defined by Kariuki (2013), is the combination of technical and administrative measures associated with retaining or restoring an item to a state that can perform its required role. It includes inspection, testing, servicing, repair and reclamation.

In sum, maintenance encompasses all works carried out on a plant or a facility with the view to rectifying a defect or failure in its functioning or performance, preventing failure in its functioning, and/or improving the state of the facility so as to sustain its utilisation and value. In a production facility, maintenance supports the production process, where the production input is converted into specified production output. Industrial maintenance is a secondary operation that must contribute to the achievement of production goals. Maintenance must be able to keep or restore the systems in order to carry out a flawless production function (Dhingra & Velmurugan, 2015).

Maintenance investment is regarded as a critical aspect of leveraging the value of industrial assets. It could be in individuals, training, or technology. In spite of the maintenance increasing awareness and its influence on both enterprises and society, maintenance is still considered an unpredictable and unavoidable expense. This could be due to, among other reasons, the difficulty of seeing the impact of maintenance on companies' bottom-line results (Bob, 2007; Alsyough, 2009). Every organisation should set enough budgets for maintenance works and refurbishments. The amount provided has a direct impact on the effectiveness of maintenance practices. In the power sector, there are normally enough funds allocated for planned outages; however, no allocation is set aside for 18 breakdown maintenance. This, at times, results in prolonged outages as you seek funds to facilitate procurement of any major equipment breaks.

Peter (2017) expounded that poorly maintained infrastructure increases costs, and deferring maintenance makes fixes more expensive later. It has been said that prevention is cheaper than cure. As such, waiting for the collapse of the road bridge is much more expensive than buttressing the bridge before it collapses. While talks on the need to address the increasing government debt frequently include the interests of future generations, they rarely mention the quality of assets bequeathed to future generations. Deferred maintenance is just as much of a debt burden for coming generations.

In India, the government initiated electricity schemes through distribution bodies accepted that grid connectivity is not feasible in all geographies and provisioned for distributed generation models using renewable energy resources in select areas where the grid cannot (Government of India., 2021). However, there has been limited interest from the government in developing models for distributed generation as the primary source of electricity provision. The main reason for the lack of confidence in distributed generation is concerns around technical and financial viability, particularly in difficult terrain. Given the low willingness and ability to pay for electricity, the financial viability of distributed generation projects in rural areas has yet to be conclusively demonstrated. Subsidies have played an important role in creating the business case for such projects, and many see them as stop-gap arrangements till grid connectivity is established.

A number of research undertaken in industries across the United States established that 70% of equipment failures are self-inflicted. The lack of basic maintenance knowledge on the part of maintenance staff accounts for between 30% and 50% of self-induced failures. An additional 20% to 30% of those failures may be the result of skilled maintenance workers who decide not to adhere to optimal maintenance repair practices (Smith, 2000). Alsyouf (2009) investigated the Swedish industry's maintenance practices. A cross-sectional survey of Swedish enterprises with at least 100 employees was conducted for the study. The study's key findings indicate that the role of maintenance is underappreciated. It is necessary to spend and invest more in maintenance, which is regarded as an essential investment by the majority of Swedish industries. Although about 13% of the maintenance department's time is spent on planning maintenance tasks, about one-third of the time is spent on unplanned tasks. Reliability-centred maintenance (RCM) and total productive maintenance (TPM) are two maintenance approaches that require more adoption. A shortage or ineffectiveness of planning and scheduling may significantly hamper the maintenance department's ability to achieve its goals, preventing the organisation from maximising business profits and delivering competitive advantages.

Amnie (2016) in his study concluded that the use of a prepaid billing system has reduced revenue collection costs for Kenya Power. It further recommends that Kenya Power should convert more meters into prepaid, as it will enhance its revenue collection capabilities and, at the same time, reduce costs associated with collection. Smart Energy International (2021) also highlighted in a similar study that in South Africa, the emergence of prepaid meters has also come as a solution for debt recovery by the state-owned utility firm. Eskom has, to date, reached a number of agreements with municipalities to use the system. To benefit from the project, residents are required to pay Ksh 15,000.

Kariuki (2013) examined maintenance practices at KenGen to benchmark and evaluate the Practices with the world's best maintenance practices and to ascertain the relationship between plant performance and maintenance practices in terms of availability and operation and maintenance costs. The study established that KenGen has in place good maintenance practices. When they were benchmarked with world best practices, it was apparent that breakdown maintenance works were extremely high, but surprisingly, the plant's availability recorded very good results. There was a weak relationship between O&M cost, number of breakdowns and the plant availabilities. Kariuki (2013) exemplified that about 10% of all commercial energy needs are from electricity. Strong electricity demand growth in Kenya is being driven by continued economic growth, increased rural electrification and the transmission and distribution network reinforcement. On the supply side, cyclic drought conditions pose a challenge to power supply given the dominant nature of hydro sources that account for over 49% of all electricity supply. Existing projections place electricity's annual average growth at about 8%. Currently, the highest recorded peak demand is at 1,194MW, with a reserve margin of just above 10%, some of which is from the temporary Emergency Power Plant. This creates a sharp national focus on the Electric Power Sub-Sector, which has been identified as one of the infrastructure enablers for the realisation of the National Vision 2030. The current peak demand has increased to 1357MW as of July 2013. This upsurge in demand consequently culminates in an increase in maintenance costs.

The discussion revolves around maintenance costs and their impact on the financial performance of the Kenya Power and Lighting Company. This analysis draws insights from various studies and sources to provide a comprehensive view of the subject. Maintenance Costs Definition: Maintenance costs encompass expenditures related to both repairs and preventive maintenance activities. This definition aligns with the perspectives of Liu and Yi (2021), Perčić, Ančić, & Vladimir (2020), and Pinello et al. (2018). In Brazil, Valer et al. (2017) noted that rural electrification projects face elevated maintenance costs due to their remote locations and the dispersed nature of households in rural areas. Challenges include increased costs after funding periods conclude, difficulties in sourcing technical expertise, and the frequency of technical visits. Studies conducted by Holguín, Flores Chacón, and Gamarra (2019) highlighted the challenges associated with maintenance costs in remote rural electrification projects. Factors such as extended travel distances for technicians and the quality of access roads significantly impact cost considerations.

Peter (2017) underscored the critical role of maintenance in retaining or restoring the functionality of assets. Neglecting maintenance can lead to higher costs in the long run and a decrease in asset value. In India, concerns regarding the financial viability of distributed generation models for rural electrification have hindered their widespread adoption. Subsidies have played a pivotal role in supporting these projects (Government of India, 2021). Alsyouf (2009) emphasised the significance of adopting effective maintenance practices in industries to reduce failures and maximise business profits. Annie (2016) found that the implementation of prepaid billing systems at Kenya Power reduced the costs associated with revenue collection and suggested expanding their use. Kariuki (2013) conducted an examination of maintenance practices at KenGen and revealed a weak relationship between operation and maintenance costs, the number of breakdowns, and plant availabilities. The discussion also touched upon the substantial growth in electricity demand in Kenya, driven by economic expansion and increased rural electrification, contributing to higher maintenance costs (Kariuki, 2013).

In summary, maintenance costs are a critical aspect of the financial performance of Kenya Power and Lighting Company. They are influenced by various factors, including the location of electrification projects, the quality of infrastructure, and the level of technical expertise available. Proper maintenance practices are essential for optimising asset value and minimising unexpected expenses. Additionally, the financial viability of distributed generation models and the sustained growth in electricity demand are key considerations in managing maintenance costs effectively.

METHODOLOGY

This study used a predictive research design. According to Gathii et al. (2019), a predictive research design seeks to predict the dependent variable based on the changes in the independent variable. The target population for the study were employees of Kenya Power who were directly involved in the implementation of the last-mile projects. There are 242 employees directly involved in last-mile project implementation, ranging from company personnel such as county project managers, county last-mile project engineers, last-mile project supervisors, last-mile project clerks, accountants and account assistants represented in every region. These formed the populations for the study. Given that the target population is not too large, the study employed a census where all the employees were taken as the study respondents. This study used primary data for the research. The primary data was obtained by use of structured questionnaires consisting of close-ended questions. The questionnaires were administered to the selected employees company-wide. The questionnaires were structured based on research objectives. Likert scales were used for the study. In this study, the questionnaire was constructed on a five-point Likert scale items (1-Strongly Disagree (SD) 2-Disagree (D) 3-Undecided (U) 4-Agree (A) 5-Strongly Agree (SA)). The instrument will be pilot-tested to check for validity and reliability before the actual data collection. This study undertook the quantitative data analysis for the collected data from structured questionnaires. IBM SPSS software was employed to analyse the quantitative data. The data was first coded into SPSS software. The SPSS was used to run descriptive analyses to produce frequency distribution and chi-square test of agreement. The study further

undertook the correlation analysis. The Pearson correlation coefficient was utilised in examining the relationship between variables due to the continuous nature of the summated variables from multi-item scale measurements of the variables. Regression analysis was also undertaken in the study. The regression analysis was used in this study to examine the independent variable predictive power (Last Mile infrastructure maintenance cost) against the dependent variable (financial performance).

RESULTS AND DISCUSSION

Response Rate

Out of 232 questionnaires distributed to the respondents for the purposes of data collection, 210 of them were properly filled and returned. This constitutes a 90.5% response rate. According to Gathii et al. (2019) and Mugenda and Mugenda (2019), a response rate of above 80% is considered adequate for a study. This study achieved a response rate of 90.5%, which was above 80.0 per cent and was thus

considered adequate in nature. The high response rates in the study are attributed to the rapport created with the staff in the Kenya power company who assisted in reaching out to some of the respondents.

Last Mile Infrastructure Maintenance Cost

The five-point Likert scale was used to measure the last-mile infrastructure maintenance costs. The study used a set of seven indicators to measure the last-mile infrastructure maintenance costs. These indicators included the presence of proper risk mitigation control aspects, the presence of structured guidelines governing maintenance costs, benefits arising from sharing fixed costs, budget on maintenance and refurbishment, the presence of maintenance procedures, incurring of high costs due to maintenance of idle capacity, and reduction of costs variation through planning aspects. The results are presented in Table 1.

Table 1: Descriptive Statistics on Last Mile Infrastructure Maintenance Cost

| | SA (%) | A (%) | U (%) | D (%) | SD (%) | χ^2 | P-Value |
|---|--------|-------|-------|-------|--------|----------|---------|
| There are proper risk mitigation controls to monitor Kenya last mile connectivity projects | 17.1 | 27.6 | 22.4 | 24.8 | 8.1 | 24.810 | .000 |
| There is a structured guideline governing expenses relating to the maintenance cost of the last-mile project | 14.8 | 37.6 | 23.8 | 16.7 | 7.1 | 55.524 | .000 |
| Last-mile electricity connectivity benefits from sharing fixed costs with the company's normal operations | 31.4 | 41.0 | 14.8 | 5.7 | 7.1 | 101.476 | .000 |
| Kenya Power has budgeted for the maintenance and refurbishment of last-mile connectivity projects | 19.5 | 39.0 | 20.5 | 14.3 | 6.7 | 60.238 | .000 |
| There is an elaborate plan by Kenya Power Company on the maintenance procedures for last-mile connectivity projects | 19.5 | 35.7 | 21.9 | 17.6 | 5.2 | 49.810 | .000 |
| Kenya Power incurs a great deal of financial cost due to maintenance of idle capacity in the last mile project | 51.0 | 30.5 | 11.0 | 6.2 | 1.4 | 176.952 | .000 |
| Through planning and estimation, variation costs are greatly reduced in last-mile projects | 15.7 | 32.9 | 33.3 | 11.4 | 6.7 | 64.333 | .000 |
| Valid N (listwise) | 210 | | | | | | |

From the results, there was a high percentage of respondents who were in agreement and strong agreement (44.7%; $\chi^2 = 24.810$, $P = 0.000$; < 0.05). There were proper risk mitigation controls that helped monitor Kenya's last-mile connectivity projects and

ensure that poor households got electricity connections. The presence of risk mitigation controls is associated with financial performance in diverse ways. Scholars linking risk mitigation to financial performance include Mikugi and Bagudu (2021) as well

as Haryetti (2021), amongst others. The financial risk controls ensure that the financial resources are used in a prudent manner and that there is accountability in their utilisations. The risk mitigation controls thus ensure that potential financial risks are adequately mitigated and addressed to ensure that the project's financial objectives are achieved.

52.4% ($\chi^2 = 55.524$, $P = 0.000$; < 0.05) of those asked agreed and strongly agreed that there was a structured guideline that governed the expenses and costs incurred as a result of maintaining the projects. The presence of structured guidelines for cost management aspects in project maintenance is a recurrent theme explored by other scholars such as Karimi et al. (2018), Islam et al. (2019), Jung and Han (2017), and Durdyev (2020), amongst others. The presence of structured guidelines in cost management aspects leads to the presence of cost efficiency in the project operations, preventing cost overruns that potentially undermine the financial performance of the project.

The study further showed that (72.4%; $\chi^2 = 101.476$, $P = 0.000$; < 0.05) agreed and strongly agreed cumulatively that the last mile connectivity benefited from the shared fixed costs with the normal operations of the company. The concern of fixed costs that is raised by this study is consistent with other scholars, such as Lee et al. (2020) and Jadhav (2020), who noted that fixed costs constitute a huge proportion of the costs in connectivity projects. The ability to reduce the fixed costs, such as through sharing with the normal Kenya Power operations, thus leads to cost efficiency and, hence, improved financial performance of the organisation. The sharing of the fixed costs of specific connectivity projects of Kenya Power with normal operational costs are thus ways in which Kenya Power can leverage the existing infrastructure to lower the costs of power connectivity aspects.

Kenya Power seemed to have set aside a budget for the maintenance and refurbishment of the last mile connectivity project according to a statistic of (58.5%; $\chi^2 = 60.238$, $P = 0.000$; < 0.05) people who strongly agreed and agreed cumulatively. Bostani et al. (2018) noted the importance of maintenance budgets in sustaining connectivity projects. The presence of

maintenance budgets ensures that the maintenance is undertaken in a timely manner, preventing power outages and hence improving customer satisfaction levels. Customer satisfaction levels are associated with driving the customer utilisation of the power and further financial performance of the organisation.

From the study, it was evident that there was an elaborate plan by Kenya power company for the maintenance procedures of the projects with strong agreement and agreement from (55.2%; $\chi^2 = 49.810$, $P = 0.000$; < 0.05) of those interviewed. The results of this study on the importance of maintenance procedures in the performance of Kenya Power is consistent with other study results on Kenya Power, such as (Muiruri & Mwangangi, 2017; Musoga & Otieno, 2019; Ingutia, 2020; Orina, 2018; Yusuf, 2018) amongst others. In this context, Edward (2018) asserts that the presence of proper maintenance is key to both the operational and financial performance of Kenya Power due to the high costs associated with maintenance aspects. Yusuf (2018) further noted that maintenance procedures are essential at Kenya Power in order to ensure that repairs and maintenance works are always undertaken in a timely manner. The maintenance procedure ensures that maintenance is undertaken in a cost-effective and on time while meeting quality requirements.

It was seen that Kenya Power incurred a great deal of financial costs as a result of the maintenance of the idle capacity of the projects, with (86.5%, $\chi^2 = 176.952$, $P = 0.000$; < 0.05) agreeing and strongly agreeing to this statistic. The study results, with a cumulative percentage of 48.6% in agreement and strong agreement ($\chi^2 = 64.333$, $P = 0.000$; < 0.05), found that through planning and estimation, the Kenya power company could greatly reduce the variation costs of the project. Sohu et al. (2018), Mitra et al. (2019), and Kumar et al. (2018) noted in their studies that the lack of proper planning aspects in project implementation is one of the factors driving cost escalation aspects of project implementation. Challenges with planning aspects lead to imprudent utilisation of human resources, equipment, and financial resources aspects, leading to cost escalation aspects. The need for proper planning with respect to the electrification projects has also been noted by Songa (2020), Cicilio et al. (2019) and Khodayar (2017), amongst others.

Financial Performance

The financial performance aspects were examined using seven indicators. The study indicators included the increase in revenue, increase in income, increase in

profitability, increase in gross profit margins, growth in revenue growth, return on investments, and experience of large losses.

Table 2: Descriptive Statistics on Financial Performance

| | SA (%) | A (%) | U (%) | D (%) | SD (%) | χ^2 | P-Value |
|--|--------|-------|-------|-------|--------|----------|---------|
| Kenya Power has increased revenue generation as a result of Kenya Power mile connectivity projects | 8.1 | 11.4 | 5.7 | 33.8 | 41.0 | 110.143 | .000 |
| The company has increased its income from last-mile projects | 4.8 | 14.3 | 9.5 | 34.3 | 37.1 | 91.619 | .000 |
| Lately, due to last-mile connectivity, Kenya Power has been increasing its profits | 5.7 | 7.6 | 7.6 | 35.7 | 43.3 | 136.714 | .000 |
| Kenya Power has been recording increased gross profit margins | 7.6 | 11.4 | 6.7 | 34.3 | 40.0 | 105.905 | .000 |
| With the increased connectivity, the revenue generation in Kenya's power grows constantly | 8.1 | 9.5 | 9.0 | 33.3 | 40.0 | 99.667 | .000 |
| The company has seen a positive return on investment from the last-mile connectivity project | 22.4 | 21.4 | 14.8 | 20.0 | 21.4 | 3.905 | .419 |
| The company has experienced huge losses as a result of developed idle capacity from last-mile electricity connectivity | 41.4 | 23.8 | 9.5 | 13.3 | 11.9 | 72.810 | .000 |
| Valid N (listwise) | 210 | | | | | | |

When asked whether Kenya Power had increased revenue generation as a result of the last mile connectivity, a huge percentage of respondents, 74.8%, disagreed and strongly disagreed cumulatively, respectively ($\chi^2=110.143$, $P=0.000$; < 0.05). The challenges of the low revenue generation from the power connectivity can be attributed to electricity theft (Boamah et al., 2021; Otchere-Appiah et al., 2021), low demand due to difficulty in paying electricity bills (Hemapala et al., 2017; Irechukwu & Mushi, 2021; Nhalur et al., 2018b) and vandalism of the electricity infrastructure that undermined electricity supply hence, revenue generation (Ikejemba & Schuur, 2018; Kareithi & Muhua, 2018; Limo & Mirwoba, 2018). The power connectivity, therefore, hardly yields sufficient revenue generation due to the many challenges associated with the target areas of the large-scale connectivity projects, that is, the rural and urban slum areas. The study further indicated that 71.4% of the respondents disagreed and strongly disagreed ($\chi^2=91.619$, $P=0.000$; < 0.05) that Kenya Power had increased income from the last mile. This can be

associated with revenue growth challenges, as enumerated earlier.

The respondents were further asked whether there was an increase in profit margin in recent months, of which a cumulative percentage of 79% strongly disagreed and disagreed ($\chi^2=136.714$, $P=0.000$; < 0.05). This can be attributed to the challenges of revenue collection from the connected power connections. The recording of increased gross profit margin was reported to have been done by the company, with only 19.0% agreeing and strongly agreeing cumulatively ($\chi^2=105.905$, $P=0.000$; < 0.05). With the increased connectivity, there continues to be a constant growth in revenue generation for the Kenya power company; statistics from the study show that only 17.6% of the respondents strongly agreed and agreed ($\chi^2=99.667$, $P=0.000$; < 0.05). A positive return on investment has been seen; this is as a result of the last mile project by the Kenya power company (43.8%; $\chi^2=3.905$, $P=0.000$; < 0.05) agreed and strongly agreed.

On the downside, the Kenya power company experienced a huge loss due to the developed idle capacity from the last mile electricity connectivity; the results show that (65.2%; $\chi^2=72.810$, $P=0.000$; < 0.05) strongly agreed and agreed to this. This is consistent with Kenya Power's financial reports. Kenya Power (2021), in commenting on its 2020 financial performance, noted that the company recorded a reduction in income growth of 3.5% due to a reduction in electricity consumption. The company further made higher provisions for credit losses, leading to increases in the costs of transmission and distribution of Ksh 47,834 million shillings in the financial year ending 30th of June 2020, which was a 16.5% increase from the previous financial year (Kenya Power 2021). The company further declared a reduced operating income of 13.9 per cent in the financial year under examination from the previous financial year. The Company

recorded a loss before tax of Shs 7,042 million, a decline from the previous year's profit before tax of Shs 334 million (Kenya Power., 2021).

Correlation Analysis

The correlation analysis is used to establish the association between variables of interest (Gathii et al., 2019). This study used correlation analysis to determine whether there is an association between the independent variable (last-mile maintenance costs) and financial performance as the dependent variable. The study transformed the responses on the study independent variable and financial performance into composite scores of their means. The composite mean scores for the independent variables and financial performance were correlated to establish the relationship between them. The findings from the correlation analysis are presented in Table 3.

Table 3: Correlation Matrix

| | | Financial performance |
|------------------|---------------------|-----------------------|
| Maintenance cost | Pearson Correlation | .253** |
| | Sig. (2-tailed) | .000 |
| | N | 210 |

The association between last-mile infrastructure maintenance costs and financial performance was examined using correlation analysis aspects. The composite mean scores for infrastructure maintenance cost were correlated with composite means for financial performance. Pearson product-moment correlation coefficient was used in determining the relationship between the two variables. The results revealed that there was a positive correlation between last-mile infrastructure maintenance costs and the financial performance of Kenya Power. The study established that there was a weak but significant ($r=.253$, $p=.000$) relationship between last-mile infrastructure maintenance cost and the financial performance of Kenya Power Limited Company. Thus, last-mile infrastructure maintenance cost has a role in determining the financial performance of Kenya Power Limited Company. The role of maintenance costs in the sustainability and financial performance of diverse connectivity projects has also been raised by different scholars. These scholars include (Jimenez et al., 2017; Khodayar, 2017; Litzow & Pattanayak, 2019) amongst others. Cost

management aspects are associated with the financial performance aspects of organisations. Organisations must ensure that they minimise the costs of operations, such as maintenance costs, within organisations in order to increase their profitability aspects. There is an established evidence of cost management and financial performance of organisations. Studies that have established the link between cost management and financial performance aspects include (Erasmus, 2021; Gitau, 2019; Nazaripour & Mirzaee, 2018) amongst other scholars. Thus, the ability of Kenya Power to minimise operational costs, such as maintenance costs, is critical to its financial performance aspects. Within the context of Kenya Power, several studies have indicated the need for cost management to improve on the organisational performance aspects, such as financial performance aspects. These studies include (Tirop, 2018; Cheruto & Munene, 2019; Muiruri & Mwangangi, 2017) as well as Ingutia (2020) amongst others.

Influence of Last Mile Infrastructure Maintenance Cost on Financial Performance

The study's hypothesis opined that last-mile infrastructure maintenance cost has no significant influence on the financial performance of Kenya

Power Company Limited. Simple regression analysis was adopted to test this hypothesis using analysis of variance. The findings from the analysis were presented hereafter.

Table 4: Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|--|-------------------|----------|-------------------|----------------------------|
| 1 | .253 ^a | .064 | .060 | 5.66968 |
| a. Predictors: (Constant), Last Mile Infrastructure Maintenance Cost | | | | |

From the table above, the adjusted R-squared value was .060. This indicated that last-mile infrastructure maintenance cost accounted for up to 6.0% of the total variance in financial performance. This was a very small contribution, given that 94.0% could be explained by other factors not included in the model. The maintenance costs are one of the costs that the electricity supply firms face in order to maintain a constant supply of electricity connectivity to the target beneficiary area. One of the reasons for the

need for maintenance is the cases of the vandalism of electricity supply infrastructure. Studies detailing the challenges of vandalism in the slum include (Murey et al., 2020) and (Gertler et al., 2017), amongst others. Maintenance costs in the electricity supply sections lead to an increase in the operational costs of the firms, leading to financial performance challenges. The hypothesis testing was examined using the one-way ANOVA, and the findings are presented in Table 5 below.

Table 5: ANOVA^a

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|-----|-------------|--------|-------------------|
| 1 | Regression | 459.136 | 1 | 459.136 | 14.283 | .000 ^b |
| | Residual | 6686.221 | 208 | 32.145 | | |
| | Total | 7145.357 | 209 | | | |

a. Dependent Variable: Financial Performance

b. Predictors: (Constant), Last Mile Infrastructure Maintenance Cost

The table gave an F-statistic value of 14.283, which was significant at $p < .05$. Hence, it was established that last-mile infrastructure maintenance cost has a significant influence on financial performance. It was, therefore, found from the research that last-mile infrastructure maintenance cost was a determinant of financial performance at Kenya Power Limited Company. Therefore, the null hypothesis H_{02} , that last-mile infrastructure maintenance costs have no statistically significant influence on the financial performance of Kenya Power and Lighting Company, Kenya, was rejected. The maintenance costs within Kenya Power can be attributed to the vandalism of the electricity transmission infrastructure, together with the routine repair and maintenance works. Studies in the context of Kenya Power detailing vandalism challenges include (Kirunguru, 2017), (Limo & Mirwoba, 2018), and (Koinange, 2017), amongst others. The vandalism

within Kenya Power for both the transformer and other infrastructure acts to impact the maintenance costs, leading to an influence on the financial performance of Kenya Power.

CONCLUSION AND RECOMMENDATIONS

Conclusion: The findings showed that last-mile infrastructure maintenance costs play a significant role in determining the financial performance of Kenya Power Limited company. The organisation was shown to have a significant budget for maintenance and refurbishment of the last-mile power connectivity projects. Regression analysis demonstrated that maintenance cost significantly accounts for variation in financial performance. Therefore, the study concluded that last-mile infrastructure maintenance cost has a significant influence on the financial performance of Kenya Power Limited company.

Recommendations: The study recommended that Kenya Power should deploy strategies to mitigate challenges associated with vandalism that serve to increase the costs of maintenance of electrical supply infrastructure. Vandalism mitigation strategies should particularly be heightened within the slum areas and the connection infrastructure within those areas.

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