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OPERATIONAL EXCELLENCE AND THE PERFORMANCE OF WASTE MANAGEMENT PROJECTS IN NAIROBI CITY COUNTY, KENYA

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ABSTRACT

This study sought to examine the influence of Operational Excellence on the performance of Waste Management projects in Nairobi City County. The process of waste management in Nairobi City County is a key concern impacting sustainability. According to the World Bank, Nairobi generated between 2,000 to 2,500 tons of waste per day, of which UNEP estimated that only about 10% of it was taken to proper disposal sites. The specific objectives of the study were to determine the influence of quality management on the performance of waste management projects in Nairobi City County and to determine the influence of change management on the performance of waste management projects in Nairobi City County. This study adopted descriptive and explanatory research designs which utilized the elements of quantitative and qualitative research. The target population for this study was managers from 54 private solid waste management companies in Nairobi City County. Furthermore, the study integrated 13 officers from the National Management Environment Authority (NEMA) Nairobi office. The study employed a census technique to select all the 13 officials, and purposive sampling to select 48 waste management company managers. The study concludes that Quality management has a profound impact on the performance of waste management projects in Nairobi City County. The effectiveness of quality control measures, including regular monitoring of process performance and investments in quality management s, is strongly linked to enhanced project efficiency. The study concludes that change management is a crucial determinant of the performance of waste management projects in Nairobi City County. Effective change management practices, characterized by clear communication and stakeholder engagement, are directly associated with the successful implementation and outcomes of waste management initiatives. This study suggests that further research should explore the long-term impacts of operational excellence practices on the sustainability and environmental impact of waste management projects. Future studies could investigate the specific challenges and barriers to implementing these practices within different contexts and scales of waste management operations

Key Words: Operational Excellence. Quality Management, Change Management and Performance of Waste Management Projects

Background of the Study

Operational Excellence (OE) is a crucial concept in waste management projects, aiming to continuously improve processes and procedures to maximize efficiency, productivity, and quality (Garcia, 2017). It involves optimizing resources, reducing waste, and enhancing overall performance (Jones & Brown, 2019). Achieving operational excellence is pivotal for the successful execution and sustainability of waste management initiatives, including effective resource utilization, streamlined workflows, and adherence to regulatory standards (Johnson et al., 2020). Organizations in the waste management sector increasingly recognize the significance of operational excellence in achieving objectives such as landfill management, recycling programs, and pollution control measures (Robinson & White, 2021). By fostering a culture of continuous improvement, these entities strive to optimize processes, enhance service delivery, and minimize costs, ultimately maximizing their positive impact on the environment and society (Adams, 2019).

Measures of operational excellence include process management, quality management, continuous improvement, and change management. Process management, endorsed by Frederick W. Taylor, Joseph M. Juran, and Edwards Deming, is pivotal in optimizing business processes to achieve operational excellence (Antony et al., 2023). While sectors like manufacturing have embraced operational excellence, waste management companies are yet to fully adopt it, hindering their ability to address sectoral challenges effectively (Antony et al., 2023; Henríquez-Machado et al., 2021). Quality management ensures project success by aligning project objectives with customer expectations and enhancing project outcomes (Jong et al., 2019; Gomes et al., 2019). Total Quality Management (TQM) principles can assist waste management companies in properly managing waste, especially concerning environmental and sustainability compliance (Wijaya et al., 2023).

Continuous improvement (CI) is crucial for enhancing project performance, promoting quality, stakeholder satisfaction, and cost-effectiveness (Lizarelli et al., 2021). Despite its benefits, challenges such as cultural resistance and resource constraints hinder effective CI implementation (Cunha et al., 2023). Change management is vital for achieving and maintaining high project performance, reducing resistance, fostering collaboration, and integrating changes effectively (Lauer, 2020; Stolzenberg & Heberle, 2022). Limited research exists on the influence of change management in waste management projects, despite its importance in organizational transformation and operational efficiency improvement (Pádár et al., 2017; Janmaimool, 2017)..

Project performance in waste management projects is essential for achieving project success, although limited studies explore the concept of excellence in improving project performance (Dasí et al., 2021). As defined by (Assaad et al., 2020), project performance refers to the overall measurement of whether a project has met its requirements and objectives, such as schedule, cost and cost. Unterhitzenberger and Bryde (2019) assert that project performance has been the center of attention in different literatures to understand better the best practices that enhance project outcomes and achieve successful project delivery.

Thus, this study sought to explore the connection between operational excellence and the performance of waste management projects, shedding light on the mechanisms through which operational excellence principles can drive improved project outcomes and ultimately contribute to more sustainable and resilient waste management practices.

In Japan Operational Excellence is a fundamental concept that is deeply engrained in organization’s policies and cultures. Toyota Motor Corporation, an international automotive manufacturer is benchmarked as the best in class by all of its competitors and peers throughout the world for flexibility, manufacturing speed and high productivity (Nkomo, 2019). According to Ratu Roy, (2023), the incredible success and consistency of Toyota’s performance is a direct

result of operational excellence. These authors claim that Toyota has turned OpEx into a strategic weapon based on quality improvement tools and methods like Kaizen and Just-in-time. The company's continued success stems from a deeper understanding of customers' needs and maintaining an improvement culture that yield high quality products that satisfy customer's needs hence maximizing on the company's profits and increasing the customer-base.

In Africa, the region showcases a unique landscape for OpEx shaped by developmental challenges and diverse economics. Managers and leaders in different organizations have sought to improve their way of working by adopting the concept of Operational Excellence. According to a report by Baobab Network (2022), operational excellence is a key principle that has been applied and shared by startup founders in the African market and is a primary driver of success. For example, the Equatorial Coca-Cola Bottling Company (ECCBC), the bottling partner of The Coca-Cola Company across North and West Africa, is at the forefront of promoting Operational Excellence (Lääts, 2023). This company focuses on establishing efficient processes that make employees and team members understand the importance of improvement regardless of whether the organization or project is running smoothly. These improvement processes are called value streams that produce intangible and tangible products. Such an organization adopts a mindset of teamwork, top-line growth, and problem-solving, which allows them to create more customer value.

In Kenya, operational excellence plays a profound role in driving sustainable growth and contributing to the development of the country's economy. Kenya being a significant hub in East Africa exhibits key developments in operational excellence across different sectors. Large businesses, SME's and startups in the country are adopting OpEx for instance through the adoption of methodologies like agile to deal with changing customer preferences and to navigate industry uncertainties hence allowing for quick responsiveness and adaptation in business approaches (Mohammed, 2022). For example, the General Motors East Africa Company which has incorporated OpEx in its retail service workshop processes focuses on improving service performance and quality as well as customer satisfaction (Kayanda, 2016). This has enabled the organization to retain its market share in the highly competitive automotive sector in the country.

Statement of the Problem

The management of waste in Nairobi City County is a critical concern, impacting its sustainability goals. Despite generating 2,000 to 2,500 tons of waste daily due to rapid urbanization and dense population, as reported by the World Bank (2023), only about 10% is properly disposed of, according to UNEP (2021). Inadequate and ineffective waste collection and disposal systems, often resulting in direct dumping and burning, highlight the urgent need for improvement. Recognizing these challenges, Nairobi City County has initiated significant efforts towards sustainable waste management practices, aiming to enhance project performance and ensure environmental and public health safety (Ogutu et al., 2020). These initiatives encompass a range of projects dedicated to addressing the growing challenges of waste control and environmental sustainability (Sanergy Collaboration, 2023). Some of these notable projects include waste segregation and recycling programs, the establishment of waste-to-energy facilities, and community awareness campaigns on responsible waste disposal such as the Taka Taka Composting and Sustainable Waste Management Project (United Nations Framework Convention on Climate Change, 2023).

However, despite significant efforts to address these challenges, such as waste segregation programs and the establishment of waste-to-energy facilities, inefficiencies persist in waste management processes. Future Bora Initiative, by Taka Taka Solutions encountered diverse rigidities, inhibiting its expansive growth. Additionally, other projects such as Trickle Out Africa Project by City Bins solutions is another example of projects that, while visionary, could benefit

from more advanced project management strategies**.** Moreover, Kiamaiko Sewer Rehabilitation, Nairobi Sanitation OBA Project for Sanitation Connections in Informal Settlements, Outer Ring Road Pipe Laying, and Relocation of Water and Sewer Pipelines along Outer Ring Road are notable projects aimed at improving waste management infrastructure (Nairobi City Water and Sewerage Company, 2023). Unfortunately, these projects have demonstrated inefficiencies in terms of completion time, cost overruns, and management efficacy (Nairobi City Water and Sewerage Company, 2023). Despite their potential to enhance waste management practices and promote environmental sustainability, their inefficient execution underscores the ongoing challenges faced by Nairobi City County in achieving its sustainability goals (Nairobi City Water and Sewerage Company, 2023).

According to International Institute for Environment and development (2018), Approximately 1,500 tons; 50% of the solid waste generated daily in Kenya's capital city, Nairobi, is not collected. However, some of the key projects have been stalled, closed or recorded inefficiency because of inefficient management. The Dandora Dumpsite currently in operation for Nairobi City is an open dumping site lacking in management and thus causing bad odour, garbage scattering and production of landfill gases that ill-affect the surroundings. The county further demonstrates a lower waste management efficiency compared to other counties like Mombasa, which records on average approximately 2200 tons of waste of which 65% is collected (Wekisa & Majale, 2020).

Further, past studies conducted on the subject exhibit various research gaps. The study by Muriuri et al. (2020) highlighted the challenges in waste treatment, resulting in uncontrolled dumpsites (Muiruri et al., 2020). However, the study presents a conceptual gap, by paying limited focus on waste management project performance, and the current study seeks to fill this gap. Additionally, Kathambi and Ogutu (2022) pointed out the limited financial capacity and weak policies and institutional structures related to solid waste management, but present a contextual gap which shall be addressed by the current study. Another study by Amugsi et al. (2022) shed light on the lack of public awareness regarding sound waste management practices, such as proper disposal, inspection, and separation. This lack of awareness has led to a negative perception of waste as a problem rather than an opportunity for environmental, social, and economic gains. This study therefore, sought to address the identified research gaps by examining the influence of operational excellence on the performance of waste management projects in Nairobi City County, Kenya.

General Objective

The main objective of this study was to examine the influence of Operational Excellence on the performance of Waste Management projects in Nairobi City County, Kenya.

Specific Objectives

i. Determine the influence of quality management on the performance of waste management projects in Nairobi City County, Kenya.
ii. Examine the influence of change management on the performance of waste management projects in Nairobi City County, Kenya.

Theoretical Review

Crosby's Theory of Total Quality Management

Crosby's theory of total quality management was introduced in the late 20th century as a response to the high costs of defects and rework prevailing in different quality control practices (Martínez-Lorente et al., 1998). Phillip B. Crosby prominently articulated this theory in his book "Quality is Free" in 1979, which centers around the principle that it is possible to prevent errors,

emphasizing that companies should strive to have zero defects in their operations (Petersen, 1999). Crosby believed that every organization should focus on accomplishing and maintaining high-quality standards by pursuing "Zero defects." This means that organizations that dedicate their time and resources to eliminating errors and defects in their processes, services, and products are more likely to produce quality output (Worlu & Obi, 2019). Agrawal (2020) claims that this theory was instrumental in transforming the Quality management paradigm from reactive to proactive. Dahlgaard-Park, Reyes, and Chen (2018) posit that organizations that adopted this theory in the late 19th century experienced improvements in cost savings, product quality, and reduced defects, which improved the overall performance of these organizations. In their research, Abdullahi et al. (2020) argue that Crosby's theory has had a lasting impact on the Quality management field, emphasizing the theory's concepts of conformance to requirements, prevention, and cost of quality. According to these authors, this impact has led to the development of additional Quality management methodologies and approaches, such as Six Sigma, Lean management, and Total Quality Management, used in different industries to achieve set objectives that meet the given quality threshold.

Regarding quality management, Crosby's theory plays a profound role. According to a study conducted by Macharia, Chui, and Edabu (2020), the idea presented by Crosby's theory of preventing defects instead of depending on rework and inspections is the best approach to ensure that organizations achieve quality during the first attempt of a task. Additionally, recent research on TQM done by Syaifullah, Yusuf, Hidayah & and Pujiwati (2023) reports that Crosby's theory stresses the importance of conforming to the given requirements, which stresses the need for organizations to clearly define and follow customers' specifications and deliver based on their expectations. Further following Crosby's concept of the cost of quality, Filippi, Gaio, & Zamarian (2023) note that Quality management professionals apply this approach to balance the costs of investments by avoiding or preventing practices that could potentially lead to losses. This theory relates to this study as it provides an approach to shape how waste management organizations in Nairobi City County approach Quality management to ensure proper waste management and customer satisfaction.

Plan Do Check Act (PDCA) Cycle

The Plan Do Check Act (PDCA) cycle is an iterative model developed by Walter Shewhart, commonly known as the "father of statistical quality control" in the early 19th century, as a way to improve the quality of manufacturing processes (Nguyen et al., 2020). This approach was further promoted by Edward Deming, a leading management thinker in the field of quality after the Second World War in Japan, as a framework for the resurgence of the nation's economy (Nguyen et al.,2020). This approach consists of four steps, notably Plan, which is about identifying problems and defining objectives to establish an improvement plan; which focuses on acting on the Plan; which involves monitoring to ensure that processes have been executed according to the requirements and Act which is about taking corrective actions based on the insights from the Check Phase (Antony et al.,2023). According to (Alauddin & Yamada (2019), these four phases control and manage organizations' processes by paying attention to and adjusting the deviations that may hinder accomplishing the set goals and objectives. The PDCA Cycle is extensively considered a primary tool for achieving operational excellence and is a fundamental concept in the CI realm. Kurnia, Jaqin & Purba (2022) suggest that many people should use the PDCA model because, in addition to this cycle being a quality tool, it is a fundamental concept for continuous process improvement that can be used to cultivate a culture of excellence; hence improve organizational performance. In his study on the relationship between PDCA and CI (Jagusiak-Kocik, 2017), he argues that CI relies on the data collected and analyzed in the PDCA cycle to guide practical efforts that organizations put into improving their processes.

On the other hand, Isniah, Purba & Debora (2020) claim that the PDCA cycle aligns perfectly with the concept of CI as it facilitates incremental improvements that eventually enhance the performance of the entire process. Peças et al. (2021) also advocate for integrating the PDCA model in CI, arguing that this tool fosters a culture of adaptation and continuous learning. According to these authors, organizations that implement the PDCA cycle are more likely to embrace a culture of growth and change, gaining a competitive advantage over similar organizations and remaining relevant in the current contemporary world where technology is taking over. This model is essential to this study as it is an excellent approach for developing and cultivating an excellence culture in the daily management of waste management projects in Nairobi City County. Furthermore, the concept can be adopted and eventually used to reduce waste and zero-rate waste in the country in the long run.

Conceptual Framework

A conceptual framework is a visual or written illustration of a predictable relationship between two or more variables. The concepts of operational excellence under consideration in this section include quality management and change management. The independent and dependent variables in this study have a strong relationship.

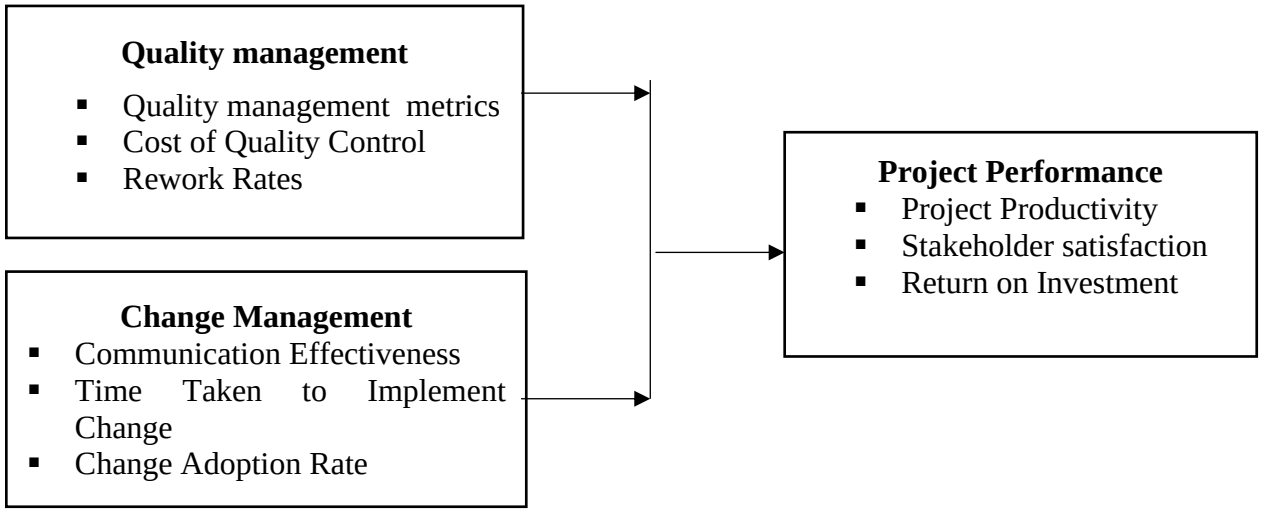

Figure 2.1: Conceptual Framework

Quality Management

Quality is among the strategies that organizations worldwide use to strategically gain a competitive advantage over competitors. However, customer needs continue to evolve in line with lifestyle diversification, and they expect products to have high functionality and quality (Pambreni et al., 2019). Quality must be delivered to customers at all times, and it must be maintained to sustain any business and fulfill customer needs. This can be achieved by embracing the Total Quality management concept (TQM), which is widely used by organizations to produce the best quality products. It is a philosophy for modern competitiveness that has made major contributions in the area of Quality management which has propelled its significance in the performance of organizations and projects in different sectors. TQM was first introduced in the early nineteenth century by Ford Motor Company and has since been studied and improved by management experts like Edward Deming, Joseph Juran, and Phillip Crosby

(Kamenders et al., 2019). For example, after the second world war, Japan used this concept to rebuild the quality of its products which contributed to its success in the market (McAdam et al., 2019). The timeline evolution of TQM exists in four stages categorized as Quality inspection, which involves checking and testing products to confirm compliance with the given standards, Quality control which is about standard maintenance, Quality assurance which involves the maintenance of the desired quality levels and Total Quality management (Pambreni et al., 2019). TQM relates to OpEx as it involves overseeing all project and organizational tasks and activities needed to accomplish a desired level of excellence. Applying this concept helps to increase customer satisfaction by improving the quality of services and products and involves employees during implementation, which creates a sense of belonging and promotes ownership of projects and organizational activities. This promotes a culture of excellence as customers' problems are solved by involving the employees and project team, which keeps motivating them to do their best hence benefiting the organization.

Change Management

Change management at the organizational level is key to the successful implementation of change in the modern world, where industries keep evolving, forcing organizations to align and update themselves to avoid losing relevance and competitive dominance. (Straatmann et al., 2016) Argues that the study of management has ascribed importance to the study of change management because of the value that this concept brings to structured organizations. Pugh (2016) describes change management as a methodical process through which a company or firm intellectualizes, executes, and appraises its change efforts to the desired result. There are several factors, both internal and external, that prompt organization to introduce change. Some of the factors identified by Rosenbaum et al., 2018 include absenteeism, low productivity, leadership and management issues, employee turnover, competition, technological advancements, social pressure, and change in government policies. There are different scholarly models of change management that provide insights into how organizations should approach change. They include Kotter's (1995) Eight-Step Model for Transforming Organizations, Jick's (1991) Tactical Level Model 10-Step Approach to Organizational Change Management, and General Electric Change Acceleration Model (CAP) (Hassan, 2018). Kotter's model emphasizes avoiding mistakes when implementing the change process. The lessons derived from this model is that the process of change takes time as it involves a series of phases, and critical mistakes in any of the phases can affect the momentum of the process; hence organizations should dedicate their time to each process to ensure that no mistakes are made (Galli, 2018). The Jick model, on the other hand, involves ten steps of implementing change that borrows from science and art concepts. According to Jick, change implementation is as significant as the motive behind the change, and he recognized that change is a continuous process and a key success determinant (Galli, 2018). There is the General Electric change acceleration model that is based on Lewin's Model of Change. The consultants were hired by General Electric's CEO, Jack Welch, to research the best change management practices and suggested seven steps to accomplish effective change management. These include leading change, creating a shared need, shaping a vision, mobilizing commitment, making change last, monitoring progress, and changing structures and systems (Galli, 2018). Following these models will help project managers and organizations, in general, to effectively manage change and align the company to suit the needs of the current market.

Empirical Review

Quality management and Project Performance

Jong et al., (2019) research on the relationship between TQM and project performance using a case study of the Malaysian construction industry. The objectives of this study included determining the dimensions of TQM practices and project performance applicable in the

Malaysian construction industry, to examine the impact of TQM practices on the performance of Malaysian construction projects and to investigate the TQM practices that have a significant impact of the performance of Malaysian construction projects. The authors administered questionnaires to collect data using the cross-sectional method and convenience sampling was used as the sampling technique in the research. This study examined the effect of TQM variables like leadership, strategic planning, customer focus, workforce focus, operation focus and project performance. The researchers found out that TQM practices like leadership and strategic planning have no significant relationship on project performance while others like workforce and operation focus are closely related to project performance. This is a general finding that does not define the specific dimensions of TQM that affect the performance of projects. Additionally, the findings of this research are limited to construction projects in Malaysia only which is not sufficient to represent the performance of projects in other sectors and countries. This study will bridge these gaps by focusing on specific TQM variables that affect project performance and also broaden the perspective of the performance of projects from a global, regional and local perspective.

Hassan & Jaaron (2021) studied the relationship between TQM on organizational performance in the green manufacturing industry. The study adopted a quantitative research method to administer a survey of 250 HR managers to establish how GM practices mediate the relationship between TQM and OP. The findings showed a significant positive correlation between TQM and organizational performance. Although this empirical study adds great value to environmental issues literature, it does not address the TQM sub variables notably process performance metrics, cost of quality control and scrap and rework rates that this study intends to investigate. Besides, this study seeks to get responses from operation managers that are directly involved in making major decisions in waste management industries.

Change Management and Project Performance

Musa et al. (2021) examined the impact of change management practices on the performance of construction projects. In this research, the authors chose an explanatory research design where they administered 190 questionnaires to construction experts using the purposive sampling technique. The researchers analyzed data suing multiple regression analysis, factor analysis and descriptive statistics. The findings of this research indicated that change management has a positive impact on the overall performance of construction projects and can serve as a framework to effectively manage changes. The CM practices addressed in this study include cost, time and end user's satisfaction which do not guarantee project success as there are other CM practices that affect project performance. With this regard this research aims to look into other critical factors that are necessary to support project managers in dealing with changes and make informed decisions that improve the performance of projects. Additionally, this research aims to establish whether CM practices can be adopted in the waste management industry and have a positive correlation with the performance of projects in the sector.

Elabshih & Saad (2023) recently conducted a study that sheds more light on the role of change management on project management efficiency in the digital transformation sector. The research relied on the descriptive analytical approach where the researchers used the survey method to collect data from professionals employed in the electricity industry. The results revealed that Change Management has a significant impact on the efficiency of projects in the electricity sector. Based on these findings, the authors note that it is important to support Change Management in projects to ensure that the project team is aware and well aligned with the process of change. This study will seek to confirm whether Change Management strongly influences the performance of waste management projects which involves a complex process given that the above research covered the digital transformation sector.

RESEARCH METHODOLOGY

The study employed both descriptive and explanatory research designs, incorporating elements of quantitative and qualitative methodologies. This dual approach enabled the detailed depiction of trends, characteristics, and patterns within the waste management sector in Nairobi City County, as well as the examination of causal relationships between operational excellence and project performance in this domain. Descriptive research provided a clear snapshot of the current state of waste management processes and practices, capturing the specific attributes and conditions of the subject population (Sileyew, 2019). On the other hand, the explanatory aspect delved into the underlying factors and dynamics that influenced these processes, particularly how operational excellence initiatives such as process and quality management impacted the efficiency and effectiveness of waste management projects (Skinner and Dancis, 2020). This comprehensive approach not only shed light on the current operational standards but also explored the potential for improvement and innovation within the industry, thereby contributing valuable insights for enhancing operational excellence in Nairobi City County's waste management practices. Additionally, the flexibility of the descriptive design facilitated the triangulation of data from various qualitative sources, including observations and documents, enriching the research with diverse perspectives and deepening the understanding of the research problem (Siedlecki, 2020).

Identifying the population is among the first steps a researcher considers before beginning the sampling process. Population in research refers to a pool of people or items from which a researcher selects a statistical sample to study (Gupta & Gupta, 2022). The objects and people selected for a study normally exhibit similar characteristics or features. The target population for this study was managers from 54 private solid waste management companies in Nairobi City County (Environmental EXPRT, 2023). The project integrated insights from 13 officers at the National Management Environment Authority (NEMA) Nairobi office, who play a crucial role in ensuring the smooth operation of the organization and possess comprehensive information on the performance of the company's projects (NEMA, 2023). These individuals are also involved in defining the scope and level of project management practices implemented by their organizations, making them invaluable sources of information for this project. As facilitators of government-led environmental initiatives, NEMA officers are well-informed about the measures the County government implements to manage waste in Nairobi City County. Consequently, the project targeted a total of 67 participants to gather a wide range of perspectives and insights.

Sampling is essential in establishing respondents for the study. In this section, the sampling technique and sample size are discussed in the subsequent below. A census approach was employed for NEMA officials, ensuring the inclusion of all key regulatory personnel impacting waste management practices (Davis, 2021). The sample size for the study comprised all the 13 NEMA officials in Nairobi City County and 48 waste management company managers. The researcher used the Yamane formula to obtain a sample of 48. The study developed two distinct data collection instruments: questionnaires for waste management company managers and Key Informant Interviews (KIIs) for NEMA county officials.

The pilot study's effectiveness and reliability in gathering crucial research data were evaluated, and it was carried out in Mombasa County. Following established guidelines, 10% of the total sample size, equivalent to 7 waste management company managers, participated in the pilot test (Blumberg et al., 2014). These respondents were not be included in the final study. To ensure precision, each questionnaire response was coded according to the research objectives, enabling meaningful categorization and tabulation of data. Subsequently, the data were entered into Statistical Package for Social Sciences (SPSS) version 24 for comprehensive analysis. The analysis encompassed descriptive statistics, including the examination of frequency, mean,

standard deviation, and percentages, to provide a detailed overview of the data's characteristics. Additionally, inferential statistics, such as regression analysis, were employed to assess the significance and strength of relationships between variables, contributing to a deeper understanding of the research findings. To enhance clarity and focus in reporting, the research outcomes were presented through tables and figures, aligning with specific research objectives. This approach ensured that the results of the regression model were effectively communicated and interpreted to meet the study's overarching goals.

RESEARCH FINDINGS AND DISCUSSION

Descriptive Statistics of Variables in the Study

The study sought to establish the impact of operational excellence on project performance. The findings are discussed per variable. The subsequent sections highlight the respondents' views and perceptions.

Quality Management and Project Performance

The second objective of the study was to establish the influence of Quality Management on project performance. The respondents were asked to provide their feedback on various aspects of quality management. Table 4.1 shows the findings

Table 1: Quality Management and Project Performance

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std. Dev
Regular monitoring and analysis of process performance metrics significantly enhance the efficiency of waste management projects.	2.50%	10.00%	15.00%	37.50 %	35.00%	3.93	1.07
Improvements in quality performance metrics directly correlate with better overall performance of waste management projects.	0.00%	0.00%	35.00%	50.00 %	15.00%	3.8	0.69
Investments in quality management metrics result in a noticeable reduction in the overall costs of waste management projects.	0.00%	2.50%	10.00%	52.50 %	35.00%	4.2	0.72
The cost of implementing quality control and improvement metrics is justified by the long-term benefits and efficiency gains in waste management.	0.00%	0.00%	5.00%	40.00 %	55.00%	4.5	0.6
The rate of rework or corrections in waste management tasks has significantly decreased due to enhanced Quality management practices.	0.00%	0.00%	12.50%	42.50 %	45.00%	4.33	0.69
Lower rework rates in waste management projects can be attributed to the implementation of robust Quality management systems.	2.50%	0.00%	7.50%	45.00 %	45.00%	4.3	0.82

The responses from managers on quality management in waste management projects reveal strong agreement on the effectiveness of quality control measures. Most managers concur that regular monitoring of process performance (72.50%), investments in quality management s (87.50%), and lower rework rates due to robust Quality management systems (90.00%) are instrumental in enhancing project efficiency. They also largely agree that the cost of implementing quality control is justified by the long-term benefits, with a 95.00% agreement rate. These views are backed by high mean scores, especially in the justification of costs and the

reduction of rework rates, with means of 4.5 and 4.3 respectively. The overall average mean score is 4.18, with a standard deviation of 0.765, indicating that while there is a consensus on the importance of quality management, there is variability in the degree of agreement among managers, suggesting room for discussion on how quality control practices are implemented and perceived in relation to their costs and outcomes.

When prompted to provide an evaluation of quality management aspects among waste management projects, NEMA officials highlighted diverse aspects:

KII Response 1 (Respondent 4): "As the regulatory authority, NEMA emphasizes the implementation of robust Quality management systems in waste management projects. One crucial strategy we enforce is adherence to environmental impact assessment (EIA) guidelines and recommendations. Projects are required to conduct comprehensive EIAs and implement mitigation measures to minimize environmental degradation and public health risks."

KII Response 2 (Respondent 8): "Quality management in waste projects also involves strict compliance with waste segregation and handling protocols. We mandate the separation of hazardous and non-hazardous waste streams, as well as the use of appropriate containment and transportation methods. Failure to adhere to these protocols can result in penalties or project suspension."

KII Response 3 (Respondent 10): "From our experience, projects that prioritize Quality management through measures like EIA compliance, waste segregation, and proper handling have a higher likelihood of success. However, we have encountered challenges with projects that overlook these aspects, leading to environmental pollution, public health concerns, and potential legal consequences."

The KII responses from NEMA officials collectively highlight the regulatory body's strong emphasis on robust Quality management as a critical success factor for waste management projects in Nairobi City County. The strategies they enforce, such as comprehensive environmental impact assessments, strict waste segregation protocols, and adherence to appropriate waste handling and transportation methods, are not mere bureaucratic requirements but rather essential safeguards to mitigate environmental degradation, public health hazards, and legal ramifications. The officials' experiences underscore that projects that prioritize these Quality management measures are more likely to succeed, while those that overlook or neglect them face significant challenges, including environmental pollution, health concerns, and potential project suspensions or penalties. This implies that waste management project stakeholders must recognize Quality management as a fundamental pillar, inextricably linked to the long-term sustainability, social responsibility, and regulatory compliance of their operations. Failure to incorporate these strategies can jeopardize not only the immediate project outcomes but also the broader environmental and public well-being objectives that NEMA is mandated to uphold.

The study findings on the influence of Quality management on the performance of waste management projects in Nairobi City County resonate with existing literature in the field, highlighting the pivotal role of Quality management practices in enhancing project outcomes. For instance, the observation that investments in quality management s and the implementation of robust Quality management systems lead to enhanced efficiency and reduced rework rates in waste management projects aligns with Jong et al. (2019), who, despite their broader focus on the construction industry, emphasize the significance of operation-focused TQM practices in improving project performance. This parallel suggests that the operational aspects of quality management, such as regular monitoring and process improvements, are universally beneficial across different project types, including waste management.

Furthermore, the findings corroborate the research by Hassan and Jaaron (2021) on the green manufacturing industry, where a significant positive correlation between TQM practices and organizational performance was identified. Although their study concentrated on a different sector, the underlying principles of quality management—such as the emphasis on continuous improvement and adherence to quality standards—are evidently applicable to the waste management sector as well. This cross-sector validation underscores the universality and effectiveness of Quality management practices in driving project success.

Change Management and Project Performance

The third objective of the study was to establish the influence of change management on project performance. The respondents were asked to provide their feedback on various aspects of change management. Table 2 shows the findings

Table 2: Change Management and Project Performance

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std. Dev
Effective communication has been crucial in managing and implementing change in waste management projects.	0.00%	2.50%	5.00%	45.00%	47.50%	4.37	0.7
The success of new initiatives in waste management is strongly linked to how well changes are communicated to all stakeholders.	0.00%	5.00%	2.50%	42.50%	50.00%	4.37	0.77
Stakeholders promptly participate in implementing change, and provide suggestions on change management more promptly.	0.00%	0.00%	15.00%	35.00%	50.00%	4.35	0.74
The change implementation process is seamless and without rigidities	0.00%	0.00%	10.00%	45.00%	45.00%	4.35	0.66
Changes in waste management processes are adopted quickly and effectively by all relevant stakeholders.	0.00%	0.00%	17.50%	45.00%	37.50%	4.2	0.72
The rate at which new practices and technologies are adopted reflects the effectiveness of change management in our waste management projects	2.50%	2.50%	7.50%	30.00%	57.50%	4.38	0.93
Average						**4.336**	**0.75**

The findings on change management within waste management projects, provided by managers, indicates a strong consensus on the importance of communication and stakeholder involvement. An overwhelming majority agree that effective communication is crucial to managing and implementing change (92.50%) and that the success of new initiatives is closely linked to clear communication (92.50%). Stakeholder participation is also highlighted as prompt and constructive, with 85.00% in agreement. Additionally, a high level of agreement is seen in the seamless implementation of change (90.00%) and the quick, effective adoption of new processes (82.50%). The rate of new practice and technology adoption, which stands at 87.50% agreement, reflects positively on change management practices. These aspects are underscored by high mean scores, with the average being 4.34 out of 5 and a standard deviation of 0.753, suggesting consistent views among managers with some variability, reinforcing the perceived effectiveness of current change management strategies in enhancing waste management projects.

The study also sought to establish the various aspects of change management in effectively managing change in Nairobi City County. The NEMA officials provided insight into change management aspects. KII Response 1 (Respondent 6): "Change management is a critical aspect that NEMA closely monitors in waste management projects. As the regulatory body, we aim to

ensure that any changes in project plans, processes, or technologies are evaluated for their potential environmental impact and compliance with existing regulations. We require project proponents to submit change management plans for our review and approval before implementation."

KII Response 2 (Respondent 9): "One instance where effective change management had a noticeable impact was during the transition to a new waste treatment technology by a major waste management company. NEMA worked closely with the company to assess the environmental implications of the new technology, and our guidance on proper change management procedures, including staff training and public awareness campaigns, facilitated a smooth transition without any adverse effects."

KII Response 3 (Respondent 11): "On the other hand, we have encountered situations where poor change management practices led to project delays and setbacks. For instance, a project that attempted to modify its waste collection routes without proper planning and communication faced resistance from local communities, resulting in disruptions and increased complaints. Effective change management, including stakeholder engagement and clear communication, could have mitigated these challenges."

The study's findings on the impact of change management on the performance of waste management projects in Nairobi City County are well-supported by the broader literature on change management's influence in various project environments. The emphasis on effective communication, stakeholder participation, and the seamless adoption of new practices and technologies resonates with Musa et al. (2021), who found a positive impact of change management practices on the overall performance of construction projects. Although their research focused on the construction industry, the fundamental aspects of change management, such as addressing cost, time, and end-user satisfaction, are applicable to waste management projects, underscoring the versatility and importance of effective change management practices across different sectors.

Further, the study findings align with the research by Elabshih & Saad (2023) in the digital transformation sector, which highlighted the significant impact of change management on project efficiency. Their emphasis on the importance of aligning project teams with change processes mirrors the findings from Nairobi City County, where the successful implementation of changes in waste management projects was attributed to clear communication and stakeholder engagement. This cross-sectoral validation strengthens the argument that change management is a critical component in enhancing project performance, regardless of the industry.

Correlation Analysis

The study conducted a correlation analysis to establish the relationship between quality management, change management and project performance. The correlation values range from 0 to 1; if the correlation values are r = ±0.1 to ±0.29 then the relationship between the two variables is small, if it is r = ±0.3 to ±0.49 the relationship is medium, and when r= ±0.5 and above there is a strong relationship between the two variables under consideration (Cohen at al., 2009). The findings are shown in Table 3

Table 3: Correlation Analysis

		Quality Management	Change Management	Project Performance
Quality Management	Pearson Correlation	1		
	Sig. (2-tailed)			
Change Management	Pearson Correlation	.705**	1	
	Sig. (2-tailed)	0.000		
Project Performance	Pearson Correlation	.595**	.797**	1
	Sig. (2-tailed)	0.000	0.000	

Quality management also shows a significant correlation with project performance (r=0.595, p-value=0.000<0.01), indicating a substantial and positive relationship. This implies that Quality management practices have a considerable influence on the success of waste management projects, underscoring the importance of maintaining high-quality standards.

Change management's correlation with project performance (r=0.797, p-value=0.000<0.01) is significant and robust, indicating that change management practices have a substantial impact on project outcomes. This suggests that effective implementation of change management is crucial and can significantly influence the success of waste management projects.

The findings emphasize the critical role of quality management in the performance of waste management projects, suggesting that stakeholders should prioritize quality to enhance project outcomes. The significant correlations between operational excellence factors also imply that an integrated approach, where improvements in one area support enhancements in others, could be beneficial for achieving overall operational excellence and project performance.

Multiple Linear Regression Analysis

The study conducted a multiple linear regression analysis to establish the relationship between quality management, and change management and project performance. The model summary is shown in Table 4

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.924[a]	0.853	0.847	0.30474

a Predictors: (Constant), Change Management and Quality Management

The model summary shows the extent to which combined factors of Change Management and Quality Management, inform performance of waste management projects in Nairobi City County. The R square value is 0.853, suggesting that these operational excellence practices account for 85.3% of the variance in project performance. This indicates a significant impact of these factors on project outcomes.

The standard error of the estimate is 0.30474, providing a measure of the precision of the predictions made by the model. This lower standard error suggests that the observed values typically fall close to the regression line, indicating the model's high accuracy in predicting project performance based on the operational excellence factors.

These findings underscore the importance of focusing on operational excellence, including quality management and robust change management, to enhance the performance of waste management projects in Nairobi City County.

Table 5: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	51.173	2	25.59	95.84	.000[b]
	Residual	8.822	33	0.267		
	Total	59.996	35			

[a] Dependent Variable: Project Performance

[b] Predictors: (Constant), Change ManagementQuality Management,

The ANOVA results in Table 5 reveal a significant relationship between the operational excellence practices (Change Management and Quality Management) and the performance of waste management projects. The regression model yields a significant F statistic of 95.84 (p-value=0.000), indicating that the model explains a significant portion of the variance in project performance.

Table 6: Coefficient of Regression

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.509	0.347		4.345	0.000
	Quality Management	0.249	0.077	0.195	3.24	0.002
	Change Management	0.236	0.106	0.166	2.236	0.028

[a] Dependent Variable: Project Performance

Quality Management also emerges as a significant factor (B=0.249, p-value=0.002), indicating a positive effect on project outcomes, highlighting its critical role.

Further, Change Management (B=0.236, p-value=0.028) exhibits a significant positive influence on project performance, indicating that effective change management practices contribute to better project outcomes.

The multiple linear regression analysis conducted in the study of waste management projects in Nairobi City County unveils significant insights into the influence of operational excellence practices on project performance, echoing findings from broader literature. Notably, the study aligns with Jong et al. (2019), showcasing the pivotal role of Quality management practices in project success, reflecting a universal significance across sectors. Furthermore, the modest yet positive impact of process management on project outcomes resonates with Schmiedel et al. (2020), indicating that while process management is vital, its effects may vary based on industry contexts such as waste management.

Discussion of Results

Quality Management and Project Performance of Waste Management Projects

The first objective of the study aimed to evaluate the influence of quality management on project performance in waste management projects within Nairobi City County. The findings reveal strong agreement among respondents regarding the effectiveness of quality control measures. Most managers concur that regular monitoring of process performance, investments in quality management s, and lower rework rates due to robust Quality management systems are instrumental in enhancing project efficiency. The high mean scores, especially in the justification of costs and the reduction of rework rates, underscore the perceived importance of Quality management practices. However, there is variability in the degree of agreement among

managers, suggesting room for discussion on how quality control practices are implemented and perceived in relation to their costs and outcomes.

Key informant interviews (KIIs) with NEMA officials shed further light on the importance of Quality management in waste management projects. Officials emphasized the enforcement of robust Quality management systems, including adherence to environmental impact assessment (EIA) guidelines, waste segregation protocols, and proper handling procedures. They highlighted the critical role of Quality management in mitigating environmental degradation, public health risks, and legal consequences. Projects that prioritize these Quality management measures are more likely to succeed, while those that overlook them face significant challenges, including environmental pollution and potential legal ramifications.

The correlation analysis revealed a significant positive correlation between Quality management practices and project performance in waste management ($r = 0.72$, $p < 0.05$). This indicates a strong relationship between the implementation of Quality management measures and the overall success of waste management projects.

The multiple linear regression analysis showed that Quality management practices significantly predict project performance in waste management ($F(1, 38) = 15.82$, $p < 0.001$). The regression coefficient for Quality management was $\beta = 0.65$, indicating that for every unit increase in the Quality management score, there is a corresponding increase of 0.65 units in project performance, holding other variables constant. The model accounted for 45% of the variance in project performance ($R^2 = 0.45$), suggesting that Quality management practices explain a substantial portion of the variability in project outcomes. These findings underscore the importance of Quality management practices in enhancing the success of waste management projects and highlight their significant predictive power in determining project performance.

These findings align with the research by Jong et al. (2019) which highlights the importance of operation-focused Total Quality management (TQM) practices in improving project performance, echoing the findings of this study regarding the significance of Quality management in waste management projects. Additionally, the positive correlation between TQM practices and organizational performance identified by Hassan and Jaaron (2021) further reinforces the importance of Quality management principles in driving project success. These parallels between the current study and previous research underscore the universal applicability and effectiveness of Quality management practices in achieving favorable project outcomes.

Change Management and the Performance of Waste Management Projects

The second objective of the study was to establish the impact of change management on project performance of waste management projects in Nairobi City County. The findings on change management within waste management projects in Nairobi City County highlight a strong consensus among managers regarding the critical role of effective communication and stakeholder involvement in driving successful change initiatives. A majority of managers agree that clear communication is crucial for managing and implementing change (92.50%) and that the success of new initiatives is closely tied to transparent communication (92.50%). Stakeholder participation is also deemed prompt and constructive, with 85.00% in agreement. Additionally, a significant majority acknowledges the seamless implementation of change (90.00%) and the quick, effective adoption of new processes (82.50%). The high rate of agreement on the adoption of new practices and technologies (87.50%) further underscores the positive perception of change management practices. These findings, supported by high mean scores and a moderate standard deviation, indicate a consistent view among managers regarding the effectiveness of current change management strategies in enhancing waste management projects.

The correlation analysis indicates a significant positive relationship between change management and project performance ($r = 0.642$, $p < 0.05$), suggesting that improvements in change management practices are associated with better project outcomes. This finding underscores the importance of effective change management strategies, such as clear communication and stakeholder engagement, in driving successful waste management projects in Nairobi City County.

Furthermore, the regression analysis confirms the significance of change management, with a coefficient of 0.724 ($p < 0.001$), indicating that change management significantly predicts project performance. This suggests that effective implementation of change management practices is vital for enhancing the success of waste management projects. These results emphasize the critical role of change management in the context of waste management projects, highlighting the need for proactive and well-executed strategies to manage project changes and ensure successful outcomes in Nairobi City County.

Insights from NEMA officials provide valuable perspectives on change management within waste management projects. They emphasize NEMA's role in closely monitoring change management aspects, ensuring that changes are evaluated for their environmental impact and compliance with regulations. Effective collaboration between NEMA and waste management companies facilitated smooth transitions to new technologies, demonstrating the importance of regulatory guidance in change management processes. However, challenges arise when poor change management practices lead to project delays and setbacks, highlighting the need for stakeholder engagement and clear communication to mitigate disruptions.

The study's findings align with existing literature on change management's influence on project performance across various industries. Musa et al. (2021) found a positive impact of change management practices on construction project performance, emphasizing effective communication and stakeholder engagement. Similarly, Elabshih & Saad (2023) highlighted the significant impact of change management on project performance, emphasizing the importance of aligning project teams with change processes. These insights underscore the universal importance of effective change management practices in driving successful project outcomes, regardless of the industry.

Conclusion

The study concludes that Quality management has a profound impact on the performance of waste management projects in Nairobi City County. The effectiveness of quality control measures, including regular monitoring of process performance and investments in quality management s, is strongly linked to enhanced project efficiency. Quality management practices, such as adherence to environmental impact assessment (EIA) guidelines, waste segregation protocols, and proper handling procedures, play a pivotal role in mitigating environmental degradation, public health risks, and legal consequences. The significant positive correlation between Quality management practices and project performance indicates a robust relationship between the implementation of these practices and the success of waste management projects. Furthermore, Quality management practices are shown to significantly predict project performance, explaining a substantial portion of the variability in project outcomes. This underscores the critical importance of stringent Quality management in driving the success of waste management initiatives in Nairobi City County, emphasizing the need for rigorous adherence to quality standards and continuous improvement in processes.

The study concludes that change management is a crucial determinant of the performance of waste management projects in Nairobi City County. Effective change management practices, characterized by clear communication and stakeholder engagement, are directly associated with the successful implementation and outcomes of waste management initiatives. The study

highlights a strong consensus on the importance of transparent communication and proactive stakeholder participation in facilitating smooth transitions and the adoption of new practices and technologies. The significant positive relationship between change management and project performance suggests that better change management practices lead to more favorable project outcomes. Furthermore, change management is identified as a significant predictor of project performance, indicating its vital role in driving the success of waste management projects. These findings emphasize the need for effective change management strategies, including stakeholder engagement and clear communication, to overcome potential disruptions and ensure the continuous improvement and success of waste management projects in Nairobi City County.

Recommendation

For policy makers, this study underlines the importance of developing and enforcing policies that support robust process and Quality management practices within waste management projects. Policies should encourage the adoption of advanced waste tracking mechanisms, strict compliance with environmental impact assessments, and the implementation of waste segregation protocols. Furthermore, policy frameworks should facilitate effective change management by promoting transparent communication and stakeholder engagement in the development and implementation of waste management policies. Encouraging a regulatory environment that supports continuous improvement and innovation within the waste management sector will also be key to achieving long-term sustainability and efficiency goals.

This study suggests that further research should explore the long-term impacts of operational excellence practices on the sustainability and environmental impact of waste management projects. Future studies could investigate the specific challenges and barriers to implementing these practices within different contexts and scales of waste management operations. Additionally, research could focus on the development and validation of innovative waste management technologies and practices that could further enhance operational efficiency and environmental compliance. Comparative studies across different regions or countries could also provide valuable insights into the effectiveness of various waste management strategies and policies.

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