Assessment of solid waste management in Nairobi City County, Kenya

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Ngong River is a vital water resource which is heavily polluted due to improper waste disposal. Despite restoration programmes that have been ongoing for decades and efforts to develop and implement restoration strategies such as integrated system of solid waste management, little has been achieved. This study aimed at investigating the effectiveness of stakeholder's roles in solid waste management and their contribution to the successful restoration of Ngong River. Purposive sampling method was used in selection of 30 officials for the study. This approach permitted for target selection which ensured inclusion of only key stakeholders in the study, who participated directly in solid waste management, implementation of policies and restoration of river. Institutional questionnaires and key informant interviews were used to collect the information from the respondents and result presented in tables, graphs and charts. The findings revealed that, restoration of Ngong River entailed multiple stakeholders engaged in diverse solid waste management activities, primarily focused on public awareness and education (36%), waste collection (31%), and recycling initiatives (14%). Government agencies and NGOs/CBOs collaborate to implement policies and provide technical support, but challenges such as inadequate funding, poor infrastructure, and inconsistent waste collection hinder effective management. Among the stakeholders, Nairobi City County Government was rated most ineffective (75%) in waste collection and disposal services. Solid waste management in restoration of Ngong River restoration necessitates collaboration among government agencies, Nairobi County, NGOs, CBOs, and local communities, despite challenges. Holistic approach should be applied in improving solid waste management in restoration of heavily polluted Ngong River restoration.
Key words: Effectiveness, stakeholders, solid waste management (SWM), restoration, Ngong River

Introduction

Solid waste are materials that are no longer useful and are managed through an intricate process involving a range of strategies aimed at minimizing environmental impact and promotion of sustainable practices. Solid waste management entails an orderly method that encompasses the whole lifecycle beginning from generation to disposal (Orhorhoro & Oghoghorie, 2019). Waste generation and separation, is the beginning of this process, followed by categorization of waste materials into organic, recyclable, and non-recyclable. Safe storage is important in preventing contamination of environment as well as the health related risks (Cobo *et al., 2*018).

Nairobi City County has been actively enhancing its solid waste management practices through a multifaceted approach. The county generates approximately 3,086 tonnes of waste daily, with a collection rate of about 65%. To improve efficiency, the county has acquired 27 new garbage trucks and recruited 3,500 youth, known as the "green army," to assist in waste collection across all 85 wards. Stakeholders in solid waste management in Nairobi City include; county government, private waste collectors, community-based organizations, informal waste pickers, NGOs, and national government agencies, collaborating for efficiency and environmental sustainability (Ochieng, 2016).

The role of stakeholder participation is a crucial component of current management of solid waste and it stresses consultation in stakeholder awareness and actively participating in making of decision in management of solid waste (Lissah *et al.*, 2021; Mbui *et al.*, 2016). The restoration strategies of Ngong River were anchored on infrastructural development which include waste management, urban greening, and pollution control. In addition, the strategies were further anchored on stakeholder participation such as community participation, and public awareness. Campaigns and publishing of thematic maps on pollution status on the Ngong River database were also anchored on stakeholder participation (Ondigo *et al.*, 2018). However, the approach was hampered by low level of awareness among the communities living along river basin (Mwiti, 2014).

The lack of effective stakeholder's participation in solid waste management, the rising generation of solid waste triggered by population that is rapidly growing and the related economic activities in slums along Ngong River as well as poor regulatory frameworks and weak implementations of policies governing waste has led to the increase in pollution of the river (Ochieng, 2016; Odha & Mbataru, 2024). Furthermore, Ngong River is facing heavy pollution as a result of improperly disposed solid waste. Key aspect of challenges facing the river includes solid waste pollution caused by plastic materials which is made up of bags, bottles and packaging material.

Improper disposal and inadequate waste management infrastructure has led to large amounts of plastic, raw sewage, waste from industries, agro and petro chemicals waste, heavy metals and other waste resulting in depletion of oxygen level, extinction of aquatic life and turn its water unusable (Mugeni, 2023; Njuguna *et al.*,2017). Few studies have been conducted on roles of stakeholders in restoration of Ngong River for example an examination of stakeholder participation and learning outcomes by Sobowale (2019) among others. However, none of these studies have assess solid waste management in relation to restoration of Ngong River. Given the situation of pollution of Ngong River and the way solid waste is poorly managed, the study therefore, sought to assess effectiveness stakeholder role in solid waste management and their contribution to the successful restoration of Ngong River.

Literature Review

Solid waste management involves various stakeholders, including local authorities, landlords, NGOs, national government, residents, garbage collectors, CBOs, manufacturers, and office workers. Successful management of solid waste relies on involving these stakeholders and clearly defined terms of service (Tennakoon & Kulatunga, 2021). Sustainability in managing solid waste varies in different municipalities due to the diversity of their roles. Local authorities have a responsibility of collecting, transporting, and disposing waste as well as issuing licenses for waste management. They also ensure proper zoning of waste collection areas and emptying facilities to prevent nuisance. Local authorities are responsible for cost-effective transportation using licensed trucks and disposing of waste to designated areas (Wangui, 2022).

Landlords and tenants are responsible for waste generation within their household's premises. They ensure sufficient waste management and ensure adequate storage points for waste and controlling littering by tenants or wind. In slum areas, local authorities provide waste collection points and facilities, while landlords ensure tenants dispose-off their waste in designated storage sites. NGO's/CBO's/private sector performs a critical role in provision of solid waste management services, for example advocacy, awareness creation, mobilization of funds, and creating links between authorities and local communities (Kathambi & Ogutu, 2022). The Kenyan constitution (2010) created national government and county government and appropriate departments. The functions of waste management are fully vested on county government and the appropriate departments, while the national government has a general role of policy regulation on waste management. The National Environment Management Authority (NEMA) is the main agency of the national government, responsible for formulation of policies, enforcement of laws, and surveillance on waste activities (Ali *et al.,* 2010).

Research Methodology

The study employed a descriptive survey research design (Siedlecki, 2020) to evaluate stakeholders' effectiveness in solid waste management and their role in restoring Ngong River. This approach was chosen as it effectively examines existing conditions, prevailing practices, beliefs, attitudes, and emerging trends (Schmuck *et al.,* 2019). A mixed-methods approach was adopted for data collection, combining both qualitative and quantitative methods, as the research problem required comprehensive understanding that could not be achieved through a single data type alone (Almalki, 2016). This dual approach ensured a thorough analysis of stakeholders' contributions to the river's restoration.

The research employed purposive sampling to identify 30 officials from key institutions and community organizations playing direct roles in Ngong River's restoration. Community perspectives were gathered from village elders and CBOs, community leaders played a crucial role as key stakeholders due to their direct involvement in mobilizing local residents, coordinating community clean-up activities, promoting environmental awareness, and liaising with governmental and non-governmental organizations in the restoration of Ngong River. Institutional insights were obtained from the Nairobi Rivers Commission (NRC), Nairobi City County's Environment Subsector (Green Nairobi), NEMA, and relevant NGOs. This selective methodology specifically targeted actors with hands-on involvement in waste management, policy execution, and rehabilitation activities, ensuring the study captured authentic, operationally-grounded perspectives from those actively shaping the river's restoration.

Questionnaires were used in this study because of their ability to collect data efficiently, and economically (Kuphanga, 2024). The institutional questionnaires used were structured according to the set objectives in order to obtain the information from the respondents who were officials from County Government, government agencies such as NEMA and NRC and NGOs.

In addition to the questionnaire, the study also employed semi-structured interviews to collect in-depth qualitative data from the respondents, allowing flexibility to explore emerging themes while maintaining focus on the study objectives. Each interview lasted approximately 30 to 45 minutes, providing sufficient time for comprehensive responses. The interviews were conducted face-to-face to facilitate better engagement and rapport with the participants. With the respondents' consent, the sessions were audio-recorded to ensure accurate capture of responses for subsequent transcription and analysis. Respondents who were interviewed were the officials from an NGO (Mazingira Yetu) and a CBO

(Quality Smile Restores, Olympic, Kibera Slum) as well as community leader (Village elder, Gatwekera Village).

According to Dunwoodie *et al.* (2023), interviews are useful in gaining in-depth, rich qualitative data, allowing researchers to explore complex phenomena, understand individual experiences, and delve into sensitive topics.

Thirty (30) officials from CBOs, NGOs, Nairobi County Government and two government agencies (NEMA and NRC) each participated in filling institutional questionnaire. Out of 30 institutional questionnaires administered, 22 responses were received which represent a response rate of 73 %.

Excel and SPSS were used for analysing quantitative data by generating, percentages, and results were presented in form of tables, graphs, pie charts. Qualitative data were analysed using thematic content analysis. The data were systematically reviewed, organized, and categorized to develop detailed narratives and discussions. Subsequently, thematic analysis was applied to identify, analyse, and generate sub-themes, as well as to capture patterns aligned with the specific objectives and research questions. The analysed qualitative data were then presented thematically, with narratives and discussions structured according to the study's objectives.

Ethical considerations

The study adhered to strict ethical guidelines to protect participants from physical or psychological harm, ensuring their rights were respected throughout data collection, analysis, and reporting. Respondents were fully informed about the research to enable voluntary and informed participation before questionnaires or interviews were administered. To safeguard privacy and confidentiality, personally identifiable information (such as names) was avoided, with anonymous identifiers used instead. Data were solely utilised for academic purposes, as disclosed to participants, and only those who provided explicit consent were included in the study.

Result and Discussion

Roles and responsibilities in solid waste management in restoration of Ngong River

Multiple stakeholders contributed to Ngong River's restoration through diverse solid waste management activities. Data revealed their primary focus areas: public awareness/education (36%), waste collection/transport (31%), recycling/processing (14%), policy formulation (5%), and regulation/enforcement (5%). Most institutions concentrated on waste collection and awareness campaigns, aiming to establish effective systems that reduce environmental harm **(Table 1)**. CBOs and NGOs played a complementary role by emphasizing recycling initiatives and community empowerment through education programs. A CBO representative's interview testimony underscored the importance of these collaborative efforts in addressing river pollution challenges.

> *"We are involved in community awareness, waste collection, and advocacy for better waste management practices. We also carry out clean-up activities along the Ngong River and we are working closely with youth and women's groups in creating income-generating activities from waste recycling."*
>
> KII 1, Programme Officer, Quality Smile Restores, Olympic, Kibera Slum (CBO), (2025).

Government agencies, led by Nairobi City County and NEMA, were responsible for policy formulation (5%) and regulatory enforcement (5%) in Ngong River's waste management. They partnered with NGOs, CBOs and private entities to implement these regulations. The findings support Joshua's (2023) research showing that successful conservation requires both public education to change disposal behaviours and policies that reflect community needs, underscoring the value of collaborative stakeholder engagement for Nairobi River's protection.

Table 1: Primary role of the institutions in solid waste management

Role	Percent (%)
Public awareness and education	36
Recycling and waste processing	14
Waste collection and transportation	31
Policy formulation and regulation	5
Enforcement of waste management laws	5
Others	9
Total	**100**

Strategies and policies implemented for solid waste management

Stakeholders implemented diverse solid waste management strategies, including smart waste collection (14%), community empowerment in Kibera, waste bag distribution, integrated waste systems (ISWM), and public-private partnerships (PPP). Key policy frameworks like the Nairobi City County Solid Waste Management Act (2015) and National Strategy (2022) promoted waste segregation and established collection points through licensed providers. While these measures aimed to

enhance sustainability and urban development, partial implementation along Ngong River's riparian zones has failed to prevent severe pollution (Athi Water Services Board, 2015).

Frequency of waste collection near Ngong River

Waste collection practices in Kibera and Ngong River areas showed significant variation, with 74% of institutional respondents actively participating while 26% were uninvolved. Collection frequency primarily followed weekly schedules (32%), though monthly (18%), on-demand (14%), and irregular patterns were also reported (**Table 2**). Challenges like high population density, poor infrastructure, and inconsistent services led to direct waste dumping in the river. The 2018 closure of Ngong dumpsite exacerbated these issues, forcing reliance on distant alternatives like Dandora that only Nairobi City County could regularly service (Villa *et al.,* 2024). These systemic limitations continue to hinder effective waste management provided in the area.

Table 2: Frequency of waste collections

Frequency	Percentage
Weekly	32
Monthly	18
On demand	14
Daily	5
Bi-weekly	5
Unknown	26
Total	100

Collaboration of stakeholders in solid waste management

Multiple institutions partnered to implement sustainable waste management for Ngong River's restoration, including Nairobi County Government, NEMA, NGOs, CBOs, and private waste companies. Their collaboration primarily involved joint projects (50%), funding partnerships (27%), and regular meetings (18%), with only 5% reporting no collaboration **(Table 3)**. Government agencies provided policy guidance and enforcement, while private entities contributed technical expertise in waste management solutions (Odha & Mbataru, 2024). A CBO representative provided additional insights about implementation challenges.

"There are collaborations with various stakeholders, but they are not well-structured. There is lack of regular platform for every stakeholder to coordinate their efforts effectively. Stakeholder meetings and community engagement forums are occasional and lacking follow-up and implementation strategies. Moreover, there are funding conflicts, whereby many stakeholders are competing for limited resources. Some stakeholders are blaming one another rather than working together."

KII1, Programme Officer, Quality Smile Restores, Olympic, Kibera Slum (CBO) (2025)

Table 3: Stakeholders collaboration in solid waste management

Form of collaboration	Percent (%)
Regular meetings	18
Joint projects	50
Funding partnerships	27
No collaboration	5
Total	**100**

Effectiveness of stakeholders' roles in solid waste management

Nairobi City County's waste disposal performance in Kibera and Ngong River areas received predominantly negative evaluations, with 75% of respondents rating it ineffective (65%) or very ineffective (10%). Only 5% considered it effective, potentially due to limited stakeholder collaborations and awareness programs **(Table 4)**. Key challenges included inconsistent practices, weak enforcement, and resource limitations, leading to illegal dumping despite designated sites. These findings corroborate ULA's (2021) report on Nairobi's waste management crisis, emphasizing the urgent need for stronger enforcement, particularly in riparian zones, to support river restoration efforts.

Table 4: Effectiveness of Nairobi City County's in safe disposal of waste collected

Rating	Percent (%)
Very Ineffective	10
Ineffective	65
Neutral	15
Effective	5
Very effective	5
Total	100

Major challenges faced by organizations its role in solid waste management

Ninety-five percent (95%) of the respondents cited critical obstacles in solid waste management: inadequate funding, poor infrastructure, rapid urbanization, low public awareness, weak regulation enforcement, and over-reliance on informal collectors. A CBO official interview reinforced these systemic challenges hindering government and private organizations' restoration efforts along Ngong River.

> *"While efforts have been made, the river remains heavily polluted. Waste collection services are not consistent, and there is persistent waste dumping into the river. Lack of very strict enforcement of laws and improvement in waste management infrastructure, is worsening the state of the pollution of Ngong River."*
>
> KII1, Programme Officer, Quality Smile Restores, Olympic, Kibera Slum (CBO), (2025).

According to Odha and Mbataru,(2024), Ngong River restoration faces challenges in solid waste management due to insufficient funds, poor enforcement of waste management legislation, lack of public understanding, logistical issues, and fragmented stakeholder collaboration. Urbanization and population growth also increases garbage output, necessitating a multifaceted strategy including increased funding, robust policy enforcement, public education, and enhanced stakeholder engagement.

Stakeholder collaboration and public participation

Stakeholders employed multiple awareness methods, with workshops/trainings (54%) and public campaigns (27%) being most common, followed by social media (9%), local leader collaborations (5%), and other approaches (5%) **(Figure 1)**. Workshops proved effective for direct community engagement in waste management education, while government-led campaigns addressed pollution impacts. Digital tools complemented these efforts by broadening reach. These findings align with Joshua's (2023) Nairobi Rivers study emphasizing community engagement through collaborative awareness initiatives as key to fostering environmental stewardship.

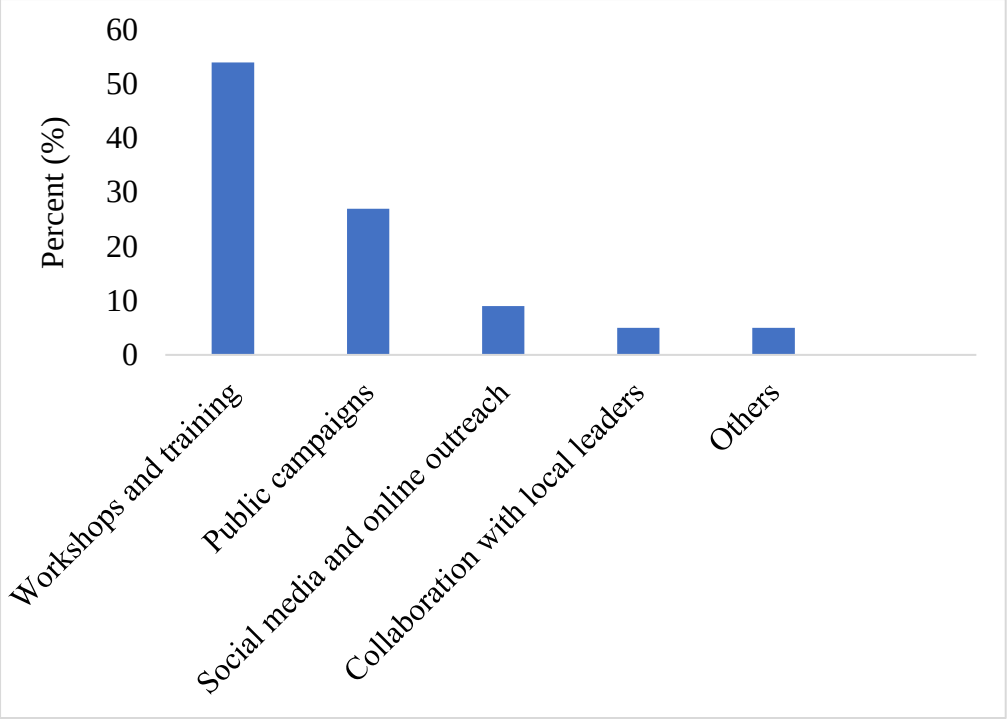

Figure 1: Strategies used in raising awareness on solid waste management and river restoration

Creation of linkages between various stakeholders for solid waste management activities

Efforts to establish linkages among stakeholders received mixed responses: 54% neutral, 31% positive (22% successful, 9% very successful), and 15% negative (10% unsuccessful, 5% very unsuccessful) **(Table 5)**. Successes were credited to government policy support and NGO/CBO-led community engagement, while failures stemmed from poor coordination and communication gaps. Despite challenges, ongoing collaboration aims to strengthen solid waste management outcomes (Ngatia *et al.*, 2023).

Table 5: Creation of linkages between various stakeholders for solid waste management

Ratings	Percent
Very successful	9
Successful	22
Neutral	54
Unsuccessful	10
Very unsuccessful	5
Total	100

Participation in multi-stakeholder meetings or forums on solid waste management

Stakeholder engagement in SWM meetings varied: 50% participated occasionally (annually), 41% regularly (monthly/quarterly), and 9% rarely **(Figure 2)**. Meeting frequency depended on project urgency and scale. These forums facilitated strategy alignment, progress reviews, policy updates, and community engagement. Regular participation was deemed critical for coordinated restoration efforts and adaptive management (Sobowale, 2019).

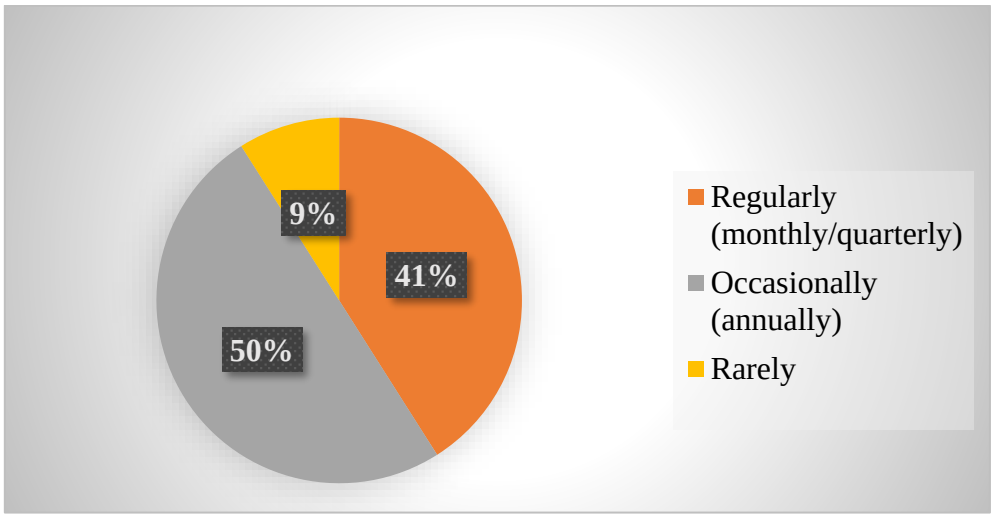

Figure 2: Participation in multi-stakeholder meetings or forums on solid waste management

Level of involvement of local communities in solid waste management activities near Ngong River

A majority (72%) of government, NGO, and CBO respondents reported full community engagement in solid waste management (SWM) through clean-ups and consultations near Ngong River. Meanwhile, 22% noted partial involvement, and only 1% observed no participation **(Figure 3)**. A key informant interview provided further insights into these findings.

> *"There is an increase in involvement by the local community, however many people are still dumping waste into the river because of lack of sufficient awareness. Younger people are more involved than older generations. More people are involved because of incentives and recycling businesses opportunities which generate income."*
>
> KII 2, Village elder of Gatwekera Village, (2025).

While 72% of organizational respondents reported significant local community engagement in Ngong River's solid waste management (SWM), this contrasts with limited participation observed in Kibera Slums due to corruption, nepotism, and leadership barriers. Community involvement through awareness campaigns, training, clean-ups, and waste collection proves vital for successful SWM and river restoration (Joshua, 2023).

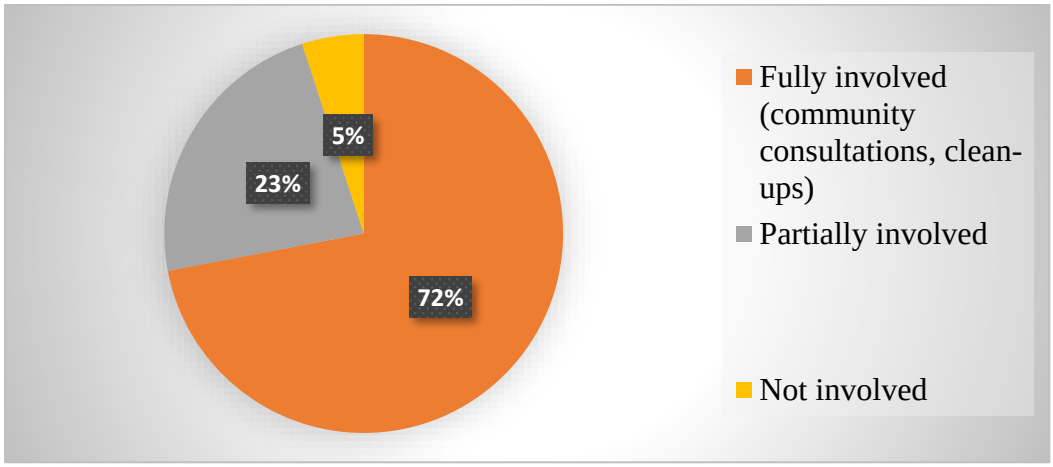

Figure 3: Level of involvement of local communities in solid waste management activities near Ngong River

Role of the local community in the restoration of Ngong River

Local communities play a vital role in successful solid waste management (SWM) and river restoration by adopting sustainable waste practices and taking ownership of their environment (Odha & Mbataru, 2024). While respondents expressed varying opinions, all agreed that community involvement is essential for improving Ngong River's restoration through better waste management.

> *"We teach the communities in Kibera Slum on waste disposal, as well as organizing river clean-ups activities, and facilitating collaboration with NGOs and government agencies in managing solid waste. Our role also includes youth mobilization for waste collection and reporting illegal dumping to authorities."*
>
> KII 2, Village elder, Gatwekera Village, (2025).

Local communities play a vital role in restoring polluted rivers through proper household waste segregation, responsible disposal, and reducing waste entering the river. They can also organize clean-up activities, monitor dumping sites, and collaborate with local authorities to maintain cleanliness. By educating others and forming community-based waste management groups, residents help support recycling and ease the pressure on municipal systems. Ultimately, active community involvement and leadership are essential for achieving sustainable, long-term solutions for river restoration and protecting both the environment and public health (Mandela, 2020; Jenkins *et al.*, 2021).

Impact of solid waste management on the Restoration of Ngong River

The impact of government agencies and organizations in reducing waste pollution in Ngong River's restoration was perceived as moderate by 40% of respondents, while 36% reported high or very high impact, and 24% noted low or no impact **(Table 6)**. Moderate impacts stemmed from public awareness, waste collection, and community engagement, whereas stronger results were tied to clean-ups, waste segregation, and education campaigns. However, limited participation, resource shortages, weak enforcement, and poor coordination hindered greater effectiveness. As highlighted by Mazingira Yetu magazine (Irungu, 2022), sustainable progress demands continued collaboration, stricter enforcement, improved infrastructure, and community empowerment to achieve lasting river restoration.

Table 6: Impacts of reducing waste pollution in Ngong River

Rating	Percent
Very high impact	5
High impact	31
Moderate impact	40
Low impact	18
No impact	6
Total	100

Outcomes as a result of solid waste management efforts near Ngong River

The collaborative solid waste management initiatives by NGOs, CBOs, and government agencies along Ngong River have yielded multiple positive results, with increased recycling activities being the most prominent outcome (47%). Other significant impacts included reduced illegal dumping, improved water quality, and enhanced community health (each reported by 14%, 14%, and 7% of respondents respectively), while 4% noted additional benefits like youth employment through waste collection programs (Figure 4). A small proportion (14%) observed no substantial changes from these interventions.

> *"Some progress has been made, in restoration of Ngong River however, illegal dumping of solid waste into the river remains a major challenge. In addition, waste collection services are not reliable, and this makes it to maintain cleanliness."*
>
> KII 3, Project Officer, Mazingira Yetu, (NGO) (2025).

Solid waste management initiatives near Ngong River have achieved notable successes, particularly in boosting recycling rates (47%) through effective awareness campaigns and waste segregation programs. These efforts have yielded multiple benefits including reduced illegal dumping, improved water quality, and enhanced community health by minimizing pollution-related diseases. However, some areas showed limited progress due to ongoing challenges like insufficient infrastructure, lax enforcement of policies, and inconsistent community engagement. While these interventions have made measurable impacts, comprehensive and sustained strategies remain essential to ensure the river's long-term restoration and environmental health

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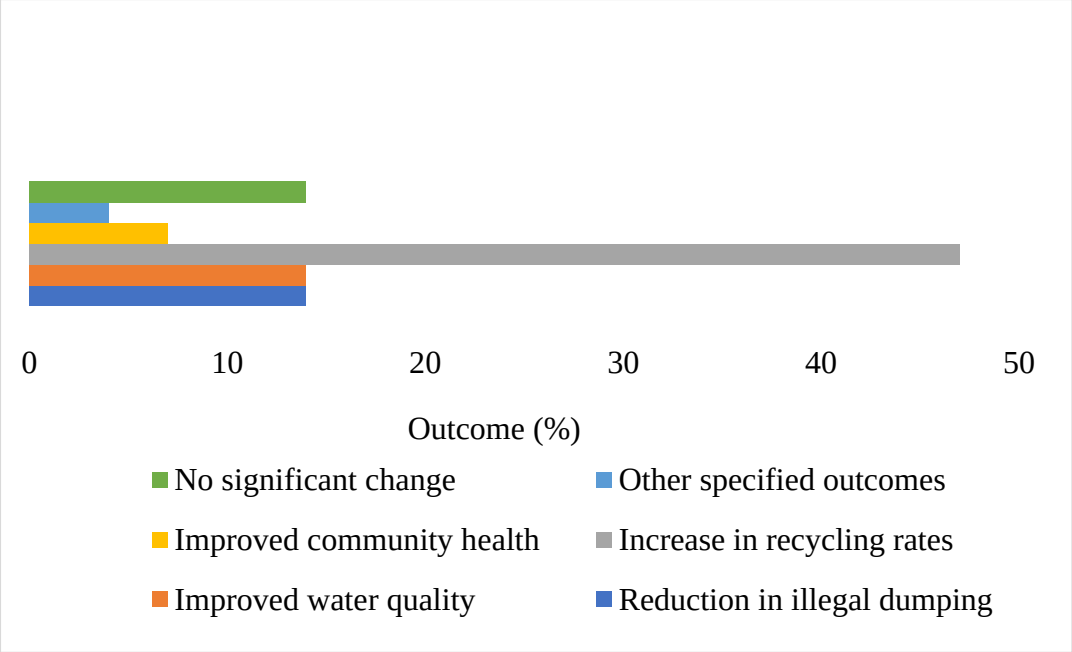

Figure 4: Outcomes as a result of solid waste management efforts near Ngong River

A research conducted by Odha (2024) on prevention and control of pollution of Ngong River aligns with the results obtained in this study. The study suggests a multidimensional approach, with consideration of the outcome of restorations which are not only reducing pollutant level through ways such as reduction in illegal dumping, and improvement of water quality. But also, improvement in the overall health of the ecosystem. For example, through evaluation of the presence of biodiversity and restoration of riparian area which should be explored.

Conclusion

The restoration of Ngong River relies on a multi-stakeholder approach involving government agencies, Nairobi County, NGOs, CBOs, and the local community. While these stakeholders have contributed to waste management through public awareness, waste collection, recycling, and policy enforcement, challenges such as inadequate infrastructure, weak enforcement, and low public awareness hinder progress. Despite some improvements in waste management strategies, issues like inefficient waste transportation and poor stakeholder coordination remain. The study emphasizes the importance of inclusive governance in environmental management, particularly in sustainable restoration efforts like the Ngong River restoration. It emphasizes the interdependence of institutional structures, community engagement, and environmental outcomes. Moreover, the study was limited because of its focus on stakeholder participation without including environmental assessment of actual waste and pollution level of Ngong River. To ensure long-term sustainability, strengthening institutional frameworks, increasing funding, enhancing enforcement, and fostering structured collaboration are essential. Addressing these gaps can make Ngong River's restoration a model for urban river rehabilitation, improving environmental sustainability and community well-being.

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