



Social aspects in the pathway towards the closure of a dumpsite: the case of Ngong (Kenya)

Francesca Villa¹ · Sonia Maria Dias² · Jane Bosibori Oteki Masese³ · Lewis Sitoki³ · Duncan Miheso³ · Mario Grosso¹

Received: 7 February 2023 / Accepted: 2 October 2024
© The Author(s) 2024

Abstract

Dumpsites are a common way for waste disposal around the world. Since their impact is not controlled, they represent a threat to the public health and to the environment, being a source of pollutants and greenhouse gases. The dumpsite of Ngong (Kajiado County, Kenya) has been addressed since years as a serious issue affecting the surrounding community. A project for its closure and the establishment of a new facility for waste treatment was elaborated in 2017, and recently the conversion of the dumpsite in a park has been proposed by the local authorities. Nonetheless, the framework appears still complex from the environmental, economic and social points of view: any intervention is expected to raise challenges for the municipal solid waste management (MSWM) system in place, which involves many stakeholders, including informal workers of the dumpsite. After presenting a general overview on the MSWM system in place at the time, this paper presents the results of the social assessment (SA) carried out in 2018, where some of the criticalities encountered by the local authorities at a later time were already predicted. In the opinion of the authors, the importance of qualitative and sociological research within a technological project is highlighted by the results of the SA, and the shared methodology can be helpful for practitioners on the field, whose support will enhance the capacity of stakeholders to deal successfully with challenges related to waste management.

Keywords Social assessment · Closure of a dumpsite · Waste pickers · Low-income countries · Municipal solid waste management

✉ Francesca Villa
francesca.villa@polimi.it

¹ Politecnico di Milano, Piazza Leonardo Da Vinci, 32, 20133 Milano, Italy

² WIEGO, 521 Royal Exchange, Manchester M2 7EN, UK

³ Technical University of Kenya, Environment and Energy Technologies, Haile Selassie Avenue, Nairobi 52428- 00200, Kenya

1 Introduction

One third of the waste generated all over the world is disposed of in open dumps, with this percentage strongly increasing in lower-middle (66%) and low-income countries (93%) (Kaza et al., 2018). Even though these figures are estimates (given the fact that open dumps are usually not controlled) (UNEP & ISWA, 2024), they describe a huge amount of waste that, improperly treated and disposed of, is affecting the lives of millions of people (ISWA, 2016). Consequently, the closure of a dumpsite and its replacement with controlled and environmentally sound treatment and disposal facilities is a desirable fact, particularly in the context of growing concerns around climate change.

However, even such an action may have unexpected outcomes, since Municipal Solid Waste Management (MSWM) is a very complex system to deal with; the promotion of hasty processes that end up neglecting livelihood protection represents a concrete risk. An integrated approach to address it requires dealing with both physical and governance components (Wilson et al., 2013). The former are related to public health and waste collection, to apply the 3Rs principle (reduce, reuse, and recycle) to the environmental protection and the final proper disposal. Governance components refer instead to the inclusivity of both users and providers, to the existence of sound institutions and proactive policies, as well as financial sustainability. Consequently, several aspects need to be considered when designing or modifying existing systems (Coffrey & Coad, 2010).

Besides the environmental impacts, social ones are also very relevant, since they affect mainly vulnerable shares of the population (Kaza et al., 2018). Just as an example, improper waste management mainly happens in peripheral areas, with several impacts on residents; management changes may lead to exclusion dynamics (Bernstein, 2004), affecting many subjects and especially the workers from the informal sector (so-called *waste pickers*) (Dias, 2011). UNEP & ISWA (2024, page 43) mention all these impacts as “*barriers to change*”. For all these reasons, strategies for the social management of dumpsite closure are necessary and should be based on Social Impact Assessments (ISWA, 2016).

In 2017, UNHabitat promoted a feasibility study for the closure of the informal dumpsite in Ngong town (Kenya) and the construction of an integrated sustainable waste management facility (UNHabitat, 2017), funded by the Italian Agency for Development Cooperation (AICS). The dumpsite of Ngong was a threat to human health and the environment due to its improper management and its location very close to settled areas. Its closure would have been associated with the construction of a new facility to process waste in a more sustainable way. More details related to this proposal are described in Del Pero et al. (2020). The feasibility study was carried out by a consortium of three organizations, [removed from blinded manuscript]. Several analyses were prepared: a baseline diagnostic survey on the current status of MSWM in Ngong; an Environmental and Social Impact Assessment (ESIA) for both interventions; supporting guidelines for consultation and awareness campaign; a full project document for the new proposal of an integrated solid waste management facility. While the pursuit of technical and financial feasibility was explicit within the Call for expression of interest, the need for addressing livelihoods depending on the dumpsite was not explicitly mentioned.

The Social Assessment (SA) presented in this paper was carried out in the field during the first semester of 2018, as a part of the feasibility study. In fact, all the proposed interventions would have affected not only the final disposal of waste, but the whole MSWM system of

Ngong, including the provision and use of solid waste services, the financial arrangements required to ensure the sustainability of the system and the design of transport routes. Like in other situations (UNEP&ISWA, 2024; Kaza et al., 2018; ISWA, 2016), such changes were likely to cause social impacts, both positive (e.g. less accidents, better communication, social progress, livelihood options) and negative (e.g. increase in the cost of fodder for animals, marginal increase in the time required to travel for people continuing with waste picking, displacement, loss of livelihoods (Houe et al., 2014).

Given the scarcity of peer-reviewed and grey literature on this topic, this paper aims to present the methodology used to create a coherent framework for the Social Assessment. Qualitative and quantitative investigations were carried out, and a list of relevant aspects was specifically created to consider all issues and evaluate their relevance. This list highlighted a variety of social impacts that were at risk of being overlooked in the follow-up of the project and may represent an important tool for the decision-makers within MSWM systems; these social impacts will be presented as well, along with recommendations on how to mitigate them.

2 Context: municipal solid waste management in Ngong

Kenya is a country in Eastern Africa with a population of about 53 million inhabitants. It is experiencing an increase in urban areas, and it is struggling for appropriate solid waste management (NEMA, 2014). The informal sector is playing a crucial role, especially in waste segregation, but its inclusion in governance practices is still an issue (ISWA, 2017).

Ngong is a town of about 150,000 inhabitants (KNBS, 2015) which pertains to the County of Kajiado, in Kenya. Its dumpsite is located in the city centre, next to the slum of Mathare. The location of both the dumpsite (in Ngong) and the proposed site for the waste management facility (Kerarapon) are shown on the map. Historical imagery for the dumpsite itself represents its state before the project and a more recent picture see (Fig. 1).

The authority responsible for the MSWM system in Ngong is the County Government (CG), with its Department of Water, Irrigation, Environment and Natural Resources. The CG has the following tasks: interactions with other stakeholders; planning of the MSWM; street cleaning and collection from street containers; surveillance of the Ngong dumpsite and regulation of the access by trucks.

The functioning of the MSWM system, with relevant stakeholders, as it was observed in 2018 during a field visit by the authors, is briefly described as follows; however, changes are likely to have occurred, since the dumpsite is no longer operational.

2.1 Collection

The collection of waste in Ngong is performed by different players. The CG is responsible for street cleaning and street collection: street containers (skips of about 6 m³) are moved to the dumpsite by means of a skip loader and discharged there. Private Service Providers (PSPs) perform a sort of door-to-door collection at the household level. Other associations involved in waste management and environmental protection exist in Em Bulbul, a township of Ngong.

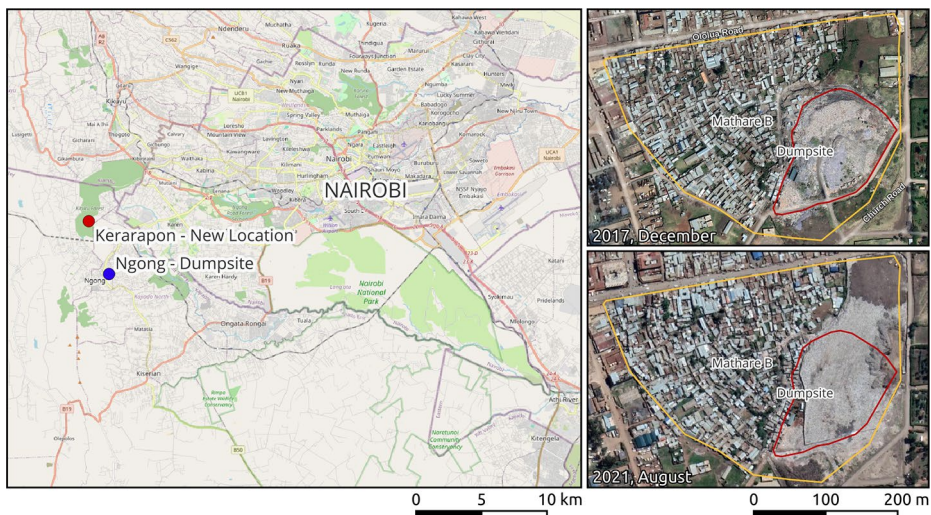


Fig. 1 Map of the dumpsite (Ngong) and the new proposed location (Kerarapon) (OpenStreetMap, 2024) and historical imagery of the dumpsite in December 2017 and August 2021 (Google Earth Pro, 2024a,b)

The coverage of the collection is ensured apparently based on the private land tenure system. In some areas, the coverage is ensured by PSPs, while the County Government is charged with collection in other areas (and residents should pay a tariff).

2.2 Final disposal

In 2018, waste was disposed of in the dumpsite of Ngong (Fig. 2). The dumpsite started operating between 1990 and 1995 on land owned by the CG. After its establishment, a school and a church were built in its proximity, and the slum of Mathare raised in the area destined for liquid waste treatment (lagoon). The CG was operating the dumpsite in agreement with the National Environment Management Authority (NEMA), without the license and any Environmental Impact Assessment (EIA). The daily amount of waste entering the dumpsite was estimated between 120 and 160 tonnes.

A Community-based organization (CBO), the Nuru Youth Group (Nuru) (Fig. 3), has been performing the management of waste and the separation of recyclables inside the dumpsite since 2004.

With reference to the management of the dumpsite, trucks are charged an entrance fee and directed to a specific unloading zone, depending on the type of charge and its estimated value (County trucks are considered valueless, since they collect waste from street containers). Subsequently, the waste load is assigned to a person/buyer and then moved to a sorting zone to facilitate the handling inside the dumpsite.

Nuru was provided by NEMA with two shelters (one hosting the office of Nuru, the other dedicated to temporary storage and rest) and a shredding machine, which never started working because the costs of the connection to the electric grid or of a generator were not sustainable considering the temporariness of the dumpsite of Ngong.



Fig. 2 The dumpsite of Ngong, with a collection truck dumping waste and waste workers in activity (February, 2018)

Working and health conditions of the Nuru people are of course very harsh, with continuous exposure to physical and chemical hazards, due to the presence of rotting waste, of smoke because of fires, etc.

2.3 Service charges and fees

Information provided by stakeholders on service charges and fees was not always coherent. Service charges are not asked to the population. Anyway, the population served by PSPs was paying them a monthly tariff ranging from 300 to 500 Ksh per household (about 2–3 € per month in 2018).

2.4 Location of the new facility

The CG proposed as a location for the new facility in an area known as Vet Farm, near Kerarapon, a township of Ngong of about 5,000 inhabitants. The area is a clearing surrounded by the Kibiko forest. A local association, the KErarapon REsident Association (KEREA), was seriously concerned about the establishment of the new facility. The existence of springs in the area has required also the involvement of the Water Resources User Association (WRUA) (WRA, 2016).



Fig. 3 Meeting of Nuru Assembly at the dumpsite of Ngong (February 2018)

2.5 Recent updates

According to Clean Up Kenya (2021) and other journalistic sources, in 2020 the dumpsite of Ngong was officially closed by the CG, but the absence of an alternative disposal site besides Dandora (one of the biggest and most (in)famous dumpsites in the world, located 40 km far from Ngong), provoked a waste management crisis in the surrounding area. In 2022, the closure of the Ngong dumpsite and its rehabilitation into a recreational facility has been announced and celebrated by part of the residents. Nonetheless, this result has been reached after a dispute between the CG and the residents relying on waste picking (Musa, 2021). Segregation-at-source and recycling seem to have been introduced (Nghoto, 2023), the waste now being disposed of in a quarry named Isinya (resulting from road construction works), and the CG intends to build a facility; however, the land for the transitional centre has not been identified yet (Githaiga, 2022), and the Vet Farm area is still at stake.

2.6 Stakeholders

Stakeholders are generally described as subjects affected directly or indirectly by a project, or with the capabilities or willingness to affect the project itself. Stakeholders identified within the project, already mentioned in the previous paragraphs, are described in Table 1.

Table 1 Stakeholders description

Category	Stakeholders (number of people)
Institutions	<ul style="list-style-type: none"> • National Environmental Management Authority (NEMA) is the national-level governmental institution responsible for solid waste management, in terms of decisions, strategies and authorizations. • Kajiado County Government (CG) represents the intermediate level of public institutions, consisting of a county executive and a county assembly. The CG was recently born, as defined in the new Constitution of Kenya (2010). In fact, the County became operative in 2013. Within the MSWM system, the CG is the authority responsible for its management through the Department of Water, Irrigation, Environment and Natural Resources.
Private Sector	<ul style="list-style-type: none"> • Private Service Providers (PSPs) are organized in associations and should be considered important stakeholders as they provide the service of waste collection to most of the households in Ngong. They can also collect information on waste streams and contact a huge number of customers, having a key role in participation and awareness activities. In Rongai, the association of PSPs consists of 33 enterprises, whether formal or informal. Each collector has its own stickers to identify households which are their customers.
Waste workers	<ul style="list-style-type: none"> • Nuru Youth Group is the Community based organization (CBO) responsible for the management of Ngong dumpsite, and its role is unofficially recognized by the County Government and PSPs. Nuru started its activity in 2004 when some people began to buy plastics from the dumpsite. According to its Committee (a group of supervisors composed of 9 persons), Nuru has 132 registered members (about half women and half men) and 64 not-registered members.) Members of Nuru may act as selectors (pickers, generally specialized in different materials), traders (3 out of 5 buyers of selected materials are members of Nuru), or cleaners (not specialized). Some of them are breeding animals (cows, pigs) within the dumpsite. Non-members select the organic waste or are charged with cleaning the unloading area. Considering health issues, Nuru maintains a sort of welfare, supporting people if they get sick or families when someone dies.
CBOs	<ul style="list-style-type: none"> • Em Bulbul Associations is a network of associations of the township of Ngong, concerned with environmental protection. These associations seemed to play an important role in transforming Em Bulbul from a slum to a township when the market of Em Bulbul itself was a dumpsite. They have experience in dealing with public institutions. Moreover, they represent valuable stakeholders due to their direct involvement in solid waste collection and their strong concerns about the environment, public hygiene, and cleanliness of the town. • KERIA (Kerarapon Resident Association) is the association gathering residents of Kerarapon and it is really concerned about the establishment of the new facility. • WRUA (Water Resources User Association) is the association of residents dealing with WRMA (Water Resources Management Association), a state corporation responsible for the use of water sources. Both are entities related to the Ngong Mbagathi Basin river. WRUA has been involved in the project due to the existence of springs in the area.

3 Materials and methods

The objective of the Social Assessment was to clearly identify the possible impacts of the closure of the dumpsite in Ngong and the opening of a new waste management facility in Kerarapon. Consequently, it was necessary to create a general framework to gather the results of the field investigation and to allow their interpretation.

3.1 Design of the social assessment

The literature related to the assessment of environmental, social and economic impacts of waste management was reviewed in order to properly design the Social Assessment. At the time of this investigation, many publications were pointing out the relevance of the social impact of waste management (ISWA, 2016; Zurbrügg et al., 2014; Wilson et al., 2013; Danthurebandara et al., 2012; Coffrey & Coad, 2010), considered as a dimension of “sustainability”, and often focusing on stakeholders’ analysis. However, still, few studies are targeting social impacts directly related to solid waste, from the theoretical point of view (Gorgos, 2009; Bernstein, 2004) or discussing case studies of dumpsites (Houe et al., 2014; Obadina, 2016; GA Environment Ltd, 2015), providing insights on the aspects that need to be considered.

The present research is based on the “*five entry points of inquiry*” (Bernstein, 2004; page 13), chosen as the main reference to measure the social impacts. These points are briefly summarized as follows (Bernstein, 2004):

1. Social diversity and gender: it refers to the social organization of the local population, and considers possible dynamics of exclusion or discrimination based on social level or gender; it refers also to consumption patterns and habits of waste management.
2. Institutions, rules and behaviour institutional analysis: it investigates characteristics and relationships between local groups, institutions and organizations, and formal and informal sets of rules.
3. Stakeholders: similar to the most-known stakeholders’ analysis, it aims at the identification of all the actors who are interested in, or likely to impact on, or affected by the changes in the waste management organization.
4. Participation: it analyses opportunities and conditions for stakeholders to influence the project, and willingness to include specific actors within the process.
5. Social risks: it analyses external conditions that may affect the project, such as external shocks, political instability, local and regional military conflicts, corruption, governance capacity, etc.

The dimension related to Stakeholders has been a guideline during all the assessment, and the findings have been included in the Context, for a better understanding. Consequently, in the discussion of the results, only the other four dimensions have been used.

Subsequently, other two dimensions have been developed by the authors, as they were only partially covered by the “five entry points of inquiry”:

6. Physical impacts with social consequences, because a construction project will have physical impacts that may affect the population, with social consequences. An example may be the depletion of springs and groundwater, which will affect the population dependent on local water sources.
7. Health issues, with reference to both the population living around the dumpsite and the waste workers. In fact, the resident population around the dumpsite is subjected to a health risk, due to the contamination of soil and water, to the smoke of the burning waste, and to the breeding of animals vectors of disease. On the other side, waste workers are more likely to suffer from diseases or accidents if compared with the general

workforce (Poulsen et al., 1995). A list of the most common occurrences has been derived from the literature (Njagi et al., 2013; Giusti, 2009; Bokhoree et al., 2014; Domingo & Nadal, 2009; Sankoh et al., 2013; De & Debnath, 2016; Poulsen et al., 1995), with reference to possible diseases (chest pain, stomach problem, diarrhoea, eyes infections or conjunctivitis, skin rashes or other skin diseases, hoarseness, cough, nausea, vomits, joint or muscle pains) or accidents (fractures, sprains, wounds, burns or bites).

Finally, these six dimensions constituted the general framework for the classification of each information arising from the data collection; thus, each dimension was divided into subcategories, according to Bernstein (2004). This classification allowed the subsequent analysis and discussion.

Primary data have been collected in the field, using qualitative (semi-structured interviews and informal dialogues with key stakeholders) and quantitative methods (questionnaires administered to the resident population in both Ngong and Kerarapon, divided into “target groups”). Those methods have been chosen based on similar studies (Sankoh et al., 2013; Patwary et al., 2011). Secondary data from the study of scientific papers but also reports and web sources, the so-called “grey literature” (Domini et al., 2017; Schöpfel & Farace, 2010), have also been used.

3.2 Qualitative investigation

The qualitative investigation was carried out during the field visit (February 2018). Despite the short time available, all efforts were made to get in touch with most of the typical stakeholders of a solid waste management system (Dias, 2011; Budlender, 2009; Snel & Ali, 1999). Semi-structured interviews (including closed and open questions) were performed with several stakeholders, and informal dialogues have been used as well, for example during the visit to the dumpsite of Ngong or during the inception workshop organized by the County Government and UNHabitat. Regarding waste workers, they were not individually interviewed, but most of the questions were asked them during a meeting of their Committee, in which part of the project team participated. In Table 2 the categories of stakeholders, the number of involved stakeholders and the tool used to collect information are listed.

3.3 Quantitative investigation

Questionnaires have been prepared in cooperation between [removed from blinded manuscript] and [removed from blinded manuscript] and administered by the [removed from blinded manuscript] team between April and June 2018. They were addressed to target groups likely to be affected by the project:

- Resident Population living in both areas, the current location of the dumpsite (Ngong) and the proposed location for the new plant (Kerarapon), is expected to be affected by both interventions, the closure of the dumpsite and the siting and opening of the new waste management facility. Consequently, two groups have been identified: the resident population living within 500 m from the dumpsite of Ngong or within 50 m from the river flowing downstream of the dumpsite (RPN), and the resident population living in

Table 2 Stakeholders interviewed for the social assessment

Category	Stakeholders (number of people)	Tool
Institutions	Kajiado County Government (3)	Semi-structured interview
	Local level and politicians (3)	Semi-structured interview, inception workshop.
Private Sector	Private Service Providers (1)	Semi-structured interview.
Waste workers	Nuru Youth Group (8) (informal workers)	Semi-structured interview, inception workshop, visit to the dumpsite.
CBOs	Em Bulbul Oloolua Env. and SWM Project (1)	Semi-structured interview, inception workshop.
	Kerea (1)	
	Kerarapon Youth Group (2)	
Experts in SWM	TUK (2)	Inception workshop.

Kerarapon, in the proximity of the location for the new facility (RPK).

- Resident Population living in both areas, the current location of the dumpsite (Ngong) and the proposed location for the new plant (Kerarapon), is expected to be affected by both interventions, the closure of the dumpsite and the siting and opening of the new waste management facility. Consequently, two groups have been identified: the resident population living within 500 m from the dumpsite of Ngong or within 50 m from the river flowing downstream of the dumpsite (RPN), and the resident population living in Kerarapon, in the proximity of the location for the new facility (RPK).
- Waste Workers (WW), also identified as informal waste workers or “waste pickers”, are vulnerable to all changes in the waste management system, which might prevent them the access to recyclables, such as the establishment of waste-to-energy plants or the implementation of security measures (e.g. enclosures) and rules which forbid and punish the collection of waste. Workers employed in picking, sorting, cleaning and commerce of waste at the dumpsite will be affected by its closure because they risk losing their source of income, and they can be subjected to forced displacement as well.

In addition to the three different questionnaires (RPN, RPK, WW), a fourth one combining questions from the others (CQ) was prepared and administered to a small sample of people attending the town of Ngong, intercepted through a field visit.

In terms of analysis, some questions were aimed at exploring the perception of people about the current situation of waste management and the impacts of the project; some of these results were analyzed through SPSS, and only aggregated results were shared within the team. Other questions were investigating the context and the current situation, and their relationship with the project has been inferred by the authors. All listed data have been classified with reference to the six dimensions of the Social Assessment, to the impact assessed as positive or negative or both, and to the relevance assigned.

4 Results

4.1 Qualitative investigation

The interaction with the stakeholders allowed to recognise several social issues. The main questions of the semi-structured interviews were the following: (1.a) *Have you ever heard about the relocation of the illegal dumpsite of Ngong?* (1.b) *Do you support the idea? Why?* (1.c) *What do you think should be taken into account within the project?* (1.d) *In your opinion, which are the major issues concerning waste management in Ngong?*

The answers to these questions were referring to both the current situation and the changes potentially caused by the implementation of the project, whether in Ngong or Kerarapon. Issues raised during the interviews or dialogues were classified according to the six dimensions (and related subcategories) identified during the design stage, as resumed in Table 3. For each issue, the following information is presented: a short description, its interaction with the project or its expected impact according to the authors, and stakeholders raising the particular issue. Finally, each issue is signed with an ID to be clearly identified in the following discussion, and to be correlated with the quantitative results in a second stage.

There are some aspects that have been mentioned by almost all stakeholders, such as the concerns about the livelihood of waste pickers (Pov_N1) and the forced relocation of families living at the dumpsite (Pov_K1), or, more generally, the lack of both communication and trust in institutions (SR_A1).

4.2 Quantitative investigation

The questionnaires were administered to 122 persons, as summarized in Table 4. In all the cases, the questionnaires were compiled by fieldworkers acting as interviewers, and not directly by the interviewees.

The dimension of the sample for the Resident population (RPN, RPK, CQ) was not enough for the analysis to be statistically significant, while only 10% of the waste workers answered the questionnaire. In terms of demography of the sample, 100 of the interviewed answered about the sex (69% male, 24% female, 7% n.a.) and 58 about the age (21–30 years segment overrepresented, at 45%). Despite the scarce statistical significance, results can be used to understand whether issues raised by key stakeholders are acknowledged or mentioned as well within the population.

Different questions have been analysed in different ways. First, as previously said, a section of all the questionnaires was aimed at exploring the perception of people about the current situation of waste management and the impacts of the project. People were directly asked to select relevant issues from a list (Yes/No), divided into the following categories: (a) *negative impacts of the dumpsite*; (b) *benefit of the dumpsite*; (c) *benefit of the relocation of the dumpsite*; (d) *institutional waste management issues*.

As shown by Table 5, not all target groups were asked the same questions. However, selected issues were connected to Table 3 through the ID. A column “Impact” was added in order to provide a qualitative evaluation of the perceived impact with respect to given answers, based on the average percentage of respondents mentioning the issue: *Very low* (0–19%); *Low* (20–39%); *Medium* (40–59%); *High* (60–79%); *Very high* (80–100%); the answer “*All the stated benefits / all the above*”, when given, was distributed between the

Table 3 Issues raised by the stakeholders, synthesis table

Issue	Description	Interaction with the project / Expected impact	Raised by:	ID
Physical impacts with social consequences				
Environmental impacts	Current situation in Ngong: Smoke (waste burning) affects houses in the valley Oloolua River has been damaged Improper location of the dumpsite	Positive - The closure of the dumpsite of Ngong will reduce the impact on the environment.	Institutions, CBOs, PSPs	Env_N1
	Current situation in Kerarapon: Lack of a proper disposal area around Kerarapon Several illegal collection points	Positive – The new facility will receive waste from Kerarapon	Institutions, CBOs, PSPs	Env_K1
	Project impact in Kerarapon: Risk of water contamination or depletion (Gateway springs - outlet of Ngong hills; another spring - outlet of Mombasa) Pollution, dust, noise, birds	Unknown	CBOs, PSPs	Env_K1
Social diversity and gender				
Society	Differences between Ngong and Mathare (low-income areas) and Kerarapon (high-income area).	Unknown	CBOs	Soc_A1
Poverty	The temporariness of the situation affects long-term strategies (e.g. operation of the shredder)	Unknown	Waste workers	Pov_N1
	Employment and livelihood of waste workers: • Funds obtained from the work in the dumpsite have enabled them to take care of their families and educate their children. • Losing the job is a main concern with reference to • current workers • elderly people, who risk being excluded • considering different roles of waste workers (selecting or sale of recyclables) • In the new facility, Nuru should be involved in the selection and sale of recyclables • Menace to both waste workers and PSPs coming from the high magnitude of the project (external influence)	Negative	All CBOs, Institutions, Waste workers, PSPs	Pov_N1
	Employment: • young people • local communities in Ngong and Kerarapon	Unknown	Institutions, all CBOs, PSPs	Pov_A1
	Reallocation of families living in the dumpsite	Negative	Institutions, CBOs	Pov_N2
Waste generation	With the plastic ban, garbage has decreased drastically!	Neutral -	Institutions, PSPs	WG_A1

Table 3 (continued)

Issue	Description	Interaction with the project / Expected impact	Raised by:	ID
Waste management (disposal, storage, reduction at source, recycling)	Different perceptions of waste in different ethnic groups (Luo, Somali, Kikuyo)	Unknown	CBO	WM_A1
	People don't cooperate on environmental issues	Negative - The project can be affected in a negative way by the lack of cooperation of users.	PSPs	WM_A2
	Challenges related to the management of household waste			
	“Garbage mafia” is apparently absent in Ngong	Positive	Waste workers	WM_N1
Institutions, rules and behaviour institutional analysis	Hospital waste reaching the dumpsite	Positive	PSPs	WM_N2
	Resources and roles	Scarce resources allocated for MSWM	Institutions	Inst_A1
	The project should generate revenues for the County government	Neutral – it is necessary to tackle the economic sustainability of the project.	Institutions	Inst_A1
Training and capacity building	Licenses for waste dealers and waste collectors are supposed to be released by the National Environment Management Authority (NEMA) and not by the County Government.	Unknown	Institutions	Inst_A2
	The following categories should be targeted: Waste workers • Young people and the local community	Neutral	All CBOs, Experts, PSPs, Institutions	Inst_A3
	Institutions: • requested capacity building • funds are needed	Neutral	Institutions	Inst_A4
Awareness	Lack of awareness: • people don't know how to handle waste (factories, hospitals, agriculture, households...) • improper language is used creating alarm (e.g. waste-to-energy and not landfill) • “the problem is where the waste comes from”	Neutral	Experts, CBOs, Institutions	Inst_A5
Participation	Lack of involvement of population and stakeholders	Negative	Institutions, CBOs, PSPs	Part_A1
Participation	High request for public participation			
Social risks	Lack of conservation plan for the area	Neutral	CBOs	Part_A2

Table 3 (continued)

Issue	Description	Interaction with the project / Expected impact	Raised by:	ID
Institutional risks	<p>Lack of communication:</p> <ul style="list-style-type: none"> • lack of information on the new location • lack of understanding due to lack of information • no visible results for investment in awareness <p>Lack of trust in institutions:</p> <ul style="list-style-type: none"> • doubts on the adequate capacity of management • required transparent accountancy of the subject that will manage the new IWTF • interest of the Government limited to the waste issue <p>Involvement of institution:</p> <ul style="list-style-type: none"> • requested involvement of local institutions (Environmental Committee, local chief and subchief) • role of the County Government to be clarified 	Negative -	CBOs, waste workers, Institutions, PSPs	SR_A1
Not In My Backyard	<p>Property value diminution</p> <p>Security (scavengers, thieves)</p> <p>Lawyers will be hired to stop the project</p>	Negative	CBOs	SR_K1
Forced resettlements and asset/land acquisition	<p>The location has already been chosen, no alternatives exist. No opinion on alternative proposals. [KC]</p> <p>The existence of alternatives (e.g. quarry) supported by the community</p> <p>Conflict on the land property with the Keekonyokie / Masai</p>	Negative	Institutions	SR_K2
Health issues				
Resident population	<p>Current situation in Ngong:</p> <ul style="list-style-type: none"> • Safety issue related to kids moving inside the dumpsite • Health hazards, respiratory diseases • Proximity of the dumpsite to living places • Public hygiene is threatened <p>Impact of the project in Kerarapon</p>	Positive – the closure of the dumpsite and changes in waste management will improve the situation.	Institutions, CBOs	HI_N1
Workers	Health issues affecting waste workers	Neutral	CBOs	HI_K1
		Neutral	Expert	HI_N2

Note The ID is composed as follows: identifier of the relevant aspect with reference to the general dimension (Env – environment; Soc – society; Pov – poverty; WM – waste management; Inst – institution; Part – participation; SR – social risks; HI – health issues); area of impact (N – Ngong; K – Kerarapon; A – all) and sequential number

different issues. The percentages were not referred to the whole sample because the purpose was to identify relevant issues, not depending on the dimension of the affected group. Qualitative impact was used to rate the expected impact of the project in terms of perception.

Other data about the views of residents at Kerarapon (RPK) on waste management (challenges and best ways to manage waste) were shared by TUK (2017) as average aggregated data, obtained through SPSS. In this case, the respondents were asked about their attitudes, measured on a Likert Scale of 1–5 (where 1 = Strongly Disagree, 2 = Disagree, 3 = Not sure,

Table 4 Target groups of the questionnaires

Target group	Methodology	Number of questionnaires
RPN – Resident population Ngong	Questionnaire	36 with interviewer
RPK – Resident population Kerarapon	Questionnaire	42 with interviewer
WW – Waste workers	Questionnaire	22 with interviewer
CQ – Combined Questionnaire	Questionnaire	22 with interviewer

4=Agree and 5=Strongly Agree). Results are shared in Table 6. As before, both a qualitative “Impact” factor and the ID for the connection to Table 3, were added.

Finally, other questions were not directly investigating the perception of the population about the project, but rather the existing situation and the current behaviour of people. These questions have been analysed through a statistical analysis of data to evaluate not only the perception but also the tangible impact. For example, people’s sensitivity to health risks related to improper waste management may be low, but if the incidence of waste-related diseases is high, this aspect should be considered as more relevant. Considering the small size of the sample and the little time available for the preparation of questionnaires, only a few aspects can be analysed with this approach. These aspects are presented as follows, with their associated ID and the expected impact:

- **Water sources:** People using local water sources (i.e. boreholes – 9% of respondents – but also public taps – 33% of respondents) are likely to be affected by their depletion. Further studies are necessary (*Env_K1, Unknown impact with High relevance*).
- **Affordability and willingness to pay:** 48% of the whole sample was already paying a fee, as well as 42% of people living in low-income areas. The new project is likely to lead to higher costs, which may be co-financed through fees (*Inst_A1, Neutral, with High relevance*), but the value of these fees should be set up in a proper way in order not to exclude vulnerable people from a proper waste collection (*Pov_A3, Negative, with Medium relevance*).
- **Waste disposal:** Most of the people disposed of waste in an improper way: open dumping (45% of CQ, 36% of RPK); roadside disposal (5% of CQ, 10% of RPK); backyard disposal (9% of CQ, 26% of RPK). The project may have a positive influence (*WM_A3, Positive, with Medium relevance*).
- **Communication:** The lack of communication was revealed by the question investigating awareness about the relocation plans of the dumpsite of Ngong (target: RPK) or the development of a new modern integrated waste management facility (IWMF) (target: RPK, WW). About 67% of interviewed people, on average, were not aware of one or both aspects of the project, so the relevance of lack of communication is considered High (*SR_A1, Negative, with High relevance*). NIMBY or local opposition to the project was investigated by asking RPK if they supported the new IWMF and RPN and WW if they supported the relocation plans of the dumpsite. The relevance of local opposition, if calculated based on the percentage of contrary respondents, should be estimated in both cases as “Low” (18–28%). Anyway, few people can do a relevant opposition to projects, so this issue should be considered as Medium (*SR_N1, Negative with a Medium; SR_K1, Negative with a Medium*). Bigger efforts in dealing with the opposition are suggested, understanding its main reasons.

Table 5 Perceived impacts of the dumpsite (percentage of positive – “Yes” - responses)

Presence of the dumpsite	CQ	RPN	WW	RPK	Impact	ID
<i>Negative impacts of the dumpsite</i>	(73% of respondents)	(25% of respondents)	(59% of respondents)	not asked		
Air pollution / pollution / toxic gases	18%	22%	0%		Very low	Env_N1
Aesthetic degradation		3%	41%		Low	Env_N1
Diseases			32%		Low	HI_N1
<i>Benefits of the dumpsite</i>	not asked	not asked	(100% of respondents)	not asked		
Business / scrap metal business / sale of pig food			27%		Low	Pov_N1
Casual job / informal employment / income			77%		High	Pov_N1
None			27%		Low	-
Institutional waste management issues	CQ	RPN	WW	RPK	Impact	ID
<i>Negative</i>	(86% of respondents)	not asked	not asked	not asked		
Failure of garbage collection, recovery and disposal systems	27%				Low	WM_A3
Lack of finance	41%				Medium	Inst_A1
Health hazards	41%				Medium	HI_A1
Transportation	23%				Low	WM_A3
Rainy season	27%				Low	WM_A3
Insecurity	27%				Low	SR_N1
Lack of cooperation / partnership / coordination	32%				Low	SR_A1
Lack of equipment	27%				Low	WM_A3
Fluctuation of prices	18%				Very low	SR_A2
Ineffective laws	9%				Very low	Inst_A2
Rapid urbanization	9%				Very low	WM_A4
#N/A	14%				N.D.	N.D.
Project (closure of the dumpsite)	CQ	RPN	WW	RPK		
<i>Negative</i>	(73% of respondents)	not asked	not asked	n.d.		
Disruption of social networks	5%				Low	Pov_N2
Influx of people in the area	5%				Low	SR_N1
Loss of dumpsite linked livelihood	64%				High	Pov_N1
<i>Positive</i>	(100% of respondents)	(89% of respondents)	not asked	n.d.		

Table 5 (continued)

Presence of the dumpsite	CQ	RPN	WW	RPK	Impact	ID
Reduced respiratory and waterborne diseases	73%			88%	Very high	HI_N1
Clean and healthy environment	73%	78%		90%	Very high	Env_N1
Reduced scavengers	59%	75%		67%	High	SR_N1
Reduced fire outbreak	41%	81%		64%	High	Env_N1
Reduced child labour	45%			60%	High	Pov_A2
Improved infrastructure				64%	High	WM_A3
Stoppage of cultivation of toxic loaded food crops				50%	<i>Medium</i>	Env_N1
Conducive learning environment	59%			67%	High	Inst_A3
None		6%			Very low	-
Project (opening of the facility)	CQ	RPN	WW	RPK		
<i>Negative</i>	<i>not asked</i>	<i>not asked</i>	<i>not asked</i>	<i>n.d.</i>		
Disruption of social networks				36%	Low	SR_K1
Atmospheric pollution by dust and smoke emissions				50%	<i>Medium</i>	Env_K1
Leachate discharge into the river				33%	Low	Env_K1
Exposure to toxic gases				40%	<i>Medium</i>	HI_K1
Influx of heavy trucks and machinery in the area				52%	<i>Medium</i>	Env_K1
Loss of vegetation and bird life				48%	<i>Medium</i>	Env_K1
Influx of people in the area				43%	<i>Medium</i>	SR_K1
<i>Positive</i>	<i>not asked</i>	<i>not asked</i>	<i>not asked</i>	<i>n.d.</i>		
Creation of dumpsite linked livelihood				66%	High	Pov_A1

- Health:** Health issues have been investigated only within the target group identified by CQ (22 interviews). The result is not statistically significant. An epidemiological analysis should be carried out. Anyway, it has to be highlighted that diseases likely related to the dumpsite are the most mentioned: diarrhoea (41%), cough (36%), malaria (27%), cholera and typhoid (23%), stomach pain, skin rashes, respiratory diseases (9%). A case of miscarriage (5%) was identified as well (*HI_N1, Negative with a High relevance*).

Table 6 Views of residents at Kerarapon (RPK) on waste management

Waste management challenges expected at Kerarapon	Mean	Impact	ID
Rapid urbanization	4.6	Very high	WM_A4
Limited human capacity and financial resources	4.2	Very high	Inst_A1; Inst_A4
Weak organizational structure	2.2	Low	SR_A1
Ineffective laws on waste management failure of garbage collection, transportation, recovery and disposal systems	3.6	High	Inst_A2
Lack of public awareness	4.5	Very high	Inst_A5
Lack of framework for public private partnership	3.2	Medium	SR_A1
Emergence of new streams of waste (E-waste, ELVs, sanitary waste)	3.7	High	WG_A1
Views on the best way to manage waste at Kerarapon	Mean	Impact	ID
Waste reduction at the sources	4.1	High	WG_A1
Waste recycling and compositing	4.2	High	WM_A3
Promotion of 3R's principles(reduce, re-use & recycle	4.6	Very high	WM_A3
Management of hazardous and special waste, medical waste, waste tyre and End of Life vehicles	4.1	High	WM_N2
Financing reforms	2.2	Low	Inst_A1
Capacity building	4.5	Very high	Inst_A3
Promotion of community involvement and participation	3.6	High	Part_A1
Planning for sustainable solid waste management system	3.6	High	Part_A2
Environmental planning	3.2	Medium	Part_A2
Institutional and organizational reforms	4.1	High	SR_A1
Resource mobilization through public private partnerships	4.3	High	SR_A1

4.3 Discussion and recommendations

The social impacts of a new waste management project, including the closure of an existing dumpsite, have been assessed by means of interviews, informal dialogues and questionnaires. Collected data have been analysed in order to highlight relevant aspects and to obtain a list of aspects which can be used to better understand the positive and negative impacts of the project.

Starting from the issues raised by stakeholders during the qualitative investigation, the main impacts have been identified; thus, each expected impact has been evaluated (positive, negative, neutral or unknown) by the authors, showing also its magnitude in terms of perception of the population (very high, high, medium, low, very low), as revealed by the quantitative investigation. Finally, the Social Assessment was the base for identifying actions for tackling, or at least mitigating, each impact properly; these actions are resumed as recommendations in Table 7.

Table 7 Social assessment, table of synthesis showing for each impact its magnitude in terms of perception and recommendations for its mitigation

ID	Definition	Impact on/of the project	Perception	Recommendation for the project
Physical impacts with social consequences				
Env_N1	Environmental situation around the dumpsite of Ngong	Positive – Long-term decrease of air and water pollution in the surroundings.	High	Monitoring – The real impact on this issue should be properly assessed.
Env_K1	Environmental situation in Kerarapon neighbourhood	Unknown – The opening of the new facility will partially solve the problem of improper disposal of waste around Kerarapon. Anyway, the depletion of water sources has been mentioned as a risk due to both construction works and mismanagement of the new facility.	High	Required – Proper management should be guaranteed in order to minimize possible negative environmental impacts. The depletion of water sources would affect severely the local population.
Social diversity and gender				
Pov_N1	Employment and livelihood of waste workers	Negative – High risk for vulnerable populations and elderly people.	High	Required – A Livelihood Restoration Plan (LRP) for dumpsite workers should be prepared to protect their livelihoods.
Pov_A1	Employment of the local community	Positive – The project is supposed to create employment opportunities.	High	Monitoring – The real impact on this issue should be properly assessed.
Pov_N2	Displacement of waste workers	Negative – Houses built inside the dumpsite of Ngong will be removed.	Low	Required – A Resettlement Plan for people living in the dumpsite is necessary.
Pov_A2	Reduction of child labour	Positive – The closure of the dumpsite is supposed to reduce child labour	High	Monitoring to assess the real impact on this issue. Required - Strategies for guaranteeing schooling for children should be part of the LRP.
Pov_A3	Willingness and affordability to pay	Neutral – The project may provoke an increasing of management costs.	Medium	Required – Affordability of fees should be assessed.
WG_A1	Generation of waste	Neutral – The project should be able to deal with variations in waste generation.	High	This aspect should be considered in the new strategy for SWM.
WM_A2	Lack of cooperation of user	Negative – Lack of cooperation can affect negatively the project.	Medium	This aspect should be considered in the new strategy for SWM.
WM_A3	Existence of infrastructures suitable for a proper waste management	Positive – The new project may lead to an improvement in SWM infrastructures.	Medium	This aspect should be considered in the new strategy for SWM.
WM_A4	Rapid urbanization	Negative – Rapid urbanization is supposed to affect negatively SWM	Medium	This aspect should be considered in the new strategy for SWM.

Table 7 (continued)

ID	Definition	Impact on/of the project	Perception	Recommendation for the project
WM_N2	Improper management of hazardous and special waste	Positive – The project could lead to a better management of hazardous and special waste	High	This aspect should be considered in the new strategy for SWM.
Institutions, rules and behaviour institutional analysis				
Inst_A1	Economic sustainability and availability of resources	Neutral – The project may provoke an increasing of management costs.	High	Required – Affordability of the system should be properly assessed.
Inst_A2	Ineffective laws	Negative – Ineffective laws may be affect in a negative way the project.	Medium	This aspect should be considered in the new strategy for SWM.
Inst_A3	Capacity building for people and workers	Neutral – The project may create an opportunity for the formation and training of people and workers.	High	Required – Capacity building within people and waste workers is required.
Inst_A4	Capacity building for institution	Negative – Lack of knowledge within institutions would affect negatively the project.	Very high	Required – Capacity building within institutions is highly required to guarantee a proper management of the system.
Inst_A5	Lack of awareness	Negative	Very high	Required – Awareness campaign.
Participation				
Part_A1	Lack of the involvement of population	Negative – It may enhance local opposition.	High	Required – Promotion of community involvement and participation.
Part_A2	Lack of the planning	Negative – It may affect the effectiveness of the project.	High	Required – Proper urban and environment planning
Social risks				
SR_A1	Lack of trust in institution and lack of communication	Negative – It may generate a local opposition within the population.	High	Required – A proper communication strategie is required to raise the level of trust in institutions
SR_A2	Changes in external markets	Negative – They may affect the economic sustainability of the system	Very low	Monitoring -
SR_N1	Local opposition in Ngong	Negative – Local opposition of people depending on the dumpsite may raise.	Medium	Required – Promotion of the participation of waste workers
SR_K1	Local opposition in Kerarapon	Negative – The opening of the new facility may raise local opposition.	Medium	Required – Promotion of participation within the resident population in Kerarapon
SR_K2	Conflict on land property	Negative – Local opposition to the decision due to the lack of involvement of the population.	Medium	Required – Promotion of participation within the resident population in Kerarapon.
SR_K3	Loss of grazing ground for cattle	Negative - The new site will raise in an area currently used as a grazing ground for cattle.	Low	Required - An alternative should be provided, in order not to raise conflicts.

Table 7 (continued)

ID	Definition	Impact on/of the project	Perception	Recommendation for the project
SR_N2	Displacement of grazing ground	Negative - Temporary loss of land available for grazing pigs and cattle.	Low	Required - Requalification of the area will admit a safer carrying out of those activities. Access to the area should be guaranteed in order to ensure livelihood based on these activities.
Health issues				
HI_N1	Exposure of RPN to health risk	Positive – The closure of the dumpsite will lead to improved health conditions in Ngong.	Very High	Monitoring – The real impact on this issue should be properly assessed.
HI_A1	Health hazard due to improper SWM	Positive – The project could lead to a better SWM as a consequence.	Medium	This aspect should be considered in the new strategy for SWM.
HI_K1	Exposure of RPK to health risk	Negative – The construction of the new facility could have a negative impact on the health of the resident population in Kerarapon.	Medium	Required – Proper management should be guaranteed in order to minimize negative health impacts.
HI_N2	Exposure of dumpsite workers to health risk	Neutral – The new project may affect positively the health conditions of waste workers.	Very low	This aspect should be considered in the new strategy for SWM.

The impacts listed in Table 7 have been grouped in thematic strategic lines, since many of them cannot be treated as separated from the others, and an integrated approach is suggested to deal with them. Thematic strategic lines are discussed as follows, mentioning both recommendations and the potential for further investigations.

4.3.1 Environmental, health-related and security issues (Env_N1, Env_K1, HI_N1, HI_K1)

Which are supposed to be positive for the area surrounding the dumpsite of Ngong. On the other side, these impacts may affect in a negative way the area of Kerarapon, where the new facility is going to be established. All interventions within the project have been designed to be environmentally sound and healthy. Anyway, their impacts strongly depend on the capacity of the institutions to manage properly the whole system and the proposed plants.

4.3.2 Labour and vulnerability of waste workers (Pov_N1, Pov_A1, Pov_N2, Pov_A2, Inst_A3)

The management of waste in Ngong involves more than thirty Private Service Providers, while about 200 waste workers or associates depend on the selection and purchase of recyclables in the dumpsite. This equilibrium is based mainly on self-organization and on the private market and not, or just a little, on public funds. Any change in MSWM, even the introduction of waste separation at the source without a thoughtful set of rules, may affect

the livelihood of people currently involved in waste management (Dias, 2016; Marelllo & Helwege, 2014; Bernstein, 2004). Finally, even if a small portion of the population seems to be negatively affected in this sense, the sensibility towards this issue is widely spread among all actors. The following issues should be further explored: the current conditions of informal workers (including health and living conditions) (Musasia, 2022); the existence of integration strategies for their involvement in the system and the need for changes in the municipal legislation; the possible initiatives for development/strengthening their organization and capacity building programs; the existence of child labour and possible actions to stimulate the education of children.

4.3.3 Trust in institutions, community participation and local opposition

A big challenge resulting from the social analysis is the relationship between institutions and local communities:

- The lack of trust in institutions is widely spread among stakeholders, and many communication gaps are evident from questionnaires (SR_A1). The reason for the lack of trust is not clear (e.g. it may arise from political reasons, or it is mainly connected with the previous County Government) but it should be targeted as it may affect the functioning of the whole SWM system. Moreover, it should be considered that the society of Ngong is apparently characterized by strong relationships between stakeholders, so the increased trust may generate a positive chain effect.
- Capacity building within institutions (officers and technical staff of the CG) is considered very important for the improvement of the SWM system by several stakeholders (Inst_A4). Apparently, there is a good attitude towards training.
- Public participation has been required by several stakeholders and within questionnaires (Part_A1, Part_A2). Promoting public participation may raise trust in institutions. Population and local chiefs in the area of the new plant, and key stakeholders of the SWM system in general, should be involved. The implementation of a multi-stakeholder platform including as well waste workers is highly recommended.
- Several conflicts may arise within the project (SR_N1, SR_K1, SR_K2, SR_K3, SR_N2). The siting of the new facility in the area known as Vet Farm is the most evident conflict, with several reasons mentioned by stakeholders: the possible depletion of water springs in the area; the potential contamination of Kibiko forest; NIMBY syndrome as property values for Kerarapon land are likely to be affected; conflicts on the land property and land use, as the area may be subjected as well to phenomena of land grabbing; other interests on Vet Farm, as the area is considered interesting for urban expansion. A trustful relationship between institutions and local communities is a prerequisite for dealing successfully with this issue. In fact, reasons for local opposition are overlapped, and there are many concurrent interests.

4.3.4 Awareness

The interviews demonstrate a frequent misunderstanding between the concepts of participation and awareness. Concerns about pollution are rather symptomatic of awareness and not of “lack of awareness”. A correct description of both the new concept of waste manage-

ment and the new facility should have been done following the trail of public participation, including the actors already targeted within the Inception Workshop organised at the beginning of the project, and the population as well. Awareness of correct waste management should be raised as well (Inst_A5).

4.3.5 New strategies for SWM

The SA highlighted many aspects which are likely to influence the effectiveness of the SWM system in Ngong (WG_A1, WM_A2, WM_A3, WM_N2, HI_A1): waste reduction, recycling, composting, promotion of 3R's principles are recognized as important by interviewed people. With reference to the management of the new facility, it should be discussed with Nuru and PSPs.

Insights on these issues are described in Bernstein (2004); an updated discussion on all these topics is provided within the report of UNEP & ISWA (2024), which mentions scarce understanding of the magnitude of the waste issue, lack of inclusion, inadequacy of the legislation, and other aspects as relevant barriers to an overall improvement of the waste management.

The process of the closure of the dumpsite has proceeded, and the works were completed in 2023. It is worth noting that the most relevant impacts and expected conflicts raised within the Social Assessment finally exploded: the residents in Kerarapon continued their opposition to the relocation at the Vet Farm area (KBC Channel, 2021), preventing its realization until now; many families living at the dumpsite were displaced. According to interviews given by the former waste pickers to a local television channel, with the closure of the dumpsite they have lost any opportunity for income, they are facing severe issues in terms of basic livelihood, and no compensation or alternatives have come yet from the institutions. Job opportunities should be provided, in order to prevent youth from engaging in criminal activities (Elveza Media, 2022).

4.4 Limitations of the research

The SA was affected by some difficulties in the organization, mainly in the design of the questionnaire and its administration.

For what regards the quantitative investigation, some questions were changed or removed during the administration of questionnaires by the local team, without a proper explanation; moreover, the sample was not designed in order to be statistically significant. In the qualitative investigation, other stakeholders should have been involved in the SA, to allow for a deeper Stakeholder Analysis. These difficulties were probably consequences of the short time available for the whole study.

Another criticality was related to the project team, which was composed mainly of technicians and engineers, without experts in anthropology, sociology, economics, etc. during the field analysis (as suggested by Bernstein, 2004).

5 Conclusions

The Social Assessment was conducted within the “Comprehensive feasibility study for the closure of the informal dumpsite and construction of an integrated sustainable waste management facility in Ngong Town, Kenya” promoted by UNHabitat and funded by AICS. Qualitative and quantitative methods have been applied, and primary data collection has been carried out on the field at the beginning of 2018.

The Social Assessment led to the identification of the positive and negative impacts perceived by different stakeholders. These impacts were grouped in strategic lines, addressing the following aspects: environmental, health-related and security issues; labour and vulnerability of waste workers; trust in institutions, community participation and local opposition; awareness, and new strategies for SWM. For all these aspects, causal nexus has been explored, and recommendations provided.

The most evident result of the Social Assessment is that an integrated approach is highly recommended to deal properly with the social impacts raised by the project (Bernstein, 2004). In fact, an intervention on the MSWM system of this scale will have diverse impacts (UNEP & ISWA, 2024); some issues can be approached simultaneously, while others (e.g. the lack of trust in institutions) are not directly related to waste management but can be influenced through the introduction of good practices.

The evolution of the situation, that led to the closure of the dumpsite, improving the situation of the slum of Mathare at least in terms of air pollution and landscape, at the same time raising forecasted conflicts, highlighted the need for mitigation countermeasures (e.g. the integration of waste workers, which were involved in the recent dispute with the County Government). Besides including a social analysis in the feasibility studies, funds should be allocated to study and implement comprehensive social management. It is important to note that international organizations promoting and funding the closure of the dumpsite are co-responsible for the success or failure of tackling livelihood protection. Thus, it is advisable from their side to oversee the process to ensure workers’ concerns are addressed (Dias, 2018).

The SA had some limitations, as explained previously, mainly due to the scarcity of time and social science expertise within the team. Nonetheless, the information provided by this study succeeds in showing the complexity underlying this type of project, and it can be used by both practitioners and decision-makers facing a similar case, or waste-related interventions, to successfully target important issues.

Acknowledgements The authors want to acknowledge the collaboration of their colleagues at the Politecnico di Milano, especially Dr. Claudio Del Pero and Dr. Paola Caputo, Purity Sheneda for her assistance in the field work, and the County Government of Kajiado and the UNHabitat Urban Basic Services Branch of Nairobi for its involvement.

Author contributions Francesca Villa and Mario Grosso contributed to the study conception and design. Material preparation was performed by Francesca Villa and Jane Bosibori Oteki Masese. Qualitative investigation and data collection was performed by Francesca Villa, while questionnaires were administered by Jane Bosibori Oteki Masese, Lewis Sitoki and Duncan Miheso. Data analysis and discussion were performed by Francesca Villa under the supervision of Sonia Maria Dias. The first draft of the manuscript was written by Francesca Villa and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding Open access funding provided by Politecnico di Milano within the CRUI-CARE Agreement.

This study was funded by UNHabitat within the “Comprehensive feasibility study for the closure of the informal dumpsite and construction of an integrated sustainable waste management facility in Ngong Town, Kenya”.

Declarations

Competing interests The authors have no relevant financial or non-financial interests to disclose.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article’s Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article’s Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

- Bernstein, J. (2004). *Social assessment and public participation in municipal solid waste management – Toolkit*, World Bank.
- Bokhoree, C., Beeharry, Y., Makoondlall-Chadee, T., Doobah, T., & Soomary, N. (2014). Assessment of environmental and health risks associated with the management of medical waste in mauritius. *APCBEE Procedia*, 9, 36–41. <https://doi.org/10.1016/j.apcbee.2014.01.007>
- Budlender, D. (2009). *How to analyse government budgets from an informal economy perspective*. WIEGO Technical Brief n.1. <https://www.wiego.org/wp-content/uploads/2019/09/Budlender-Analyse-Governm ent-Budgets-Informal-Economy-WIEGO-TB1.pdf>
- Clean, U. K. (2021, April 30). *Ngong municipality faces waste management crisis as Governor closes dumpsite*. Retrieved February 7, 2022, from <https://cleanupkenya.org/ngong-municipality-faces-waste-management-crisis-as-governor-closes-dumpsite/>
- Coffrey, M., & Coad, A. (2010). *UNHabitat Solid Waste Management in the World’s Cities*, UN-Habitat.
- Danthorebandara, M., Van Passel, S., Nelen, D., Tielemans, Y., & Van Acker, K. (2012). *Environmental and socio-economic impacts of landfills*. Linnaeus University.
- De, S., & Debnath, B. (2016). Prevalence of health hazards associated with solid waste disposal - A case study of Kolkata, India. *Procedia Environmental Sciences*, 35, 201–208. <https://doi.org/10.1016/j.proenv.2016.07.081>
- Del Pero, C., Aste, N., Caputo, P., Villa, F., & Grosso, M. (2020). Comprehensive feasibility study for the construction of an integrated sustainable waste management facility in Kajiado County, Kenya. In N. Aste, S. Della Torre, C. Talamo, R. Adhikari, & C. Rossi (Eds.), *Innovative models for Sustainable Development in Emerging African Countries. Research for Development*. Springer. https://doi.org/10.1007/978-3-030-33323-2_8
- Dias, S. (2011). Integrating informal workers into selective waste collection: The case of Belo Horizonte, Brazil. *WIEGO Policy Brief (Urban Policies)*, 4.
- Dias, S. (2016). Waste pickers and cities. *Environment & Urbanization*. Vol 28(2): 375–390. International Institute for Environment and Development (IIED). <https://doi.org/10.1177/0956247816657302>
- Dias, S. (2018). WIEGO’s Position on Dump Closures. Position paper, June 2018. https://www.wiego.org/sites/default/files/resources/files/WIEGO%20POLICY%20STANCE%201_DUMP%20CLOSURES.pdf
- Domingo, J. L., & Nadal, M. (2009). Domestic waste composting facilities: A review of human health risks. *Environment International* 35 (2009) 382–389. <https://doi.org/10.1016/j.envint.2008.07.004>
- Domini, M., Gibellini, S., Villa, F., Vidoni, A., DiFrancesco, L., Sorlini, S., & Vaccari, M. (2017). The challenge of sharing data in cooperation projects: cause for reflection, *Proceedings of V Congresso Coordinamento Universitario Cooperazione allo Sviluppo (CUCS)*, Milano.
- Elveza Media (2022, May 28). Former Ngong Dumpsite workers seek compensation. Retrieved March 1, 2024, from <https://www.youtube.com/watch?v=Nh8QX8M2RL8>
- GA Environment (Pty) Ltd (2015). *Impact assessment for the decommissioning of the Middlepos landfill (closure and post closure phases)*, Appendix G2.

- Githaiga, P. (2022, June 26). *Old vs new: Ngong residents celebrate relocation of dumpsite*. The Standard News. Retrieved February 7, 2022, from <https://www.standardmedia.co.ke/entertainment/news/article/2001448760/old-vs-new-ngong-residents-celebrate-relocation-of-dumpsite>
- Giusti, L. (2009). A review of waste management practices and their impact on human health. *Waste Management*, 29, 2227–2239. <https://doi.org/10.1016/j.wasman.2009.03.028>
- Google Earth Pro (2024a). 7.3.6.9750 (64-bit). 2017/12/27. Ngong (1°21'43.16S; 36°39'30.25E).
- Google Earth Pro (2024b). 7.3.6.9750 (64-bit). 2021/08/03. Ngong (1°21'43.16S; 36°39'30.25E).
- Gorgos, D. (2009). *Social Impact and Input in Waste Management*, ISWA.
- Houe, N. E., Vishwakarma, A., Kunte, A., Mishra, D., Panchal, S., & Kundu, S. (2014). *Dhapa Dumpsite Environmental and Social Assessment Report - Draft Final Report*. COWI, West Bengal Pollution Control Board.
- ISWA. (2016). *A Roadmap for closing Waste dumpsites - the World's most polluted places* (pp. 2015–2016). International Solid Waste Association Scientific and Technical Committee Work-Program.
- ISWA (2017). Special Report for #closedumpsites: Kenya's Dandora Dumpsite – a Health and Environmental Tragedy. ISWA News. <https://www.iswa.org/blog/special-report-for-closedumpsites-kenya-s-dandora-dumpsite-a-health-and-environmental-tragedy/?v=cd32106bcb6d>
- Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series*. World Bank. <https://doi.org/10.1596/978-1-4648-1329-0>. License: Creative Commons Attribution CC BY 3.0 IGO.
- KBC Channel (2021, 31 May). Closure of main Ngong dumping site leaves the satellite town in a mess. Retrieved March 1, 2024, from <https://www.youtube.com/watch?v=r8-hwyMJmuA>
- KNBS. (2015). *County Statistical Abstract - Kajiado County*. Kenya National Bureau of Statistics and the County Government of Kajiado.
- Marello, M., & Helwege, A. (2014). Solid waste management and social inclusion of waste pickers: opportunities and challenges. Global Economic Governance Initiative (GEGI) Working Paper n.7. Boston University. Center for Finance, Law & Policy.
- Musa, C. (2022, June 1). *Ngong dumpsite converted into recreational facility*. K24TV. Retrieved February 7, 2022, from <https://www.k24tv.co.ke/news/ngong-dumpsite-recreational-facility-65116/>
- Musasia, B. S. (2022, November 24). *Garbage collectors who are treated like trash*. Retrieved March 1, 2024, from <https://ke.boell.org/en/2022/11/24/garbage-collectors-who-are-treated-trash>
- NEMA. (2014). *National Solid Waste Management Strategy*. National Environment Management Authority, Kenya (NEMA).
- Nghoto, S. (2023, December 11). Ngong town gets new green space as landfill is turned into lush fields. Retrieved March 1, 2024, from <https://nation.africa/kenya/counties/kajiado/ngong-town-gets-new-green-space-as-landfill-is-turned-into-lush-fields--446808>
- Njagi, J. M., Ileri, A. M., Njagi, E. N. M., Akunga, D., Afullo, A. T. O., Ngugi, M. P., Mwanzo, I., & Karugu, N. I. (2013). Assessment of knowledge, attitude and perceptions of village residents on the health risks posed by Kadhodeki Dumpsite in Nairobi, Kenya. *World Environment*, 3(5), 155–160. <https://doi.org/10.5923/j.env.20130305.02>
- Obadina, A. (2016). *Solid waste management livelihood on Lagos dumpsite: Analysis of gender and social difference*. Loughborough University.
- OpenStreetMap (2024). <https://www.openstreetmap.org/copyright/en>
- Patwary, M. A., O'Hare, W. T., & Sarker, M. H. (2011). Assessment of occupational and environmental safety associated with medical waste disposal in developing countries: A qualitative approach. *Safety Science*, 49, 1200–1207. <https://doi.org/10.1016/j.ssci.2011.04.001>
- Poulsen, O. M., Breum, N. O., Ebbehoj, N., Hansen, Å. M., Ivens, U. I., van Lelieveld, D., Malmros, P., Matthiassen, L., Nielsen, B. H., & Nielsen, E. M. (1995). Sorting and recycling of domestic waste. Review of occupational health problems and their possible causes. *The Science of the Total Environment*, 168, 33–56.
- Sankoh, F. P., Yan, X., & Tran, Q. (2013). Environmental and Health Impact of Solid Waste Disposal in developing cities: A case study of Granville Brook Dumpsite, Freetown, Sierra Leone. *Journal of Environmental Protection*, 04, 665–670. <https://doi.org/10.4236/jep.2013.47076>
- Schöpfel, J., & Farace, D. J. (2010). Grey literature. 2029–2039.
- Snel, M., & Ali, M. (1999). *Stakeholder analysis in local solid waste management schemes. WELL Study* (Vol. 69). WEDC, Loughborough University. <https://www.ircwash.org/resources/stakeholder-analysis-local-solid-waste-management-schemes>
- TUK. (2017). *Baseline survey on the current status of solid waste management in Ngong town*. Kajiado County; Current waste composition.
- UNEP & ISWA (2024). *Global Waste Management Outlook 2024 - Beyond an age of waste: Turning Rubbish into a Resource*. United Nations Environment Programme, & International Solid Waste Association. <https://wedocs.unep.org/20.500.11822/44939>.

- UNHabitat (2017). *Comprehensive feasibility study for the closure of the informal dumpsite and construction of an integrated sustainable waste management facility in Ngong Town, Kenya*. Call for Expression of Interest.
- Wilson, D. C., Velis, C. A., & Rodic, L. (2013). Integrated sustainable waste management in developing countries. *Proceedings of the Institution of Civil Engineers - Waste and Resource Management* 2013 166:2, 52–68 <https://doi.org/10.1680/warm.12.00005>
- WRA - Water Resources Authority (2016). *The Water Act*.
- Zurbrügg, C., Caniato, M., & Vaccari, M. (2014). How assessment methods can support solid waste management in developing countries—A Critical Review. *Sustainability* 2014, 6, 545–570; <https://doi.org/10.3390/su6020545>

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.