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The Joint Effect of Capacity in Monitoring and Evaluation and Stakeholder Engagement on Execution of Street Lighting Projects in Turkana County, Kenya

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Abstract

Project implementation is a critical phase of the project lifecycle that directly determines project success. Sustainable organizational performance relies on structured project management procedures rather than arbitrary methods, which frequently lead to unpredictable outcomes. This study assessed the joint effect of capacity in M&E and stakeholder engagement on implementation of street lighting projects in Turkana County, Kenya. Anchored in stakeholder theory, the study adopted a cross-sectional survey design. The target population consisted of 34 Chief Officers/M&E Experts, 6 Sub-county Quantity Surveyors, 6 Sub-county Electrical Engineers, 6 M&E Focal Persons, 6 Project Implementation Committee Chairpersons, 6 Sub-county Financial Directors, and 6 Sub-county Procurement Officers. Simple random sampling was used to select 27 Chief Officers/M&E Experts, while a census approach was adopted for all other categories. Data were collected using questionnaires and document analysis checklists. Quantitative data were analyzed using frequencies, means, and standard deviations, while hypotheses were tested via simple linear regression using SPSS Version 25 and the Hayes PROCESS Macro v4.1. The findings demonstrated a significant relationship between stakeholder management and the implementation of street lighting projects ($p < 0.05$). Actively involving stakeholders in decision-making processes improved the quality of project monitoring and evaluation (M&E) reports, ultimately enhancing project execution. Furthermore, the interaction term (X × W) explained an additional 14.5% of the variance in project implementation ($\Delta R^2 = 0.145$), and the overall model was statistically significant ($p < 0.05$). This indicates that the independent and moderator variables jointly predict the dependent variable. Notably, the results confirm that the moderator variable (stakeholder engagement) significantly alters the relationship between M&E capacity and the implementation of street lighting projects.

Keywords: Stakeholder engagement, M&E, Project implementation, Street lighting projects.

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BACKGROUND OF THE STUDY

Infrastructure development serves as the foundational cornerstone of socioeconomic transformation, particularly within developing nations. Among essential public infrastructure interventions, street lighting projects have assumed immense prominence due to their multifaceted developmental benefits. Beyond basic illumination, modern public lighting enhances citizen security, extends commercial trading hours into the night, improves road safety, and upgrades urban aesthetics (Mukamwiza & Hakizimana, 2021). Historically, street lighting has evolved from pre-modern torches and oil lamps to contemporary, algorithm-controlled, solar-powered systems, a trajectory that mirrors human civilization and urbanization. In the modern era, implementing street lighting is an intricately complex, socio-technical process that extends far beyond the physical installation of hardware (Schwabe et al., 2024). Urban lighting design shapes a community's "sense of place," steers pedestrian traffic, highlights architectural heritage, and directly influences local energy consumption and grid stability. Furthermore, public lighting acts as a critical indicator of community well-being, directly impacting quality of life, the perception of safety, and the capacity of citizens to engage in night-time social and economic activities (Ntshangase et al., 2024). Consequently, comprehensive Monitoring and Evaluation (M&E) for these projects must transcend simple asset counting. Effective M&E frameworks must systematically assess energy conservation metrics, maintenance response times, and systemic changes in economic activity, public perception, and local crime rates.

Global Constraints in Project Implementation

Unprecedented urbanization and rapid technological advancements in the 20th and 21st centuries have placed immense strain on municipal infrastructure, particularly across Asia and Africa. Local authorities face an escalating demand for reliable, cost-effective public lighting to support expanding road networks and vulnerable informal settlements where darkness compounds criminal activity (Nduhura et al., 2024). However, executing these public works in resource-constrained environments presents severe execution challenges. To bypass budgetary deficits, innovative financing mechanisms such as leasing agreements and performance-based contracts have been globally adopted to delegate installation and maintenance to private entities based on efficiency metrics. Yet, international precedents demonstrate that irrespective of the procurement or financing model used, structural vulnerabilities in installation, commissioning, and continuous maintenance can trigger rapid asset deterioration. As observed by Chowdhury, Sultana, and Sourav (2022), neglecting proper maintenance procedures causes frequent outages, diminishes public confidence, and rapidly depletes hard infrastructure investments. This underscores the reality that "soft" management capabilities, specifically robust M&E and inclusive stakeholder management, are vital safeguards for physical capital.

Regional and National Legal Frameworks

In Kenya, the right of citizens and institutional stakeholders to actively participate in developmental initiatives is legally protected. This right is constitutionally mandated under the Constitution of Kenya (2010) and operationalized through the Public Participation Act (2019). These statutory frameworks recognize that sustainable development relies on local ownership and institutional accountability. To bridge the infrastructure gap nationwide, the national government has historically launched large-scale electrification initiatives. For instance, in 2016, a Ksh. 7.6 billion national street lighting project was commissioned, which included a Ksh. 2.5 billion allocation earmarked for installing 24,485 lighting units across various counties

(Government of Kenya, 2022). Despite these massive capital injections, empirical evidence indicates that the delivery of these public utilities remains suboptimal. National project failures are frequently linked to deficient stakeholder engagement and weak institutional M&E strategies (Micheni, 2023).

The Local Context: Turkana County

Turkana County is the second-largest county in Kenya, accounting for approximately 13% of the nation's total landmass. Characterized by an arid and semi-arid (ASAL) climate, the region experiences extreme temperatures exceeding 40°C and low, erratic annual rainfall ranging between 150 mm and 400 mm. These harsh climatic conditions limit agricultural productivity, leaving nomadic pastoralism and fishing as the primary economic pillars. Fresh agricultural produce must be transported by road from Kitale in the Rift Valley to the county capital of Lodwar, which serves as the central commercial hub for the northwestern region and neighboring countries like Ethiopia, South Sudan, and Uganda. Socioeconomically, Turkana remains highly marginalized; according to UNICEF (2021), 88% of the county's population lives below the poverty line, compared to a national average of 45%. Despite these vulnerabilities, the commercial discovery of viable oil reserves in 2012 catalyzed fresh public and private investments. Because daytime temperatures are prohibitively high, the expansion of street lighting became an economic necessity to foster equitable socio-economic development through a thriving night-time economy.

Stakeholder Engagement

In the context of public infrastructure development, a participatory approach is essential to the sustainability of street lighting projects. Local residents, as the primary beneficiaries, are uniquely positioned to provide experiential feedback regarding whether newly installed infrastructure effectively stimulates the night-time economy, mitigates crime, or enhances general neighborhood security. By actively involving community members in data collection and feedback loops, project evaluators can capture qualitative, real-life impacts that strictly quantitative metrics often overlook (Irungu & Maitho, 2022). Conversely, institutional stakeholders, such as local government representatives, contribute vital technical and regulatory oversight to the monitoring and evaluation (M&E) process, ensuring alignment with statutory guidelines and national policy frameworks. Furthermore, supply-side stakeholders, including energy providers and private contractors, offer critical data regarding maintenance schedules, technical grid constraints, operational challenges, and cost-effectiveness. Integrating this diverse matrix of stakeholders yields a highly comprehensive, reliable, and actionable data repository that directly improves project oversight (Nkuebe & Ochieng, 2023).

Project Implementation

Project implementation constitutes the operational phase within the project lifecycle where planned objectives are translated into actionable tasks to achieve specific goals (Amadi, 2023). According to Yanwen (2022), successful execution requires that a project achieve its predefined scope while remaining constrained by budgetary allocations and tight schedules. This demands rigorous fiscal monitoring, precise resource allocation, and continuous task tracking to secure the desired deliverables (Musau & Kirui, 2019). Comprehensive project implementation culminates in goal attainment, the realization of end results, and the seamless transfer of ownership and responsibility to the end-users or local authorities (Chinn & Kramer, 2020).

Empirical evidence demonstrates that public and non-profit initiatives frequently struggle with execution inefficiencies due to unstructured methodologies, leading to unpredictable outcomes and project stagnation (Muli, 2022; Ochieng & Prince, 2023). To circumvent these challenges and ensure successful implementation, critical determinants must be established. These include clear objective alignment, robust strategic planning, competent team selection, stakeholder relationship management, structured project scheduling, and open channels of communication (Riggs, 2021).

Street Lighting Projects in Turkana County

Public lighting infrastructure is central to the socioeconomic stability of developing regions, making its delivery a priority for municipal and regional authorities. Efficient street lighting is a critical public good; conversely, inadequate or poorly maintained lighting systems impose substantial financial deficits and exacerbate public safety risks. Consequently, contemporary urban centers are increasingly investing capital into energy-efficient lighting upgrades, which simultaneously curtail municipal energy consumption, reduce long-term operational costs, optimize public safety, and catalyze nighttime commerce (Shaw, 2024). In Kenya, this modernization agenda gained momentum in 2014 through a national street lighting project initially targeting rehabilitation in Nairobi County, which subsequently scaled to major urban hubs, including Mombasa, Kisumu, and Nyeri, ultimately reaching over 500 towns and market centers across the country (Kariuki, 2022). To operationalize these national targets at the local level, county governments such as the Turkana County Government have deployed diverse delivery frameworks, ranging from localized community-based initiatives to complex public-private partnerships (PPPs) designed to bridge the infrastructure deficit.

Research Problem

The implementation of public infrastructure projects is frequently undermined by systemic bottlenecks, including inadequate stakeholder engagement, deficient communication channels between developmental actors and government entities, fragmented institutional structures, and acute resource constraints (Aupe & Sagwa, 2020). While street lighting initiatives are universally recognized as critical interventions for enhancing urban livability, stimulating night-time commerce, and improving civic security, their execution in developing regions is severely compromised. These localized challenges are further compounded by a lack of reliable baseline data and the absence of sustainable Monitoring and Evaluation (M&E) systems. Ultimately, the success of these public installations depends on the organizational capacity to manage complex technical designs and maintain continuous oversight.

Within localized and marginalized environments like Turkana County, the efficacy of project execution is directly tied to key structural indicators of M&E capacity. These indicators primarily include human resource competence, institutional financial capability, and the formal integration of stakeholder feedback systems. Prior literature establishes that active stakeholder participation is crucial for enhancing the technical and operational accuracy of M&E frameworks (Ngigi, 2023; William, 2024). Furthermore, public sector project sustainability depends heavily on knowledge-sharing networks, continuous capacity building, and transparent governance models (Elmi & Minja, 2023; Ojok & Basheka, 2024). When these structural components are missing or weak, public trust erodes, project efficacy drops, and expensive physical capital quickly deteriorates.

Despite the extensive body of literature focusing on general infrastructure management, a notable empirical gap persists. While international studies indicate a positive correlation

between M&E strategies and stakeholder engagement, such as the work by Wade et al. (2024) in Australia, there remains an acute shortage of context-specific research addressing these dynamics within sub-national jurisdictions in developing nations. Specifically, few studies have explicitly evaluated stakeholder engagement as a formal moderating variable that influences the relationship between M&E capacity and infrastructure delivery within the unique socioeconomic and climatic conditions of Turkana County.

Consequently, without localized empirical evidence, municipal managers lack actionable frameworks to resolve project stalling, vandalism, and operational failures. This study directly addresses this research gap by evaluating how stakeholder engagement influences and moderates the implementation of public street lighting projects in Turkana County, Kenya.

Research Question

What is the joint effect of capacity in M&E and stakeholder engagement on implementation of street lighting projects in Turkana County, Kenya?

Research Objective

To establish the joint effect of capacity in M&E and stakeholder engagement on implementation of street lighting projects in Turkana County, Kenya.

Value of the Study

This study is highly significant given the systemic bottlenecks confronting Kenya's devolved governance structures, including financial irregularities, a deficit in participatory management competencies, and fragmented institutional decision-making frameworks that routinely stall county-level infrastructure delivery. By isolating the dynamics of participatory public works, this study provides project managers, municipal planners, and policy architects with actionable empirical insights. Specifically, it deepens the operational understanding of the core mechanisms and structural methodologies required to institutionalize effective stakeholder engagement strategies.

Stakeholder Theory

The conceptual foundation of this study is anchored on Stakeholder Theory, which was rigorously articulated by R. Edward Freeman (1984) and subsequently advanced by scholars such as Koskela and Howell (2020), Kivits et al. (2021), Deegan (2022), and Mitchell (2022). Freeman’s seminal work provided a revolutionary paradigm shift in organizational management by challenging the traditional shareholder-primacy model. Instead of viewing an institution as a solitary entity answerable exclusively to its financial shareholders, Stakeholder Theory posits that an organization functions within a complex network of internal and external relationships. These include employees, clients, suppliers, local communities, and any other parties whose interests are affected by, or can affect, the achievement of the organization's objectives. Under this framework, the strategic and ethical management of these relationships is considered the core determinant of long-term operational success.

When applied to the public sector, the theory contends that the viability of government-led development initiatives depends heavily on the systemic identification and active integration of relevant stakeholders throughout the project lifecycle. Empirical success is tied to the psychological and operational buy-in of these actors; when communities and end-users perceive that their inputs are genuinely incorporated into decision-making processes, their

motivation to support and protect the infrastructure increases. Integrating Stakeholder Theory with project management principles demonstrates how collaborative strategic actions drive specific, sustainable deliverables. As Koskela and Howell (2020) note, a project task force must possess the requisite operational capacity, and necessary resources must be secured prior to project approval. However, implementation viability is frequently threatened by shifting variables such as contract duration, operational continuity, and the volatility of external funding. Consequently, active stakeholder engagement and a shared commitment to localized Monitoring and Evaluation (M&E) are critical mechanisms to mitigate these operational risks.

Despite its widespread application, Stakeholder Theory faces practical criticisms, primarily regarding its operational boundaries. Critics like Mitchell (2022) argue that an overly expansive definition of a "stakeholder" can dilute managerial focus, making it structurally unfeasible to prioritize conflicting demands or make rapid operational decisions. To resolve this limitation, Freeman and later scholars introduced stakeholder salience models. These frameworks systematically categorize and rank stakeholders based on three attributes: power, legitimacy, and urgency. By transitioning the theory from an abstract philosophical model into a practical management tool, salience mapping allows project managers to strategically allocate engagement resources, ensuring that participatory processes remain manageable and directly aligned with the project's core objectives.

In public infrastructure initiatives such as the implementation of street lighting projects in Turkana County this theoretical framework directly intersects with empirical practice. Within this context, local communities, traders, and regulatory bodies are not bureaucratic roadblocks but essential partners within the project's operational framework. By utilizing structured institutional agreements and open communication channels, public managers can navigate execution bottlenecks, align conflicting socio-economic goals, and foster community ownership. Ultimately, this demonstrates that within complex developmental environments, the intersection of ethical stakeholder commitment and efficient resource management is the primary driver of project sustainability.

Empirical Studies

Within decentralized governance systems like Turkana County, stakeholder engagement represents the institutional mechanism through which local residents and institutional actors actively participate in policy formulation, priority setting, resource allocation, and program execution. The sustainability of county-level developmental initiatives requires not only physical and financial capital injections but also the meaningful involvement of the local populace. This participation fosters local resource ownership, encourages the collaborative identification of systemic developmental bottlenecks, and aligns project strategies with local needs (Mongula, 2023).

In the energy and infrastructure sectors, effective engagement requires project managers to systematically identify, analyze, and address the divergent needs of diverse interest groups, including municipal authorities, local communities, private financiers, and environmental organizations. Managing these dynamics is crucial for securing regulatory compliance, mitigating social risks, and obtaining the social license or community endorsement required for long-term project viability (Osinakachukwu et al., 2024).

The intersection of rigorous Monitoring and Verification (M&V) systems and stakeholder communication is well established in international public works. Evaluations of India's Street Lighting National Programme (SLNP) by the Bureau of Energy Efficiency (BEE) and the

Energy Efficiency Services Limited (EESL) demonstrate that combining engineering telemetry with structured communication channels minimizes vendor non-performance and preserves energy-saving metrics (kWh) across thousands of municipalities (BEE/EESL/World Bank, 2024). Similarly, comparative analyses of LED and smart lighting upgrades across various cities in the United States confirm a direct correlation between proactive public outreach methodologies and successful implementation performance (Northeast Group & CityLab Insights, 2022).

Recent technological advancements in public lighting further highlight the need to balance engineering design with participatory governance. A systematic review by Zhou et al. (2024) regarding Internet of Things (IoT)-based smart public lighting deployments revealed that integrating remote telemetry with formal citizen reporting mechanisms yields superior long-term maintenance outcomes. This finding indicates that hardware installations are insufficient if they lack structured institutional channels for stakeholder feedback.

This socio-technical dependency is further supported by renewable smart lighting pilots, which demonstrate that combining device telemetry with active community committees and local caretakers significantly reduces equipment down-time and mitigates infrastructure theft and vandalism (Smart Lighting Pilot Report, 2023).

Furthermore, smart lighting case studies compiled by Marousková et al. (2021) indicate that cross-departmental coordination within municipalities, paired with public user feedback, is essential for translating monitoring data into enforceable maintenance policies. Even within ecologically focused field experiments, such as those conducted by Stone et al. (2021) regarding the impact of street lighting on local insect populations, empirical findings suggest that municipal governments should adopt stakeholder-inclusive monitoring frameworks to balance civic safety priorities with localized biodiversity preservation.

International development institutions increasingly mandate participatory frameworks to safeguard capital investments. Comparative case syntheses from the World Bank, the European Bank for Reconstruction and Development (EBRD), and the Organization for Economic Co-operation and Development (OECD) demonstrate that integrating mandatory stakeholder disclosure and grievance redress mechanisms directly correlates with improved project responsiveness and reduced community complaints (World Bank IEG, 2024). Beyond infrastructure, the utility of participatory methods is evident in complex healthcare environments; for instance, Haun et al. (2024) utilized participatory intervention mapping among healthcare professionals to illustrate that structured engagement is critical for translating theoretical evidence into clinical practices and mitigating institutional barriers to care.

In large-scale engineering operations, the capacity to adapt to shifting stakeholder dynamics is an important determinant of success. Dolan et al. (2025) conducted a five-year longitudinal mixed-method investigation tracking 15 mega-infrastructure projects budgeted above $1 billion. Utilizing stakeholder network analysis alongside quantitative performance markers, the researchers determined that projects utilizing adaptive stakeholder management strategies, which dynamically adjust to changing lifecycle relationships, realized 38% higher performance ratings and 45% greater stakeholder satisfaction scores than rigid, non-adaptive projects.

Similarly, in the construction industry, stakeholder engagement acts as an essential bridge for risk management. Examining 247 construction projects in developing nations, Chen et al. (2025) observed that stakeholder engagement significantly mediated the relationship between risk management practices and sustainable project performance. Notably, projects exhibiting

high concurrent levels of risk management and stakeholder engagement scored 51% higher on sustainability metrics, yielding a 43% improvement in environmental compliance and a 38% reduction in execution delays. Furthermore, a systematic review of 34 transport mega-projects by Kumar and Patel (2024) across six nations revealed that comprehensive engagement strategies generated 49% higher community acceptance rates, a 36% reduction in implementation delays, and a 42% increase in long-term sustainability ratings.

In East Africa, the execution of public-private partnerships (PPPs) for municipal lighting depends heavily on the regulatory capacity of public authorities. A multi-case analysis by Nduhura et al. (2024) revealed that PPP configurations deliver optimal public utility values only when municipal entities retain strong monitoring and stakeholder engagement capabilities to enforce service standards, coordinate maintenance, and process community complaints.

To optimize these collaborative networks, Masvaure and Fish (2022) examined Evaluation Capacity Development (ECD) interventions across African programs, finding that upgrading institutional M&E routines and skills enhance the utilization of empirical evidence in public decision-making, providing a useful framework for multi-agency infrastructure delivery.

Regionally, Prebanic and Vukomanovic (2023) utilized thematic analysis to examine stakeholder engagement within complex infrastructure developments in Croatia. Their resulting framework model integrated stakeholder participation across three distinct management tiers and three outcome dimensions, concluding that inclusive participation acts as an operational cornerstone for accountability, conflict minimization, and successful project delivery. Similarly, Aaltonen et al. (2024) explored engagement dynamics within temporary organizations, advocating for a transition away from rigid transactional management in favor of collaborative structures that actively include marginalized groups, thereby driving societal value integration.

Within the Kenyan context, empirical research consistently links project outcomes to the depth of participatory management. Kimanzi (2020) investigated the Ngara Housing Project in Nairobi County utilizing a descriptive survey design ($n = 108$). The study established a statistically significant positive correlation between comprehensive stakeholder involvement spanning design, implementation, and M&E reporting and timely project completion ($r = 0.244$, $p < 0.01$), noting that inclusive decision-making improves local accountability and eases operational bottlenecks.

Expanding this scope to county-level governance, Kimanzi (2022) evaluated project delivery within the Kitui County Government, establishing that inclusive stakeholder participation significantly improved project outcomes across scope, cost, time, and quality metrics. This research recommended that county project managers utilize interest-and-influence matrices to categorize stakeholders, streamline resource mobilization, and ensure public accountability.

The consequences of failing to institute robust engagement frameworks are evident in Kenya's higher education sector. Moegh (2023) reviewed the performance of public university construction initiatives following a 2020 parliamentary report revealing that stalled institutional projects had accumulated Ksh. 200.7 billion in stalled works, with over Ksh. 70.3 billion classified as wasted asset value. Surveying 80 institutional practitioners across four state universities in Nairobi County, Moegh (2023) determined that active collaboration among government regulators, university managements, contractors, and local communities significantly determines project completion rates, recommending stricter oversight and synchronized lifecycles to prevent project stalling. Finally, within Arid and Semi-Arid Lands

(ASAL), infrastructure execution requires localized adjustments. Abdi, Okeyo, and Machoka (2024) examined the role of community participation in road project planning across Kenyan ASAL counties. Their analysis revealed a strong positive baseline relationship between project planning and performance (R = 0.648), which was further enhanced when mediated by community participation (R = 0.718). Together, project planning and community participation explained 51% of the total variance in road project performance (R^2 = 0.510). The authors concluded that community engagement alters the connection between planning models and final project deliverables, and they advised engineers to formulate highly contextualized planning frameworks tailored to the unique socio-economic and geographical conditions of ASAL regions.

While the reviewed literature confirms a strong relationship between stakeholder engagement, project performance, and infrastructure sustainability across global and regional contexts, a clear empirical gap remains. The majority of smart lighting and public utility studies (e.g., Thitai & Kamaara, 2024; Maraga, 2024) treat stakeholder engagement either as an independent predictor or a general mediating variable within stable urban settings like Nairobi or Kiambu counties. Furthermore, while pilots by Putra et al. (2023) established direct links between stakeholder involvement and rural lighting execution, there is an acute shortage of empirical data regarding how stakeholder engagement functions specifically as a moderating variable (W) within marginalized, resource-constrained, and climate-stressed ASAL environments like Turkana County. This study addresses this empirical gap by evaluating how stakeholder engagement moderates the relationship between institutional M&E capacity (X) and the implementation success of public street lighting projects (Y) in Turkana County, Kenya.

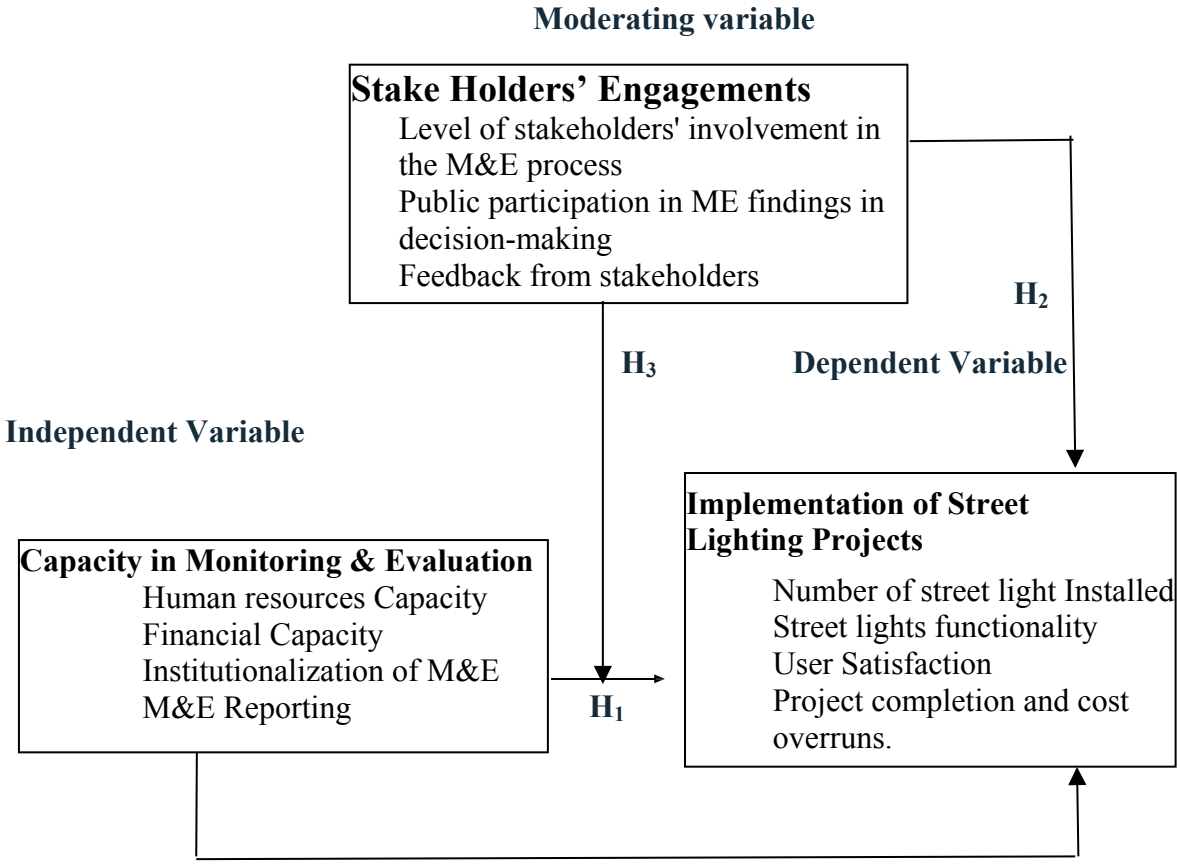

Figure 1: The Study's Conceptual Model
Source: Researcher conceptual framework, (2025)

Research Hypothesis

H_{o1} The joint effect of capacity in M&E and stakeholder engagement does not significantly predict the implementation of street lighting projects in Turkana County, Kenya.

RESEARCH METHODOLOGY

Research Philosophy

This study was anchored on the pragmatic research philosophy (pragmatism). Pragmatism is characterized by an operational focus on selecting structural methods and research designs that "work best" to address the specific research problem under investigation (Creswell, 2022). Rather than being restricted to a single philosophical paradigm, pragmatism allows researchers to bridge the gap between objective positivism and subjective interpretivism. Consequently, this orientation justified the integration of a mixed-methods approach. It accommodated qualitative inquiry specifically through key informant interviews with county administrative leaders involved in managing infrastructure alongside rigorous quantitative analysis across the designated sub-counties as the primary units of analysis. This philosophical framework was highly appropriate for this study, as it provided the flexible, empirically driven methodology necessary to test the research hypotheses and fulfill the stated objectives within a complex public sector environment.

Research Design

The study adopted a descriptive cross-sectional survey design. A cross-sectional design is characterized by the collection of empirical data from a predefined target population at a single, specific point in time. This approach is highly effective for determining the prevalence of institutional attributes, analyzing baseline organizational characteristics, and mapping relationships between distinct variables without manipulating the research environment. For the purposes of this study, the cross-sectional survey design was uniquely suited to measure institutional Monitoring and Evaluation (M&E) capacity, evaluate existing stakeholder engagement strategies, and assess project execution metrics concurrently. By utilizing this descriptive framework, the study systematically captured a comprehensive snapshot of target respondent characteristics. This provided an accurate, empirically sound foundation to analyze how institutional capacity and participatory mechanisms influence the overall implementation of street lighting projects in Turkana County.

Population of Study

The unit of analysis in this study was the implementation of street lighting projects in the various 6 sub-counties in Turkana County (Turkana Central, Turkana South, Turkana West, Turkana East, Turkana North, and Loima).

Table 1: Summary of the sampling matrix by study population units

Study Population Unit	Estimated Number of The Target Population	Sample Size	Sampling Technique
Chief Officers/M&E Expert	34 (Turkana CPSB, 2023)	27 (79% * N)	Purposive Sampling Use Questionnaire
Sub-county Quantity surveyors	6 (Turkana CPSB, 2023)	6	Census Use Questionnaire

Sub-county Projects Electrical engineers	6 (Turkana CPSB, 2023)	6	Census Use Questionnaire
M&E vocal persons	6 (Turkana CPSB, 2023)	6	Census Use Questionnaire
Project implementation committee chair	6 (Turkana CPSB, 2023)	6	Census Use Questionnaire
Sub County Financial director	6 (Turkana CPSB, 2023)	6	Census Use Questionnaire
Sub-county procurement officers	6 (Turkana CPSB, 2023)	6	Census Use Questionnaire
	Total (N) = 70	**Total Sample (n) = 63**	

Source: Researcher, (2023)

Sample Design

A sample is a representative subset of the entire population. Sampling allows you to collect a wide range of data on the population of interest (Bartlett et al., 2001). There are several techniques for selecting the appropriate sample size for a given study. The researcher recorded the number of street lights in each sub-county Project before moving on to Turkana County. The researcher collected data from the six sub-county street lighting projects. This is because the researcher focused on the installation of street lighting projects rather than individual Turkana County citizens. As a result, the target audience was the individuals working on the projects in the various sub-counties, including quantity surveyors, electrical engineers, contractors, subcontractors, county financial directors, county city managers, county procurement officers, county M&E vocal persons, community chairpersons, and chief officers. The people were chosen as the target group because they sparked the researcher's imagination and helped shape how the street light projects were implemented in Turkana County.

Given that the population number was known, the research employed Yamane's (1967) formula for determining a definite sample size as given by the relation $n = \frac{N}{1+N(e^2)}$

Where n represents the sample size, N is the population size, and e is the margin of error set at 5% (the level of precision or 95% confidence level). When we apply this calculation to the target population, we get n = 70 / (1 + 70(0.05)) = 63.

The sample size for this study was 63 people involved in Turkana's street lighting projects. The census was used for all target categories except the chief officials. Purposive sampling was employed for 79% of the 34 county officers. The 27 chief officers were selected from 27 relevant agencies and directly involved in Turkana County's Street light initiatives.

Data Collection Instruments and Procedures

To evaluate the moderating effect of stakeholder engagement on the implementation of street lighting projects in Turkana County, primary data were collected using a structured, self-administered questionnaire alongside an observation checklist. The questionnaire was specifically tailored for county administrative staff and Monitoring and Evaluation (M&E) Focal Persons.

The instrument was divided into distinct, structured components: Part I: Captured the demographic and institutional characteristics of the respondents. Part II: Evaluated the core research variables using a five-point Likert scale ranging from "Strongly Agree" to "Strongly Disagree." This section was systematically subdivided into operational blocks tracking: *Section A:* Institutional Capacity in M&E (Independent Variable, X). *Section B:* Stakeholder Engagement Strategies (Moderator Variable, W). *Section C:* Implementation Success of Street Lighting Projects (Dependent Variable, Y).

To preserve data integrity, the researcher hand-delivered the questionnaires to the respondents, allowing a five-day completion window before collection. Concurrently, an observation checklist was deployed across the six sub-counties to visually audit the operational status and physical condition of the street lighting infrastructure. Prior to analysis, the raw dataset underwent rigorous data cleaning. System-generated and user-missing responses were isolated and explicitly coded as 99 within the Statistical Package for the Social Sciences (SPSS) to prevent missing fields from skewing the statistical output. The final dataset was verified to be free of impossible values, outliers, and unaddressed missing data.

Data Analysis and Statistical Presentation

The cleaned quantitative data were analyzed using both descriptive and inferential statistical methods via SPSS Version 25 and the Hayes PROCESS Macro (v4.1). Descriptive statistics including frequencies, percentages, means, standard deviations, and minimum/maximum values were computed to summarize the demographic profiles and contextual variables from Part I of the questionnaire. To determine the predictive weight of the variables and explicitly test the study's moderation hypothesis, hierarchical linear regression modeling was applied. This approach evaluated the direct effect of M&E capacity (X) on project implementation (Y), followed by the introduction of the interaction term (X × W) to isolate the unique variance (ΔR^2) explained by stakeholder engagement acting as a moderator. The resulting empirical outputs and statistical distributions were organized and presented using structured APA tables, charts, and graphs for clear academic interpretation.

Ethical Considerations

To maintain the highest standards of academic integrity, the researcher ensured that all findings accurately reflected original field evidence. Before launching data collection, formal research clearance and authorizations were obtained from the relevant national and county authorities.

The rights, safety, and privacy of the human participants were protected throughout the research process. Participation was strictly voluntary, and every respondent signed an informed consent form detailing the scope, purpose, potential risks, and civic benefits of the study before accessing the questionnaire. Finally, strict confidentiality was maintained by anonymizing all respondent identities and managing the collected field data securely.

RESULTS DISCUSSION AND INTERPRETATION

Respondents' Response Rate

A questionnaire and an observation schedule were used to gather data. Chief officers and M&E specialists, sub-county quantity surveyors, sub-county electrical engineers for projects, M&E representatives, the chair of the project implementation committee, the sub-county financial

director, and sub-county procurement officers were among the respondents. The response rate attained during the administration of the research instruments is shown in Table 2.

Table 2: Response Rate

Questionnaires	Percentage
Response	100%
Non-response	0%
Total	**100%**

Source: Researcher, (2024)

A total of 63 questionnaires were distributed to the 63 respondents, and all were returned to the researcher, resulting in a 100% response rate for the study. Therefore, the response rate in this study was adequate, as evidenced by the results in Table 2. This is also substantiated by Ogula, Ogoti, and Maithya (2022), who suggest that a minimum of 25-50 observations be used for minor subgroups and above 50% for significant groups, particularly for correlation to causal comparative research designs. Consequently, the researcher was able to extrapolate the findings to the entire population. The questionnaire was administered to an individual, and the response was collected on the same day, resulting in a satisfactory response rate.

Results of Diagnostic Tests

It refers to the outcomes or findings from special statistical tests that are done to check whether the data and model used in the study are valid, reliable, and meet the required assumptions before carrying out the final analysis.

Reliability of Research Instruments

The study utilized the test-retest reliability method by administering the questionnaire to a cohort of 15 participants. The test-retest reliability technique was evaluated by giving the identical questionnaire to the same group of 15 people on two different occasions, with a week-long gap between the two times. The objective was to assess the reliability or stability of the questionnaire over time. After both rounds of testing were done, the results from the first round (pre-test) were compared to the scores from the second round (post-test) using Pearson's r, a correlation coefficient. Table 3 showed the results.

Table 3: Correlation between Pre-test and Post-test Results

		Post-test
Pre-test	Pearson Correlation	.926**
	Sig. (2-tailed)	.001
	N	15

Source: Researcher, (2024)

The coefficient that was used to determine the dependability of the instrument for the investigation was 0.926, as shown in Table 3. The instrument was capable of gathering data in a dependable manner because the coefficient was larger than 0.7, which meant that it was capable of eliciting consistent responses from the participants (Field, 2020). The questionnaire was expected to produce answers that were both consistent and dependable over an extended period of time, as demonstrated by the strong correlation.

Table 4: Reliability Analysis of the Variables

Variable	Cronbach's Alpha	No. of Items
Capacity in Monitoring & Evaluation	.930	20
Stakeholder Engagement	.923	9
Implementation of Street Lighting Projects	.925	12

Source: Researcher, (2024)

Cronbach's alpha serves as an indicator of reliability for scales comprising multiple items, including questionnaires or surveys. Table 4 indicates that the reliability analysis revealed all Cronbach's Alpha values exceeded 0.7, suggesting a consistent response pattern between the pre-test and post-test for each variable. Stakeholder engagement was evaluated with 9 items, resulting in a reliability coefficient of 0.923. The implementation of street lighting projects was measured using 12 items, which produced a reliability coefficient of 0.925. The results demonstrated a satisfactory level of internal consistency for the questionnaire or measurement scale. The items in the questionnaire exhibited a strong correlation for each construct, indicating that they were effectively measuring the same underlying concept.

Validity Results

Validity measures the degree to which a research instrument accurately assesses the specific constructs it was designed to evaluate, a property that is significantly strengthened through expert evaluation (Yue, 2016). To ensure structural rigor, the questionnaire designed for this study was submitted to two independent experts from the Department of Business Science at the University of Nairobi for technical review and critique. Their assessment verified that the questionnaire possessed strong face validity, confirming that the individual items were clearly articulated and appropriately aligned with the study's core variables. Furthermore, the experts established the tool's content validity, affirming that the questions comprehensively covered the relevant theoretical and practical domains required for this investigation.

Test of Multicollinearity

The multicollinearity test describes a phenomenon observed in statistical models, especially within the realm of multiple linear regression, which assesses whether two or more independent variables exhibit a high degree of linear correlation among themselves. This obstructs the capacity to ascertain the distinct impact of each variable on the outcome (Gujarati & Porter, 2023). The study employed the Variance Inflation Factor (VIF) to identify and mitigate multicollinearity. A VIF value exceeding 1 indicates the potential existence of multicollinearity to some extent. Generally, a VIF that surpasses 5 is considered a sign of significant multicollinearity; therefore, for the research to conclude that multicollinearity is absent, the value should remain below 5 (Field, 2022). The study sought to assess and mitigate potential complications stemming from multicollinearity through the examination of the VIF, thereby safeguarding the precision and dependability of the findings produced.

Table 5: Multicollinearity Analysis

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Capacity in M&E	.947	1.056
	Stakeholder Engagement	.947	1.056

Source: Researcher, (2024)

The variance inflation factor was 1.056, showing that there was a low correlation between capacity in M&E and stakeholder engagement. The tolerance of 0.947 indicated that 94.7% variance in one variable cannot be accounted for by the other variable. This implied that capacity in M&E was providing unique and non-redundant information, and its regression coefficient was stable and reliable.

Test of Normality

A normality test observes the distribution of data. A normal distribution is represented by a symmetrical bell-shaped curve around its mean. The study employed Shapiro-Wilk test to calculate a W statistic and compare it to the critical value based on the sample size to determine the distribution of the dataset (Shapiro and Wilk, 1965). This test is essential for studies using multiple regression analysis. The W statistic ranges from 0 to 1, where values closer to 1 indicate more normality. If $p \leq 0.05$, the implication is that data is not normally distributed. The findings are presented in Table 6.

Table 6: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Implementation of Street Lighting Projects	.195	63	.055	.906	63	.062

Source: Researcher, (2024)

Considering the dependent variable, the p-value for Shapiro-Wilk test was 0.062. Since the value was greater than 0.05, the data was normally distributed. The data does not significantly deviate from a normal distribution and is therefore suitable for running parametric tests.

Test of Homoscedasticity

Homoscedasticity points to equal variance of the dependent variable across various levels of other variables. This inquiry adopted the Breusch-Pagan statistical analysis test, which calculated a chi-square statistic based on the residuals and compared it to critical values based on the independent variables and the sample size (Stewart, 2022). It is worth noting that if heteroscedasticity is present, it can affect the accuracy of regression analysis by interfering with the regression coefficients. Homoscedasticity is an assumption that concerns the distribution of residuals. To ensure that the data is homoscedastic, the researcher checked if the residuals were spread evenly across the range of predicted values. This uniform distribution ensures that the variance of Robust standard errors is constant. The findings are presented in Figure 2.

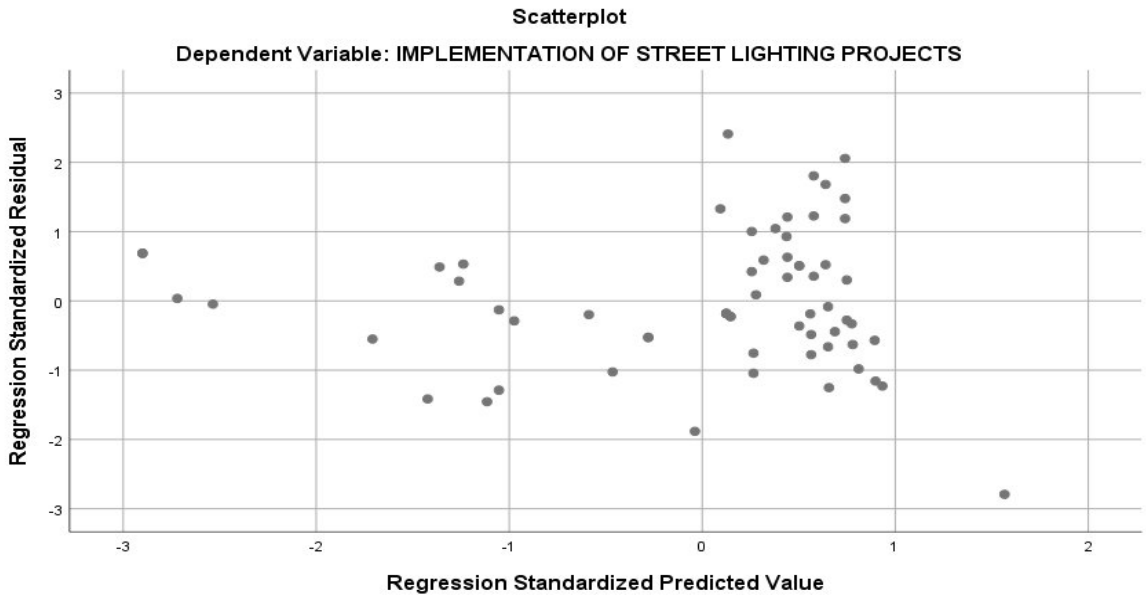

Figure 2: Scatter Plot
Source: Researcher, (2024)

The points were not equally distributed above and below zero on the X axis and to the left and right of zero on the Y axis; therefore, homoscedasticity has not been met. The distribution of data met heteroscedasticity.

Test of Linearity

Linearity implies that the connection between the independent variable(s) and the dependent variable is linear in the regression analysis. This study adopted a scatter plot to visually assess the linearity of the dependent variable against the independent variable(s) (Harrell, 2021). If the points in the scatter plot form a straight line, then the assumption of linearity is met. However, if the points show a curved pattern, then the assumption of linearity may not be met.

Demographic Information of the Respondents

This section deals with the demographic information of all the respondents. The information was focused on gender, level of education, working experience, and frequency of promotion for the officers.

Distribution of Respondents by Gender

The respondents were asked to specify their gender; Table 7 presents a summary of their responses. Inclusion of gender diversity ensured that research findings were not biased toward one group and could be applied to broader populations.

Table 7: Gender of the Respondents

Respondents	Frequency	Percentage
Male	52	82.5%
Female	11	17.5%
Total	**63**	**100%**

Source: Researcher, (2024)

The findings in Table 7 showed that 82.5% of the respondents were male, while 17.5% were female. This implied that there was gender disparity among the officers dealing with the implementation of street lighting projects in Turkana County. However, for this study, the results showed representation of both genders to give diverse opinions on capacity on monitoring and evaluation, stakeholder engagement, and implementation of street lighting projects.

Influence of Stakeholder Engagement on the Implementation of Street Lighting Projects

Regression analysis was carried out at a significance level of 0.05 in order to establish a direct association between stakeholder engagement and the delivery of street lighting projects. A summary of the findings is included in the following Tables. The theory stated the following: Holmium Oxide Stakeholder engagement and the implementation of street lighting projects do not have a substantial link with one another.

Table 8: Model Summary Table

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.618[a]	.382	.372	6.12505

The Pearson correlation coefficient was calculated to be 0.618, which is indicative of a high positive link between stakeholder engagement and the delivery of street lighting projects. The results indicated that if there were improvements in stakeholder participation, the implementation of street lighting projects would be more successful. 38.2% of the changes in implementation of street lighting projects were accounted for by stakeholder participation, as evidenced by the fact that the value of R2 was 0.382. The efficiency with which resources are mobilized and utilized is affected by the level of stakeholder involvement. Projects involving the installation of street lights are usually capital-intensive and involve financial, technical, and human resources. Encouraging the active participation of stakeholders, including government departments, actors in the commercial sector, and development agencies, makes it easier to pool resources and share costs. When stakeholders are involved, they are more willing to devote resources and protect the assets of the project. This feature is exemplified by public-private partnerships (PPPs) in street lighting, in which governments, private investors, and local communities work together to ensure that both capital and operational expenditures are met in a sustainable manner. In situations where there is a lack of engagement from stakeholders, resource gaps frequently develop, which results in projects being delayed, installations that do not meet quality standards, or maintenance structures that are not sustainable. This is what Osinakachukwu, Ogbu, Ikevuje, and Paul-Emeka (2024) have stated in their research. As a result, involvement serves as a catalyst that enhances the financial and institutional capacity for project implementation.

Table 9: ANOVA Table

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1414.941	1	1414.941	37.715	.000[b]
	Residual	2288.487	61	37.516		
	Total	3703.429	62			

The ANOVA table shows that F-ratio was 37.715 and the p-value was 0.000. Since the p-value was less than 0.05, the resulting model significantly explains variations in implementation of street lighting projects well.

Table 10: Table of Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	12.209	4.552		2.682	.009
	Stakeholder Engagement	.935	.152	.618	6.141	.000

Source: Researcher, (2024)

The equation y = 12.209 + 0.935x is the regression model that demonstrates the relationship between the implementation of a street lighting project and the engagement of stakeholders. Since the p-value of 0.000 was lower than 0.05, it may be inferred that there was a substantial relationship between stakeholder management and the implementation of street lighting projects. When stakeholders are included into the decision-making processes of a project, the result is more effective implementation and an improvement in the quality of the project monitoring and evaluation reports. In order to make project decisions based on accurate information, it is necessary to ensure that all of the important concerns and issues of stakeholders are defined and addressed through the process.

Moderating Effect of Stakeholder Engagement

The moderation analysis was completed with the help of Hayes PROCESS Macro v4.1, which included a user-friendly interface and automated a number of processes in the moderation analysis. In addition, this software provided bootstrap confidence intervals for the interaction effects. Hayes PROCESS Macro v4.1 was also used to calculate the moderating effect of stakeholder engagement. The technique improved the dependability of the results while simultaneously decreasing the number of mistakes made by humans. The moderation study sought to determine if stakeholder participation moderates the connection between capacity in monitoring and evaluation (M&E) and the implementation of street lighting projects. The following statement constituted the third null hypothesis: Ho3. The implementation of street lighting projects is not significantly predicted by the combined effect of capability in M&E and stakeholder engagement.

Table 11: Model Summary Table

Model	R	R-Sq	MSE	F	df1	df2	p
1	.9064	.8216	11.2001	90.5539	3.0000	59.0000	.0000

The dependent variable's observed and anticipated values had a greater association with one another as a result of the correlation coefficient of 0.9064, which was calculated between the observed and predicted values of the execution of street lighting projects. An R-Square value of 0.8216 was obtained, which indicates that 82.16 percent of the variance in the execution of street lighting projects was accounted for by the capacity in M&E, stakeholder involvement,

and the interaction of the two factors. This was determined using an F-test, which produced the following results: F (3, 59) = 90.5539, p < 0.05.

Table 12: Table of Coefficients

Model 1	coeff	se	t	p	LLCI	ULCI
Constant	39.4836	.4404	89.6492	.0000	38.6023	40.3649
IV	.4833	.0442	10.9277	.0000	.3948	.5718
MV	.9038	.1257	7.1878	.0000	.6522	1.1554
Int_1	.0199	.0091	2.1870	.0327	.0017	.0380

Source: Researcher, (2024)

The coefficients revealed that, in the first model, both the capability of M&E (β=0.4833; SE=0.442; p<0.05) and stakeholder participation (β=0.9038; SE=0.1257;p<0.05) had a substantial impact on the implementation of street lighting projects. In addition, the execution of street lighting projects was significantly impacted by the interaction (IV*MV) of the two factors (β=0.0199; SE=0.0091; p<0.05).

Table 13: Test of Highest Order Unconditional Interaction

	R2-chng	F	df1	df2	p
X*W	.0145	4.7831	1.0000	59.0000	.0327

Source: Researcher, (2024)

The interaction term (X*W) explained an additional 1.45% variance in implementation of street lighting projects ($\Delta R^2 = 0.145$). The p-value was 0.0327, which was less than 0.05; the model was therefore considered statistically significant. This implied that the independent and moderator variables together significantly predicted the dependent variable; the interaction term (X*W) significantly predicted the implementation of street lighting projects. The p-value also indicated that the moderator variable (stakeholder engagement) had an effect on the relationship between capacity in M&E and implementation of street lighting projects.

SUMMARY OF FINDINGS

The p-value indicated that the implementation of street lighting projects and capacity relationship was moderated by the moderator variable that, in the present case, was the stakeholder engagement.

The moderation analysis filled using Hayes' PROCESS Macro v4.1 showed that the observed and expected values of the dependent variable were more associated with each other due to the correlation coefficient of 0.9064 between the observed and expected values of the execution of the street lighting projects. The R-SQ was estimated as 0.8216, which means that the capacity in M&E, the involvement of the stakeholders, and the interaction of the two factors explained 82.16 percent of the variance in the execution of street lighting projects. This was calculated by performing an F-test and the results of this test are as follows: F (3, 59) = 90.5539, p < 0.05. These coefficients showed that in the model, both capability of M&E (b=0.4833; SE=0.442; p <0.05) and stakeholder participation (b=0.9038; SE=0.1257; p<0.05) significantly

influenced implementation of street lighting projects. Moreover, street lighting project execution was affected greatly by the interrelationship between the two factors (b=0.0199; SE=0.0091; $p<0.05$).

The p-value of 0.0327, which was lower than 0.05, meant that the model was statistically significant, meaning that the independent and moderator variables jointly significantly predicted the dependent variable; the interaction term significantly predicted implementation of street lighting projects. Such a moderating impact implies that the correlation between the M&E capacity and the project implementation is not consistent at all levels of stakeholder involvement. With high stakeholder engagement, the favorable impact of M&E capacity on project implementation gets increased, leading to even greater project outcomes. On the other hand, in case of poor stakeholder engagement, the value of M&E capacity can be reduced. This observation highlights why M&E capacity building and engagement of stakeholders should be considered important elements in the development of the infrastructure. Thus, investments in M&E systems will allow more returns to be ensured by strong stakeholder engagement mechanisms, and vice versa.

CONCLUSIONS

The study concludes that the implementation of street lighting projects was significantly predicted by the interaction term (X*W). The link between capacity in monitoring and evaluation (M&E) and implementation of street lighting projects was influenced by the moderator variable, which was stakeholder engagement. As a result, engaging with stakeholders is seen as one of the most important elements in ensuring that the execution of a program is successful. This is due to the fact that it entails establishing trust, communicating in an effective manner, and working together with the individuals who have an interest or influence in the project's vision and goals. More specifically, the project results were positively impacted by monitoring and evaluation (M&E) capabilities, and this positive impact was further enhanced by the existence of active and meaningful stakeholder involvement.

The advantages of improved M&E capacity were more obvious when stakeholders were successfully included through discussions, active engagement in the process of making decisions, and feedback on the results of M&E. This resulted in improved project planning, execution, and accountability. On the other hand, where stakeholder engagement was either insufficient or completely absent, the influence that M&E capability had on project implementation was reduced, which resulted in decreased effectiveness and unhappiness in the community. The results of this investigation emphasize the importance of engaging with stakeholders in order to increase the efficacy of M&E systems. As a result, in order to ensure that development projects are successfully implemented, Turkana County must not only strengthen its technical monitoring and evaluation (M&E) capabilities but also institutionalize strong stakeholder engagement practices as a complementing and reinforcing aspect.

RECOMMENDATIONS

One of the techniques that contributes to success when it comes to project implementation is capacity building on the personnel for monitoring and evaluation (M&E) and stakeholder improvement. Turkana County should therefore strengthen the amount of time it takes to empower their workers and the areas the participants are trained on, with the goal of enhancing methods for the implementation of projects.

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