Check for updates

# Solid waste management regulation in the informal settlements: A social-ecological context from Kampala city, Uganda

Florence Muheirwe[1], Jacob Mabula Kihila[1], Wilbard Jackson Kombe[1] and Alessio Campitelli[2]*

[1]Institute of Human Settlements Studies, Ardhi University, Dar es Salaam, Tanzania, [2]Department of Material Flow Management and Resource Economy, Institute IWAR, Technical University of Darmstadt, Darmstadt, Germany

So far, literature on solid waste management regulation in the informal settlements of Sub-Saharan African cities has yet to enlist the social-ecological context. To examine this context, we employ a mixed methods approach to collect data on waste management regulations and practices in the Makindye informal settlements. Our study reveals that multiple waste management practices are conducted simultaneously by households. Poor socio-economic status, spatial challenges and ignorance of regulations determine undesirable waste management practices such as open dumping and burning. Desirable practices such as waste sorting or recycling are neither merely practiced for monetary gain nor in observance of regulation. Practices, whether desirable or not, are acquired through interactions in the community, where formal rules, as well as informal ones, are at play. Notably, most residents are unaware of waste management regulations for Kampala city or their community. Thus, some residents engage in illegal waste management practices without the inclination to commit an offense, while others adopt "community malpractices". However, residents are relatively more aware of informal rules than formal ones confirming the role of socialization. We argue that practices are not by instinct; therefore, while regulations shape values and norms, the reverse should also be true. Since residents are unaware of prevalent formal rules, we conclude that policymakers and enforcers may not have effectively socialized residents on regulatory instruments to transform undesired values and norms. Consequently, values and norms at the intrapersonal and interpersonal levels have influenced behaviors more than policies enforced by the government. Thus, sensitization initiatives should focus on socialization structures if responsive behaviors that conform to guidelines for better waste management practices are to be promoted in the informal settlements of Sub-Saharan African cities.

KEYWORDS

waste management, regulation, socialization, practices, informal settlements

## 1. Introduction

Various factors determine waste management practices in the informal settlements of Sub-Saharan African cities. For instance, open waste burning and burying are attributed to the inaccessibility of collection services and a lack of awareness of the environmental consequences (Gutberlet and Uddin, 2017; Nuwematsiko et al., 2021). Segregating recyclables from non-recyclables may be for economic gain (Agbefe et al., 2019; Desmond and Asamba, 2019),

whereas segregating harmful from non-harmful waste for health and safety reasons (Haregu et al., 2017). Biodegradables are separated from non-biodegradables for agricultural composting, livestock feeding or energy generation (Mukama et al., 2016; Mugambi, 2017; Gasco et al., 2020). Homesteads may opt to store waste to reduce the frequency of waste disposal and associated costs (Kirama and Mayo, 2016; Abdel-Shafy and Mansour, 2018) or for nostalgic attachment, particularly e-waste (Nuwematsiko et al., 2021). The existence and absence of regulation and weak enforcement can also encourage or restrict particular waste management practices, respectively (Caniato, 2017; Serge Kubanza and Simatele, 2020; Kyayesimira and Muheirwe, 2021). Notably, households engage in multiple waste management practices simultaneously, some of which conform to policies.

Policies are meant to regulate and discourage undesirable practices while strengthening and promoting appropriate practices in society. For instance, to prevent irresponsible littering in the surrounding areas, policy action at the community level may encourage responsible waste disposal practices (Kaza et al., 2018). In the broader context, policies ought to guide society in managing particular waste streams, for instance, plastics, electronics, metals, and others (Rajashekar et al., 2019; Ayeleru et al., 2020; Maphosa and Maphosa, 2020). In addition, policies can influence waste separation at homesteads', making waste not only easy to handle by waste collectors, supporting recycling initiatives but also reducing the burden at the dumping site (Kinobe et al., 2015; Mukama et al., 2016). Thus, a supportive policy infrastructure for sorting at the household level is crucial in the waste management chain. The aforementioned waste management practices are acquired through norms, values (informal rules) as well as policies, laws and guidelines (formal rules).

There is a discourse on the regulation of waste management in the literature from Sub-Saharan Africa. Regulations are lacking or inadequate in South Sudan (Mier and Zhuo, 2020) and Rwanda (Rajashekar et al., 2019). They are also ineffective and inefficient in Uganda (Kinobe et al., 2015; Muheirwe et al., 2022) and Congo (Kubanza and Simatele, 2016). Regulations are also neither contextualized nor content specific. For instance, regulations for waste types in South Africa (Maphosa and Maphosa, 2020), Ghana (Ayeleru et al., 2020), Nigeria, Cameroon, and Zambia (Sandra and Weghmann, 2019), are missing. Inept and ambiguous regulations have also been reported. For instance, a combined policy for waste and water in Ethiopia was developed, yet not all waste generators were connected to the water system (Bjerkli, 2015). In Ghana, waste collection fees based on income levels did not consider the wage earners (Oteng-Ababio et al., 2013). Studies seem to suggest that good and adequate regulation may translate into good waste management practices. However, Muheirwe et al. (2022), drawing examples from Uganda, Ghana, Nigeria, Rwanda, and South Africa, among other Sub-Saharan African countries, conclude that neither the presence nor the absence of regulation may determine the waste management status of countries. Whereas the debate among scholars is substantive, it is more inclined to the "formalness" of policies with limited attention to informal rules that shape behaviors and are mainly acquired through socialization.

Socialization is a sensitization process that influences behaviors through ecological and social components (values, norms, policies and status). These components are acquired through interaction in the environment in which one lives (Golden et al., 2015). However, studies on waste management practices and regulation from Sub-Saharan Africa have yet to give attention to the social ecological context. For instance, studies inclined toward waste management practices do not explicitly explore regulation (Gutberlet and Uddin, 2017; Muiruri et al., 2020; Nuwematsiko et al., 2021), while those inclined toward regulation do not consider the social ecological perspective (Somaroo and Gukhool, 2015; Tukahirwa and Lukooya, 2015; Amugsi et al., 2016; Haregu et al., 2016, 2017). For studies that have applied the social-ecological context, Yu et al. (2020) focus on understanding the potential health risks of waste pickers in South Africa, while the study by Ssemugabo et al. (2020) is on Water, Sanitation and Hygiene (WASH) programs in Uganda. These studies do not help us understand how multiple household waste management practices are socialized in the informal settlements.

Using the social-ecological system's ideology, we examine factors that determine and influence waste management practices in Makindye subdivision, Kampala city. This study thus contributes to the desirability of relevant formal and informal rules to improve waste management in poor neighborhoods. For the remaining part of the paper, in section two, we reflect upon the ideological inclinations of this study. In the third section, we explain the methodology used, and in the fourth, we present the findings. A discussion of the findings is made in the fifth section. Finally, in the sixth section, we provide conclusions and suggest recommendations.

## 2. Solid waste management practices and social-ecological systems: A theoretical precept

The social-ecological systems theory has various proponents relevant to understanding community waste management practices. One, it negates that to understand a phenomenon, requires understanding the individual, community, institutional, cultural environment, and regulatory factors (Stokols, 1996). Two, the theory reveals that one's behavior results from complex intricacies of interactions. Three, it expounds that the environmental system contributes to human development, and an individual may encounter different environmental systems in a lifetime. Environmental systems include the: microsystem, mesosystem, exosystem, macrosystem, and chronosystem. The microsystem refers to the environment where we interact directly with others, for instance, family members, friends, or neighbors, while the mesosystem emerges from the interactions between microsystems in peoples' lives (Bronfenbrenner, 1992). McLeroy et al. (1988) add that the microsystem and mesosystem are the first and second levels of socialization, where norms, values, education level, skills, and other individual factors influence behaviors through interaction between and among people. Thus, for instance, if one often interacts with people who litter waste, they may acquire this behavior too.

According to McLeroy et al. (1988), the exosystem is the third level, where an individual is socialized through different associations that one belongs, while the macrosystem is the fourth level, where socialization takes place through the community's formal and informal social initiatives and norms (McLeroy et al., 1988; Nahapiet and Ghoshal, 1998). This may include sensitization programs on waste management policies and bylaws from administrative units in society. Finally, the chronosystem (fifth level of socialization) denotes that an individual's culture is broad and varies with socioeconomic status, ethnicity or even the place one stays (Bronfenbrenner, 1977). Thus, an individual may continuously acquire different practices depending on place and time (McLeroy et al., 1988). In this perspective, if one relocates from a place with improper waste management practices to another, they adopt proper practices. Likewise, if income level improves and one interacts with people from affluent communities, the practices may change too. Hence, behaviors reflect socialized norms, values, beliefs, and policies at different societal levels.

We thus find the social-ecological theory relevant to our study because it has been applied in the social sciences and interdisciplinary studies mainly focusing on environmental issues and policy (Stokols, 1996; Golden et al., 2015; Kyayesimira and Muheirwe, 2021). However, the application of the theory in waste management studies has been limited (Ssemugabo et al., 2020; Yu et al., 2020; Sewak et al., 2021). Marshall and Farahbakhsh (2013) affirm that social-ecological factors shape solid waste management practices. More so, waste management is an environmental concern. Notably, informal settlements are settings where socialization occurs at different levels of interactions which may shape solid waste management practices in line with acquired, shared norms, values and policies. For instance, one may acquire the waste sorting practice by staying in a household or neighborhood (microsystem) that separate waste. Furthermore, if the community (exosystem) has strict waste management policies and bylaws which are adequately enforced, individuals in that community may conform to appropriate practices. Thus, the social-ecological context facilitates our understanding of households and neighborhoods as socialization systems influencing behaviors. It also grounds us on the role of formal and informal rules in determining waste management practices in most homesteads and, consequently, the community.

## 3. Methodology

### 3.1. Study design and setting

We employed a case study design to explore solid waste management practices and regulations in informal settlements. The design was favored because it facilitated drawing inferences from the population, which enabled conclusions on the relationship between practice and policy. In this context, the design facilitated identifying study areas that would provide information on conformism or violation of waste management regulation and socialization of practices. Thus, we conducted the study in the informal settlements of Kibuye 11 and the industrial area zone in Makindye subdivision, Kampala city. Informal settlements were chosen following Rodić and Wilson's (2017) advice that they rapidly evolve and available data becomes obsolete, thus, requiring new information. Furthermore, Kibuye 11 was particularly selected because of the observable

challenges of solid waste mismanagement and mixed settlements with residents of varying socio-economic status. In contrast, we selected the industrial area zone based on the existence of community bylaws for solid waste management. Therefore, it was deemed that the areas would provide rich information on households' solid waste management practices and adherence to regulations.

### 3.2. Data collection methods, sample, and sampling procedures

Mixed methods for collecting quantitative and qualitative data were employed. Residents in the informal settlements are marginalized, and Creswell (2014) advises that soliciting a combination of qualitative and quantitative data enables a complete understanding of changes needed for a marginalized group. The collection of quantitative data on solid waste collection and disposal was vital for examining solid waste management practices by the diverse households in the informal settlements, while the collection of qualitative information enabled an understanding of existing solid waste management formal policies and regulations, as well as, informal values and norms, implementation of policies and adherence. Applying mixed methods facilitated checks and balances so that the strength of one approach (Yin, 2014) would overcome the inadequacies of the other. Hence we employed in-depth interviews, household surveys, focus-group discussions, document reviews and observations. In addition, applying different methods facilitated the triangulation of information to identify areas of convergence and divergence (Babbie, 2005; Dawson, 2009).

In total, 120 participants were engaged in this study: 94 household members, 17 participants in group discussions and 12 Key informants. Engaged in in-depth interviews, Key informants included 2 officials from Kampala City Council Authority (KCCA) and 2 officials from the National Environment Management Authority (NEMA), who were selected purposively because of their roles and responsibilities in solid waste management activities and solid waste management regulation; development, and/or enforcement. Others were 4 officials from the two local council authorities selected because local leaders develop bylaws and enforce proper waste management practices in their areas of jurisdiction. Key informants also included 1 official from the private firm engaged in providing solid waste collection in the area and 2 informal waste collectors. These were selected because they work directly with households and may be more informed about waste management practices of households from the nature and status of waste they collect, as well as rotes. From the community-based organization engaged in waste management sensitization programs, 1 official participated in the study to explore views on awareness and waste management behavior transformation. While we held some interviews virtually due to the pandemic situation, we held others at places suggested by the participants and lasted between 30 min to 1 hour. In addition, 2 group discussions, one with 7 participants and another with 10, were held in the two study areas. Participation in the group was by choice and involved participants of different gender, social status and age groups, but not below 18 years. Information from discussions was necessary for enhancing the validity of the

information received from the household survey. In addition, we held discussions in community open spaces. Information enlisted ranged from common waste management practices at the household and community level to awareness of bylaws and waste management policies, values, and norms regarding waste management. The discussions lasted 1–2 hours and were scheduled on weekend evenings when participants were relatively free from daily city hustles.

We administered questionnaires in 94 households selected randomly to capture data on solid waste management practices' particularly sorting, storage, collection and disposal, and to understand how these practices had been acquired. In addition, it also covered information on knowledge and awareness of existing national and community regulations for solid waste management in the questionnaire. We found the survey relevant because of its strength in measuring attitudes and orientations in a large population when dealing with the context of social life (Babbie, 2005). There were no available statistics on the population of Makindye sub-division; thus, an adequate sample in a statistically challenging environment based on the saturation point, where when no new information seemed to come up from respondents, was followed.

We reviewed documents to establish the existing policies and regulations on solid waste management in the country and for Kampala city to examine relevancy, adequacy and applicability. While collecting data, we made observations around the settlement to see the reality (Yin, 2014), which in this study were the practices of solid waste collection, storage and disposal. For example, we sought waste collection containers or sacks placed inside or outside homesteads for waste collection or storage. In addition, we visited illegal and legal dumping sites in the communities and observed the general environment, checking out the littering or cleanliness in the surroundings.

## 3.3. Data analysis

We employed content analysis for analyzing qualitative data and transforming some quantitative data qualitatively. We grouped emerging issues into categories and coded them. The categories formed the study themes presented in the section of findings. When transforming quantitative data into qualitative, we focused on views and perspectives to derive meaning. We analyzed the rest of the quantitative data using the Statistical Package for Social Sciences (SPSS) for descriptive statistics. Although this study applied an embedded mixed method, it was predominantly a qualitative-oriented study. SPSS was used to facilitate generating information specifically on household management practices since these may vary in the community, which would have otherwise been hectic if analyzed manually. Besides practices, the rest of the quantitative information was interpreted and presented qualitatively, as aforementioned. We exported the analyzed data to Microsoft word and Microsoft excel for table and graphic presentation. Qualitative data enabled drawing meaning from the findings, while quantitative data was fundamental for arriving at conclusions.

## 4. Findings

The findings focus on prevalent waste management regulation on household practices derived from the themes. The themes are; waste management regulation on household vis-a-vis community practices; waste management practices and attributing circumstances; awareness of existing regulations by households; and socializing agents of waste management practices in the informal settlements.

## 4.1. Waste management regulations vis-a-vis household and community practices

We reviewed specific regulations to understand whether the waste management practices of households were either conforming to or violating existing regulations. These included; the KCC ordinance Act of 2000, the Penal Code Act cap 120, and the National Environment (Waste Management) Regulations, 2020 (GU, 2007; NEMA, 2020). In the KCC Ordinance Act 2000, placing waste in undesignated areas is prohibited, and illegal dumping is vehemently discouraged to prevent public health nuisances (KCC, 2000). In this view, individuals who dump waste in open spaces, streets, and undeveloped plots commit an offense. The ordinance emphasizes proper waste practices and states under Section 12: '*no person (s) shall bury, dump, or deposit, or cause to be buried, dumped or deposited upon any street, alley, or premises, solid waste of any kind* (KCC, 2000). This regulation focuses on individuals, households, and communities at large. The ordinance further indicates that scattering or littering solid waste upon any private or public property and keeping solid waste in a manner other than prescribed by the ordinance is an offense.

Complementing the ordinance is the Penal Code Act cap 120, which provides that persons commit an offense if they voluntarily pollute the atmosphere or the environment that may have health impacts on people in the neighborhood or others (GU, 2007). In the National Environment (Waste Management) Regulations 2020, section 18 provided for solid waste separation at the source. This encourages the sorting of recyclable, hazardous, and/or non-biodegradable waste. In addition to these regulations, community leadership is mandated to develop bylaws deemed suitable in their areas of jurisdiction, to control illegal waste dumping and other waste malpractices. Whereas a few local council areas have developed the bylaws, KCCA acknowledges the industrial area zone as a model village for waste management bylaws in Makindye sub-division. These regulations apply to all city residents regardless of socio-economic status and in different settlements regardless of context, whether or not formal. This is evidence of homogenizing and universalising regulation, which is unrealistic. Despite the stipulations in the policy instruments and the existence of bylaws, the waste management practices in the study area reflect a violation of the rules and regulations. The existence of illegal dumping sites, practices of littering waste in narrow streets and burning of waste observed by the research team as we strolled through the study area is a manifestation of the violation of prevalent regulatory frameworks. In the subsequent sections, we highlight more malpractices and intensity, as revealed by respondents and participants.

TABLE 1  Practices of household waste management.

| Practice | Frequency | Percentage |
|---|---|---|
| Burning | 64 | 68 |
| Burying | 17 | 18 |
| Illegal dumping | 42 | 45 |
| Designated spaces | 33 | 35 |
| Others | 24 | 16 |
| Total | 180* | 182* |

*The percentage exceeds 100 and the number of respondents exceeds the population sample because of multiple responses.

## 4.2. Waste management practices and attributing circumstances

The common waste management practices carried out by households, as indicated in Table 1, are burning waste (68%) and illegal dumping (45%). That burning waste is the most common practice may signify an endeavor by households to manage waste in the only plausible manner they know and think is suitable but also can afford. Yet, the practice pollutes the environment and is illegal according to the Penal Code Act cap 120, while burying is an offense, as the Kampala city council ordinance stipulates.

Notably, households are engaged in over one waste management practice simultaneously and sometimes consecutively, depending on various circumstances. For instance, households with a backyard or any other space burn or bury waste, or both, to reduce waste volumes.

Households also apply different practices for different waste streams. For instance, participants revealed that households do not burn plastics to reduce pollution of the environment because of the density of smoke that may be emitted and the repugnant smell. This revelation indicates that the existing pollution prevention-focused regulations are not the reason for households' decision not to burn waste. More so, plastics are left to be picked by waste scavengers. This notwithstanding, households could also earn a living from selling plastics but seem not to attach an economic value to it. Organic waste is mainly buried, while waste with an awful odor may be buried or dumped in un-developed plots or open spaces. Respondents confirmed not storing electronic or metallic waste but instead sell it to scrap buyers. When probed why metallic waste was sold and yet plastics were not, respondents indicated plastics fetch less money than metallic waste. This seems to confirm that economic gain from waste may thus influence how waste may be treated.

Among other waste management practices was that waste is sometimes thrown in places one would least expect, as one participant lamented:

> I am a landlord in this community, but I have been shocked by tenants who throw peelings and sanitary waste in the pit latrines. So you see [...] this place floods when it rains, and everything gets out of the pit and floats around.

Broken glass and sharp objects are also thrown in pit latrines to get them off children's harm's way. Women's menstrual pads are also thrown in pit-latrines, with the argument that 'nobody should ever see a woman's flow' as respondents revealed. Respondents also revealed sanitary pads are thrown in a pit latrine to avoid being "bewitched". The respondents' views indicate the social-cultural values that sometimes determine practices. Baby diapers are also thrown in pit latrines, but most respondents said they are conscious that this may lead to filling up the pits quickly and also attract flies. Thus, diapers are often dumped in undesignated spaces or burnt.

Participants argued that open dumping is rampant because waste management facilities in the communities are absent, and paying for waste collection fees is costly, given their low-income status. However, sometimes they use informal waste pickers within their community because they are relatively cheaper but may also dump waste, as local council officials revealed. In the interview with one of the waste pickers, it was affirmed:

> There is one place in the community where the plot owner allows us to throw waste, but it is far. If the waste load is heavy, leaking or smelly, when I find a place where someone else has already dumped, I leave mine there and go away quickly before I am seen and fined by the local leaders or the owner of the plot.

This revelation seems to comply with the notion that "waste attracts waste", which may be one reason open dumping is a common practice in the informal settlements. But, overly, revelations indicate that illegal dumping, open burying and burning are dictated by varying reasons but mainly inaccessibility to waste collection facilities and unaffordability of service costs.

We wanted to determine whether some households were engaged in waste sorting and recycling as desirable waste management practices for the circular economy. Waste sorting and recycling were not popular, as Figure 1 indicates. Only 25 and 8 respondents were engaged in waste sorting and recycling, respectively, out of 94 participants. Waste separation varies regarding the type of waste, its effect and intended outcome. Whichever waste is not buried, dumped or burned, such as plastics, porcelain ceramics, and electronic and metallic waste, is sorted. Later, plastics are sold to waste pickers, and if many, otherwise they are dumped in open spaces, where waste pickers can access them. Porcelain ceramics are sold to artisan dealers, while electronic and metallic wastes are sold to scrap buyers. For some households, even organic waste is sorted. Organic waste, mostly banana peelings, is used to make charcoal briquettes for energy by women groups or given to urban farmers for agriculture composting or feeding livestock. Residents are not engaged in sorting or recycling for mainly economic gains because participants revealed that they mostly gave out the waste for free, arguing that, after all, the money from the waste was not a lot unless one had a pile of it. Participants further revealed that giving out waste also enbales the hommetaeds to reduce on the volume of wase to dipsose of. The practice of waste separation at source, as required in the National Environment (Waste Management) Regulations 2020, section 18, is not highly practiced and is only conducted merely for its benefits, not as a desirable waste management practice. In the interview with waste pickers, they confirmed they go to open dumping spaces to pick waste but also go to the households for other types of waste that recyclers, whom they deal with, may have requested.

Household waste management practices revealed violations of the guiding policy instruments presented in 4.1 against dumping, burying, burning, and littering. Therefore, it was vital to understand whether residents were aware that some of their waste management practices contradicted prevalent rules and regulations or whether some of the good practices had been influenced by the desire to conform or fear of punitive measures.
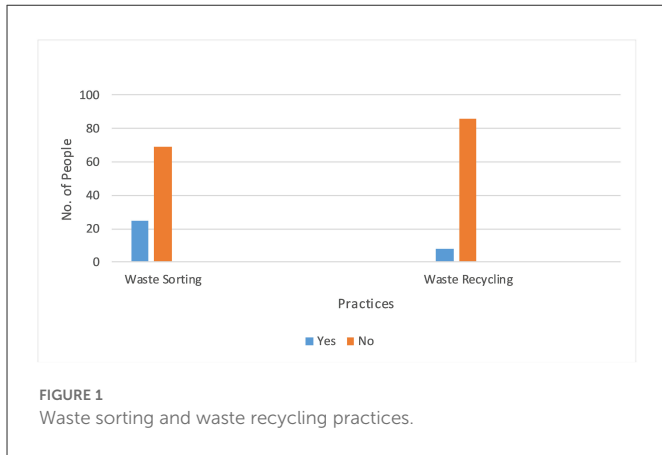
**FIGURE 1**
Waste sorting and waste recycling practices.



**FIGURE 2**
Awareness about regulation and waste management practices.

## 4.3. Awareness of existing regulations by households

Almost all the respondents (95%) needed to be aware of national waste management policies. However, 82 % of the respondents acknowledged being aware of the government's drive to ban polythene bags because of the multiple radio and television programs relayed to sensitize the masses. Despite the sensitization, households are still using them and justified their actions by saying that shops were still selling them, which indicates an enforcement loophole from the government. In almost equal measure, 51% of the respondents were aware of community bylaws and rules regarding waste management, while the rest were not. They revealed meetings were conducted where members discussed the waste mismanagement status of the community. In these meetings, local leaders have been cautioning residents that whomever they caught littering the environment would either be fined handsomely or reported to KCCA and executed in courts of law. Respondents' level of awareness about programs and regulations indicates the significance of sensitization in waste management regulation and sensitization as a socialization process. Figure 2 presents the state of awareness of regulations as highlighted.

Most respondents were aware that dumping and littering were illegal because of community rules, for example, warning signs on buildings near open spaces or erected posters in open spaces (see Plate A). Confirming their level of awareness about dumping, one participant narrated:
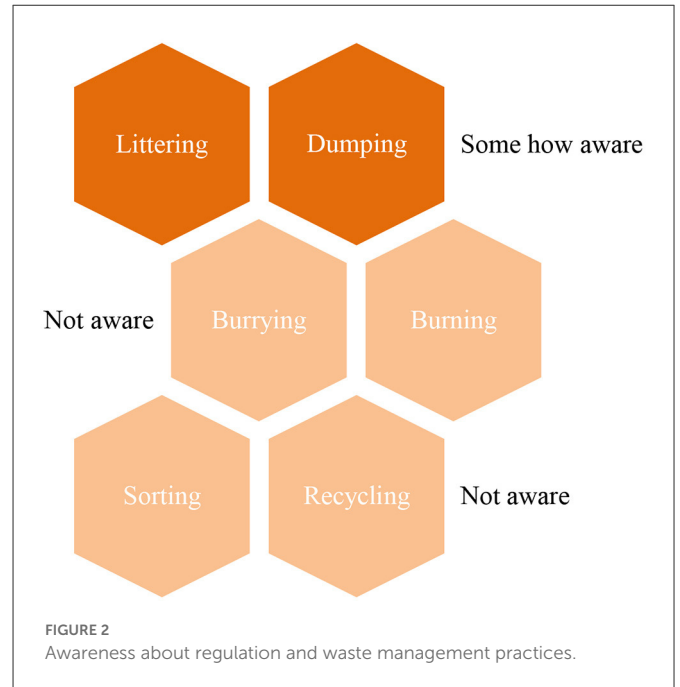


*Residents dump waste in the middle of the night like wizards. For example, I usually close my shop at midnight and go home. At that time, the street may be clear and clean, but when I come to open at 6.00 a.m., I see some sacks of dumped waste in the middle of the street.*

Participants in the discussions concurred that this was an indication that the culprits know that what they are doing is indecent and, if known, may face the wrath of community members, which is why they do it stealthily at night. In addition, some respondents knew that they had banned waste pickers with carrier carts or bicycles from operating in communities and so households do not enlist their services because they dump waste in undesignated areas. One of the waste pickers confirmed:

*Even if a household calls me to pick up the waste and I find it is a lot, I have to make two trips because if any of the local council officials find me pushing waste on either a bicycle or wheelbarrow, I may be fined heavily.*

These revelations indicate that community members are more aware of informal rules than formal ones. However, in the interviews with officials from KCCA and NEMA, it was confirmed that it is not only the residents in the informal settlements who might not be aware of the regulations but also those in affluent societies. The difference is that varying environments engage residents to adapt dominant practices, as one official from KCCA stated:

*Because cleanness is the norm in organised communities, even when new residents join the community, they adopt good practices. However, on the other hand, in informal settlements, people also quickly adapt to common malpractices. [...] This is not about awareness of policies but instinct.*

FIGURE 3
Waste practices socialization structures in the informal settlements.
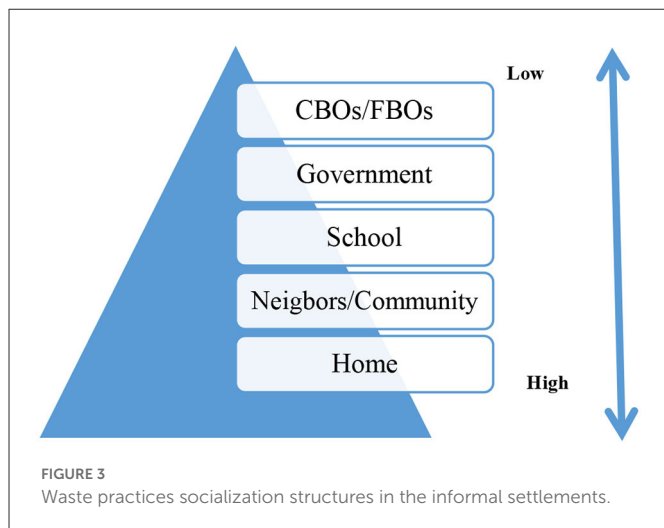
Having examined household waste management practices, and if not developed by instinct, we needed to explore how they had been acquired.

## 4.4. Socializing agents of waste management practices in the informal settlements

Structures through which individuals in the community are most likely to be influenced by waste management behaviors were central to this study. If policies, laws and guidelines were not informing communities on how to manage or not mismanage waste, how had residents acquired the multiple waste management and/or mismanagement practices? Individuals' behavior regarding waste management may be acquired through values, norms, beliefs (informal rules), or policies, laws guidelines (formal rules). Household members are socialized into different practices through various agents. In the interviews, most respondents attested they had been influenced by neighbors and the community, especially the practice of littering and dumping waste everywhere. One respondent narrated:

> Sometimes when you see how other people manage waste, you may copy them, even when it is not an appropriate practice. For instance, my friend confided in me that in the morning, while going to work, she moves with her waste in a polythene bag as if it is something valuable, and when she reaches the stand for public transport, she puts it down. Then, when the taxi arrives, she rushes quickly, abandoning her waste along the main road. Since then, I have also done the exact countless times.

During discussions, participants were asked to rank which socializing structure had most influenced them. They ranked the home first, followed by neighbors and the community in the second rank and the school in the third, as Figure 3 shows. Government, referring to local government and city authorities, was ranked fourth, while community-based organizations were ranked last.

Households were mentioned as primary structures where children get groomed on any behaviors, including littering or not to litter. Participants echoed that values, norms and behaviors acquired from childhood are entrenched; even when one becomes

an independent adult, their actions often reflect upbringing. Emphasizing the role of the family in waste management grooming, one participant shared:

> […] growing up, we were told never to throw away 'engata' (head cushion locally made for carrying things on the head). Behind this norm was to avoid littering, since in those days, carrying things on one's head was very common, so if it had not been discouraged, you can imagine how all paths would have been littered.

Agreeing in unison, another participant shared that children are discouraged by parents not to eat on the way (while walking in the streets) because, most times, it is either a sugar cane or a banana. If this is to be encouraged, the whole community will be littered with sugarcane molasses and banana peels. We note from these revelations the significance of instilling values, norms, and beliefs in the young generation. Revealing the significance of community in influencing good behaviors, participants noted that the good role of education in shaping good waste management practices is overridden. For instance, one respondent lamented:

> At school, they teach children not to litter their environment. The school where my children study has dustbins in every corner of the compound and paintings showing how to keep the environment clean. Surprisingly, some of my children, when at home, throw rubbish anywhere.

This reflects individuals being socialized differently. For example, while at school, one is socialized to dispose of waste appropriately, the community on the other hand shows the individual that littering is "business as usual". The hierarchy of socialization for an individual thus presents a complex situation for shaping behavior. More so, in households, there is close and high interaction among members; therefore, the rate at which it may influence a member to behave may be higher.

Referring to the government, participants mentioned that local leaders would pass within the community sensitizing members if the drainage systems got blocked due to waste or when there was a looming outbreak of cholera. This indicates that strategies for socializing communities have been reactive rather than proactive, which may not contribute to sustainable socialized practices. Community-Based Organizations (CBOs) and Faith-Based Organizations (FBOs) were ranked last because few associations and churches are involved in waste management practices. During a discussion with one official from the CBO, he revealed that:

> Our role has been to sensitise members on proper waste management practices. We have also linked women in this community with other organisations that have trained them in briquette making.

However, the official reported that they were engaged in WASH programs but faced many challenges since they were the only ones operating in the division. The official further noted that working in the informal settlements was very complex because of the cosmopolitan nature of members but also that most people come to stay temporarily. Then, when their income status improves, they relocate to better settlements. Accordingly, that was one of the issues for the unchanging waste management malpractices. This view was also shared by one of the local leaders:

> *[...] because some members may not be permanent residents, they are more engaged in malpractices knowing that they are not well known and may be shortly relocating [. . . ] otherwise permanent residents and landlords are concerned about the state of their environment.*

It was reported that local churches were ranked because they preach about environmental consciousness and sometimes participate in organizing communities' cleaning exercises. However, this is not quite often and not all churches in the community were doing so; that is why they were ranked last.

Findings have indicated that households manage waste in various ways. Most of these practices are undesirable. Residents' spatial, socio-economic conditions, accessibility and affordability of waste collection services, among others, predominantly determine practices. Because residents are ignorant about policies, laws, and bylaws, the restraining effect is missing. We also note that waste management practices are acquired through socialization at the household and community levels.

## 5. Discussion

This study aimed to explore how households in informal settlements get oriented in their waste management practices. By doing so, we examined the prevalent formal and informal rules and waste management practices at the household and community levels. In the following discussion, we dwell upon the role of socialization in influencing behaviors, including waste management practices. We draw examples beyond the Sub-Saharan African context. The significance of sensitization in socializing community members toward desired waste management practices is discussed too.

Socialization, particularly in non-individualistic communities, is fundamental for influencing behaviors. This is reflected in the informal settlements' tendency to accommodate communal cohesion. In Makassar City, Indonesia, Permana et al. (2015) contend that informal settlements accommodate low-income people who spend more time interacting. Consequently, over time, residents acquire various waste management practices from members of their households and the community at large, as this study exposed. In his study of the East African cities of Kampala, Nairobi and Dar es Salaam, Solomon (2011) notes that households have "established habits" of managing waste and norms toward cleanness which determine waste management in the broader context other than the households. A study by Sewak et al. (2021) in Fiji reports that solid waste management practices are socialized through the norms and values of people one often closely interacts with. In their WASH study in Kampala, Ssemugabo et al. (2020) also acknowledge that peers can influence individuals because of close interaction. This confirms that interpersonal and intrapersonal interactions, as espoused by social ecologists (McLeroy et al., 1988; Golden et al., 2015) are fundamental in influencing behaviors. Following the hierarchy by McLeroy et al. (1988), it seems evident that in the informal settlements, at the household level, waste management practices become the norms and values of waste management in that particular household because members interact closely. In this regard, the microsystem and mesosystem are critical for influencing behavior. This is more so because people with low incomes, who have small businesses within the community, occupy informal settlements, and even the

children go to schools within the community; hence residents are constantly mingling.

By observing their environment, community members pick practices. Since in informal settlements people dump waste, it is apparent community members adapt to this practice as evidenced in this study and others, for instance, a study by Ziraba et al. (2016) in developing countries drawn from Africa, and Latin America, Omollo (2019) in Eldoret, Kenya and Campos and Zapata (2014) in Managua. Scholars have argued that the status of the surrounding environment determines how one contributes to it. For example, a study by Mukama et al. (2016) in Uganda reveals a community's lack of concern about a littered environment, which indicates this has become the "new normal". Drawing from Nigeria's experience, Ojedokun (2011) argues that an individual's behaviors toward littering reveal personality attributes but also the surrounding environment. Ojedokun's argument seems to align with the notion of "waste attracting waste" manifesting through the emergence of illegal dumping sites in informal settlements, which develop by an incident of one person dumping waste in a particular spot which attracts other people to dump in that very spot. This resonates with Permana et al. (2015) in Indonesia and Haregu et al. (2017) in Kenya that household waste management practices are correlated to the status of cleanness in their community.

A study by Moqbel et al. (2020) in Jordan also reported that 70% of the studied population were engaging in littering the environment because that was commonly seen as the norm and that friends were doing the same. Kigali is one of the cleanest cities in Africa, attributed to Rwanda's cleaning exercise known as "Umuganda" (Squire and Nkurunziza, 2022). Because this exercise maintains environment cleanness, residents are compelled to keep it so. The examples highlighted depict evidence of the impact of ecological socialization that propels households and communities to adopt waste management practices reflective of their surrounding environment. The discourse is that behaviors are influenced and perpetuated by the environment in which one lives (Golden et al., 2015). If the environment is littered, households will contribute to the littering; if clean and pristine, members are conscious of maintaining the status quo.

The existence and or lack of policies may influence waste management practices. Notably, in this study, policy instruments did not influence good practices like recycling and sorting. Contrarily, in Latin America, especially in Brazil and Argentina, Gutberlet (2016) noted that the circular economy has developed partly due to supportive policies and the desire for socially and economically excluded groups to search for a living. In the present study, residents' awareness of existing bylaws about waste pickers forced some degree of conformity out of fear of punitive measures. However, anti-littering informal rules, though known, were still violated. This contrasts with Babbie (2005) that informal rules regulate social behavior. Continued violation of the bylaws could also be attributed to the low-income status of residents in the informal settlements, as the present study reveals. Thus while at some point one may use waste collection services, at another may not afford and concede to waste malpractices. This is similar to what Gutberlet (2016) refers to as the ecological and social solidarity economy in Brazil's circular economy that motivates waste picking and management activities. Other studies from South Sudan (Mier and Zhuo, 2020) and Ghana and Nigeria (Sandra and Weghmann, 2019) confirm that most residents in poor neighborhoods are engaged in burning waste or

dumping it because they cannot afford waste collection fees. This is in congruence with the social-ecological perspective that people's socioeconomic status determines behavior (Bronfenbrenner, 1977). This also resonates with the study in Malaysia by Yukalang et al. (2017), who concur that social-cultural factors influence negative attitudes and behavior of residents toward waste sorting. Although other factors may contribute to waste mismanagement, the role of regulation in influencing behavior cannot be ruled out. However, this can only work when the communities are fully aware of the repercussions of non-compliance.

Sensitization of waste management regulation is vital for improving the waste management status of communities. As noted in this study, the bylaws that communities comprehend, although violated, happen with extra measures not to be caught. Levi-Faur (2017) notes that empowering policy instruments hinges on sensitization. The role of sensitization of regulation and its impact on waste management practices in cities has been underscored in Ghana (Amugsi et al., 2016), Malaysia (Yukalang et al., 2017) and Brazil (Alfaia et al., 2017). Alfaia et al. (2017) conclude that sensitization is crucial for transforming cultures and habits concerning waste management and generation. The authors note that sensitization facilitated the reduction of waste volumes in Brazil as communities resorted to minimizing waste generation.

Scholars have agreed that communities may only adopt waste management policies after fully comprehending the consequences of not doing so or the benefits of doing so (Mwanza et al., 2018; Omollo, 2019; Muheirwe et al., 2022). Muniafu and Otiato (2010) caution that lack of awareness should not always be an excuse for waste mismanagement; otherwise, it would require endless sensitization. In a dispute, Katusiimeh and Mol (2011) emphasize that the continuous sensitization of communities significantly impacts transforming waste management behaviors. Katusimmeh and Mol's argument rhymes with the adage that "old habits die hard". Campos and Zapata (2014) confirm this, demonstrating the significance of sensitization by reflecting on contestations against introducing waste transfer stations in Managua informal settlements until residents were gradually sensitized. In tandem, Domingo and Manejar (2021), in their study conducted in Brazil, recommend that sensitization should be focused on transforming waste management cultural values and norms and policy adaptation. It takes time for behaviors that have been formed for many years to certainly disappear after a few years of enforcement and sensitization. Even at the household or community level, waste management practices may not be socialized in a single encounter. Thus, the role of sensitization of policies, values, and norms cannot be ignored.

# 6. Conclusion and recommendations

Household waste management practices are dynamic and influenced by varying factors, including lack of access to waste collection services, waste streams, and the purpose or benefit sought. Like other human behaviors, waste management practices are socialized and are not static. By observing the surroundings, residents also adapt to them. Not that regulations for waste management in informal settlements are irrelevant, but they are rather complex to enforce, given the dynamics of dwellers. However, that residents were aware of informal rules, fearful of being known to violate them, shows that administrative structures from the top to the bottom levels of

administration have not ensured the socialization of the formal rules. Therefore, most waste management values and norms have been passed down through interactions at the household level and personal interactions with community members. Because socialization plays a more prominent role in influencing waste management practices in informal settlements, regulations can only transform behaviors over time with vigorous and continuous sensitization. Until sensitization programs and structures encourage practices that finally appear like the "norm" for households and communities, solid waste management status in the informal settlement may not reach desirable levels.

The study recommends that policy enforcers give equal measure to formal and informal rules using appropriate socialization structures. For instance, since household members belong to various faith denominations, local leaders could engage the existing faith structures that usually have weekly services to integrate information on waste management regulations and practices in their programs with congregants. Furthermore, it is vital for local leaders to socialize communities about existing regulations that prohibit burning, dumping and littering by conducting door-to-door dialogue sessions with households that may be suspected of engaging in these practices and even new members joining the community. Such personalized awareness-raising sessions are crucial since the study identifies households as the primary socialization structures and residents are unaware of their illegal practices. In these sessions, desired practices such as waste sorting and separation at source should be discussed. Leaders need to mobilize communities and seek for support from KCCA to identify partners that can train women groups and the youth in recycling initiatives such as briquette making, vermicomposting among others. Also, the establishment of participatory community cleaning initiatives can gradually transform the waste practices of households and the community since the environment will be kept clean to counteract the notion of waste attracting waste. Strict fines and penalties for waste mismanagement and not participating in the cleaning initiatives should be implemented. These should be monetary and non-monetary, for instance, by utilizing community service action where offenders are compelled to clean in the community. This may contribute to keeping the environment clean and serve as a socializing lesson for residents to reflect upon.

Also, households could mobilize resources communally and engage waste collectors in their communities to overcome the lack of management facilities and reduce collection fees. This would reduce the amount an individual pays when they manage their waste but also using collectors within their communities would ensure timely collection. However, all these approaches require commitment from local leaders and participatory efforts such as support from Kampala City Council Authority and existing Community-Based Organizations such as Slum Dwellers International, which already has a community presence in Makindye sub-division but also engages in waste-related activities.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Author contributions

FM developed the idea, collected field data, and developed the first draft of the paper. WK engaged in the shaping of the idea and the development of data collection protocols, and methodology. JK participated in the revision of tools and methodology, revision of the document and developing of illustrations. AC revised the first draft of the manuscript and provided technical insights. All authors contributed to the article and approved the submitted version.

## Acknowledgments

The authors acknowledge the contribution of DAAD toward the scholarship of doctoral studies of FM under the project titled Governance and Planning of Resilient Cities of East Africa (GOPLAREA), which enabled the author to embark on this study. In addition, the authors acknowledge support by the Deutsche Forschungsgemeinschaft (DFG — German Research Foundation) and the Open Access Publishing Fund of the Technical University of Darmstadt.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

## References

Abdel-Shafy, H. I., and Mansour, M. S. (2018). Solid waste issue: Sources, composition, disposal, recycling, and valorisation. *Egypt. J. Petrol.* 27, 1275–1290. doi: 10.1016/j.ejpe.2018.07.003

Agbefe, L. E., Lawson, E. T., and Yirenya-Tawiah, D. (2019). Awareness on waste segregation at source and willingness to pay for collection service in selected markets in Ga West Municipality, Accra, Ghana. *J. Mat.Cycles Waste Manage.* 21, 905–914. doi: 10.1007/s10163-019-00849-x

Alfaia, R. G. D. S. M., Costa, A. M., and Campos, J. C. (2017). Municipal solid waste in Brazil: A review. *Waste Manage. Res.* 35, 1195–1209. doi: 10.1177/0734242X17735375

Amugsi, D. A., Mwangi, J. N., Haregu, T. N., Aboderin, I., Muindi, K., Mberu, B. U., et al. (2016). *Solid Waste Management Policies in Urban Africa: Gender and Life-Course Considerations in Nairobi and Mombasa. Urban Africa Risk Knowledge. Working Paper 4.* U.K.: London, ESRC and Department for International Development.

Ayeleru, O. O., Dlova, S., Akinribide, O. J., Ntuli, F., Kupolati, W. K., Marina, P. F., et al. (2020). Challenges of plastic waste generation and management in sub-Saharan Africa: A review. *Waste Manage.* 110, 24–42. doi: 10.1016/j.wasman.2020.04.017

Babbie, E. (2005). *The Basics of Social Research.* Belmont, CA, Thomson/Wadsworth.

Bjerkli, C. L. (2015). Power in waste: Conflicting agendas in planning for integrated solid waste management in Addis Ababa, Ethiopia. *Norsk Geografisk Tidsskrift-Norwegian J. Geogr.* 69, 18–27. doi: 10.1080/00291951.2014.992806

Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *Am. Psychol.* 32, 513–531. doi: 10.1037/0003-066X.32.7.513

Bronfenbrenner, U. (1992). *Ecological systems Theory. Six Theories of Child Development: Revised Formulations and Current Issues.* London, Jessica Kingsley Publishers.

Campos, M. J. Z., and Zapata, P. (2014). The travel of global ideas of waste management. The case of Managua and its informal settlements. *Habitat Int.* 41, 41–49. doi: 10.1016/j.habitatint.2013.07.003

Caniato, M. (2017). "Assessment and design of local regulation in solid waste management in low- and middle-income countries," in *The Political Economy of Local Regulation: Theoretical Frameworks and International Case Studies*, eds. A. Asquer, F. B., and D. Russolillo. U.K.: London: Palgrave Macmillan.

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches Thousand Oaks*, California, SAGE Publications, Inc.

Dawson, C. (2009). *Introduction to Research Methods 5th Edition: A Practical Guide for Anyone Undertaking a Research Project.* United Kingdom: Begbroke, Oxford, Robinson.

Desmond, P., and Asamba, M. (2019). "Accelerating the transition to a circular economy in Africa: Case studies from Kenya and South Africa," in *The Circular Economy and the Global South.* Routledge, London.

Domingo, S. N., and Manejar, A. J. A. (2021). An analysis of regulatory policies on solid waste Management in the Philippines: Ways forward. *PIDS Discussion Paper Series.*

Gasco, L., Biancarosa, I., and Liland, N. S. (2020). From waste to feed: A review of recent knowledge on insects as producers of protein and fat for animal feeds. *Curr. Opin. Green Sustain. Chem.* 23, 67–79. doi: 10.1016/j.cogsc.2020.03.003

Golden, S. D., Mcleroy, K. R., Green, L. W., Earp, J. A. L., and Lieberman, L. D. (2015). Upending the social ecological model to guide health promotion efforts toward policy and environmental change. *Health Educ. Behav.* 42, 8–14. doi: 10.1177/1090198115575098

GU (2007). *The Penal Code Act (Cap. 120), as amended through the Penal Code (Amendment) Act, 2007 (Act No. 8 of 2007).* Available online at: https://www.ilo.org/dyn/natlex/natlex4.detail?p_isn=92140&p_lang=en (accessed on March 19, 2013).

Gutberlet, J. (2016). *Waste Governance: An Introduction. Urban Recycling Cooperatives.* England, UK: Routledge.

Gutberlet, J., and Uddin, S. M. N. (2017). Household waste and health risks affecting waste pickers and the environment in low-and middle-income countries. *Int. J. Occup. Environ. Health* 23, 299–310. doi: 10.1080/10773525.2018.1484996

Haregu, T. N., Ziraba, A. K., Aboderin, I., Amugsi, D., Muindi, K., Mberu, B., et al. (2017). An assessment of the evolution of Kenya's solid waste management policies and their implementation in Nairobi and Mombasa: analysis of policies and practices. *Environ. Urban.* 29, 515–532. doi: 10.1177/0956247817700294

Haregu, T. N., Ziraba, A. K., and Mberu, B. (2016). Integration of Solid Waste Management Policies in Kenya: Analysis of coherence, gaps and overlaps. *Afr. Popul. Stud.* 30, 2876–2885. doi: 10.11564/30-2-889

Katusiimeh, M. W., and Mol, A. P. (2011). Environmental legacies of major events: Solid waste management and the Commonwealth Heads of Government Meeting (CHOGM) in Uganda. *Afr. Stud. Q.* 12, 47–65. Available online at: https://agris.fao.org/agris-search/search.do?recordID=NL2020017386

Kaza, S., Yao, L., Bhada-Tata, P., and Van Woerden, F. (2018). *What a waste 2.0. a global snapshot of solid waste management to 2050.* Washington, D.C.: World Bank Publications. doi: 10.1596/978-1-4648-1329-0

KCC (2000). *The Kampala City Council (Solid Waste Management) Ordinance.* Entebbe, Uganda: UPPC.

Kinobe, J. R., Bosona, T., Gebresenbet, G., Niwagaba, C., and Vinnerås, B. (2015). Optimisation of waste collection and disposal in Kampala city. *Habitat Int.* 49, 126–137. doi: 10.1016/j.habitatint.2015.05.025

Kirama, A., and Mayo, A. W. (2016). Challenges and prospects of private sector participation in solid waste management in Dar es Salaam City, Tanzania. *Habitat Int.* 53, 195–205. doi: 10.1016/j.habitatint.2015.11.014

Kubanza, N. S., and Simatele, D. (2016). Social and environmental injustices in solid waste management in sub-Saharan Africa: a study of Kinshasa, the Democratic Republic of Congo. *Local Environ.* 21, 866–882. doi: 10.1080/13549839.2015.1038985

Kyayesimira, J., and Muheirwe, F. (2021). Health concerns and use of biomass energy in households: voices of women from rural communities in Western Uganda. *Energy Sustain. Soc.* 11, 1–13. doi: 10.1186/s13705-021-00316-2

Levi-Faur, D. (2017). "Regulatory capitalism," in: *Regulatory Theory: Foundations and Applications*, ed. P. Drahos. Australia: ANU Press.

Maphosa, V., and Maphosa, M. (2020). E-waste management in Sub-Saharan Africa: A systematic literature review. *Cog. Bus. Manage.* 7, 1–19. doi: 10.1080/23311975.2020.1814503

Marshall, R. E., and Farahbakhsh, K. (2013). Systems approaches to integrated solid waste management in developing countries. *Waste Manage.* 33, 988–1003. doi: 10.1016/j.wasman.2012.12.023

McLeroy, K. R., Bibeau, D., Steckler, A., and Glanz, K. (1988). An ecological perspective on health promotion programs. *Health Educ. Q.* 15, 351–377. doi: 10.1177/109019818801500401

Mier, I. A. M., and Zhuo, L. (2020). Current status of municipal solid waste management in Juba city, south Sudan. *Int. J. Sci. Res. Publ* 10, 671–684. doi: 10.29322/IJSRP.10.08.2020.p10485

Moqbel, S., Abu-Zurayk, R., Bozeya, A., Alsisan, R., and Al Bawab, A. (2020). Assessment of sustainable recycling at The University of Jordan. *Int. J. Sustain. High. Educ.* 21, 1111–1129. doi: 10.1108/IJSHE-11-2019-0334

Mugambi, P. (2017). *Factors Influencing House Hold Functional Solid Waste Manage. In Meru Town, Meru County, Kenya.* (Doctorial Thesis). University of Nairobi. Kenya: Nairobi.

Muheirwe, F., Kombe, W., and Kihila, J. M. (2022). The paradox of solid waste management: A regulatory discourse from Sub-Saharan Africa. *Habitat Int.* 119, 1–9. doi: 10.1016/j.habitatint.2021.102491

Muiruri, J., Wahome, R., and Karatu, K. (2020). Assessment of methods practiced in the disposal of solid waste in Eastleigh Nairobi County, Kenya. *AIMS Environ. Sci.* 7, 434–448. doi: 10.3934/environsci.2020028

Mukama, T., Ndejjo, R., Musoke, D., Musinguzi, G., Halage, A. A., Carpenter, D. O., et al. (2016). Practices, concerns, and willingness to participate in solid waste management in two urban slums in Central Uganda. *J. Environ. Public Health* 6830163, 1–7. doi: 10.1155/2016/6830163

Muniafu, M., and Otiato, E. (2010). Solid Waste Management in Nairobi, Kenya. A case for emerging economies. *J. Lang. Technol. Entrepreneur. Afr.* 2, 342–350. doi: 10.4314/jolte.v2i1.52009

Mwanza, B. G., Mbohwa, C., and Telukdarie, A. (2018). Levers influencing sustainable waste recovery at households level: a review. *Procedia Manuf.* 21, 615–622. doi: 10.1016/j.promfg.2018.02.163

Nahapiet, J., and Ghoshal, S. (1998). Social capital, intellectual capital, and the organisational advantage. *Acad. Manage. Rev.* 23, 242–266. doi: 10.2307/259373

NEMA (2020). *The National Environment (Waste Management) Regulations 2020.* Kampala, Uganda: National Environemet Managemnt Authority.

Nuwematsiko, R., Oporia, F., Nabirye, J., Halage, A. A., Musoke, D., Buregyeya, E., et al. (2021). Knowledge, Perceptions, and Practices of Electronic Waste Management among Consumers in Kampala, Uganda. *J. Environ. Public Health* 3846428, 1–11. doi: 10.1155/2021/3846428

Ojedokun, O. (2011). Attitude towards littering as a mediator of the relationship between personality attributes and responsible environmental behavior. *Waste Manage.* 31, 2601–2611. doi: 10.1016/j.wasman.2011.08.014

Omollo, W. O. (2019). Solid waste management in the informal settlements: a land use planning perspective. *World Environ.* 9, 19–27. doi: 10.5923/j.env.20190901.03

Oteng-Ababio, M., Arguello, J. E. M., and Gabbay, O. (2013). Solid waste management in African cities: Sorting the facts from the fads in Accra, Ghana. *Habitat Int.* 39, 96–104. doi: 10.1016/j.habitatint.2012.10.010

Permana, A. S., Towolioe, S., Abd Aziz, N., and Ho, C. S. (2015). Sustainable solid waste management practices and perceived cleanliness in a low income city. *Habitat Int.* 49, 197–205. doi: 10.1016/j.habitatint.2015.05.028

Rajashekar, A., Bowers, A., and Gatoni, A. S. (2019). *Assessing Waste Management Services in Kigali.* U.K.: London: International Growth Centre, London School of Economic and Political Science.

Rodić, L., and Wilson, D. C. (2017). Resolving governance issues to achieve priority sustainable development goals related to solid waste management in developing countries. *Sustainability* 9, 1–18. doi: 10.3390/su9030404

Sandra, V., and Weghmann, V. (2019). Municipal solid waste management services i n Africa. *Working Paper.* PSI. France: Cede, 1–69.

Serge Kubanza, N., and Simatele, M. D. (2020). Sustainable solid waste management in developing countries: a study of institutional strengthening for solid waste management in Johannesburg, South Africa. *J. Environ. Plann. Manage.* 63, 175–188. doi: 10.1080/09640568.2019.1576510

Sewak, A., Deshpande, S., Rundle-Thiele, S., Zhao, F., and Anibaldi, R. (2021). Community perspectives and engagement in sustainable solid waste management (SWM) in Fiji: A socioecological thematic analysis. *J. Environ. Manage.* 298, 1–12. doi: 10.1016/j.jenvman.2021.113455

Solomon, A. O. (2011). *The Role of Households in Solid Waste Management in East African Capital Cities,* Netherlands: Wageningen Wageningen University and Research.

Somaroo, G. D., and Gukhool, O. (2015). "Localised approach to solid waste management: System dynamics, life-cycle assessment, institutional and legislative frameworks," in *Future Directions of Municipal Solid Waste Management in Africa,* R. Mohee and T. Simelane. South Africa: Pretoria: Africa Institute of South Africa.

Squire, J. N., and Nkurunziza, J. (2022). Urban Waste Management in Post-Genocide Rwanda: An Empirical Survey of the City of Kigali. *J. Asian Afr. Stud.* 57, 760–772. doi: 10.1177/00219096211035430

Ssemugabo, C., Nalinya, S., Lubega, G. B., Ndejjo, R., and Musoke, D. (2020). Health risks in our environment: Urban slum youth'perspectives using photovoice in Kampala, Uganda. *Sustainability* 13, 248. doi: 10.3390/su13010248

Stokols, D. (1996). Translating social ecological theory into guidelines for community health promotion. *Am. J. Health Promot.* 10, 282–298. doi: 10.4278/0890-1171-10.4.282

Tukahirwa, J. T., and Lukooya, N. B. (2015). "The role of policy and institutional reform in enhancing the technical efficiency of urban authorities: Reference to solid waste management in Kampala City," in *Uganda. Future Directions of Municipal Solid Waste Management in Africa,* eds. R. Mohee and T. Simelane. South Africa: Africa Institute of South Africa.

Yin, R. (2014). *Case study Research: Design and Methods.* Thousand Oaks, CA, Sage.

Yu, D., Blaauw, D., and Schenck, R. (2020). Waste pickers in informal self-employment: Over-worked and on the breadline. *Dev. South. Afr.* 37, 971–996. doi: 10.1080/0376835X.2020.1770578

Yukalang, N., Clarke, B., and Ross, K. (2017). Barriers to effective municipal solid waste management in a rapidly urbanising area in Thailand. *Int. J. Environ. Res. Public Health* 14, 1013. doi: 10.3390/ijerph14091013

Ziraba, A. K., Haregu, T. N., and Mberu, B. (2016). A review and framework for understanding the potential impact of poor solid waste management on health in developing countries. *Arch. Public Health* 74, 1–11. doi: 10.1186/s13690-016-0166-4