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FACTORS AFFECTING SUSTAINABILITY OF PUBLIC STREET LIGHT DEVELOPMENT PROJECTS IN KENYA: THE CASE OF NAIROBI COUNTY

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ABSTRACT

The main objective of the study was to evaluate factors affecting sustainability of public street light development projects in Nairobi County. This being a case study, a descriptive research design was applied where field surveys were carried out. The study was conducted at the Nairobi County offices and the population of interest was the electrical department. The respondents were all the eight engineers, all the twenty five supervisors and technical employees in the electrical section of engineering department. The population also included contractors and community leaders (administrators). Stratified proportionate random sampling technique was used in coming up with a sample of 174 out of the total population of 319. The study utilized both primary and secondary data. Data was analyzed using the Statistical Package for Social Scientists (SPSS), quantitative data was measured in real values by normalizing. The study found that technical longevity and stakeholder involvement/Participation had an influence on sustainability of Public Street light development projects in Nairobi County. The study concluded that technical longevity significantly influenced sustainability of Public street light development projects in Nairobi County. The study further concluded that stakeholder involvement/Participation had a significant effect on sustainability of Public Street light development projects in Nairobi County. The study recommended that management team of Nairobi County Government should consider operation competency when initiating projects of Public street light development. The management team of the Nairobi County should also consider product reliability of the street light since it had a significant effect on the sustainability. The study further recommended that the County Government of Nairobi should form a competent committee comprising all stakeholders with task of determining the project requirements.

Keywords: *Technical Longevity, Stakeholder Participation, Sustainability of Public Street Lighting, Nairobi County*

INTRODUCTION

Street lighting came a long way and is still developing. During the Greek and Roman civilizations, oil lamps were used for lighting up streets. The oil lamps gave a dim but long lasting and moderate flame. It was the duty of the lamp-lighter to go round the town at dusk, lighting each lamp. Since this work was very cumbersome to execute, consequent designs employed ignition devices that automatically struck the flame when gas supply was activated (Kenya Power Company, 2014).

The Kenya government made efforts to create an enabling environment for development by improving infrastructure (roads, electricity, IT, communications, water, market access) which provided opportunities to poor people and their communities (International Monetary Fund (IMF), 2008). The first electricity supplying company in Nairobi was the Nairobi Power and Lighting Syndicate (NP&LS) founded in the year 1908 by Clement Hertzel. The company merged with Mombasa Electric Power and Lighting Company (MEP&LC) to form the East African Power and Lighting Company (EAP&L) which had exclusive rights to supply electricity in Kenya. In 1954, the Kenya Power Company (KPC) was created with the Kenyan government's partial ownership– to be managed by EAP&L. EAP&L was renamed Kenya Power and Lighting Company Limited (KPLC) in 1983 (Kenya Power Company, 2014).

Nairobi's first street lights consisted of oil lamps, with extremely inefficient lighting as there was no electricity supply. The first modern street lighting project in Nairobi was done in 1910**.** One major opportunity that could grant Kenya economical usage of energy in street lighting is the achievement of Vision 2030. The economic pillar of the Vision 2030 targets the tourism, agriculture, IT manufacturing, wholesale/retail trade, and financial services which require sufficient energy to run effectively and efficiently (Wambugu, 2014).

During the year 1807, gas derived from coal was used to light the Westminster Bridge in London. Baltimore became the first American city to have its streets lit up in 1816 using this primeval model. Modern street lights, as we know them today, were first put up in Paris (City of Lights) with actual electric arc lamps lining the streets. Arc lights had two major disadvantages. Firstly, they emitted an intense harsh yellow light which caused light pollution and secondly, they were maintenance intensive as the lamps required constant replacement. In 1879, incandescent light bulbs were invented. The first street to be lit with the new technology was Newcastle, England. Africa experienced its first street lights in 1882 at Kimberly, South Africa (Kenya Power Company, 2014).

As innovations into street lighting progressed, high-intensity discharge lamps were invented and are still commonly used for today's lighting needs. Street lights are made up of a number of features. Firstly, a structural system consisting of poles and the pole's foundation; secondly, the electrical system consisting of lamps, ballasts and service cabinets (fuse box); and lastly, the optical system made up of a luminaire (New York City Global Partners, 2011).

In recent decades, attempts were made to increase project success and strengthen project management through a variety of tools. Examples include the sustainable livelihoods framework and project cycle management (DFID 2010). The frameworks sought to help practitioners understand the project process and consider issues which were important to sustainability. They had been adopted by governments and international development institutions such as DfID, UNDP, and Oxfam (CCI, 2010). The concepts had also been adapted to specific issues such as

environment or gender in development (Sustainable Business, 2012).

Sustainability of these projects was crucial. Sustainability meant that once a project had been rolled out, it continued to work overtime (Clarke, 2008). More specifically for this research, it implied the ability to recover from technical breakdown in the scheme. Built into common conceptions of the term were notions of minimal external support, national and county government financing and the continuation of a beneficial service over time (Jones, 2012). It was estimated that 35% of all street lighting projects in sub-Saharan Africa were not functioning (Baumann, 2005), and despite the frequency with which it appeared in development discourse, the reality of sustainability remained elusive.

Sustainability pertained to a multiple of aspects with institutional, social, technical, environmental and financial dimensions (Akaki, 2009). This accounts for the fact that understanding and measuring sustainability was so difficult, and why solutions were highly context specific. Practical responses to the challenge of sustainability were being tested and used by development practitioners the world over. Due to the widespread trend in developing countries of the devolution of responsibility for street lighting projects from governments to urban areas, many of the interventions aimed at improving sustainability were taking place at the city level. The use of appropriate technologies which were low cost, easy to maintain, simple to use and readily available were one response to the challenge of sustainability (Bastakoti, 2009).

The most common reasons for inefficient street lighting systems included; selection of inefficient street lamps, poor design and poor maintenance practices (Mandri-Perrott, 2012). Existing street lights could be retrofitted or replaced to increase energy efficiency. To retrofit was to add a component or accessory to something that already existed. The decision to retrofit or to replace new street lights could be based on the purpose and lighting requirements of the roadway, age of existing lighting infrastructure and whether existing poles could be used with replacement of luminaires or new poles had to be put up (New York City Global Partners, 2011).

According to Un-Habitat (2015), Informal settlements were home to more than 60% of Nairobi's population. They were generally described as havens of crime lacking modern energy, sanitation and other social amenities. There was strong evidence linking poor lighting to high levels of crime and insecurity as a result of which many commercial and productive activities in informal settlements stopped at nightfall (Kenya Power and Lighting, 2014). The Adopt a Light Slum Lighting project had the objective of lighting public spaces in informal settlements in Nairobi in order to improve security and make them safer for residents. The main force behind the project was Adopt a Light Limited, an advertising company headquartered in Nairobi. Project partners included the Nairobi City Council, the Kenyan Parliament through the Constituency Development Fund, private sector companies and the communities in the informal settlements targeted by the project. A total of 33 high light masts were installed in informal settlements in Nairobi including Kibera, Mathare, Korogocho, Huruma, Kawangware and Kangemi. The masts served in excess of 500,000 people in 150,000 households (Mwangi, 2012).

Statement of the Problem

Several community-based projects were started and failed and others struggled to survive in Nairobi County (Magutu, 2010). Working with Nairobi County Government, Electrical section, I saw projects like Street lighting installation at Kangundo Road, which was completed after a long time but some of the lights never worked while some were vandalized, Highmasts at Kahawa West and Security lighting installation at Githurai Ward initially worked but at present

some do not work. Public lighting installation at Kangemi and Kawangware were successfully installed but left idle due to standoff between the government and Kenya power. Other projects such as Nile road street lighting was awarded, however, the contractor never reported on Site two years later. Similarly, the high mast security light at central Park which was meant to provide reduced acts of crime was successfully completed but no longer in use (Wafula, 2013). In addition street light project in Roysambu area, three years later the contractor was yet to possess site. Similarly, Public street lighting at Laini Saba in Kibera was completed and county government was awaiting letter of discharge from contractor, however, some of the posts were knocked down. Lack of training and low support by community development officials and lack of community involvement were some of the reasons put forward for the failure of these projects (Wambugu, 2014).

In Kenya, King'ara (2006) conducted a study on procedural fairness and the privatization of public services: a case study of the street lighting contract between Nairobi Council and adopt-a-light limited, Rukwaro (2006) researched on urban street design and standards in architecture while Wambugu (2014) conducted a study on formulation and implementation of operations strategy for energy-efficient street lighting: the case of Nairobi County. However, none of the researchers considered factors affecting sustainability of public street light development projects in Nairobi County. This study therefore sought to answer the question; what factors affect sustainability of public street light development projects in Nairobi County?

Objectives of the Study

The general objective of the study was to evaluate factors affecting sustainability of public street light development projects in Nairobi County. The specific objectives were:-

- To assess the effect of technical longevity on sustainability of public street light development projects in Nairobi County.
- To evaluate how stakeholder participation affected sustainability of public street light development projects in Nairobi County.

LITERATURE REVIEW

Theoretical Review

Constraints Management Theory

The roots of CM could be traced to the development of a production scheduling software package known as Optimized Production Technology (OPT) in the late 1970s. Since then, CM evolved from a manufacturing scheduling method to a management philosophy that could be used to understand and improve the performance of complex systems. Eliyahu Goldratt, the founder of CM, claimed that it was a theory of managing manufacturing organizations (Fellows, 2008). Love (2005) argued that the scientific methods of CM provided a theory to communicate and enhance organizational performance. Although aspects of the theory of CM had been made explicit (Wambugu, 2014), underlying constructs of CM had not been identified. Brian (2013) argued that if CM was to be accepted as a general theory, then the theory must be empirically developed and tested. In essence, the theory said that the higher the degree of throughput orientation, the greater organizational performance would be. The three dimensions of throughput orientation were organizational mindset, performance measurement systems, and decision making. Companies that were high on all three dimensions would be expected to have better performance than companies that were low on one or more of the dimensions. The theory pointed on the effect of technical longevity on sustainability of public street light development projects in Nairobi County.

Instrumental Stakeholder Theory

The origin of the stakeholder concept lied in the business science literature (Freeman, 1984), and could be traced back even as far as Adam Smith and was The Theory of Moral Sentiments. Its modern utilization in management literature was brought about by the Stanford Research Institute, which introduced the term in 1963 to generalize and expand the notion of the shareholders as the only group that management needed to be sensitive towards (Jongbloed et al., 2008). Within this perspective, Freeman (1984) argued that business organizations be concerned about the interests of other stakeholders when taking strategic decisions. Although a relatively longstanding term, the development of stakeholder theory was set in motion by the work of Freeman (1984). The objective of his work was to delineate an alternative form of strategic management as a response to rising competitiveness, globalization and the growing complexity of company operations. As time went by, the stakeholder concept took on greater importance due to public interest, greater coverage by the media, concerns about corporative governance and its adoption as a policy within the scope of the Third Way (Hutton, 1999; Greenwood, 2008).

The instrumental stakeholder theory focused on how stakeholders' value could be applied to improve corporate performance and efficiency. It treated stakeholders as means to an end. This theory legitimized the claims of stakeholders on the grounds of stake holding as an effective means to improve efficiency, profitability, competition and economic success. This view was expressed by Campbell who supported stakeholder theory not from a leftwing reason of equity, but because it was fundamental to understanding how to make money in business (Letza & Sun 2012). Authors argued that the cooperation of stakeholder groups such as employees, customers, suppliers, lenders, stockholders and management were increasingly and vitally important in determining business success and corporate survival, corporate strategy therefore ensured that stakeholder interests were incorporated into, rather than ignored (Patrick, 2014).

Meanwhile, in accordance with Friedman and Miles (2006), the term stakeholder had been deployed indiscriminately in the last two decades. The term was highly popular with businesses, governments, non-governmental organizations and even with the media. Despite this widespread usage, many who adopted the term neither defined the concept nor provided any particularly clear understanding of what they meant as regards what a stakeholder actually was. Even in academic circles, countless definitions of stakeholder were put forward without any of those suggested ever-gaining consensus, and hence there was no single, definitive and generally accepted definition. The works of Bryson (2004), Buchholz and Rosenthal (2005), Pesqueux and Damak-Ayadi (2005), Friedman and Miles (2006) and Beach (2008) contained a total of 66 different concepts for the term stakeholder. Although each researcher defined the concept differently, they did as a rule reflected the same principle to a greater or lesser extent: the company should take into consideration the needs, interests and influences of peoples and groups who either impact on or may be impacted by its policies and operations (Frederick et al., 1992). Hence, according to Clarkson (1995), the stakeholder concept contained three fundamental factors:(1) the organization;(2) the other actors; and(3) the nature of the company-actor relationships.

However, despite the countless definitions and differing emphasizes, which resulted in distorted conceptual interpretations (Friedman and Miles, 2006), a large majority of studies adopted the definition idealized by Freeman (1984) that individuals or groups could influence or be influenced by the scope of organizational

objectives. Within this concept, a person, an informal group, an organization or an institution could all be stakeholders. Mitchell et al. (1997) stated that the Freeman (1984) definition was so broad that it opened up an infinite scope for stakeholders as even climatic factors could play this role. Hence, there was a need to establish limits to the extent of stakeholders. To this end, Freeman and Evan (1990) reduced the organizational environment to a multilateral agreement between an organization and its stakeholders.

The stakeholder theory therefore provided background to the development of project success in line with the stakeholder decision and effect where inductive thematic analysis investigated which factors stakeholders, involved in projects, perceived as key to project success. It provided a better understanding of project success and identified perceptions by senior management, project core team and project recipient stakeholder groups. The theory pointed on how stakeholder participation affected sustainability of public street light development projects in Nairobi County.

Conceptual Framework

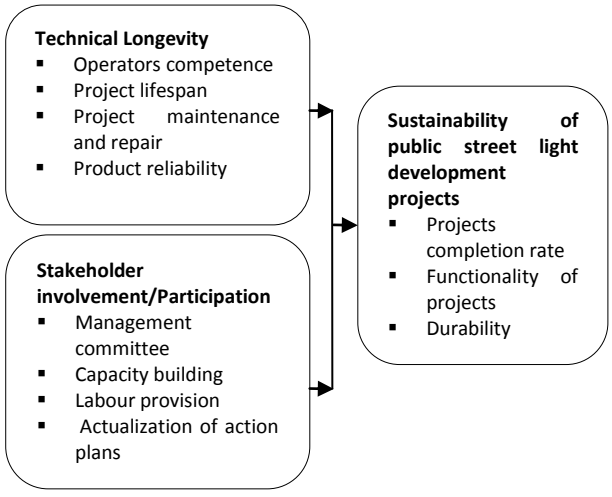

Figure 1: Conceptual Framework

Technical Longevity

Sustainable and efficient public street lighting development projects were mainly dictated by the duration of the technology adopted and the durability of the materials used in installation works. Durable and energy efficient technologies also improved the sustainability of the lightening projects (Chepesiuk, 2011). For instance, Boston city began working with the Boston Energy Alliance to implement long-term energy goals. Through this alliance, Boston was developing a strategy to eventually install solar technology throughout the city streets to reduce the effects of environmental pollution and improve the sustainability and quality of street lighting projects and life for Boston residents. This was one of many efforts the City was making to become more energy efficient and durably sustainable (Bazell, 2013).

Energy conservation technology was becoming a topic of great concern all over the world, especially in metropolitan areas when suitability of the street lighting projects was concerned. About how long a technology used was capable to sustain public lighting was a major factor that governments all over the world considered (Rogers, 2010). Because of the variances in lumens (light output), color rendition, and light distribution of LED technology, it was important to test the performance of the products on actual road surface conditions to measure the differences in light quality, color, brightness, light direction, and energy used (Ross, 2011; IDA, 2010). For instance, Grenlec conducted a survey to gain customer observations and preferences between the three types of LED street lighting being tested. The LED Street Light Pilot Project ran through May 26, 2015, providing time to collect technical performance data and customer survey information for assessing the LED street light options and their longevity to sustain the projects. Further evaluations and results of this pilot were to determine the economic feasibility and

schedule for future LED street light installations in Grenada (Administration of LED Light Watching, 2010).

Modern technology practices on public street lighting projects saved significant levels of energy and costs making such elements stay for a long period and sustaining the projects especially when costs were kept low and manageable. This was able to improve urban safety on street lighting projects hence enabling an appealing atmosphere worth living in, and sustainably reduces CO_2 emissions (Herring, 2014). As an investment project, it was therefore capable of achieving positive urban development more quickly than other modernization projects. According to a survey by the German Energy Agency (dena), the technical state of street lighting in Germany was estimated by 51% of councils as being in need of upgrading. This was scalable for different other European countries. In previous refurbishment of Public Street lighting projects, OSRAM was able to save and sustain up to 85% of lighting overheads due to the use of energy-efficient LED lighting technology and intelligent light management systems, simultaneously achieving an improvement in the quality of light and its sustainability (Geller & Leonelli, 2011).

As cities continued to expand, people were searching for new ways to become more energy sustainable and environmentally friendly (Ross, 2014). Green technology was rapidly growing in popularity and was being used more frequently in urban areas in order to benefit the street lighting by conserving energy. One way that some cities were trying to sustain energy consumption was by renovating their street lights using appropriate technologies. Although street lights only contribute to about 8% of the world's energy consumption, the current technology only allows for these lights to use 25% of the energy provided to them while the rest is converted to heat and ultimately wasted (Coltrin, 2013).

In response to this growing problem, many cities worldwide began implementing energy efficient and environmentally friendly street lighting technology. One example was a town in northwest Germany that implemented an energy savings plan developed by an engineer named Doerentup (2013). He designed an energy plan that turned off the street lights in the town at 9 p.m. to save and sustain electricity for longer periods. After a town resident registers on the town website, he or she could call a central number and enter a street code to illuminate the specific street for several minutes as needed. The reduction in energy consumption resulted in large saving on the town's energy costs (Danigelis, 2013). In addition to energy efficiency, several other concerns loomed for street lights, such as evenness of light and proper visibility. Many people were under the impression that bright lighting would create a safer and sustainable environment (Ross, 2014).

Stakeholder Involvement/Participation

Participation was the process by which stakeholders influenced and shared control over priority setting, policymaking, resource allocations and or program implementation (World Bank, 2010). It was the act of tackling part or sharing in the activities of a group. Participation could be seen as a process of empowerment of the deprived and the excluded. This view was based on the recognition of differences in political and economic power among different social groups and classes (McGee and Norton, 2001). It was widely acknowledged that sustainable economic and social development including the success of various development initiatives required not merely financial and physical investment but also effective participation of the people in ownership and control of resources, in evaluation of possible solution to their problems and obstacles to development, and in setting up development priorities and strategies (Mongula, 2015).

Food and Agricultural Organization (FAO) launched the peoples participation programme (PPP) in 1980 (FAO, 1992). Since then PPP implemented pilot projects throughout the developing world in an attempt to test and develop an operational method of people's participation for incorporation in larger rural development schemes. The experience of PPP had demonstrated that true participation was possible only when the rural poor were able to pull their efforts and resources in pursuit of objective they set for themselves. Participation had been endorsed by most of the World's governments, international financial institutions and bilateral donor agencies as the most effective instrument for bringing about sustainable development (Feeney, 2010). Michener (2008) reported that development actors believed that participation rescued the development industry from being top-down, paternalistic, and dependency-creating. It had been suggested (Michener, 2008) that urban development actors should facilitate primary stakeholders towards enhancing participation, empowerment and ownership of the development interventions for their sustainability.

According to White (2008), critics of participatory approach had argued that participatory development demanded beneficiaries' time and energy which they preferred to spend on other productive or recreational activities. In response to this, White (2008) argued that this was true for participation, which was not beneficiary-based and said that the sustainability of such development interventions was open to doubt. According to Pauline (2009), an important factor for the sustainability of projects was the genuine involvement of the beneficiaries as active participants and equal partners whose concerns and experiences were intrinsic to the project's success. The level of people support determined whether a project became established, how quickly and successfully it consolidated, and how it responded and adapted to meet changing needs. It was therefore important that involving local communities' started at the planning stage, when decisions were being made about what type of project was required.

Furthermore, Nkya (2013) noted that the more important components for development projects to succeed were the voluntary commitment of the beneficiary to the development; and the involvement of the beneficiaries in project decision making. It was important to build these elements into the design of the project. Having the beneficiaries' commitment to their own resources served several functions. First, the ability to obtain a resource commitment demonstrated that the activity was fulfilling needs that the beneficiaries thought were important. Second, a resource commitment made the people to have a sense of ownership which was necessary to ensure long-term sustainability. To ensure the sustainability of project activities and interventions, a project design must be built in an ongoing dialogue between project management and the beneficiaries. Mechanisms could be incorporated into project activities to promote the participation of the resident population in testing technological packages, organizational arrangements, and delivery and marketing systems (Cassen, 2009). Foster and Maghimbi (2010) reported that the central concern in development work seemed to be the close involvement of the people in the development process from planning and implementation to evaluation stage to ensure that, in the end, the development effort had a positive and lasting impact on the people without compromising future development prospects. This would help them to change direction of the implementation strategies used whenever needed.

Capacity building and beneficiary involvement in all stages of project cycle was a very crucial point to enhance sustainability. The most common definition of capacity was the ability of an organization to survive, that is, to be self-

sustaining. However survival was not enough. Other key concepts included empowerment, institutionalization, and its system development. Capacity was defined as the ability to anticipate changes; make informed decisions; develop programmes; attract, utilize and manage resources; and evaluate performance to guide future actions. The purpose of capacity building was to help communities handle their environment rather than having their environment control them (Eade, 2008).

One of the primary obstacles to the implementation of projects/programmes was the absence of capacity and managerial, financial or planning skills at the local level (Bhatt, 1995). At local level, residents lacked power, access to resources and skills to help themselves (FAO, 2015). Capacity building was about training and other methods to help develop skills necessary for them to maintain the projects and achieve their intended purpose (Wilcox, 1994). Capacity building was not a precursor to participation, but a process of development through action, which was supported by projects, established in accordance with certain principles (Hart, 2004). It was very important to focus capacity building at the local community driven approach to sustainability, and to establish and strengthen mechanisms to allow sharing of experience and knowledge between community groups at local, national and international levels. Although capacity building was difficult to attempt, it was the heart of the development process. Pauline (2009) further noted that professionals could play a number of different roles in community development projects, all of which required trust and good working relationships with local people and other professionals. In order to establish good rapport, professionals needed time, resources and authority to invest in a project. Flexibility was critical in the way professionals interpreted their own and others' roles and in the activities of the projects undertaken. In the street lighting projects across Africa the, developers therefore developed capacity and the residents and local authorities if the projects were to be sustainable.

Empirical Review

Due to the immense role streetlights played in bringing security to drivers and pedestrians, the development of streetlights begun in the 9th Century with Kerosene lamps to High Pressure Sodium lights in the 20th Century to the more advanced and efficient technologies like the light emitting diodes. Most street lights in the past were of the conventional nature.

A directive by the European Parliament and Council on street lighting outlined Eco design requirements for energy using products, focusing on energy consumption during the entire product lifecycle including production, transport, scrapping and recycling. One aspect of the directive was the phasing-out of high-pressure mercury (HPM) lamps by 2015 and of medium efficient metal halide lamps by 2017 (EPEC, 2009). Due to the energy required by incandescent bulbs, solar power was not previously viable.

Solar Street Lights (Solar home, 2010) were initially used mainly in Third World countries, in remote areas or where electricity was not always available or supply was unreliable. Solar technology evolved and solar projects appear in developed as well as developing countries (Solar home, 2010). Solar panels were developed to be installed on street lights of various sizes and wattages. Solar streetlights were photovoltaic powered panels generally mounted on the lighting structure that contributed to ensuring safety in the night. Most had light detectors, which informed them of how bright it was outdoors so there was no need to worry about turning them on or off because they turned on at dusk and off at dawn automatically (Solar home, 2010).

Technical Longevity

Chang et al., (2010) did a study on berry phase effects on electronic properties and established that conventional streetlight usually adopted high-brightness and high-power light emitting elements to achieve high brightness, and the heat was dissipated by the casing of the streetlight. Conventional street lighting was estimated to account on a global scale for around 159 TWh of electricity use per year. A reduction of consumption by 50% would globally eliminate around 80 TWH of electricity consumption and avoid around 40 MtCO2 per year (CCI 2010). The share of streetlights, of the electricity bills could vary between 5% to up to 60%, mainly depending on variables, such as the size of the city services as well as the efficiency of its street lights (CCI 2010, REEP 2009). It was for this reason that the need to adopt the use of solar energy to power streetlights remained an attractive venture.

Coltrin et al. (2013) assessed the effects of shock-cell structures and corresponding sound pressure levels emitted from closely spaced supersonic jet arrays. The study found out that green technology was rapidly growing in popularity and was being used more frequently in urban areas in order to benefit the street lighting by conserving energy. One way that some cities were trying to sustain energy consumption was by renovating their street lights using appropriate technologies. Although street lights only contributed to about 8% of the world's energy consumption, technology only allowed for these lights to use 25% of the energy that was provided to them while the rest was converted to heat and ultimately wasted.

Stakeholder Involvement/Participation

Mbagaya (2009) carried out an evaluation of public private partnership framework in service delivery, city of Nairobi. The main objective of the study was to evaluate the role of Pubic Private Partnerships in the provision of sustainable urban services, where the provision of core civic functions and service delivery, by the traditional providers, the City Council of Nairobi (NCC) had not kept pace with urban growth. Using data collected from both primary and secondary sources, the researcher found that the single institutional approach to service delivery was not sufficient for the provision of adequate urban services and called for a new institutional framework to supplement local authority efforts in the provision of quality public services. Additionally, the study showed that where PPPs were involved in the provision of urban services albeit on a small scale, the quality of service improved. King'ara (2012) on a study on the procedural fairness and the privatization of public Services focusing on the street lighting contract between Nairobi city council and adopt-a-light limited concluded that, procedural fairness played a unique role in maintaining public accountability. It ensured that a public administrative body was accountable to an individual in respect of its decisions that affected that person. It also improved the whole system of government decision making by increasing its openness and transparency.

Nkya (2013) established management of crises in Tanzanian secondary Schools. The study revealed that the more important components for development projects to succeed were the voluntary commitment of the beneficiary to the development; and the involvement of the beneficiaries in project decision making. These elements were to be built into the design of the project. Having the beneficiaries' commitment to their own resources served several functions. First, the ability to obtain a resource commitment demonstrated that the activity was fulfilling needs that the beneficiaries thought were important. Second, a resource commitment made people to have a sense of ownership which was necessary to ensure long-term sustainability. To ensure the sustainability of project activities and interventions, a project design was built in an

ongoing dialogue between project management and the beneficiaries.

Eade (2008) did a study on capacity building and beneficiary involvement. The finding revealed that in all stages of project cycle, capacity was a very crucial point to enhance sustainability. The most common definition of capacity was the ability of an organization to survive, that is, to be self-sustaining. However survival was not enough. Other key concepts included empowerment, institutionalization, and its system development. Capacity was defined as the ability to anticipate changes; make informed decisions; develop programmes; attract, utilize and manage resources; and evaluate performance to guide future actions. The purpose of capacity building was to help communities handle their environment rather than having their environment control them.

RESEARCH METHODOLOGY

A descriptive research design was applied in this study. Descriptive research gave the researcher the opportunity to use both quantitative and qualitative data in order to find data and characteristics about the population or phenomenon that was being studied (Mugenda & Mugenda, 2003). The study was conducted at the Nairobi County offices and the population of interest was the electrical department. The primary research data was collected from the management staff working at Nairobi County using a self-administered semi structured questionnaire. Secondary data was collected from the Nairobi County records, including the Workbook and Service Charter Manual and was used to supplement primary data as well as to give insights into current developments towards sustainability of street lighting.

FINDINGS AND DISCUSSION

The population of the study included contractors and community leaders (administrators). Stratified proportionate random sampling technique was used in coming up with a sample of 174 out of the total population of 319. Out of 174 questionnaires administered, a total of 136 filled questionnaires were returned giving a response rate of 78% which was above what Mugenda and Mugenda (2011) prescribed as a significant response rate for statistical analysis and established at a minimal value of 50%. The researcher sought to know the gender of the respondents. From the findings the study showed that 58.1% of respondents were male while 41.9% of the respondents were female. This showed that the researcher was not biased since he catered for all gender in the study. The respondents were further requested to indicate their academic qualification. From the findings 49.3% of the respondents indicated that their academic qualification was the bachelor's degree level, 33.1% indicated diploma, 9.6% indicated the post graduate level whereas 8.1% had certificate. This implied that respondents were literate enough to interpret the topic of the study. The respondents were also requested to indicate the duration of time they had worked in the Nairobi County Government offices. As per the findings the majority of the respondents had worked in county government offices for a period of 6 to 10 years as indicated with 34.6%, those who had worked for a period between 11 and 15 years were 30.0%, more than 15 years were 20%, whereas 15.4% respondents indicated that they had worked in the county government offices for a period between 1 and 5 years. These findings deduced that the respondents had enough experience in the county government offices hence they gave the relevant information researcher required.

Technical Longevity

The study assessed the effect of technical longevity on sustainability of public street light development projects in Nairobi County.

Extent Technical Longevity Influences

The respondents indicated to what extent technical longevity influenced sustainability of public street light development projects in Nairobi

County. The results of the findings were as show in the table 1.

Table 1: Extent Technical Longevity Influences

	Frequency	Percent
Very great extent	54	39.7
Great extent	43	31.6
Moderate extent	23	16.9
Little extent	16	11.8
Total	**136**	**100**

It was found that, 39.7% of the respondents indicated that technical longevity influenced sustainability of Public Street light development projects in Nairobi County to a very great extent, 31.6% indicated great extent, and 16.9% indicated that technical longevity influenced sustainability of Public Street light development projects in Nairobi County to a moderate extent whereas 11.8% indicated a little extent. This implied that technical longevity significantly influenced the sustainability of Public Street light development projects in Nairobi County. The findings were in conjunction with Rogers (2010) who indicated about how long a technology used was capable to sustain public lighting was a major factor that governments all over the world were considering.

Extent of Influence of Aspects of Technical Longevity

The study further asked the respondents to indicate to what extent aspects of technical longevity influenced sustainability of Public Street light development projects in Nairobi County. The results of the findings were as shown in the table 2.

Table 2: Extent of Influence of Aspects of Technical Longevity

	Mean	Std. Deviation
Operators competence	4.1556	0.95240
Project lifespan	3.8778	1.11373
Project maintenance and repair	3.6222	1.23009
Product reliability,	4.1006	0.83666

From the findings the respondents indicated that operators' competence affected sustainability of Public street light development projects in Nairobi County to a great extent as showed by a mean score of 4.1556. This was in accordance to Chepesiuk (2011) who indicated that durable and energy efficient technologies could also improve the sustainability of the lighting projects.

The respondents further indicated that product reliability affected the sustainability of Public Street light development projects in Nairobi County to a great extent as was noted by mean score of 4.1006. It was also indicated that project lifespan and project maintenance and repair greatly influenced sustainability of Public Street light development projects in Nairobi County as showed by mean scores of 3.8775 and 3.6222 respectively. These were in line with Ross (2014) who argued that as cities continue to expand, people were searching for new ways to become more energy sustainable and environmentally friendly.

Stakeholder Involvement/Participation

The study further evaluated how stakeholder participation affected sustainability of public street light development projects in Nairobi County.

Extent Stakeholder Involvement/Participation Influences

The respondents were further required to show to what extent Stakeholder involvement/Participation affected sustainability of Public Street light development projects in Nairobi County. The findings were as shown in the table 3.

Table 3: Extent Stakeholder Involvement/Participation Influences

	Frequency	Percent
Very great extent	43	31.6
Great extent	56	41.2
Moderate extent	22	16.2
Little extent	15	11.0
Total	**136**	**100**

According to the findings in table 3, 72.8% (99) of the respondents indicated that Stakeholder involvement/Participation affected sustainability of Public Street light development projects in Nairobi County greatly. Those who considered Stakeholder involvement/Participation to affect sustainability of Public Street light development projects in Nairobi County moderately were 16.2% only. Most of the respondents (41.2%) considered Stakeholder involvement/Participation affected sustainability of Public Street light development projects in Nairobi County to a great extent while 31.6% considered Stakeholder involvement/Participation to affect sustainability of Public Street light development projects in Nairobi County to very great extent. These results indicated that Stakeholder involvement/Participation significantly affected sustainability of Public Street light development projects in Nairobi County. According to White (2008), who did a study and found that critics of participatory approach argued that participatory development demanded beneficiaries' time and energy which they preferred to spend on other productive or recreational activities.

Extent of Influence of Aspects of Stakeholder Involvement/Participation

The study further asked the respondents to indicate to what extent aspects sstakeholder involvement/participation influenced sustainability of Public Street light development projects in Nairobi County. The results of the findings were as show in the table 4.

Table 4: Extent Aspects of Stakeholder Involvement/Participation Influences

	Mean	Std. Deviation
Management committee	4.5356	0.82637
Actualization of action plans	3.8134	0.97092
Capacity building	2.1223	0.84976
Labour provision	3.9445	0.81557

From the findings the respondents indicated that management committees affected the sustainability of Public Street light development projects in Nairobi County to a very great extent as shown by a mean score of 4.5356. The results correlated with Pauline (2009) who argued that an important factor for the sustainability of projects is the genuine involvement of the beneficiaries as active participants and equal partners whose concerns and experience were intrinsic to the project's success.

Labour provision and actualization of action plans to a great extent affected sustainability of Public Street light development projects in Nairobi County as was shown by mean scores of 3.9445 and 3.8134 respectively. These were similar to Nkya (2013) who noted that the more important components for development projects to succeed are the voluntary commitment of the

beneficiaries to the development; and the involvement of the beneficiaries in project decision making.

However, capacity building moderately influences the sustainability of Public Street light development projects in Nairobi County as indicated by a mean score of 2.1223. It was concluded that the primary goal of local community projects in the study area was to meet their basic resources needed in ways that it could be continued in future; the question of stakeholder participation from sustainability perspective was where control should reside, that is, whether mobilization, community development, organizing or empowerment strategies were employed. This concurred with (White, 2008; Hayuma, 2011; Nyiransabimana, 2017) who argued that this was true for participation, which was not beneficiary-based and said that the sustainability of such development interventions was open to doubt.

Sustainability of public street light development projects in Nairobi County

The respondents had to indicate on the trend of aspects of Community Resilience in their County for the last five years. The findings were recorded in the table 5.

Table 5: Trends of Aspects of Community Resilience in the past five years

	Mean	Std. Deviation
Projects completion rate	3.8146	0.92965
Functionability of projects	3.5423	0.70631
Durability	4.1834	0.92965

From the findings the respondents indicated that durability had improved for past five years as was shown by a mean score of 4.1834. This was in line with Eade (2008) who argued that the purpose of capacity building was to help communities handle their environment rather than having their environment control them.

Projects completion rate (Mean=3.8146) and functionability of projects (Mean=3.5423) had also improved for the past five years in the county. These concurred with Parente and Prescott (2011) who claimed that most industry studies suggested that the adoption of a new technology required investment in capital, with a substantial fraction taking the form of investment in intangible capital.

CONCLUSIONS AND RECOMMENDATIONS

The study evaluated factors influencing sustainability of public street light development projects in Nairobi County. The study found technical longevity influenced sustainability of Public Street light development projects in Nairobi County to a great extent. The analysis of study showed that operators' competence affected sustainability of Public Street light development projects in Nairobi County to a great extent. Other aspects that were found to have a great extent on sustainability of Public Street light development projects in Nairobi County were project lifespan, product reliability and Project maintenance and repair greatly.

According to the findings, stakeholder involvement/Participation was found to have a great influence on sustainability of Public Street light development projects in Nairobi County. In relation to aspects of stakeholder involvement the study noted that management committee affected the sustainability of Public Street light development projects in Nairobi County to a great extent. Labour provision and actualization of action plans had great effect on sustainability of Public Street light development projects in Nairobi County. However, capacity building was found to moderately influence the sustainability of Public Street light development projects in Nairobi County.

Conclusions of the Study

The study concluded that technical longevity significantly influenced sustainability of Public street light development projects in Nairobi County.The study established that operation competence affected sustainability of Public Street light development projects in Nairobi County. Other aspects such as Project maintenance and repair influenced the sustainability of Public Street light development projects in Nairobi County.

The study further concluded that stakeholder involvement/Participation had a significant effect on sustainability of Public Street light development projects in Nairobi County. Aspects of stakeholder involvement which included; management committee, labour provision, actualization of action plans and capacity building influenced the sustainability of Public Street light development projects in Nairobi County.

Recommendations of the Study

The study recommended that management team of Nairobi County Government should consider operation competency when initiating a project of Public street light development. This aspect of operation competence would enable the management team to assess experience of project teams brought on board. The management team of the Nairobi County should also consider product reliability of the street light components since these had a significant effect on the sustainability. Furthermore, the management should establish a strong monitoring team with responsibility of monitoring the performance of the street light in order to establish and identify those which failed or about to fail and make replacement before they failed completely, as shown by effects of maintenance and repair.

The study further recommended that that the County Government of Nairobi should form a competent committee with task of determining the project requirements. The committee should develop a plan on how the project would be introduced, implemented and properly managed. The committee would also come up with a budget or cost of the project as well as labour requirements. Capacity building should also be done to enhance efficiency of the project. This would enhance sustainability of street light development project.

Suggestion for Further Studies

Another study should also be done to explore those other factors affecting sustainability of Public Street light development projects in Nairobi County as the two considered had an effect of 65.5%. These other factors could for example include effects of cost variations in sustainability of Public Street light development projects in Nairobi County.

From the findings, conclusions and recommendations, the study suggested that an in-depth study should be carried to determine the challenges faced by County Governments in implementing the public street light development projects. A further study should also be carried out to establish the effects of public street light development projects on performance of County government of Nairobi.

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