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Environmental Policies and Sustainable Solid Waste Management in Mavoko Sub-County, Kenya

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Abstract: *Solid waste management has long been an essential component of any community. In order to cut health risks, the effects related to climate change and greenhouse gases in the atmosphere, proper solid waste management is a must. This study investigated the influence of environmental policies on sustainable solid waste management in the Mavoko sub-county, Kenya. The study was anchored on Empowerment theory. Convergent parallel research design was adopted. The study adopted 380 respondents. Krejcie and Morgan's formula was used to detaermine sample size of 191 respondents comprising of 178 Households, 2 NEMA officers, 5 Sub-County Officials and 5 Youth Groups. Data was collected using questionnaire and interview guide. Data analysis was done using statistical techniques for quantitative data and thematic analysis for qualitative data. Findings show that, implementation of policies had a positive influence on sustainable waste management with a mean of 3.17, at 43.5% of the respondents agreeing. Environmental policies demonstrate a strong positive correlation with sustainable solid waste management ($r = .924$, $p < 0.01$). Policy implementation frameworks, enforcement mechanisms, and strategic environmental assessments are recognized as essential; their true value lies in consistent and effective execution. The study recommends policy enforcement for sustainable waste management in Mavoko.*

Key words: *Environment, Environmental Policies, Sustainable, Solid Waste Management*

1.1 Background to the Study

The problem of sustainable solid waste management (SSWM) is increasingly becoming a more global concern due to a change in consumer behaviour, increased urbanization and an increasing population across the globe. According to U.N. Environment Programme (2023), Tsai et al. (2022) and Barupal et al. (2021), the growing complexity and volume of solid waste is exerting a new and unprecedented burden on waste management systems all over the world. Globally, urbanization and economic growth are closely associated with rising waste production, which in turn contributes to increasing environmental stressors and social problems. These demographic and economic shifts create complex socio-political circumstances that municipal waste systems are often ill-equipped to handle. According to the World Bank (2020), global waste generation is projected to increase by 70% by 2050, driven largely by rapid urbanization and economic growth, and many municipal waste systems, particularly in

low-income countries, are unable to manage this surge, resulting in environmental pollution and public health hazards. Similarly, research indicates that urban areas frequently lack the infrastructure necessary to manage increasing waste production effectively, exacerbating environmental contamination and social challenges (Hoornweg & Bhada-Tata, 2012; UNEP, 2023).

In many urban areas, improper waste disposal and low recycling rates are often linked to limited awareness, lack of environmental education, and negative attitudes toward waste management (Hoornweg & Bhada-Tata, 2012; UNEP, 2023). Without active engagement from residents and businesses, even well-funded municipal systems struggle to achieve sustainable waste management outcomes.

Globally, there are notable good practices that demonstrate the impact of behavior and attitudes on waste management success. For example, countries like Sweden and Germany have established strong recycling cultures, supported by comprehensive public education campaigns, incentive-based recycling schemes, and strict enforcement of regulations. In Japan, the concept of "mottainai" (avoiding wastefulness) is deeply embedded in social behavior, leading to high compliance with segregation, recycling, and minimal landfill dependency. Similarly, cities like San Francisco in the USA have achieved near-zero waste targets by combining stringent policies, community engagement programs, and reward-based participation (Zero Waste International Alliance, 2022). These examples highlight that sustainable waste management requires not only technological and infrastructural solutions but also fostering positive attitudes, awareness, and civic responsibility.

The effectiveness and sustainability of the entire waste management system are compromised in developing cities where informal waste pickers and recyclers play important roles if social dynamics are ignored, (Barupal et al., 2021; Tauringana, 2023; Nyathi et al., 2022). Marginalisation of these actors frequently results in public dissatisfaction with municipal services and missed opportunities for social inclusion and resource recovery, (Serge, 2021; Ogutu et al., 2022; Wang, 2023). Decentralising authority and encouraging multi-stakeholder collaborations through effective governance reforms can foster community ownership (Kumar, 2023; UNEP, 2023; Barupal et al., 2022).

Furthermore, maintaining a cohesive and all-encompassing approach to sustainability is ensured by coordinating regional and local waste management plans with global frameworks like the Sustainable Development Goals (SDGs) and international climate agreements, (UNEP, 2023; Tauringana, 2023; Singh et al., 2021). Understanding the significance of bottom-up participation and ownership, efforts to reduce waste generation, promote circular economy principles, and support climate action must take into account local socioeconomic realities and cultural contexts (Moyo & Chikwanha, 2022; Ogutu et al., 2022; Wang, 2023). For waste management to be sustainable in the face of growing urban and climate pressures, these integrated, community-centred approaches promote social equity, economic inclusion, and environmental resilience.

At the national level, these principles are operationalized through Kenya's legal and policy frameworks, which provide the formal mechanisms to translate global sustainability goals and community-centered strategies into actionable programs (Tauringana, 2023). Kenya's waste management system is anchored in the Environmental Management and Coordination Act (EMCA) of 1999 and implemented at the county level through County Integrated Development Plans (CIDPs). The EMCA serves as the principal

environmental legislation, establishing the National Environment Management Authority (NEMA) as the lead agency for environmental oversight. The Act mandates the integration of environmental considerations into development policies, plans, and programs to ensure sustainable resource use and environmental protection. Specifically, Section 58 requires that any development likely to have significant environmental effects undergo an Environmental Impact Assessment (EIA) prior to approval, a process that identifies potential risks and implements mitigation measures (Kenya Law, 1999; NEMA, 2023). In relation to waste management, EMCA empowers NEMA to develop regulations, prescribe standards, and issue guidelines for the management and conservation of natural resources, including overseeing waste collection systems, enforcing compliance, and promoting public awareness on environmental issues (NEMA, 2023).

At the county level, waste management is addressed through CIDPs, which are five-year strategic documents guiding local development initiatives. Each county government is required to prepare and submit integrated waste management plans for approval by the county assembly, ensuring alignment with broader development goals (Public Finance Management Act, 2022). CIDPs outline strategies for waste collection, disposal, recycling, public education, and community engagement while specifying stakeholder roles to ensure coordinated implementation. For example, the Kiambu County CIDP (2023–2027) emphasizes improving garbage collection systems, enhancing disposal methods, and promoting recycling initiatives (Kiambu County Government, 2023).

The integration of EMCA and CIDPs creates a robust framework for effective waste management. While EMCA provides overarching legal and regulatory authority, CIDPs translate these policies into actionable strategies tailored to local contexts. This approach ensures that waste management practices are not only legally compliant but also responsive to local environmental, social, and infrastructural conditions. Nonetheless, challenges such as limited financial resources, inadequate infrastructure, and insufficient public participation persist, highlighting the need for collaborative action among national and county governments, private sector actors, and communities (Ogutu et al., 2022).

These persistent challenges underscore that existing legislative and policy frameworks, while necessary, are not sufficient on their own. Given the rapid growth of global waste generation, structural governance issues, and infrastructural constraints, a paradigm shift in solid waste management is required. Sustainable outcomes depend on developing a culture of environmental stewardship through inclusive community engagement, transparent policymaking, and flexible governance arrangements in addition to technological advancements and financial investments..

1.2 Statement of the Problem

Effective solid waste management policies are crucial in prioritizing waste handling, prioritizing Reduce, Reuse, Recycle, and Recover (the 4 Rs or 5 Rs, including Refuse or Rot/Compost), and minimizing environmental and health impacts. In Mavoko Sub-County, the situation is however different. Policy implementation on solid waste management has been a challenge. While developed countries had modern SWM systems that emphasized recycling and waste reduction at the source rather than reliance on incineration and land disposal (Nathanson, 2020), the situation in Mavoko Sub-County is far from this ideal. Most households do not separate their waste, primarily due to poor environmental policy implementation and the absence of structured waste collection systems. Consequently, recyclable materials were mixed with general waste, and organic waste that could have been composted ended up

in landfills, contributing to environmental degradation. Public littering, illegal dumping, and inadequate disposal sites had made towns and urban centres unhygienic. Urbanizing areas such as Mavoko sub-county faced persistent challenges, with waste accumulating in public spaces, drainages, and fields. Ntagisanimana and Ma (2021) noted that effective SWM was a multi-step process, starting at the point of waste generation and continuing through to final disposal or treatment. Failure to separate waste at the source remained a major challenge in Mavoko Sub-County, highlighting the need for effective policy implementation and environmental stewardship. This study, therefore, sought to establish the influence of environmental policies on sustainable solid waste management in Mavoko sub-county, Kenya.

1.3 Objective of the Study

To establish the influence of environmental policies on sustainable solid waste management in Mavoko sub-county, Kenya

1.4 Significance of the Study

The findings of the study may potentially result in the improved management of solid waste and the more clean neighborhood. The findings of the study can serve as instructions to other researchers, policy implementers, county government, and the society, which can guide the transformation of SWM to becoming sustainable. The study has a possibility of being a good source of data. The assemblers of government agencies such as the sub-decision-makers county and others.

1.5 The Conceptual Framework

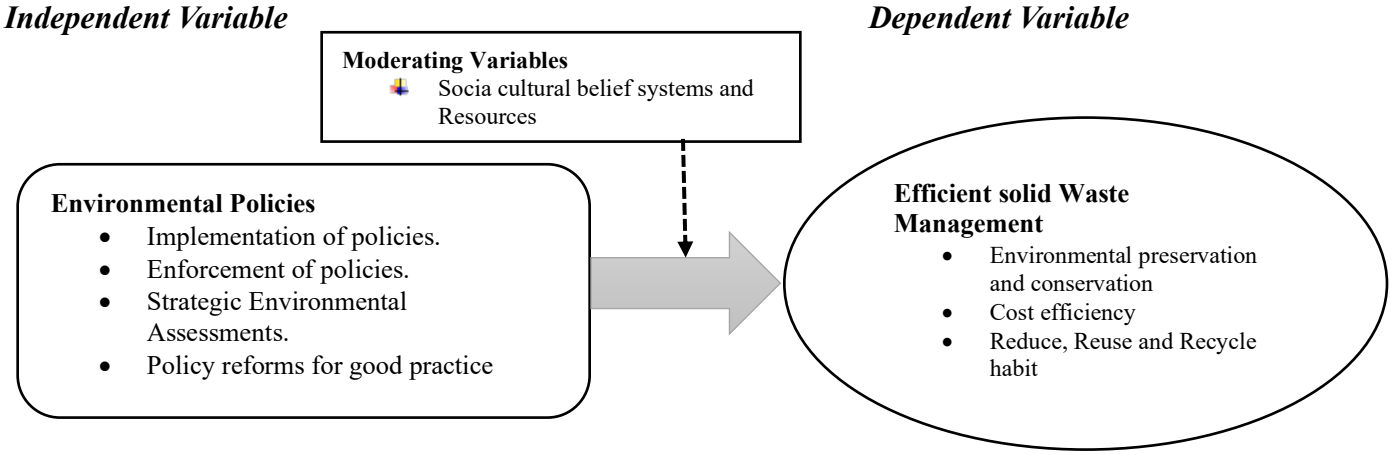

Figure 1: *The Conceptual Framework*
Source: *Own Conceptualization, 2024*

1.6 The Literature Review

In this section, theoretical and empirical reviews on the influence of environmental policies on sustainable solid waste management are presented.

1.6.1 Theoretical Review

Empowerment Theory

Empowerment Theory provides a comprehensive framework for understanding how individuals and communities connect goals, actions, and outcomes to take control over their lives. The theory was first extensively conceptualized by Julian Rappaport (1987), who emphasized empowerment as a social process that enables individuals and communities to gain mastery over their lives and environments. Zimmerman (1990, 2000) further elaborated the concept, defining empowerment as a dynamic process involving the development of skills, resources, and a sense of control that enables individuals to influence outcomes in their social and political environments. Similarly, Mechanic (1991) describes empowerment as the process by which individuals become aware of how their actions directly affect their lives, emphasizing personal agency and responsibility. The Cornell Empowerment Group (1998) adds that empowerment is a continuous, intentional process rooted in local communities, combining compassion, critical thinking, mutual respect, and group engagement, particularly for those historically marginalized. The ideal of Empowerment Theory is to foster autonomy, agency, and participatory engagement at multiple levels individual, organizational, and community so that people can influence decisions, access resources, and implement change that improves quality of life. In practice, empowered individuals and communities are able to recognize their potential, collaborate effectively, and transform social structures to achieve collective goals. Empowerment is therefore both a process and an outcome: it builds capacity, enhances decision-making, and increases the ability to take action in socially meaningful ways. Despite its widespread acceptance, Empowerment Theory has faced criticism. Some scholars argue that empowerment is context-specific and difficult to define and measure consistently. Perkins and Zimmerman (1995) highlight the challenge of operationalizing empowerment across diverse settings, pointing out that interventions effective in one context may not yield the same results in another.

Critics also note that empowerment may be limited by structural and institutional barriers; individual or community efforts may be constrained by broader socio-political conditions, resulting in a gap between perceived empowerment and actual influence (Wallerstein, 2006). Additionally, some argue that an overemphasis on individual empowerment may overlook systemic inequalities, making it essential to integrate structural and relational perspectives to fully understand empowerment dynamics. Recent studies have expanded the applications of Empowerment Theory, particularly in community development and public health contexts. Malta (2023) emphasizes strategies for community empowerment, including increasing autonomy and active participation through access to resources, knowledge, and skills. Rachmad (2022) offers a contemporary perspective, showing how empowering individuals or groups enhances performance and well-being by granting freedom, responsibility, and access to resources. Similarly, Haemel et al. (2023) explore community participation in health promotion, highlighting that local, community-driven actions and policies are effective in shaping environments that support collective well-being. These studies underscore that empowerment involves both personal agency and community collaboration, making it a flexible and context-sensitive framework applicable to various social challenges.

In practical terms, Empowerment Theory emphasizes participation, collaboration, and capacity building. Individuals who are actively engaged in decision-making, organizational activities, or community initiatives are more likely to develop skills, access resources, and influence outcomes. Organizational and community empowerment further reinforce these processes by creating environments that support inclusive participation, equitable resource distribution, and collective problem-solving. This makes the

theory particularly relevant for initiatives such as sustainable solid waste management, where community involvement, shared decision-making, and resource mobilization are critical to success. In conclusion, empowerment is a multifaceted, intricate process that involves community cooperation, organizational structures, and individual agency. It depends on reciprocal respect, critical awareness, and teamwork to gain more authority, obtain resources, and implement substantial change. The empowerment paradigm challenges conventional authoritative dynamics by prioritizing strengths and capacities, fostering partnerships, and encouraging participatory action. Although there are still issues with definition and implementation, empowerment theory continues to provide valuable perspectives and tactics for promoting individual and group well-being in various contexts.

1.61. Empirical Review

Environmental Policies on Sustainable Solid Waste Management

Reforms such as the EMCA of 1999, which created organisations like NEMA to regulate waste management, have advanced Kenya's institutional and legal environment (Kariuki, 2022). Diverse stakeholders, such as governmental organisations, non-governmental organisations, private companies, informal waste collectors, and communities, must be involved for SWM to be successful, highlighting the significance of multi-sectoral cooperation, (Mutua & Mburu, 2023; African Union, 2024). Reducing unlawful disposal practices is made possible by acknowledging informal collectors as valid stakeholders, which also improves integration, resource access, and enforcement (Njenga & Ngugi, 2022). Enforcement tools that ensure compliance include mobile violation reporting, digital tracking of waste collection trucks, and penalties like fines and service suspension (Wycliffe & Kariuki, 2022). Campaigns for public awareness raise adherence even more by educating people about the advantages of appropriate waste management for the environment and human health.

For sustainable SWM, community involvement is essential, particularly at the household level. Households can help reduce landfill loads and promote resource recovery by recycling, composting biodegradable waste, and separating waste at the source, Njenga & Ngugi, 2022; Mutua & Mburu, 2023. Behaviour change and responsibility are promoted by educational initiatives and financial incentives, such as waste banks that convert sorted waste into cash, Njoroge & Wambugu, 2021. Raising awareness through the media and community forums results in increased compliance and a decrease in unlawful dumping, (Odede & Muchiri, 2022). A participatory approach where waste management becomes a shared societal responsibility is created when household efforts are incorporated into policy enforcement, which is in line with larger sustainability and urban resilience objectives. Stakeholder cooperation, technology developments, and ongoing reforms are required to strengthen enforcement and promote sustainable SWM practices.

1.7 Research Methodology

Research Design: The study adopted a convergent parallel research design, which is a type of mixed-methods design where quantitative and qualitative data are collected and analyzed simultaneously, then compared and integrated to provide a comprehensive understanding of the research problem. This design enabled the researcher to capture both numerical trends and detailed contextual insights regarding the influence of environmental policy in sustainable solid waste management in Mavoko Sub-County, Kenya.

Target Population: Mavoko is a sub-county in Machakos County, Kenya. Mavoko sub-county has a population of 322,499 people on 834.9 Sq. Km and 109,735 households from the KNBS Census (2019).

This study focused on a leaner target population in Mavoko constituency with a population of 355 households KNBS (2019). The key informants were drawn from relevant county ministry departments, youth group waste collectors, and a representative of the national government, which is the NEMA office.

Table 1: Population Grid

Categories	Target Population
Households	355
NEMA officers	5
Sub- County Officials	10
Youth Groups	10
Total	**380**

Source: *Field data, 2025*

Sample Size: Mavoko Sub-County, located in Machakos County, Kenya, has a total population of 322,499 people living within 834.9 square kilometers, comprising 109,735 households (KNBS, 2019). For this study, the target population consisted of 355 households within Mavoko Constituency. Additionally, key informants were drawn from strategic stakeholders, including officials from relevant county departments, youth group waste collectors, and representatives from the National Environment Management Authority (NEMA), bringing the total target population to 380 respondents. The unit of analysis for this study was the household, as well as key institutional actors (NEMA officers, sub-county officials, and youth groups) involved in solid waste management. The sample size was scientifically determined using Krejcie and Morgan's (1970) formula for finite populations:
Where:

$$S = \frac{X^2 \cdot N \cdot P(1-P)}{d^2(N-1) + X^2 \cdot P(1-P)}$$

S = required sample size
X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841 for 95% confidence)
N = population size (380)
P = population proportion (assumed to be 0.5 for maximum sample size)
d = degree of accuracy expressed as a proportion (0.05)
Substituting the values, the calculated sample size was 191 respondents. The sample was proportionally allocated across the categories of households, NEMA officers, sub-county officials, and youth groups to ensure representative data collection.
Sampling Technique and Procedure: Mavoko constituency has 20,513 households. The research was based in Mavoko sub-county, Mavoko constituency. The assumption is that it was to provide 178 households which were drawn from 4 wards, Athi-river Township, Kinanie,Katani, and Syokimau. In addition, sub-county solid waste department officials, youth groups waste collectors, the county NEMA officers. The study employed probability sampling techniques; random sampling was used to access households and the key informants. Interviews and questionnaires were distributed to respondents and collected for data analysis after they were filled.

Table 2: Sampling Grid

Categories	Target Population	Sample Size
Households	355	178
NEMA officers	5	2
Sub-County Officials	10	5
Youth Groups	10	5
Total	**380**	**191**

Source: *Field data, 2025*

Research Instruments: The study's Structured questionnaires, unstructured interviews, and observation were used to gather primary data. The study used interviews for the identified county officials, NEMA officers andyouth groups. Open-ended questions were used to get an in depth understanding of the respondents' feelings and allowed them to give their opinions. These helped the researcher weigh the truthfulness of the responses. Questions about the respondent's personal information was asked in the questionnaire's initial section (age, gender, education level). The second part assessed their opinions on a level of 1-5 of the SWM situation in Mavoko sub-county. Questions measuring each of the aspects of sustainable solid waste management listed in the study goals made up this section. Likert scale questions was used for data collection. This made the results easily quantifiable and subjective to computation. Close ended questions were used to facilitate fast decision making and to help acquire specific information. The researcher used observation methods for content analysis. Secondary data for this study was sourced from existing published literature, which includes journals, articles, websites and e-books.

Data Analysis Procedures: The information was gathered, coded and tabulated. In the collected data of the surveys, we ensured that there were no errors or details that were missing. The analysis of the study was performed under the SPSS as abbreviated Statistical Package for the Social Sciences. The analysis and description of data used descriptive statistics. The data that was presented in tables and figures was tabulated using inferential statistics. This provided a better ease in being understood and conclusions being drawn. The themes captured in the qualitative data obtained during the interviews were presented in the form of story telling and direct quotation.

Ethical Considerations: The researcher obtained a letter of approval in the university as well as NACOSTI (the National Commission for Science, Technology, and Innovation) before any data was collected. The aim of the study was described by the researcher prior to inviting the participants to give their comments. The confidentiality of information of the respondents was guaranteed. The participants were willing to make no compulsory decisions to take part in the research with the aim of maintaining their dignity. The identities of participants would be anonymous in the final study, with the promise that the researcher gave to them.

1.8 Study Findings

Response Rate

The study targeted 191 respondents. Out of these 180 (94%) respondents responded to the questionnaires and the interview schedules. Babbie and Edgerton (2023) assert that a response rate of over 70 percent is excellent. The response rate of the current study falls above the threshold, allowing for different estimations and data analysis.

Gender

The study aimed to determine the gender distribution of the sample. Findings demonstrated that 51.8% of respondents were female and 48.2% were male. This suggests that female dominated this study, although the results indicate a sizable representation of women, suggesting that gender bias did not affect the study's conclusions. Given that there were more women than men, this indicated a very modest gender disparity. Although the representation of each category exceeded the 30% barrier imposed by the affirmative action plan mandated by Kenya's constitution (2010), this analysis deems the disparity to be fair. It means that both genders' perspectives are represented in the study's findings.

Highest Level of Education

We were interested in knowing the number of years of schooling each of the responders attended. This was essential since only their level of education would determine their level of knowledge on the influence of community involvement in the sustainable solid waste management in the Mavoko sub-county in Kenya.

Table 3: Level of Education

Highest level of education		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Certificate	36	21.2	21.2	21.2
	Diploma	44	25.9	25.9	47.1
	Primary	3	1.8	1.8	48.8
	Secondary	38	22.4	22.4	71.2
	University	49	28.8	28.8	100.0
	Total	170	100.0	100.0	

Source: *Field data, 2025*

The majority of the respondents had attained university education (28.8%), followed by those with a diploma (25.9%), and secondary education (22.4%). Those with a certificate qualification accounted for 21.2% of the respondents, while only 1.8% had attained primary education. This suggests that the sample was generally well-educated, with more than half (54.7%) having a diploma or university-level qualification. The cumulative percentages show that by the time university level is included, the full 100% of the respondents are accounted for. The implication of this educational distribution is that the respondents likely have a good understanding of complex issues, including policy, management, and technology adoption, depending on the study context. This level of education could enhance the reliability of the data, especially in studies involving strategic planning or technological implementation.

Period of Residency in the Area

The respondents were asked to indicate their period of residency in the area. This was important since period of residency would affect their level of experience on the role played on community participation on sustainable solid waste management in the Mavoko sub-county, Kenya.

Table 4: Period of Residency in the Area

How long have you lived in Mavoko		Frequency	Percent	Valid Percent
Valid	Less than 5 years	60	35.2	35.2
	5-10 years	29	17.05	17.05
	11-20 years	32	18.82	18.82
	Above 20 Years	49	28.82	28.82
	Total	170	100.0	100.0

Source: *Field data, 2025*

Out of 170 respondents, the largest group (35.2%) have lived in Mavoko for less than 5 years, indicating a significant portion of relatively new residents. This was followed by those who have lived in the area for above 20 years (28.82%), showing a strong presence of long-term residents as well. Respondents who had stayed between 11–20 years accounted for 18.82%, while those with 5–10 years of residence made up 17.05% of the sample. This distribution suggests that the majority of respondents have deep-rooted experiences and familiarity with the local environment, infrastructure, and socio-economic dynamics of Mavoko. Their perspectives are likely to be well-informed and reflective of the community's long-term changes and challenges. The relatively smaller proportion of recent residents implies that while newer views are present, they may not significantly influence the overall perception captured by the study. For policy-making or community development initiatives, the insights from long-term residents could provide valuable input for sustainable planning grounded in lived experiences.

Environmental Policies on Sustainable Solid Waste Management

The second objective was to consider the implications of environmental policies in Mavoko sub-county, Kenya, on the solid waste management. Respondents were also asked to indicate the extent to which they agreed on a five-point Likert scale, 1 (strongly disagree) to 5 (strongly agree), 4 (agree) 3 (neutral) and 2 (strongly disagree). The results are observable in the tables below.

Table 5: Results on Environmental Policies on Sustainable Solid Waste Management

Descriptive Statistics	**N**	**SD**	**D**	**N**	**A**	**SA**	**Mean**	**Std. Deviation**
Implementation of policies influences sustainable SWM in Mavoko	170	10 5.9%	43 25.3%	34 20.0%	74 43.5%	9 5.3%	3.17	1.055
Enforcement of policies influence sustainable SWM in Mavoko	170	16 9.4%	52 30.6%	26 15.3%	67 39.4%	9 5.3%	3.01	1.138
Strategic Environmental Assessments influence sustainable SWM in Mavoko	170	15 8.8%	27 15.9%	30 17.6%	85 50.0%	13 7.6%	3.35	1.083
Policy reforms influence sustainable SWM in Mavoko	170	16 9.4%	57 33.5%	25 14.7%	58 34.1%	14 8.2%	2.98	1.179
Valid N (listwise)	170						3.175	1.1175

Source: *Field data, 2025*

Key: N-Population, SD-Strongly Disagree, D-Disagree, N-Neutral, A-Agree and SA-Strongly Agree

The findings indicate that policy-related factors moderately influence sustainable solid waste management (SWM) in Mavoko. Among the indicators, Strategic Environmental Assessments receive the highest level of agreement, with a mean score of 3.35 and 50.0% of respondents agreeing that they significantly impact sustainable SWM. The implementation of policies also shows a positive influence with a mean of 3.17, as 43.5% of respondents agree it plays a critical role. The enforcement of policies yields a mean of 3.01, with 39.4% agreeing, though a sizable proportion (30.6%) disagrees, suggesting mixed opinions. Policy reforms receive the lowest mean of 2.98, with only 34.1% in agreement and 33.5% disagreeing, indicating greater skepticism or lack of clarity on their impact. Overall, the average mean score of 3.175 and standard deviation of 1.1175 reflect a general tendency toward agreement, though the variability in responses points to the need for stronger policy communication, implementation, and community engagement to enhance the effectiveness of policy-driven SWM strategies in Mavoko. These findings suggest that while policy implementation and environmental assessments are generally recognized as crucial for sustainable SWM, there are concerns about the effectiveness of enforcement and the impact of ongoing policy reforms in the area.

These findings agree with those of Abubakar et al. (2022) who present a comprehensive review of solid waste management (SWM) practices across the Global South, highlighting critical environmental sustainability implications. Their analysis shows that rudimentary waste systems prevalent in rapidly urbanizing regions such as mixed collection of hazardous and household garbage, aging storage facilities, informal transportation, uncontrolled dumping, open-air incineration, and poorly managed landfills are major contributors to environmental degradation and public health hazards. The consequences include air and water pollution, land degradation, methane emissions, and toxic leachate, which exacerbate climate change and disproportionately affect marginalized populations.

Pearson correlation was employed to assess the magnitude of the linear relationship between the variables. From the findings, environmental policies demonstrate a strong positive correlation with SSW management ($r = .924$, $p < 0.01$), reinforcing the importance of iimplementation of policies, enforcement of policies, strategic environmental assessments and policy reforms for good practice in waste management initiatives. The findings concur with Guo et al. (2021) findings who found that industrial structure transformation and rising urbanization contributed to more efficient waste generation per GDP unit, while technology and environmental investments helped decouple waste output from economic expansion. Furthermore, through a topic-modeling analysis of over 120 national policies, the authors documented a policy progression from institution-building to reduction, recycling, harmless treatment, and balanced development and a preference for command-and-control instruments, with growing support for social and economic incentives.

Qualitative Analysis

Qualitative data on environmental policies were collected from County Ministry Executive Officers, the NEMA County Director, Private Waste Collectors, Solid Waste Program Managers, and NGO officers. The analysis focused on understanding the implementation and impact of county-level environmental policies on sustainable solid waste management in Mavoko Sub-County. County Ministry Executive Officers indicated that several key policies had been implemented to promote sustainable solid waste management. These included the Waste Segregation at Source Policy, mandating households, institutions, and businesses to separate organic and recyclable waste prior to collection; the Zero Tolerance Policy on Illegal Dumping, supported by inspections and fines; the Extended Producer

Responsibility framework, holding producers accountable for waste generated from their products; and the Community-Based Waste Management Policy, empowering local groups and youth to participate in recycling and clean-up programs. These policies were designed to reduce environmental degradation, enhance resource recovery, and promote a cleaner and healthier Mavoko Sub-County.

NGO officers confirmed that Strategic Environmental Assessments were conducted to ensure sustainability and align projects with county and national regulations. These assessments, carried out once or twice a year, involved collaboration with environmental experts, government agencies, and community stakeholders. SEAs helped shape advocacy strategies and improve program design and implementation.

Private waste collectors reported that county policies directly influenced their participation in SSWM. Licensing and registration requirements ensured that only qualified collectors operated, improving standards while increasing administrative responsibilities. Policies against illegal dumping and the EPR framework encouraged proper disposal logistics, accountability, and collaboration with manufacturers, although they required additional investment and coordination.
The NEMA County Director highlighted that their office contributed to policy reforms by providing technical guidance, conducting audits and assessments, collaborating with stakeholders, and offering capacity-building initiatives. These efforts ensured that adopted policies were practical, enforceable, and aligned with national legislation, ultimately promoting more sustainable waste management practices.

The findings demonstrate that county-level environmental policies play a critical role in shaping sustainable solid waste management practices in Mavoko Sub-County. Policies such as waste segregation at source, illegal dumping enforcement, and the EPR framework enhanced compliance, accountability, and professionalism among waste management stakeholders (Wycliffe & Kariuki, 2022). Collaboration with NGOs and the integration of SEAs further strengthened policy effectiveness by aligning interventions with environmental standards and local needs (Njenga & Ngugi, 2022). Private waste collectors' experiences indicate that policies create both opportunities and challenges. While the regulations improved environmental outcomes and service quality, they also increased operational responsibilities and required additional resources, highlighting the importance of adequate support mechanisms and stakeholder capacity development (Wycliffe & Kariuki, 2022). The involvement of NEMA in guiding and reviewing policy reforms illustrates the significance of technical expertise and continuous monitoring in sustaining effective SSWM systems. By fostering coordination between government agencies, private operators, and the community, policies were able to promote collective responsibility, participatory engagement, and long-term sustainability (Njenga & Ngugi, 2022).

1.9 Conclusion

Basing the findings on the objective of the study, the analysis underscores the fact that while environmental policies such as implementation frameworks, enforcement mechanisms, and strategic environmental assessments are recognized as essential, their true value lies in consistent and effective execution. The strong positive correlation shows that when these policies are well-implemented and enforced, they can significantly drive improvements in sustainable SWM. However, policy reforms must be regularly reviewed and adapted to reflect emerging waste management challenges, urbanization pressures, and technological advancements. Therefore, continuous policy evaluation and the active

involvement of all stakeholders in shaping reforms are critical for creating an enabling environment for efficient, equitable, and environmentally sound waste management systems.

1.10 Recommendations

In regard to environmental policies, it is essential to improve implementation and enforcement. Strengthening enforcement mechanisms will require equipping county environmental officers with the necessary tools, personnel, and legal backing to monitor compliance and take corrective action where necessary. The county should also institutionalize regular Strategic Environmental Assessments to evaluate the environmental impacts of ongoing and planned waste management activities. These assessments should inform policy adjustments and guide strategic interventions.

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