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Original Article

### Community Participation in Management of Environmental Pollution in Thika Town, Kenya

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**Keywords:**  
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The residents of Thika Town in Kenya have long grappled with environmental degradation, primarily driven by its status as an industrial hub housing over 20 factories engaged in local and international productions. This industrial activities coupled with urban expansion to accommodate a growing population has adversely affected the town's environmental sustainability. This study investigates the role of community participation in addressing environmental pollution in Thika town. The study's objectives were assessing community awareness about environmental pollution, understanding the impacts of pollution on local communities, and evaluating the extent of community involvement in pollution management. The research was conducted in four residential estates namely Makongeni, Umoja, Kiboko and Landless within Thika town. Utilizing a mixed-methods approach, the study collected both quantitative and qualitative data through questionnaires and interviews, with quantitative data being analysed descriptively using statistical software. The study identified water and air pollution and solid waste pollution as significant environmental concerns, primarily attributed to industrial emissions, affluence, and sewage. These forms of pollution resulted in various adverse consequences, including respiratory illnesses, structural damage, increased livestock, and human mortality. The study revealed lack of community engagement as a substantial portion of residents were not part of community-based organizations focused on environmental education and advocacy, highlighting a significant gap contributing to ongoing environmental degradation. The study recommends sensitization campaigns to raise awareness among residents about their role in environmental degradation and encourage the adoption of eco-friendly behaviours. Additionally, it underscores the need for policy formulation and implementation to address inadequate waste disposal practices originating from both domestic and industrial sources within the town. In summary, community involvement and policy intervention are essential components in addressing environmental pollution in Thika town.

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**INTRODUCTION**

Urban environmental problems are characterized by solid waste, inadequate water supply, loss of natural and green spaces, wastewater and noise, soil, and air pollution (Du et al., 2018). These pollution problems are especially serious in developing countries that are grappling with economic transitions where governments have to balance between short-term economic ambitions and the need to protect the environment. Pollution in urban spaces has burdened the environment to an extent that the self-cleaning capacity is increasingly limited (Lopez, Magliocca & Crooks, 2019).

Zubir and Brebbia (2014) note that environmental challenges within urban spaces are growing particularly in developing economies such as Kenya. More particularly, there are concerns about congestion, noise pollution, and air quality. Most of these environmental challenges in developing countries are associated with developing basic infrastructure and industrial production, including consumption challenges that have increased waste (Lopez, Magliocca & Crooks, 2019; Kamaruddin, Ahmad & Alwee (2016). Urban areas are consuming an increased amount of natural resources as much as they are producing increased emissions and waste (Lopez, Magliocca & Crooks, 2019), and these have contributed to the negative ramifications that are felt both at the regional and planetary levels.

This study looked at pollution in Thika town and how it affects the lives of its residents in various residential estates, including Makongeni, Umoja, Kiboko, and Landless. Thika is described as one of the major industrial towns in Kenya because of the many manufacturing entities in the town. These companies include Bidco Africa Kenya,

Del Monte, Hope Plastic Limited, Nampak Kenya Limited, Bull Pak Limited, Jungle Macs EPZ Limited, Booth Extrusion Limited, KENBLEST Limited, and Blue Nile Rolling Mills Limited, amongst many others. Consequently, Thika town is ever susceptible to all forms of industrial pollution.

The affluence of these factories and sewage from residential estates has been blamed for the pollution of River Chania. In September 2015, residents of Ndura, Maguguni, Ngoliba, and Gatwanyaga in Thika East complained of the dumping of raw sewage in River Chania which supplies them with water for domestic use, and on their farms (Mwiraria, 2021). They linked the flow of this sewage to the pilot estate sewerage plant in Thika town that carried effluents from the Starehe, Majengo, and Ofafa estates. As a result, farmers had to walk long distances to purchase water for domestic use to avoid disease infections. They, however, watered their banana and sugarcane plants with contaminated water (Kamau, 2015).

In 2019, a Chinese national was accused of pollution while operating Benco Investment Limited without a permit in Thika town. The factories manufactured tissue paper without having proper system for treating wastewater before releasing it into the environment. The arrest came after the residents of Thika complained about the pollution of the River Chania. They also launched similar accusations against other factories located in Gosheni, Munene, and UT which they claimed were releasing toxic effluents into the river whose water they relied on for irrigation and domestic use. They complained that this pollution had turned the river water into a white form with some parts turning green and that a foul smell could be

felt half a kilometer away. They claimed they had stopped farming due to this pollution (Kamau, 2019).

There are several places around Thika town where Chania River receives micro and mega plastics from landfills and poisonous sewage waste along the bank. Companies have installed underground sewage that can be traced by sewage pipes, which send waste into the river clandestinely. Private sewage companies and residential flats situated along the river's course are also complicit in this pollution. As a result, the Chania River ecosystem is diminishing very fast, with the lives of animals such as hippos are at risk because of the high levels of contamination. The pollution has continued despite regular protests by residents who have rallied local authorities to take action against the culprits, but there seems to be little progress made in that regard (Mwiraria, 2021). The study focused on understanding the role that community play in the management of environmental pollution in Thika town. The objectives of this study included:

- To examine community awareness of environmental pollution in Thika town.
- To establish the effects of pollution on the communities around Thika town.
- To determine community participation in the management of environmental pollution in Thika town.

## LITERATURE REVIEW

### Community Awareness on Environmental Pollution

Community awareness of environmental sustainability is crucial for engaging individuals in pollution management. Numerous studies, such as those by Cankurt et al. (2008), Kamaruddin et al. (2016), Ramírez et al. (2019), and Sengupta et al. (2010), have explored the link between environmental sustainability awareness and pro-environmental behavior. According to Cankurt et al. (2008), the relationship between humans and their environment is influenced by factors like environmental awareness, consciousness, and

sensitivity. The prevailing global ecological crises are rooted in societal awareness structures regarding the environment and its value.

Educational activities targeting environmental sustainability involve information dissemination to shape environmental care behavior (Hafiar et al., 2019). Ramírez et al. (2019) define environmental care behavior as the capacity to make choices based on encouragement impulses. This behavior is integral to people understanding and actively participating in environmental conservation, forming a critical component of long-term educational efforts.

Cankurt et al. (2008) emphasize the importance of community involvement in initiatives to increase environmental awareness, leading to community development. This involves bottom-up approaches incorporating local wisdom, culture, and resources, fostering a sense of social responsibility among community members. Hafiar et al. (2019) highlight activities like participating in community programs, fundraising, and supporting environmental initiatives, which contribute to community members actively engaging in environmental sustainability as a social responsibility.

The perception of environmental sustainability issues is pivotal in motivating community members to manage pollution. Environmental awareness enables individuals to understand the connection between human activities and environmental quality, influencing their willingness to participate in environmental activities (Du et al., 2018). Ignorance hinders participation in addressing environmental concerns, necessitating comprehensive community education about environmental awareness (Lopez et al., 2019). Kaur and Chahal (2018) note that environmentally conscious individuals are more likely to modify behavior to support sustainability initiatives.

Studies also examine how community members access information about environmental pollution and management (Hafiar et al., 2019; Ramírez et al., 2019; Zikargae et al., 2022). Timely and

accurate information is crucial for mitigating pollution's harmful effects (Zikargae et al., 2022). Environmental health literacy, understanding the link between environmental exposures and health, is essential (Ramírez et al., 2019). The media, as highlighted by Hafiar et al. (2019), plays a critical role in educating the public, fostering awareness, and promoting positive behavior supporting environmental sustainability. In summary, community awareness, education, and active participation are fundamental to addressing environmental sustainability challenges. Effects of Pollution on Community

Air pollution has severe consequences on human health, leading to chronic and acute respiratory conditions such as bronchitis, asthma attacks, pneumonia, and breathing complications (Ramírez et al., 2019). These health issues not only impact individuals but also extend to broader societal implications, including the loss of business or work opportunities and school days (Cankurt et al., 2008; Ramírez et al., 2019). Premature deaths resulting from pollution, particularly among breadwinners, further contribute to the exposure of dependents to poverty (Ramírez et al., 2019; Zikargae et al., 2022).

Industrial pollution significantly affects both employees and nearby communities, with greater health risks in rural settings where limited information and capacity hinder the population from influencing policies or defending their rights. Rural communities often face neglect from businesses and government authorities, lacking adequate environmental health awareness and sustainable programs (Omanga et al., 2014).

Urban areas, according to Ramírez et al. (2019), experience major environmental challenges, including air and water pollution. Burning fossil fuels for energy in industrial, domestic, and transportation activities is a major contributor to air pollution. Noise pollution from transportation and entertainment activities is prevalent, while the expanding water consumption in urban areas leads to soil and river deterioration (Kamaruddin et al., 2016; Ramírez et al., 2019). Industrial activities,

through waste disposal, significantly contribute to water contamination in urban areas, generating industrial wastewater bodies (Kamaruddin et al., 2016).

The high pollution levels in urban areas result from the extensive inputs of food, water, raw materials, and energy necessary for mass production, leading to equivalent amounts of waste. This, in turn, results in the loss of natural resources, such as energy and raw materials, contributing to land degradation with adverse effects on air and water resources (Zikargae et al., 2022).

Rapidly growing urban areas witness transformations in vegetation and nature, replaced by asphalt and concrete, altering hydrological relationships and influencing climates (Lopez et al., 2019; Ramírez et al., 2019). Industrial processes in urban environments emit large amounts of hydrocarbons and carbon monoxide, contributing to greenhouse effects and climate change (Lopez et al., 2019; Kamaruddin et al., 2016; Zikargae et al., 2022). Urban air pollution is further exacerbated by the use of fossil fuels for domestic purposes, including inefficient burning of charcoal and wood, releasing harmful smoke (Kamaruddin et al., 2016; Ramírez et al., 2019). In summary, air pollution poses significant health risks and environmental challenges, affecting individuals and communities, particularly in both urban and rural settings.

### **Community Participation**

Environmental sustainability awareness alone is insufficient to foster pro-environmental behavior, according to studies by Kamaruddin et al. (2016), Ostrom (2014), and Sengupta et al. (2010). Beyond awareness, community members must understand pollution issues, show concern for the environment, and actively participate in environmental management programs (Ostrom, 2014; Kamaruddin et al., 2016). Participation is crucial because knowledge without action will not lead to meaningful change, and community involvement serves as a gauge for environmental awareness (Kamaruddin et al., 2016).



Communities affected by environmental degradation should be actively involved in local environmental management initiatives, contributing ideas, insights, and participating in decision-making processes (Sobhani et al., 2022; Zikargae et al., 2022). Stakeholder engagement, particularly involving community members in decision-making, empowers them to exercise their democratic rights for a pollution-free and sustainable environment (Zikargae et al., 2022).

Effective stakeholder engagement requires open and positive communication that promotes dialogue rather than advocacy or protests (Garcia & Eje, 2021). Community initiatives should establish forums for stakeholders to discuss challenges, share power, and collaboratively develop solutions (Lopez et al., 2019). Kamaruddin et al. (2016) emphasize that stakeholder participation leads to quality decision-making, resulting in agreed-upon solutions, improved environmental outcomes, and enhanced livelihoods.

The growing trend of communities demanding a say in issues affecting them has become integral to public policy and administration, necessitating resource allocation for environmental management (Sengupta et al., 2010). Community involvement represents a continuous search for innovative approaches in environmental policy and management, contributing to a comprehensive toolkit of policy instruments.

Zikargae et al. (2022) highlight key benefits of community participation, including aiding government decisions that align with local needs and keeping community members informed about environmental challenges, risks, and their contributions to sustainability programs. Increased community involvement leads to better-informed individuals who appreciate the threats of pollution and actively participate in planning, implementing, and managing their local environment (Garcia & Eje, 2021; Sengupta et al., 2010; Zikargae et al., 2022). Continuous awareness about environmental sustainability relies on bringing community members on board, making them appreciate their role in protecting

and preserving the environment (Sobhani et al., 2022). Overall, community participation is essential for translating awareness into action and ensuring sustainable environmental practices at the local level.

### **Addressing Environmental Pollution in Urban Contexts**

Studies have pointed out that the adoption of community-based organizations could go a long way toward mobilizing community members to engage in environmental management (Zikargae et al., 2022; Saepudin & Mulyono, 2019). Waititu, (2021) recommended the establishment of community-based organizations that are aimed at advocating for awareness among community members. The activities of search community-based organizations involved programs that help people appreciate the need for living in a clean, healthy and sustainable environment and this could be achieved through awareness initiatives that help people understand the effects of pollution including global warming and other health hazards. Saepudin and Mulyono (2019) noted that community-based organizations have also established environmental consumerism programs that are aimed at shaping community behaviour towards embracing sustainability. These programs target the common daily behaviours that individual community members need to adopt to become more conscious of their environment.

### **Theoretical Review**

#### ***Functionalism Theory***

Functionalism considers the population's growth, including its prospective components such as migration, birth, and death, as being normal and essential components of any functional society (Sudarsanam, Yamauchi, & Bharali, 2022). According to the functional model, societies will become dysfunctional if they lose all their members; however, they can thrive if at all they grow to an extent that they can meet their future challenges (Shukla & Kumar, 2019). More specifically, functionalism considers pollution and other environmental challenges as inevitable

consequences of current society (Dunlap & Brulle, 2015). At the same time, functionalism presumes that severe environmental challenges likely make societies dysfunctional (Sudarsanam, Yamauchi, & Bharali, 2022).

Population growth is important when it comes to supporting the growth and development of the economy. For instance, non-industrial societies, such as those that are reliant on agriculture, require high birth rates to countercheck high death rates. Industrialized societies record lower death rates even though they need the youth to provide fresh human resources once the older workers retire (Dunlap & Brulle, 2015; Shukla & Kumar, 2019). In the same vein, new industries rely on hiring young workers who are knowledgeable and skilled enough to propel them to the desired growth levels (Sudarsanam, Yamauchi, & Bharali, 2022). However, rapid population growth can easily turn a society dysfunctional, as it brings about overcrowding and the exhaustion of valuable resources such as land and food, thereby harming the environment invariably (Dunlap & Brulle, 2015).

Therefore, the functionalism model focuses on the interaction between the population and the environment they inhabit, and how they impact one another. There are certain challenges that are attributed to population growth, whereas environmental challenges have far-reaching consequences for the population within societies (Shukla & Kumar, 2019; Sudarsanam, Yamauchi, & Bharali, 2022). This theory was used to understand the relationship between population growth in Thika and how that has contributed to the ongoing sustainability challenges that the residents of the town grapple with.

The population of Thika towns has evidently grown, just like every other urban area in developing countries, and Kenya in particular. This growth is evident with the expansion of the housing infrastructure in the town (Mwiraria, 2021), which has prompted some private developers to encroach on the banks of River Chania. One of the major contributors to environmental challenges in Thika town is the

poor disposal of sewage, which developers have channelled into River Chania, subsequently destroying ecosystem ecosystem, and causing death to plants and animals that rely on the water. This indicates the dysfunction threat that the functionalism model proposes, which results from a lack of balance in the interaction between the population in Thika town and the environment. There are already cases of the loss of animals and plants (Kamau, 2015); including negative health outcomes for the residents (Mwiraria, 2021).

## METHODOLOGY

The study was based on a descriptive research design. The selection of the research design enabled systematical to description of the relationship between the key variables in the study (Cooper & Schindler, 2014; Creswell & Creswell, 2018). In this case, the researcher was focused on understanding the intersection between community participation and the management of environmental pollution in Thika town. According to Bruce, Pope, Stanistreet, (2008), the descriptive research design is adopted in studies that seek to answer the what, where, when, and how questions regarding the research problem instead of the why question.

This study was conducted in Thika town, which is situated in the Thika Sub-County in Kiambu County. Thika town is home to more than 20 major industries, which include Del Monte Kenya Limited, Bull Pak Limited, Jungle Macs EPZ Limited, Booth Extrusion Limited, KENBLEST Limited, and Blue Nile Rolling Mills Limited (Kamau, 2015). The town has experienced a growth in population over the years, reaching up to 279 429 according to the 2019 national census (Kiambu County, 2020), a growth rate that is considered parallel to that of the neighbouring Nairobi County (Muiruri & Odera, 2018). Therefore, the study's target population was Thika residents drawn from four residential estates, including Makongeni, Umoja, Kiboko, and Landless.

A systematic random sampling design was adopted to select participants who were engaged

in the study. Creswell and Creswell (2018) recommend the adoption of this sampling design in studies where researchers cannot obtain a sampling frame because of the large research population that their study targets. A sample of 100 respondents was determined using convenience sampling method, whereby participation in the study was based on participant's willingness and availability. The researchers, therefore, determined the sample size of 100 participants and then determined a kth interval of 10. The researcher, therefore, approached the 10th participant after counting from the previous one until all 100 participants were engaged.

A questionnaire was used to collect the data in the study. A questionnaire was considered appropriate for this study because of its capacity to collect data from a large sample (Cooper & Schindler, 2014; Neuman & Robson, 2013) in a timely and cost-effective manner (Creswell & Creswell, 2018). The questionnaire was structured into five segments: Section A collected demographic data from the research participants, which included gender, age, and the area of residence of the respondents. Section B included questions that measured the relationship between community environmental awareness and perceptions about pollution. Section C included questions that examined the effects of pollution on the community, and Section D had questions on community participation in pollution management. The questionnaire was structured using close-ended questions, which were considered convenient for making the filling and analysing process faster (Bell, Bryman, & Harley, 2018).

The questionnaire was pretested with 10 participants who were residents of Thika town but were excluded from the final data collection process. This was based on the suggestion by Mugenda and Mugenda (2003) who suggested using a sample for pretesting that is similar to the

one that will be used in the actual data collection and ensuring that the sample used in pretesting is not included in the final data collection. Besides, Mugenda and Mugenda (2003) suggested a sample for pretesting to range between 1-10 percent of the actual sample size, which in this case, amounted to the 10 respondents selected. The pretesting was conducted within two weeks between each other and the participants highlighted some of the challenges they encountered in answering the questions (Creswell & Clark, 2018). These included the vagueness of some questions addressed before the final data collection was conducted.

The researcher approached the residents in the selected presidential estates and required them to take part after explaining the study's purpose. Since the questionnaire was researcher-administered, a response rate of 100% was achieved after three visits to the location of the study. The collected data was transformed into numerical values and was keyed into the Statistical Package of Social Science (SPSS). The descriptive analysis method was used to generate percentages of the various variables that were measured in the study and the results were presented in tables.

## RESULTS AND DISCUSS

### Demographic Information

The results showed that 60% of the respondents were men while 40% were women. Therefore, more men than women were involved in the study, and this was attributed to the availability of men compared to that of women. The study found that the majority of the respondents were aged between 27–32 years (40%), 33% were aged between 21–26 years; 13% were aged between 15–20 years and another 13% were also aged between 33–38 years. Besides, 50% of the respondents live in Makongeni; 17% live in Umoja; 25% live in Kiboko and 8% live in Landless.

**Table 1: Demographic information of the respondents**

		Total No.	Total Percentage
Gender of Respondents	Men	60	60%
	Women	40	40%
Age of Respondents	15 – 20 Years	13	13%
	21 – 26 Years	33	33%
	27 – 32 Years	40	40%
	33 – 38 Years	13	13%
Area of Residence	Makongeni	50	50%
	Umoja	17	17%
	Kiboko	25	25%
	Landless	8	8%

### Community Environmental Awareness and Perceptions about Pollution

The results show that 23% of the respondents gained information about the environment from television; 32% from the radio; 21% from the internet (social media); 14% from newspapers and 3% from magazines (see *Table 2*). Therefore, the respondents' most predominant sources of environment were the radio and social media. Past studies acknowledge the vital role that the media plays in disseminating information about environmental issues and, therefore, boosting awareness of the members of the public. For instance, Hafiar et al. (2019) established that the media plays an integral role in educating the public about sustainability issues and that this translates into the adoption of environment-friendly behaviour that contributes to overall improved sustainability. Zikargae, Woldearegay, & Skjerdal, (2022) found that the public relies on the media to relay timely and accurate information, which has proved vital when it comes to mitigating the harmful effects of pollution.

Other previous studies have also reiterated the need for informing the public about environmental issues considering it a prerequisite to coming up with a long-term comprehensive solution. Omanga, Berhane, & Gatari, (2014) noted that environmental sustainability is a big concern in urban places because a significant proportion of the population in such a context is susceptible because of limited information about their rights and also their limited capacity to influence policy or defend themselves. Severo,

Guimarães, Dellarmelin, & Ribeiro, (2019) also found that environmental awareness empowers community members to gain insight into the fragile state of the environment and appreciates the need for protecting their environment against degradation. Kaur and Chahal (2018) concurred that being conscious about the environment predisposes people to modify or adopt behaviour that is geared towards supporting environmental sustainability.

The findings show that 64% of the respondents were aware of the pollution in Thika town; 21% were unsure whereas 15% were unaware. This indicated that most of the participants were aware of environmental pollution in the town, but since a cumulative number of 36% were either unaware or not sure there was a need for further sensitization of the issue. The findings agree with Duet al. (2018), who found that environmental awareness is the capacity of individuals to understand the relationship between human activities and the prevailing status of environmental quality, which should influence their willingness to take part in environmental activities. Lopez, Magliocca, and Crooks, (2019) also acknowledged that ignorance of environmental issues by community members is associated with apathy when it comes to taking part in initiatives that aims at addressing environmental concerns and this is remedied by strengthening community education about environmental awareness at all levels within communities.

The results showed that the respondents were knowledgeable of the various types of pollution in



the town. Water pollution was identified by 32%; air pollution (25%); solid waste pollution (30%) and noise pollution (3%). Therefore, the residents were predominantly aware of water pollution in their environment. The other major types of pollution in the town included air pollution and solid waste pollution. These findings concur with those by Ramírez et al. (2019), who established that the main environmental problems that are experienced in urban areas include air and water pollution. Kamaruddin et al. (2016) also found that the consumption of water in the urban area is ever-increasing both at the domestic and industrial levels and this has manifested contamination of water bodies in urban areas due to the disposal of waste, leading to the generation of industrial wastewater bodies.

In another study, Lopez et al. (2019) acknowledged that air pollution is a critical environmental concern in urban places because industrial processes release significant amounts of hydrocarbons into the atmosphere. Ramírez et al. (2019) also found that air pollution in urban contexts is associated with the use of fossil fuels for domestic purposes, which includes the use of charcoal and wood that is burnt in inefficient stoves and therefore, releases huge amounts of

health-damaging smoke. This reiterates the findings that pollution is not only from industrial sources but also from domestic sources as well.

The findings also revealed that there were different sources of pollution, with 92% attributing it to industrial fumes; 67% claiming it was industrial effluence; 3% associated pollution to stoves and firewood; 78% linked it to domestic waste; 20% connected it to hospital litre whereas 97% was linked to sewage. This implies that the town's most predominant pollution sources were industrial fumes and sewage. Besides, domestic waste was also a significant contributor to pollution in the town. Similar findings were reported by Kamaruddin, et al. (2016) who noted that the high levels of pollution in urban areas was a product of the significantly large inputs in terms of food, water, raw material, and energy that is necessary for generating large quantities of goods and services consumed by urban dwellers. They noted that these inputs invariably result in the generation of the same amount of waste. Ramírez et al. (2019) also found that the major causes of air pollution are related to the burning of fossil fuels that are used in the production and consumption of energy in industrial activities, domestic use, and transportation.

**Table 2: Community environmental awareness and perceptions about pollution**

		f	%
General Sources of information	Television	22	23%
	Radio	32	32%
	Internet (social media)	21	21%
	Newspapers	14	14%
	Magazines	3	3%
Pollution awareness	Yes	64	64%
	No	21	21%
	Not Sure	15	15%
Knowledge about various types of pollution	Water pollution	92	92%
	Air pollution	75	75%
	Solid waste pollution	70	70%
	Noise pollution	2	2%
Sources of pollution	Industrial fumes	92	92%
	Industrial effluence	67	67%
	Stoves and firewood	3	3%
	Domestic waste	78	78%
	Hospital litre	20	20%
	Sewage	97	97%

### Effects of Pollution to the Community

The results indicated that 77% of the residents were affected by water pollution; 60% were affected by air pollution; 62% were affected by solid waste pollution and noise pollution affected 3%. This showed that water pollution significantly affected the residents of Thika town, alongside air and solid waste pollution. The residents did not consider noise pollution to have a significant effect on them. Zikargaeet al. (2022) concurs with these findings arguing that the urban ecosystem has exhibited a high-energy consumption that is accompanied by a large amount of solid waste which is channelled towards particular places. Therefore, urban areas exhibit land degradation, which is associated with adverse effects on the air and water resources. Lopez et al. (2019) found that the quest for urbanization has resulted in the transformation of rivers and the burying of river beds, which have cumulatively affected climates in urban areas.

Despite the participants identifying several sources of pollution in the town, the results showed that they were affected differently: 45% indicated that they were most affected by industrial fumes; 2% by industrial effluence; 21% by domestic waste; 2% by hospital litter and 48% by sewage. This demonstrated that sewage and industrial fumes were the significant sources of pollution in the town. The participants claimed that the pollution source that was most difficult to control was industrial fumes (59%) and sewage (29%), including domestic waste (9%); industrial effluence (2%), and stoves and firewood (2%). This finding reflected the need for local authorities to reign in on the persons or entities responsible for releasing industrial fumes and sewage into the environment in the town.

The results showed that the major effects of pollution included corrosion and destruction of

structure (30%); increased livestock mortality (17%); increased human URTIs and other diseases (92%); increased infant mortality rates (5%); increased general mortality (12%); destruction of crops and vegetation (2%). Therefore, the most significant effects of pollution in the town included increased human URTIs and other diseases, corrosion and destruction of structures, increased livestock mortality, and increased general mortality. There were also minor effects that included increased infant mortality rates and the destruction of crops and vegetation.

Previous studies also acknowledge the negative health outcomes that are associated with environmental degradation. Omanga, Berhane, & Gatari (2014) found that industrial pollution negatively affects the health outcomes of employees and the neighbouring communities and presents them with the potential for adverse health outcomes. They attributed this to the lack of environmental health awareness and the absence of sustainable environmental health programs to counter the environmental challenges that communities are experiencing. Ramírezety al. (2019) found that some of the adverse effects of air pollution with regard to negative health outcomes include chronic and acute bronchitis, asthma attacks, pneumonia, and breathing complications.

In another study, Zikargaeet al. (2022) associated environmental pollution with premature deaths, which in some cases claimed breadwinners in households and exposed the dependents to abject poverty, which Cankurtet al. (2008) related the outcomes with loss of business or work; and loss of school days. This demonstrated that the effects went beyond affecting the health of people; their economic outcomes were also affected, considering the funds that would be required for the medication of the affected persons.

**Table 3: Effects of Pollution to the Community**

		<b>f</b>	<b>%</b>
Types of Pollutions affecting residents	Water pollution	77	77%
	Air pollution	60	60%
	Solid waste pollution	62	62%
	Noise pollution	3	3%
	Sewage	34	34%
Varying Levels of the Pollutants Effects	Industrial fumes	45	45%
	Industrial effluence	2	2%
	Domestic waste	21	21%
	Hospital litter	2	2%
	Sewage	48	48%
The most difficult pollution to control	Industrial fumes	59	59%
	Industrial effluence	25	25%
	Domestic waste	9	9%
	Hospital litter	2	2%
	Sewage	29	29%
The major effects of pollution	Corrosion and destruction of structure	30	30%
	Increased livestock mortality	17	17%
	Increased human URTIs and other diseases	92	92%
	Increased infant mortality rates	5	5%
	Increased adult mortality	12	12%
	Destruction of crops and vegetation	2	2%

### Community Participation in Pollution Management

The respondents acknowledge that various organizations were engaged in the management of pollution in Thika town. They included county government (60%); women or youth groups (10%); community-based organizations (3%); non-governmental organizations (3%); religious groups (7%) and private organizations (17%). This revealed that the local government played a significant role in the town's pollution management. Previous studies have reiterated the need for governmental interventions in environmental sustainability issues. Omanga, et al. (2014) found that it becomes increasingly difficult to attain environmental sustainability when government authority condones malpractices by businesses and ignores the calls by members of the public when they demonstrate over the degradation of their environment. Zikargaeet al. (2022), found that government needs to engage members of the community and collaboratively develop decisions to resolve any challenges associated with environmental sustainability.

The results showed that 18% of respondents belonged to a community-based organization while 82% did not. Those who did not belong to a CBO cited factors such as lack of proper advocacy and awareness (18%); lack of knowledge of existing groups (37%); ineffective groups (7%); and other commitments (20%). For those belonging to a CBO, their membership ranged in terms of duration with 27% being members for less than a year; 45% being members for a duration of between 1–3 years; while 27% belonged in one between 4–6 years. The findings reflected a weak participation of the residents in the management of pollution in the town, which could be linked to the persistence of the problem. Extant literature has reiterated the need for community engagement in sustainability issues, Zikargaeet al. (2022) found that community participation leaves the members more informed about the existing environmental challenges; the risks they pose to their health outcomes, and the contribution that they need to make towards environmental sustainability programs.

Besides, Sengupta et al (2010) found that through community participation members are involved in the planning, implementation, and management of

their local environment and therefore, take responsibility for supporting other institutions such as local government and non-governmental organizations in implementing environmental sustainability initiatives. Furthermore, Sobhani, et al., (2022) observed that community members must be brought on board for the creation of awareness about environmental sustainability to succeed. This is because the community members are the most integral stakeholders in the whole mix, considering that they are often the one who are most affected by the negative outcomes of environmental degradation happening in their communities.

The results showed that 85% of the respondents claimed that community participation in pollution management was very important; 10% said it was important; 3% were neutral, whereas 2% indicated it was slightly important. Therefore, most participants acknowledged the need for community participation in managing pollution. The findings agreed with those by Garcia and Eje (2021) who found that the more community members are involved, the better informed they become about the environmental hazard they face and become willing participants in promoting environmental sustainability. In another study, Kamaruddinet al. (2016) found that stakeholder participation in community initiatives results in quality decision-making processes that yield commonly agreed solutions. This eventually translates to better environmental outcomes and improved livelihood for community members.

The respondents also revealed that various activities were used to manage pollution in the town, including estate clean-ups (45%); tree planting (5%); peaceful demonstrations (28%); environmental education (12%); awareness creation and advocacy (20%); project design and implementation (5%); soliciting for environmental funding (5%). These results demonstrated that estate clean-up, peaceful demonstration, and awareness creation were the key environmental management activities among the residents.

Furthermore, the respondent indicated that the other initiatives that could be adopted to prevent pollution in Thika town include relocating industries that cause pollution (10%); promoting local hygiene (14%); initiating environmental-based CBOs (17%); providing grants for environmental protection project (1%); increase participation by local government (28%) and implementation of strict legislation against pollution (16%). The findings are reflective of those by previous studies such as Cankurtet al. (2008) who acknowledged that involving members of the community in initiatives that target to increase environmental awareness translated into community development as a whole. Saepudin and Mulyono (2019) linked the establishment of environmental consumerism programs to CBO, claiming the programs have become instrumental in shaping community behaviour towards embracing sustainability. Hafiar et al. (2019) noted that the social responsibilities activities that are geared towards increasing the environmental consciousness of public members include taking part in community programs; raising funds; supporting community activities and recruiting volunteers for the community programs.

The results showed that the other measures that could be taken to improve pollution management in the town included active community participation (45%). These results agrees with Waititu (2021) who found that the establishment of community-based organizations advocate for awareness among community members. Hafiar et al. (2019) found that educational activities that target environmental sustainability involve the dissemination of information with the aim of shaping environmental care behaviour. They further noted that the educational efforts should involve a continuous process that progressively educates people about their environment and what they could do to make it sustainable and can therefore only be achieved in the long-term. Ramírezet al. (2019) found that this motivates members of the community to become willing partners through their active involvement in



environmental conservation since they now consider it their social responsibility.

The results revealed that the other recommendations from the respondents included the establishment of emission standards for industries (15%); and the introduction of garbage collection vehicles and bins (13%). These are activities that involve the input of the government towards promoting environmental sustainability, ranging from policy formulation to actual implementation. These findings agree with Moran and Brondízio (2012) who suggested that the government should put in place regulatory mechanisms that ensure businesses are constrained in their operations. Omanga et al. (2014) also noted that the failure of environmental sustainability programs is closely associated with the apathy of the government regarding the environmental issues that their people are grappling with. This has created a leeway for unscrupulous businesses to release toxic wastes, sewage, and solid waste litter at the expense of environmental sustainability.

However, businesses are mostly profit-driven and they go to any extent to ensure that they boost their profitability, even if at the expense of environmental sustainability. Therefore, governments have a role to play to ensure that businesses conduct their operations within the outlined regulatory frameworks. Apart from establishing environmental-friendly regulatory

frameworks, the government should go ahead and implement it accordingly (Moran & Brondízio, 2012), as this will go a long way in safeguarding the environment and the people that the government represents.

Furthermore, the results also showed that the provision of environmental education (13%) would go a long way in ameliorating the pollution challenges experienced in the town. The findings concurred with Lopez et al. (2019) who found that environmental education was important in drawing the attention of community members toward taking the required action because in most cases people do not act or are reluctant to act because they are not well informed about the existential threat that their degrading environment is posing. Hafiar et al. (2019) argue that environmental care behaviour is a critical component of action that results in people knowing about their environment and that this is only achieved by putting in place mechanisms for ensuring that community members are educated continuously and consistently about environmental sustainability issues. Furthermore, Ramírez et al. (2019) concurs that environmental education is necessary for shaping environmental care behaviour, which in turn equips the members of a community with the capacity to make better choices about how they will respond or behave based on encouragement impulses.

**Table 4: Community participation in pollution management**

		f	%
Knowledge of organization involves in pollution management in Thika town	County government	90	90%
	Women or youth groups	10	10%
	Community-based organizations	3	3%
	Non-governmental organizations	3	3%
	Religious groups	7	7%
CBO members	Members	18	18%
	Non-members	82	82%
Factors leading to non-membership to CBOs	Lack of proper advocacy and awareness	18	18%
	Lack of knowledge of existing groups	37	37%
	Ineffective groups	7	7%
	Other commitments	20	20%
Duration belonging to CBO	Less than a year	27	27%
	1 – 3 years	45	45%
	4 – 6 years.	27	27%

			f	%
Importance of Community Participation in pollution management	of	Very Important	85	85%
		Important	10	10%
		Neutral	3	3%
		Slightly Important	2	2%
Community Participation in Managing Pollution	in	Estate clean-ups	45	45%
		Tree planting	5	5%
		Peaceful demonstrations	28	28%
		Environmental education	12	12%
		Awareness creation and advocacy	20	20%
		Project design and implementation	5	5%
		Soliciting for environmental funding	5	5%
Recommended initiatives for preventing pollution	for	Relocating industries that cause pollution	10	10%
		Promoting local hygiene	16	16%
		Initiating environmental-based CBOs	27	27%
		Providing grants for environmental protection project	25	25%
		Increase participation by local government	58	58%
		Implementation of strict legislation against pollution	20	20%
		Active community participation	45	45%
		Establishment of emission standards for industries	15	15%
		Environmental education	13	13%
Introduction of garbage collection vehicles and bins	13	13%		

## CONCLUSION

There is a complex interplay of factors influencing environmental awareness, pollution sources, community participation, and potential solutions in Thika town. Continuous environmental education, media involvement, and community participation is necessary for addressing pollution issues that Thika town residents grapple with. In consideration of the identified challenges there is a need for a comprehensive and collaborative approach involving media, government, and community engagement to address environmental challenges and promote sustainability. Implementing comprehensive solutions, including regulatory measures and the active involvement of businesses and the government is also essential for realizing environmental sustainability in Thika town. This study, is therefore, contribute invaluable insights for policymakers, environmental organizations, and community leaders seeking to develop effective strategies for pollution management and environmental conservation.

## Recommendations

Resident needs to take measures that are geared toward mitigating pollution at the domestic level. This would include proper disposal of solid waste and adopting eco-friendly energy sources for domestic use. This can be achieved through sensitization campaigns that target to make the residents appreciate the role they play in the degradation of their environment and how they can contribute to remedying the situation.

The County Government authority should take the initiative to promote environmental sustainability in Thika town. After an inspection of their waste disposal systems, there is a need for fresh vetting for the existing factories to ensure that none of them releases effluents into River Chania or toxins into the air. Only factories with satisfactory waste disposal systems should be allowed to operate. Besides, the County Government should establish an around-the-clock agency for addressing environmental issues in the town and amongst their key responsibility should be conducting regular spot-checks to ensure that none of the stakeholders flaunts the regulations

put in place to ensure environmental sustainability.

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