Innovation Opportunities in Solid Waste Disposal in Humanitarian Settings:

An exploration of problems to identify innovation opportunities in Uganda and Somalia

A report produced for Elrha by
UrbanEmerge, FLUSH and Science Practice

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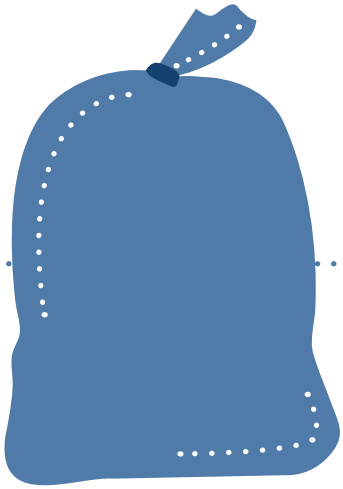
Acronyms

DRC	Democratic Republic of the Congo
FGD	Focus group discussion
HIF	Humanitarian Innovation Fund
IDP	Internally displaced person
KII	Key informant interview
NGO	Non-governmental organisation
SWM	Solid waste management
UNCHR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
VHT	Village health team
WASH	Water, sanitation and hygiene



Glossary

Gap
A broad topic that includes a range of more specific, diverse and often interconnected problems.

Humanitarian setting
Refers to different phases of humanitarian response (eg, rapid response, protracted emergencies, acute emergencies), site (eg, camp, urban), geography, environmental conditions, type of humanitarian crisis (including natural hazard-related disasters, conflicts or complex emergencies, either at regional, national or subnational levels, within lower- or middle-income countries). Also considers the social norms, religion, demographics and political situation in that setting.

(Humanitarian) innovation
An iterative process that identifies, adjusts and diffuses ideas for improving humanitarian response. An intervention is considered innovative if it is a new intervention that improves current practice (invention); or an intervention that introduces new elements that improve an existing intervention (adaptation).

Methodology
Guidance and tools to carry out research and develop a problem exploration report.

Opportunity for innovation
Where the development of new solutions or significant adaptations to existing solutions can help address the causes of an identified problem in a humanitarian setting.

Problem exploration report
A report that provides an overview of specific problems in a selected gap, and identifies their root causes, existing solutions and opportunities for innovation based on gap data and other resources.

Source Separation
Waste is separated at the source of generation – typically by the households or users of the product that discard it. Separating waste can include separation for disposal, recycling, and composting.

Solid waste management
The collection, transportation, and disposal of household trash, emergency waste (such as from hygiene kits), healthcare waste, environmental waste (such as fallen trees), and human faeces disposed of in the garbage.

Acknowledgments

This report was written by a team from UrbanEmerge, FLUSH and Science Practice. The writing team includes Kimberly Worsham (FLUSH), Andrea Wong (Science Practice), Naji Makarem (UrbanEmerge), Mansoor Ali (UrbanEmerge) and Lamax Ogwal (UrbanEmerge).

The authors would like to thank Felix Ebyachu for collecting information from the Rwamwanja Refugee Settlement, Uganda, context for us and without whom this report would not have been possible. We would also like to thank the consulting enumerators, Mohamud Hussein and Mohamed Abdikadir, who led data collection among community members in Doolow IDP Camps, Somalia.

The authors would also like to thank Ana Florescu (Science Practice) and Emily Gulliksen (Science Practice) for their invaluable support in the study. In addition, we are grateful for the support of an expert panel, which validated the findings and provided a peer review of our report. This included Azhar Ali, Dr Shafi ul Azam Ahmed, Andreas Beavor, Dr Veronica di Bella, Harrison Kwach, Brian Reed, Dr Terry Tudor, Stuart Vallis, Giovanni Vinti, Rolando Wallusche and Laurence West. Finally, we would like to thank Elrha's WASH Technical Working Group, which guided the initial design of our work.

The authors would also like to thank those that participated in the focus group discussions for their time and contributions.

Produced with support from the Swiss Agency for Development and Cooperation (SDC), the UK Foreign Commonwealth and Development Office (FCDO) and the Netherlands Ministry of Foreign Affairs (MFA).

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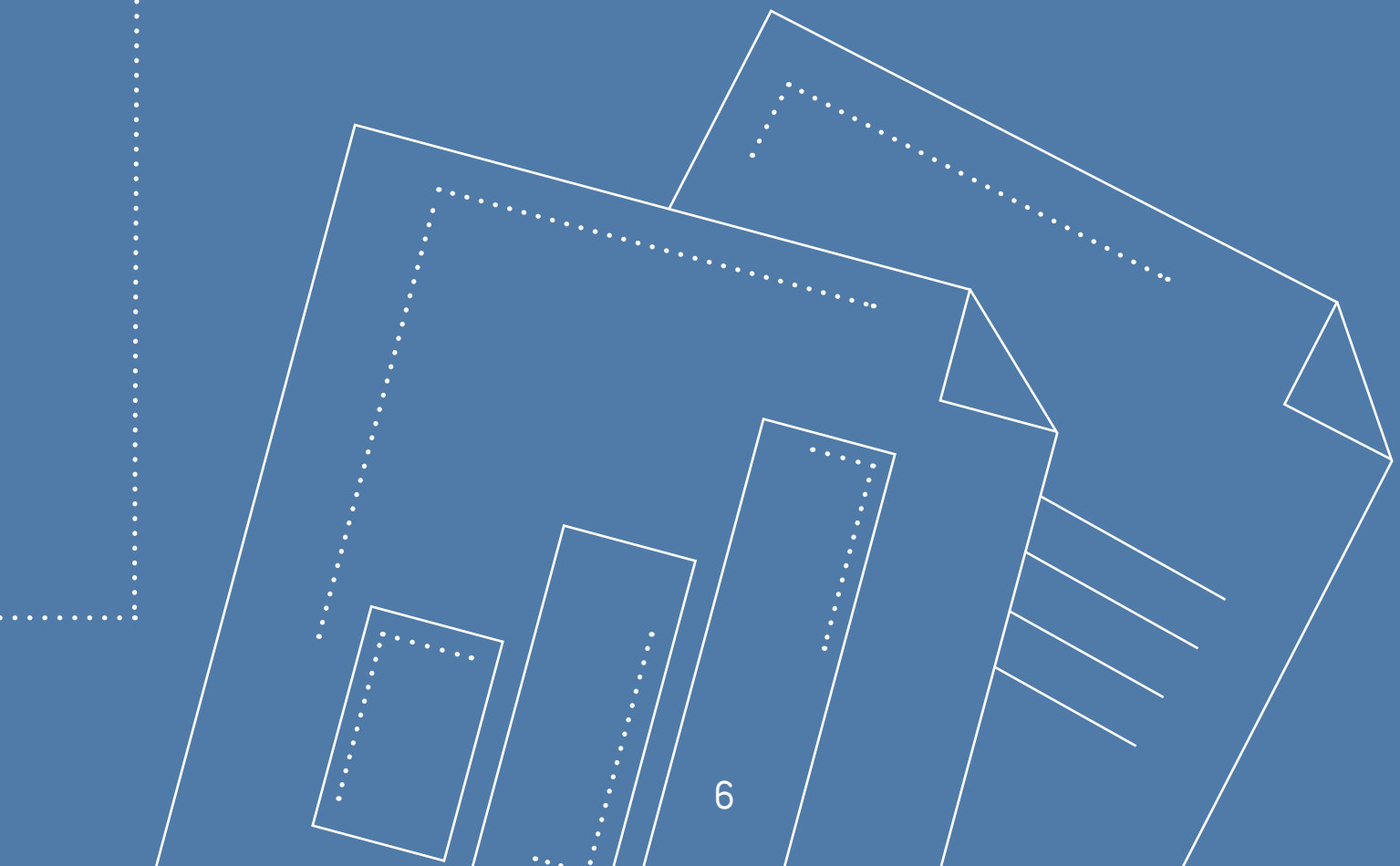
Executive Summary: Problem exploration

The research highlighted several priority problems with solid waste disposal which revealed opportunities for innovation in each of the research contexts.

Please note, these problems are not listed in priority order and there is significant overlap in the problems highlighted across the two settings. See section 4 for more detail.



Rwamwanja Refugee Settlement,
Uganda

Causes	Problem	Impacts
More pressing life-saving needs prioritised; transitory culture complicates active participation	Low priority fosters lack of waste disposal responsibility	Inadequate solid waste disposal options
Lack of designated disposal sites	Insufficient disposal options cause waste to build up in the environment	Waste accumulates in homes and public spaces, clogging drains
Distant dumping areas; lack of budget for newer sites	Poor logistics and inaccessible landfill sites exacerbate informal dumping	Air- and water-borne contamination spread diseases
Humanitarian response kits in disposable packaging	Excessive plastics and packaging without recycling options exacerbates waste volumes in the community	Excessive waste entering the settlement
Limited technical solid waste management knowledge; no humanitarian partners involved	Low financial and personnel resources mean ineffective solid waste management systems	Rotting waste piles complicate collection and disposal

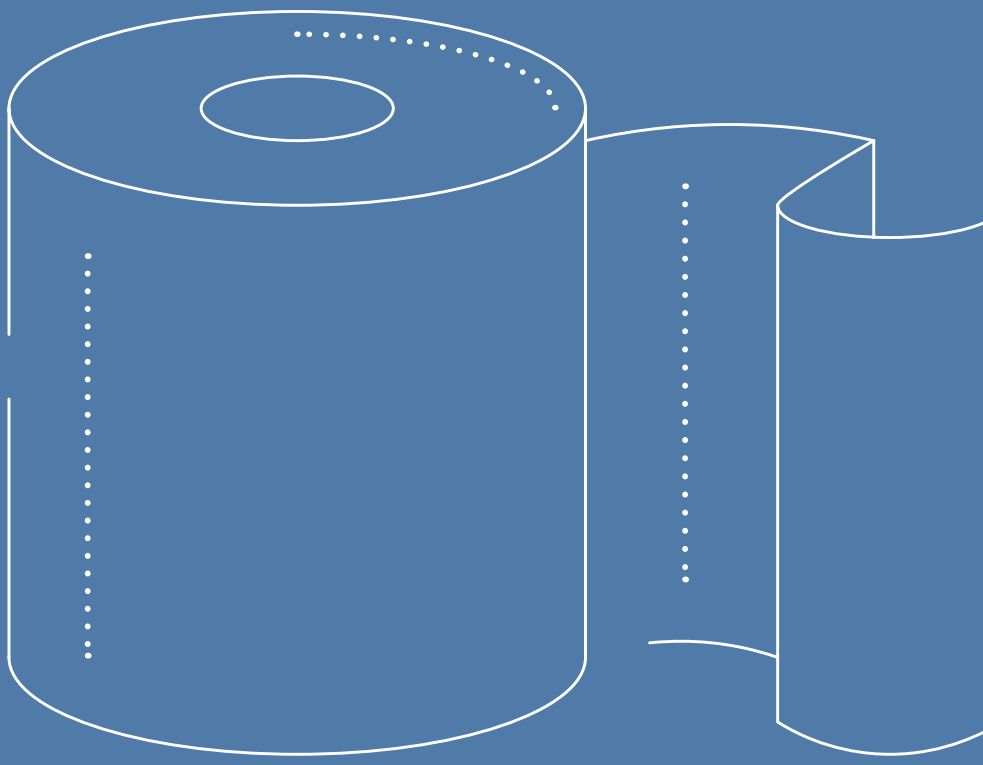
Doolow IDP Camps, Somalia

Causes	Problem	Impacts
No functional solid waste management (SWM) system in place	Lack of coordination and prioritisation to strengthen solid waste management	Solid waste remained an unallocated responsibility
No designated waste disposal sites	Indiscriminate dumping leads to waste building up in the camps	Sick animals; clogging of toilet pits
Open dumping and burning of solid waste	Environmental contamination and health and safety hazards	Exposure to dangerous materials and disease; contamination of drinking water and air
Unclear governance structures for SWM	Lack of legal frameworks, funding and the municipal government's technical capacity	No SWM planning or enforcement
Humanitarian sector complexities	The large share of solid waste the humanitarian sector generates	Increased waste generation

Executive Summary: Opportunities for Innovation

Each opportunity was proposed based on research insights into problems and barriers to solving these. We also developed specific examples for how innovators or innovation funders could leverage on each opportunity.

(For detail on each opportunity, see section 6).



Opportunities for Innovation

Opportunity 1: Build a zero-waste vision for humanitarian settings

- Design and launch an inclusive, systemic zero-waste campaign to communicate, conceptualise and develop an awareness of waste-free principles and practices, engaging and convening a range of solid waste stakeholders in ways that people recognise and understand.
- Understand, monitor and communicate data on waste inflows and outflows in camp settings to empower a range of public and private sector actors in different system positions to use this information as a basis for adaptive innovation as waste stream composition and SWM dynamics change throughout an emergency response.

Opportunity 2: Safe and accessible disposal sites

- Develop safe, accessible final disposal sites in the vicinity of humanitarian settlements, accounting for location-specific constraints and being sensitive to host community needs.
- Propose and trial new methods to address disposal site risks, including ways to support identify, analyse and accept risks associated with site selection, construction, maintenance, management, control, monitoring and use.
- Identify and adopt successful SWM approaches from medical waste management, especially for identifying, segregating and safely disposing of hazardous waste.

Opportunity 3: Sustainable collaboration models for humanitarian agencies and local authorities

- Identify and codify working models for humanitarian agency-local authority collaboration, particularly around SWM.
- Reimagine localised governance frameworks for collaboration around SWM.
- Design and trial tools for mutual accountability and trust that help support more effective leadership, clearer division of roles, more transparent decision-making, and better communication between collaborators on both sides of this relationship.

Opportunity 4: Support potential entrepreneurs to turn waste into a resource

- Develop procurement systems for contracting and supporting development of local, grassroots waste entrepreneurs.
- Create resilient, localised waste-to-resource business models that support the development of local circular economies and are not dependent on access to global markets and provide livelihood opportunities.
- Support safer access to waste to enable local small-scale enterprises in humanitarian camps and settlements to enter the waste-based economy, while managing health and safety risks.

Opportunity 5: Identify and reduce high-impact waste sources

- Develop context-adaptive protocols for waste stream analysis and waste vulnerability assessment.
- Signpost high-impact and/or high-volume waste sources to open up these targets for more focused innovation in the product, material, packaging and logistics spaces.
- Once these are known, create affordable low- or no-waste alternatives to high-volume and/or high-impact waste sources.

1. Introduction

1.1 Goal of research

Elrha commissioned **UrbanEmerge** and partner consultancies **FLUSH** and **Science Practice** to develop a methodology for researching the gaps (or problems) highlighted by the 2021 WASH Gap Analysis for innovation opportunities and to pilot this methodology to develop an innovation opportunities report. UrbanEmerge researched two humanitarian contexts in Uganda and Somalia, focusing on solid waste management (SWM). This problem exploration report is a product of the research carried out.

It is guided by the methodology and intended to open a thought-provoking space for creative thinking and innovation to solve the critical issue of solid waste in similar situations. This report provides a deeper understanding of SWM by examining two settings for opportunities for innovation. The research was conducted in Rwamwanja Refugee Settlement, Uganda, and Doolow Internally Displaced Person (IDP) Camps, Somalia. A detailed methodology can be found in Annexe 1.

Our research approach followed the story of plastic in the settlements to identify intervention opportunities to overcome bottlenecks in the flow of solid waste into and out of the settlements.

It also revealed the need for devising new ways of thinking about solid waste and innovative approaches to SWM in the two settlements through a vision of a zero-waste settlement as a galvanising force for all stakeholders.

1.2 Overview of the research methods

In the first phase of this research project, UrbanEmerge, FLUSH and Science Practice produced the Exploring Problems to Find Innovation Opportunities Methodology. This report details the findings from testing the methodology in practice for the first time. The methodology identifies potential opportunities for innovation by exploring specific problems that contribute to established gaps in humanitarian response. The methodology was developed to support funders of humanitarian innovation and innovators to gather insights after the first six months of an emergency response, beginning in the late response or stabilisation phase. This is when the need to provide life-saving assistance is not as pressing, and engaging people affected by crises and field practitioners in conversation about longer-term perspectives is more feasible.

The six steps in the methodology are as follows:

1) Select a gap and map known problems within it.
2) Check problem map against existing resources (through desk research that deepens understanding of the problem and observations).
3) Explore problems locally, particularly priorities, causes and known solutions, with small group discussions on the ground.
4) Scope existing and emerging solutions, through desk research and interviews to help generate innovation opportunities.
5) Organise and synthesise insights.
6) Validate and build on report findings.

The methodology was piloted over a three-month period and included five focus group discussions (FGDs) with people affected by crises and eight key informant interviews (KIIs) with government and humanitarian actors. For more details on how the methodology was implemented, see Annexe 1. This report included light touch engagement with people affected by crisis. Any innovation project building on these findings would need to engage more deeply with those affected communities.

In recognising that such projects will always have limitations, we outline some challenges we encountered:

- The project also focused on developing the innovation opportunities methodology, so time was prioritised for its development.
- There were logistical and security challenges in the two humanitarian contexts that limited how long enumerators could spend collecting data.
- Instability in the two humanitarian contexts meant that there were fewer available stakeholders to interview and discuss SWM with at the time.

2. Regional background

Key organisations, such as the United Nations High Commissioner for Refugees (UNHCR) and the United Nations Children's Fund (UNICEF), have included Somalia and Uganda in their regional water, sanitation, and hygiene (WASH) programmes. Additionally, the significant presence of refugees and IDPs in both countries has attracted international concern and interest from donors. Both situations are protracted emergencies, the type of context for which the methodology is most suited.

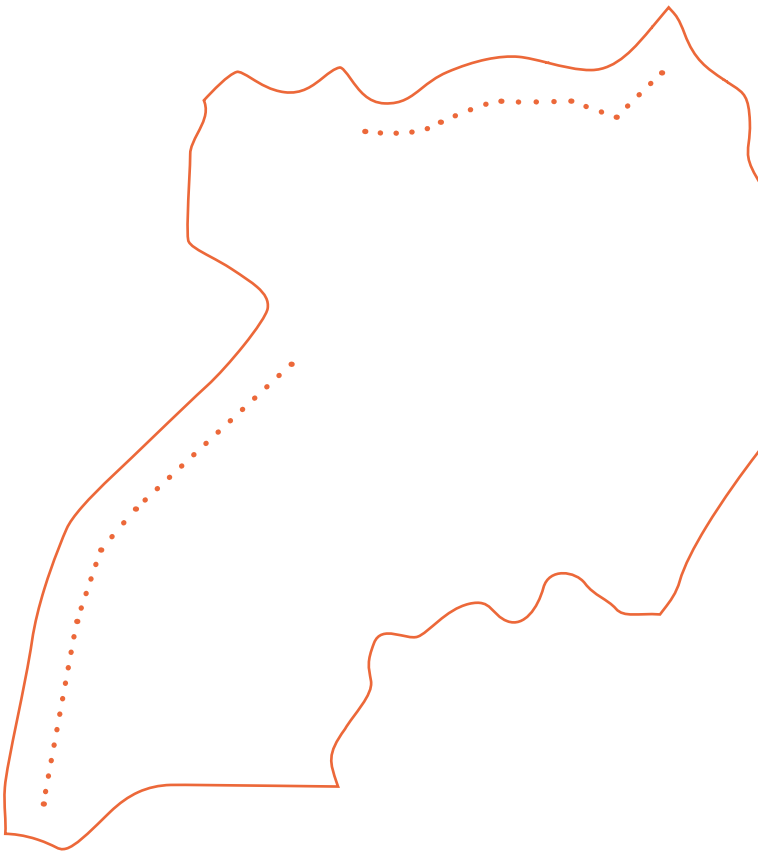
2.1 Rwamwanja Refugee Settlement, Uganda

Uganda hosts over 1.5 million refugees,[1] making it the African country hosting the most refugees.

In April 2022, Uganda received over 35,000 new arrivals fleeing from war, drought and persecution in South Sudan and the Democratic Republic of the Congo (DRC), with a projected influx of 60,000 refugees by June 2022.[2] This puts pressure on existing host community settlements to provide basic services, including education, food, shelter, health and nutrition centres, and water, sanitation and hygiene infrastructure.[3]

Rwamwanja Refugee Settlement is in the Toro region in Uganda's Kamwenge district and is managed by UNHCR and the Ugandan Office of the Prime Minister's Department of Refugees (OPM).

It hosts over 80,000 refugees and a Ugandan population of 430,000, scattered across a constellation of villages covering approximately 127 square km (50 square miles). Originally established in 1964 and closed in 1995, Rwamwanja reopened in 2012 to accommodate refugees from DRC's North and South Kivu provinces, where most refugees in the settlement come from.[4] There is no landfill for waste at Rwamwanja. Instead, solid waste is dumped next to an abattoir and a water stream. Solid waste is disposed of haphazardly and the town council only has one truck for collecting waste.[5]



1 UNHCR (2022)
2 Ibid.
3 Ibid.
4 SCC (2018)
5 Environment and Livelihood Team at Rwamwanja Refugee Settlement (2021)

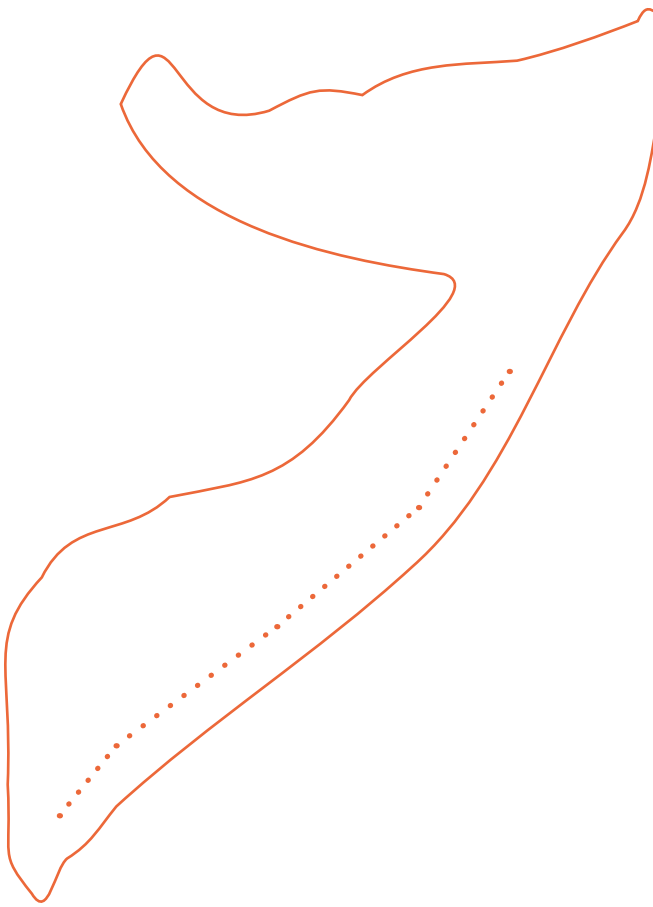
2.2 Doolow IDP Camps, Somalia

As of 2022, Somalia had about 2.97 million IDPs,[6] most of them fleeing from conflict and natural disasters.

Widespread drought has caused many people to migrate closer to rivers, although those are drying up, especially during dry seasons.[7] However, most IDPs reside in overcrowded, densely populated urban areas, such as the Kabasa and Qansaxley camps in Doolow district, managed by UNHCR.

Doolow is in western Somalia, on the border with Ethiopia, in the Jubaland administration.[8] In March 2022, Doolow was hosting 114,653 people in 21,181 households spread across the Kabasa and Qansaxley camps.[9]

Access to basic services is still a concern for new arrivals, namely WASH, health, shelter and SWM, particularly during the current drought and expected famine.[10,11] There is no organised solid waste collection. Instead, waste is gathered in several locations and burnt. Experts have recommended phased relocation of the camps to ease overcrowding, and the government supports planned relocation plans. Humanitarian actors mainly provide the current WASH services in Doolow. The packaging involved in this humanitarian assistance generates waste, which makes up a large share of the waste in the IDP camps.[12]



6 UNHCR (2022)
7 OCHA (2021)
8 UN-Habitat (2022)
9 ReliefWeb (2022)
10 Ibid.
11 Federal Republic of Somalia (2022)
12 Reed (2016)

3. Selected gap

3.1 Rationale and goals

SWM in an emergency context involves collecting, transporting and disposing of household rubbish, emergency waste (such as packaging from hygiene kits), healthcare waste, packaging, other forms of environmental waste and disposal of human faeces.[13]

This research explores the problem of improper solid waste disposal and identifies innovative opportunities to address it. Although the common Sphere Standards (2018) emphasise the need for people affected by crises to live in uncontaminated areas, humanitarian response does not sufficiently address risks from poor SWM.[14,15,16] These standards include key aspects in SWM (eg, planning SWM systems; handling, separating, storing, sorting and processing waste at source; transferring waste to a collection point; and transporting and final disposal, reuse, re-purposing or recycling). **Access to a healthy sustainable environment has been recognised as a universal right. And yet, neglect and failures in solid waste management are common and repeated; hence, there is a need to search for solutions through innovation.**

The Humanitarian Innovation Fund (HIF) commissioned a problem exploration study in 2016 covering the main aspects of waste systems in the context of humanitarian emergencies.[17] The report provides an overview of the state of SWM, the challenges and opportunities across a diverse range of humanitarian contexts.

In all the contexts examined, the existing system is broken or overloaded, but it continues to receive more or new types of waste. Existing systems are owned by the host communities and only partly operational; for example, regular waste collection is impossible because roads or paths are blocked, or access is not possible due to conflict. Reed (2016) highlighted a few areas of possible innovation, including: enhanced recycling of new waste; working on behaviours; and improving critical elements of the system, which may be final disposal sites, collection trucks, recycling facilities or storage sites. In addition, the report raised key points about ownership of the waste (or waste system) and packaging waste, which aid agencies often introduce.

In 2021, Elrha commissioned a WASH gap analysis[18] that highlighted improper SWM as one of the top four global WASH gaps, although it is often overlooked.[19,20] It is also one of the top gaps in the gap analysis data for Uganda and Somalia, meaning that exploring the problem is practical and useful in these settings.

13 Rouse and Reed (2013)
14 Ibid.
15 Oxfam (2017)
16 Laude (2020)
17 Reed (2016)
18 Elrha (2021))
19 Oxfam (n.d.)
20 Laude (2020)

In the past two years, the disposal of hygiene waste related to managing COVID-19 has been flagged as an issue in humanitarian settings. Studies show that, since the start of the COVID-19 pandemic, healthcare waste has increased up to five times in some African countries.[21] Without waste management systems, communities can become vulnerable to higher risks from their surroundings.

For this study, we created an initial list of problems based on global data sources, presented in Annex 2. From this research, the most critical problem is;

"establishing effective waste management systems that provide safe places to store, transport, and dispose of waste – bins, containers, vehicles, or landfill sites."[22]

Unfortunately, bins or disposal sites are often too far away from homes, making it hard for community members to access them. In addition, waste vehicles stop operating because of poor repair and maintenance, and those that remain in operation cannot meet demand.

SWM relies heavily on organisations' coordination and people's supportive behaviours. However, with the arrival of refugees, already weak local authorities struggle to cope with additional responsibilities. Often there is no central organisation to manage collection and disposal of waste. Coordination is poor and waste-related policies have little impact on the situation on the ground, if they exist at all.[23] During the data collection process, key informants in the two studied contexts confirmed SWM as the most neglected service in the settlements, confirming what the experts said during their interviews.

Solid waste challenges can be seen throughout the year in both contexts, including in commercial centres and host community settlements, on roadsides and riverbanks, and in IDP settlements. In addition, common overarching challenges impact solid waste disposal in both contexts.

These include lack of coordination among local authorities to manage safe solid waste disposal; low priority of SWM compared to immediate life-saving needs; the delayed and indirect impact of poorly managed solid waste on health and other areas compared to other humanitarian gaps; insufficient funding; and inadequate local technical expertise.

21 WHO (2022)
22 ICF and Cadmus Group (2020)
23 Di Bella et al. (2019)

3.2 Initial problems lists

Based on the problem longlist generated during the initial desk research, we reviewed the most frequently identified problems through the lens of the humanitarian contexts explored in Uganda and Somalia, revising the list to better reflect the reality on the ground based on data collected. Below is the list of the most common problems related to solid waste disposal in Uganda. This list was refined from the initial general longlist (Annex 2).

Problem list
Rwamwanja Refugee Settlement,
Uganda

Problem list
Doolow IDP Camps,
Somalia

Problem list

Rwamwanja Refugee Settlement,
Uganda

High-frequency problems	Description of problem
Lack of effective waste management system	Often, no central organisation manages the collection and treatment of waste. If there is one, waste policies are not effectively implemented on the ground and there can be a lack of intersectoral coordination to strengthen waste management.
Lack of waste disposal awareness and education	People are unaware of how to dispose of waste appropriately and do not know the benefits of nor have access to good waste practices, such as recycling and using organic waste.
Build-up of waste in the environment	There is an increased accumulation of non-biodegradable waste at household level, and a build-up of solid and wet waste in public settings. This leads to a deterioration of basic environmental sanitation levels.
Waste collection services are limited and ineffective	A shortage of solid waste cleaners and services leads to slow collection times and often an absence of kerbside waste collection.
Waste is not sorted or recycled	There is a lack of decentralised WASH services, such as treating biodegradable waste at village or domestic level. In addition, there is no management or modality to encourage the local community to segregate or recycle solid waste.

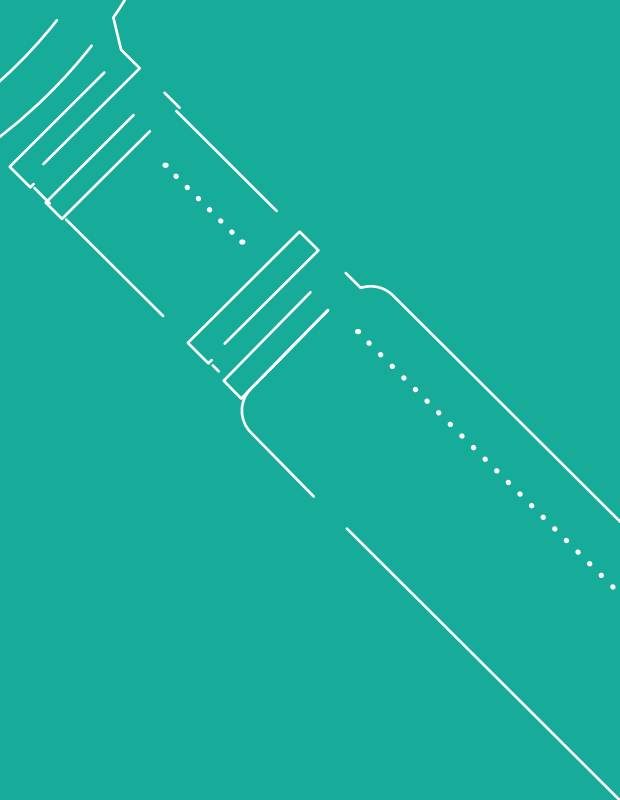
Problem list

Doolow IDP Camps,
Somalia

High-frequency problems	Description of problem
Lack of places to dispose of waste	There is often no designated safe place to dispose of waste, whether bins, containers, waste disposal sites or landfill sites.
Lack of effective waste management system	Often, no central organisation manages the collection and treatment of waste. If there is one, waste policies are not effectively implemented on the ground, and there can be a lack of intersectoral coordination to strengthen waste management.
Inefficient quantity and proximity of waste bins	There are insufficient bins and waste containers; those which do exist are often too far away from homes, and this causes difficulties in accessing them.
Lack of waste disposal awareness and education	People are unaware of how to dispose of waste appropriately and do not know the benefits of good waste practices such as recycling and using organic waste.
Waste is not sorted or recycled	There is a lack of decentralised waste services, such as treating biodegradable waste at community or household level. In addition, there is no management or modality to encourage the local community to segregate or recycle solid waste.
Lack of well-functioning transport for waste	There are challenges in transporting solid waste to final disposal sites; this can be due to a lack of transportation systems or because the vehicles themselves break down and need repairing.
Waste disposed of around water sources prevents safe access to water and makes toilets dysfunctional	Waste is often deposited around the protected perimeter of water points, and put into rivers and other water bodies. In addition, waste in toilet pits accumulates and makes them dysfunctional.

4. Problem exploration

SWM is a broad topic that includes a range of more specific, diverse and often interconnected problems. This section explores the problems in each context, then prioritises the shared problems between the two contexts at the end.



4.1 Problem exploration:
Rwamwanja Refugee Settlement, Uganda

Through field research in the Rwamwanja Refugee Settlement, five key problems emerged:

1. Low priority fosters lack of waste disposal responsibility
2. Insufficient disposal options cause waste to build up in the environment
3. Poor logistics and inaccessible landfill sites exacerbate informal dumping
4. Excessive plastics and packaging without recycling options exacerbates waste volumes in the community
5. Low financial and personnel resources mean ineffective solid waste management systems

4.1.1 Low priority fosters lack of waste disposal responsibility

In the Rwamwanja Refugee Settlement, our observations indicated that the Sphere Standards on solid waste are unmet. This may suggest responsible actors such as municipal authorities or humanitarian agencies are paying inadequate attention to the problem.

This mirrors the situation in humanitarian contexts in other countries.[24] The problem is exacerbated by the amount of plastic packaging humanitarian actors bring into the camps.

During national and international events (such as International Women's Day and World Water Week), guests and event coordinators generate and leave additional waste, reflecting how low this issue is on their priority list. In addition, 15 beverage companies sell water and juice bottles in the town; they have no responsibility for collecting the garbage.

Respondents suggested that refugees in transit centres feel they might move elsewhere at any time, so they are less likely to actively participate in SWM. They might only keep their immediate environment clean. They perceive the issue not to be their responsibility, but that of the authorities.

People living in the settlement are not encouraged to separate their solid waste from biodegradable and non-biodegradable waste, leading to mixed waste with lower potential for recycling. Households do not have garbage bins because these are not provided. Additionally, they do not have recycling bags and there are no aggregators who collect recycled material.

Humanitarian actors raise the issue of insufficient awareness and educational efforts about how to dispose of solid waste.[25] However, without basic and viable options for responsible waste disposal, awareness and education focus on health-related issues rather than solid waste disposal. For example, village health teams (VHTs) have conducted education and awareness-raising programmes, as discussed in section 5. However, funding issues halted these efforts and did not focus on solid waste disposal. This is not surprising given households' lack of solid waste disposal options.

24 Felix (2018)
25 Based on interviews with Oxfam and the Lutheran World Federation.

4.1.2 Insufficient disposal options cause waste to build up in the environment

According to humanitarian actors, the build-up of waste in the environment is partly due to the lack of designated areas to dispose of waste.

In the absence of bins at household level, waste accumulates around households. Some carry their garbage to one of the four designated collection centres serving over 70,000 people around the World Food Programme's food distribution centres. These centres are near public spaces, including the market, an area where much of the solid waste is generated (typically faster than it can be collected).[26]

Meanwhile, other households allow waste to accumulate around their houses. Public excavation sites act as larger waste storage points; from there, the council sends one truck up to three times a week. However, unless people take the waste to these excavation sites, it is kept in a refuse pit near their houses or dumped in their latrines or drains, damaging them.[27] According to the literature, a common practice in other Ugandan camps is for households to burn their rubbish in the open, and markets sometimes burn their garbage in the open to manage the build-up, resulting in hazardous air pollution.[28] In addition, other environmental issues occur with waste, such as excessive flooding when waste in the environment clogs drains.[29]

26 Felix (2018)
27 Ibid.
28 Ibid.
29 Ibid.

4.1.3 Poor logistics and inaccessible landfill sites exacerbate informal dumping

Respondents described how garbage trucks are always full to the brim, leaking garbage along the long route between the refugee settlement and the host community.

There is no formal dumping site anymore because the government-allocated sites are about 65–80 km (40–50 miles) away, which is a long distance to cover in the collection schedule. In addition, the budget to open a new dumping site nearby has not been prioritised because of competing agendas between the local and district governments.

Because of this challenge, about nine years ago, the local government opted to have waste transported by the overfilled trucks dumped in an unofficially designated site near an abattoir, creating pollution risks. There is a stream nearby, so toxic chemicals from the abattoir and solid waste build-up leak into the stream where another local community lives. This could lead to conflict between host communities and the refugee population. In addition, waste that piles up rapidly can be a big health risk, especially when the environment is hot, because flies and scavenging animals can easily spread diseases.[30]

30 Reed (2016)

4.1.4 Excessive plastics and packaging without recycling options exacerbates waste volumes in the community

Humanitarian actors are significant creators of plastic and packaging waste that could be reused or recycled.[31] Humanitarian actors are among the largest procurers and disseminators of plastic in the territory, including plastic water bottles and disposable food packaging, increasing the waste burden on and by the population.[32]

Without reduction and recycling options, and adequate SWM disposal, these plastics contribute significantly to waste leaking into the environment. That said, some of the respondents mentioned that some in the capital Kampala may be interested in working within the settlement to buy its plastics.

While some effort has been made to explore recycling opportunities (specifically for plastics and cardboard packaging – see details in section 5), this has not led to practical initiatives that have been sustained and scaled up. For example, humanitarian actors sometimes work on waste-sorting efforts, but initiatives do not last long due to unviable financial sources.

31 Felix (2018)
32 Sphere Association (2018)

4.1.5 Low financial and personnel resources mean ineffective SWM systems

No effective SWM systems exist in the settlement because the municipality lacks the resources to increase the budget for additional services. This is due to SWM being low on local stakeholders' list of priorities.

Ultimately, no partners are involved in waste collection services and the government provides limited resources to develop SWM. The single truck operates beyond full capacity and can barely keep up with demand at the few designated waste collection points.

Responsible waste disposal is inconvenient because disposal sites are far away and households lack access to large polythene bin bags (about 20–30 kg in volume) and personal protective equipment such as gloves for collecting and disposing of garbage at home. These tools would allow them to participate in source separation (separating waste for disposal, recycling and composting), with further support required for waste collection and selling recyclable contents. To dispose of waste, households fill small plastic polythene bags with unseparated waste. These bags end up sitting rotting near their homes, making collection and disposal at the four disposal sites challenging.

Another main challenge is the limited technical knowledge about SWM in the settlement. Respondents expressed their desire to do things for themselves. However, the inability to manage waste without an SWM system makes it an insurmountable challenge, despite people's best intentions.

4.2 Problem exploration:
Doolow IDP Camps, Somalia

Through field research in the Doolow IDP Camps in Somalia, five key problems emerged:

1. Lack of coordination and prioritisation to strengthen SWM
2. Indiscriminate dumping leads to waste building up in the camps
3. Environmental contamination and health and safety hazards
4. Lack of legal frameworks, funding and the municipal government's technical capacity
5. The large share of solid waste the humanitarian sector generates.[33]

33 Ibid.

4.2.1 Lack of coordination and prioritisation to strengthen SWM

There is a lack of coordination and prioritisation to strengthen SWM among stakeholders supporting the camps, the municipality and host communities. As a result, solid waste has remained an unallocated responsibility.

Normally, SWM falls under the core function of the WASH Cluster, as well as the Shelter and Non-Food Items Cluster, and the Food Security and Livelihood Cluster. Unfortunately, this does not work as responsibility falls between government entities and humanitarian agency clusters, without clear leadership and accountability on SWM aspects. Consequently, there is no management or modality to encourage the local community to practice good solid waste disposal behaviours, such as keeping waste in designated sites, source separation or recycling.

4.2.2 Indiscriminate dumping leads to waste building up in the camps

In Doolow, the poorly managed solid waste is dumped into the environment because there are no designated waste disposal sites.

There are no solid or liquid waste disposal and treatment facilities for either IDP sites or the Doolow host community. Humanitarian partners constructed two small disposal sites to serve the entire population. However, these are no longer used – they have already been filled up and are locked – which leaves people unable to conveniently and responsibly dispose of solid waste, instead dumping it in the open outside the fences.

Unsafe waste transportation leaves households with no choice but to dump solid waste indiscriminately. Domestic animals – such as cows and goats – end up scavenging in the garbage for food and eating plastic bags, leading to swelling in their stomachs and often their eventual death, affecting cattle owners' livelihoods.

Similarly, much solid waste – in particular, plastic bottles – and medical waste end up in toilets with lined pits, presenting challenges in emptying the pits, reducing the latrines' functional lifespan. There are currently more than 300 latrines in the two camps and an unknown number of pits partially filled with solid waste, as reported by the International Organization for Migration and the Camp Coordination and Camp Management Cluster in Doolow.[34]

34 Reed (2016)

4.2.3 Environmental contamination and health and safety hazards

Solid waste is poorly managed and dumped into the environment, degrading the land and water and providing a breeding ground for diseases.

Perhaps the most concerning and critical issue is that solid waste is dumped along the Dawa river, where people collect contaminated water for domestic uses, including drinking, putting their health at risk. Private clinics also dump their pharmaceutical and hazardous medical wastes into the river because they do not own or have access to incinerators or other medical waste management facilities.

Solid waste dumping is not cordoned off from the rest of the community, posing a risk to children and domestic animals. Children are often found playing in the garbage and sometimes injured by dangerous waste such as needles from health clinics. One informant resident described how her son was injured by medical waste, contracted tetanus and had to travel far for expensive medical treatment in Kenya. She paid for this journey by selling camels they relied on for their livelihood.

The solid waste also creates breeding grounds for disease-carrying vectors, bringing public health risks to the residents of the camps. This increases health problems such as disease outbreaks. There is a high risk of water-borne diseases, including acute diarrhoeal disease and cholera, spreading in the IDP camps. Indeed, cases of cholera have already been confirmed in neighbouring districts.[35]

In the absence of landfill sites and disposal services, garbage is often burnt in the open. For example, health facilities that lack proper medical waste management facilities either dump medical waste near waterways, as discussed above, or burn it in the open in fields. Burning garbage causes black smoke, carrying toxic by-products from burning rubber, plastics and pharmaceutical waste, polluting the environment. The sites used for burning are also left unsupervised and inappropriately located; when the wind shifts, it blows offensive, foul-smelling, toxic fumes towards residents close to the dumping sites, affecting their health and wellbeing. Open burning also increases the risk of fire in the camps, a major concern to households whose shelters are flammable and very close to where garbage is burnt.

35 WHO (2022) Cholera - Somalia

4.2.4 Lack of legal frameworks, funding and the municipal government's technical capacity

The municipal government is legally responsible for SWM in its jurisdiction. However, based on our interviews and discussions with United Nations agencies and supporting non-governmental organisations (NGOs) in the camps, they lack the resources – both in terms of dedicated human resources and funding – to manage and dispose of solid waste in the IDP camps and host communities. This includes lacking the capacity to build and manage infrastructure, run operations and conduct research.

Moreover, the Somalian Government's 2016 Environmental Policy is not widely known, making logistics and coordination with other stakeholders difficult.

This is partly because there is no proper governance or detailed set of rules to foster and enforce SWM. Consequently, local authorities have no monitoring function or mechanisms to enforce legal requirements. In any event, these cannot be applied without an SWM system that offers residents access to convenient waste disposal options.

For example, some people, and hotels and restaurants from Doolow's host town, dump their garbage in the informal IDP dumping sites. This exacerbates the SWM challenge in the camps.

Some residents and businesses rely on informal waste pickers without formal SWM services. No assigned body or private company operates in the town, and there are no trucks for the town of Doolow and its IDP camps. Instead, informal collectors use tricycles and donkey carts for informal waste transportation on demand (for a fee paid by households and businesses). There are no proper waste collection tools, such as wheelbarrows, and personal protective equipment for waste handlers.

Additionally, there is limited information and research on solid waste generated and dumped or burnt in Doolow. No solid waste assessment has ever been conducted in the municipality, and current municipal workers lack the technical skills and capacity to conduct such research and analysis. Knowledge of the quantities of generated solid waste will be relevant in designing waste handling, storage, transportation and treatment facilities. Building a picture of the state of SWM through research is the first essential step for designing an appropriate SWM system in Doolow.

4.2.5 The large share of solid waste the humanitarian sector generates

During the fieldwork, it was observed that packaging material left after the distribution of relief items generates significant quantities of solid waste.

These items include a mix of packaging from hygiene kits, food rations, non-food items, plastic bottles, polythene wrapping and paper boxes. This waste is generated across the IDP camps and host communities. It is readily found near clinics, schools, markets and commercial places. Amounts of certain items, such as personal protective equipment increased in the waste streams due to the COVID-19 pandemic.

This is because of a complex tapestry of humanitarian challenges. Firstly, humanitarian coordination structures do not explicitly assign responsibilities for collecting and disposing of solid waste. Secondly, funding is very low, so SWM is not prioritised, and there are insufficient incentive structures to redesign logistics to reduce solid waste. Lastly, there is a perception that SWM is a lower-priority issue disconnected from high-priority issues such as health and nutrition.

4.3 Shared and underlying problems

Initially, we had thought the two contexts in Somalia and Uganda would be different; however, our primary research revealed that they were similar in the context of SWM and shared common challenges. Furthermore, we found that the problems explored demonstrate the following underlying causes across both contexts.

Firstly, local authorities and other humanitarian stakeholders place a low priority on addressing the solid waste crisis. Instead, officials focus on issues more directly related to life-saving activities such as healthcare, personal hygiene (rather than household and community waste management) and nutrition.

Secondly, resources for effective SWM systems are not aggregated and are instead allocated by diverse stakeholders including humanitarian agencies and NGOs to address the SWM crisis and support under-resourced municipalities. As a result, settlements do not have enough disposal options and people resort to indiscriminate dumping. This means that officially designated dumping sites for solid waste reach full capacity and are overloaded. Dumping in the open happens at the household level around dwellings and in the communal environment, both in unofficially recognised dumping sites and indiscriminately.

Lastly, in both contexts waste builds up in the environment, impacting other services. For example, burning waste affects air quality in and around the settlements due to smoke and dust. Unofficial dumping sites, including rivers and around marketplaces, contaminate water and increase the spread of disease-carrying vectors, and dumping in toilet pits causes latrine dysfunction. This contributes to open defecation and the increased risk of diseases spreading.

In both contexts, humanitarian agencies, governments and those affected by crisis have made efforts to innovate by building awareness and promoting best practices – such as waste separation and recycling – but funding challenges restricted them from continuing or scaling up. Without SWM systems that offer households user-friendly disposal alternatives, the impact of awareness-raising campaigns will be limited.

5. Existing, trialled and emerging solutions

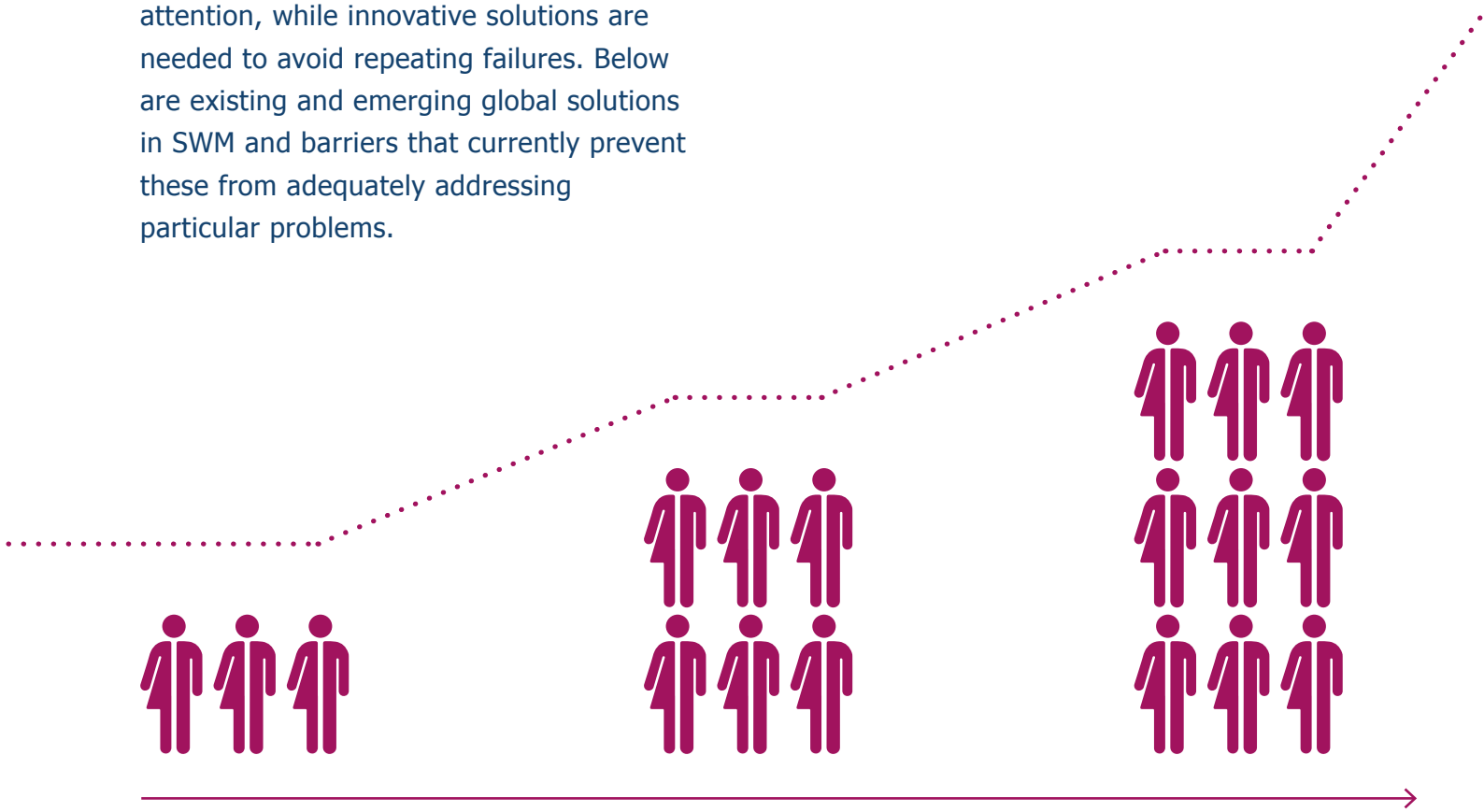
This section identifies SWM solutions that either exist, have been trialled previously or are emerging and have not yet been implemented fully to address the problems outlined above.

Solutions at global level were highlighted through the desk research, and those in Uganda and Somalia through the field research. These do not represent a comprehensive overview of all solid waste solutions, only those encountered through this research process.

5.1 Global solutions and barriers

Emergency contexts have a range of uncertainties – such as longevity and population growth – and local authorities struggle to operate in such situations.

Local authorities have been overwhelmed by continuing response efforts and lack the resources to allocate enough support to SWM.[36] The solid waste sector needs attention, while innovative solutions are needed to avoid repeating failures. Below are existing and emerging global solutions in SWM and barriers that currently prevent these from adequately addressing particular problems.



36 Blanco et al. (2013)

5.1.1 Waste supports livelihoods in development contexts, but people affected by crises lack access to waste and markets

Existing solution:

Local entrepreneurs can act to tackle the problem of waste.

Barrier:

Due to safety and security concerns, local entrepreneurs are not always given access to waste and waste markets.

In certain contexts, SWM is an important livelihood resource for people – including refugees and IDPs – working as waste collectors, pickers and buyers.

However, to do this, people need access to the waste and waste markets where they can trade the items and materials they collect. Access to waste may be difficult if it is mixed or contaminated; if authorities restrict or regulate waste; or when communal storage is far from settlements where people live. Access to markets may also be hard if security risks or environmental hazards contribute to humanitarian crises.

5.1.2 SWM technologies exist, but deployment requires large investments

Existing solution:

SWM technologies such as drone imaging, sensors and composting techniques.

Barrier:

Deployment of existing technologies is too expensive and risky for humanitarian actors.

Many technologies, practices and tools that could support SWM provision and coordination already exist.

SWM systems could benefit from many solutions such as drone imaging, sensors on and bins and vehicles to measure weight, volume or frequency of emptying, and composting approaches (eg, using black soldier flies for waste decomposition). However, existing solutions do not always reach points of impact in humanitarian or humanitarian-development nexus SWM. They may demand longer or greater investments of time or resources than humanitarian actors are prepared to make when uncertain situations and provisions are seen as temporary. Additionally, certain solutions may fail if not connected with a wider, functioning SWM infrastructure and service system.

5.1.3 Awareness and behaviour change programming could be leveraged to support SWM, but there is little incentive for meaningful change without SWM infrastructure

Existing solution:

Awareness raising and behaviour change approaches have been applied successfully for other issues (eg, health and hygiene).

Barrier:

It could be difficult to incentivise change and convince people of the significance of altering their behaviours if this is done before suitable SWM infrastructure exists.

Awareness-raising programmes on health and hygiene must include waste-related issues.

This could be an important starting point when providing basic infrastructure and services. In some situations, there may not be many practices that promoters can share because the existing SWM infrastructure is minimal, informal or does not provide a great enough benefit to make new household practices seem worthwhile. While infrastructures remain insufficient to be supportive of populations, poor SWM systems lead to a build-up of trash in public settings, contaminating the environment and increasing flooding risks. Inadequate management facilities and systems become a self-perpetuating challenge, regardless of awareness of good disposal practices. Research indicates the importance of consideration of behaviour change, as well as challenges with the relevance of planning; for example, the problem may be the accumulation of market waste, while plans may just focus on household waste.

5.2 Solutions

Rwamwanja Refugee Settlement, Uganda

During the field research in Rwamwanja Refugee Settlement, we learned of existing and emerging solutions SWM humanitarian actors have attempted, though all have faced barriers to their sustainable implementation.

It is worth noting that those tackling solid waste management issues are often refugees, such as women's groups. In addition, other SWM actors such as self-employed waste collectors, waste recyclers and waste pickers can be attracted to the settlement context.

5.2.1 VHTs build awareness, but cannot continue without funds

Existing solution:

Self-organised Village Health Teams (VHTs) visit households to offer educational sessions and organise community discussions (eg, on menstrual hygiene, sanitary hygiene and water management).

Barrier:

SWM is not well covered in VHT sessions and lack of funds affects the VHTs.

In Rwamwanja Refugee Settlement, the communities select VHTs that have received training on awareness-building skillsets.

Afterwards, VHTs actively visit households to build awareness of different subjects important to community and environmental health. They also hold group discussions with community members on managing challenges and exploring solutions to tackle these issues, such as menstrual hygiene, transport, water resource management and hygiene. Unfortunately, SWM is not covered often or well in these sessions: a humanitarian agency and the district-level government conducted the last initiative around SWM in 2021. Additionally, the solution lacks sustainable funding. This affects the VHTs, as covering a camp of more than 70,000 people requires funds, even with volunteers' support.

5.2.2 Waste management group efforts can improve waste collection, but limited disposal places make proper SWM difficult

Existing solution:

Waste committee group collecting waste in the area.

Barrier:

No official dumpsite to dispose of waste collected; limited capacity of the group.

Within the camp, environmental NGO the African Refiners and Distributors Association recently deployed a waste management committee group covering four areas (three markets and one reception centre) where waste can be deposited by households and collected by the local authority. While local authorities are supposed to collect waste from these collection points three times a week, in practice they only do so once.

The waste is collected by the only garbage truck operating at full capacity ("spewing garbage as it drives around", according to one informant) and taken to the unofficial dumpsite near the abattoir, which is already full.

5.2.3 Plastics recycling piloted, but found not to be financially viable

Trialled solution:

Project supporting a plastics recycler to create baskets.

Barrier:

The business model did not prove profitable and there were no bulk buyers to make the business viable.

A humanitarian agency led a one-off initiative to explore potential partners interested in separating waste and recycling into different types for use in products.

One man used plastic bottle seals to produce plastic rope and products such as baskets to sell in the market, which people use to buy groceries. There was potential demand for this product as the Ugandan government plans to ban the polythene bags that are in common use currently.[37] However, this initiative did not continue and was not profitable for the producer, as there were no bulk buyers, and the pilot ended.

37 Angurini (2021)

5.2.4 Stakeholders are committed and willing to participate, but coordination proves difficult

Emerging solution:

Community-led enforcement of SWM obligations and encouraging best practices.

Barrier:

Unclear coordinating body to mobilise community commitment and follow through with actions.

There are opportunities to expand the participation of NGOs and the private sector in SWM as interest and commitment already exist.

Similarly, the community has demonstrated willingness to participate in SWM programmes to maintain a clean environment, and this willingness could be better supported or facilitated. There was also a willingness to allocate land for landfill development, with humanitarian actors and the local community recognising waste disposal as a major problem. Specific solutions community members and NGOs suggested during the field research included: supporting the local authority to meet its legal SWM obligations, such as setting up community steering groups to create an enforceable SWM law; exploring opportunities for microbusiness-public partnerships to address SWM; and creating job opportunities such as creating more durable and reusable items; and recycling plastics. Unfortunately, there is no clear coordinating agent or body to mobilise the community's willingness to act and follow through on the stakeholders' ideas.

5.3 Solutions
Doolow IDP Camps, Somalia

During field research in the Doolow IDP Camps, we learned of existing and emerging solutions SWM humanitarian actors have attempted, though all have faced barriers to sustainable implementation.

5.3.1 Women's advocacy group collected waste, but services ended due to limited willingness to pay

Trialled solution:

Women's group led awareness campaigns and helped collect waste.

Barrier:

Households were unwilling to pay for services, opting for illegal dumping.

Two dozen women voluntarily created a group, Hanti-Wadaag, to improve environmental sanitation and cleanliness in Doolow town.

The group functioned for about three years, leading community awareness events about SWM, and helped collect solid waste from different places, at a cost of US$1 per household per trip. The amount of waste collected and disposed of by the group is unknown as no study was done to quantify and assess its performance. Once collected, the group took the waste to a dumpsite 4 km (2.5 miles) away from the dumpsite established by World Vision.

Unfortunately, the women's group is no longer functioning because households lacked the motivation to pay the US$1 fee, which led to illegal dumping – often in the Dawa river. The group was further challenged because the local authority did not enforce to law to reduce the illegal dumping of waste along the river and within the IDP camps, and there were no designated places to safely dump solid wastes.

5.3.2 Humanitarian WASH teams provide technical support to SWM initiatives, but limited sustained support and maintenance means infrastructure breaks down

Trialled solution:

WASH actors support technical initiatives to improve SWM infrastructure and awareness-building efforts.

Barrier:

Providing support and maintenance over the long term is difficult; equipment breakdowns slow response.

WASH actors in Doolow have supported waste management initiatives, such as constructing incinerators for healthcare facilities and excavating waste dumping pits within the camps and outside of town.

They also led camp clean-up campaigns and raised awareness of proper SWM practices at home and in public spaces. This included supporting community structures such as WASH committees and school health clubs with basic tools and equipment such as transportation equipment (tricycle motors) to collect solid waste from households in the IDP camps and town, and cleaning equipment such as spades, garbage bins, buckets, wheelbarrows and rakes. Unfortunately, consistent support for these initiatives over the long term has remained challenging. During fieldwork, actors reported that most of the equipment that had been distributed was broken or worn out, and the tricycles developed mechanical problems from lack of maintenance. Waste dumping pits were also filled to capacity without maintenance and rehabilitation by the community and local authorities.

5.3.3 Communities have SWM solutions to try out, but lack of coordination and funding hinder work

Emerging solution:

Community members and local actors have several ways to improve SWM.

Barrier:

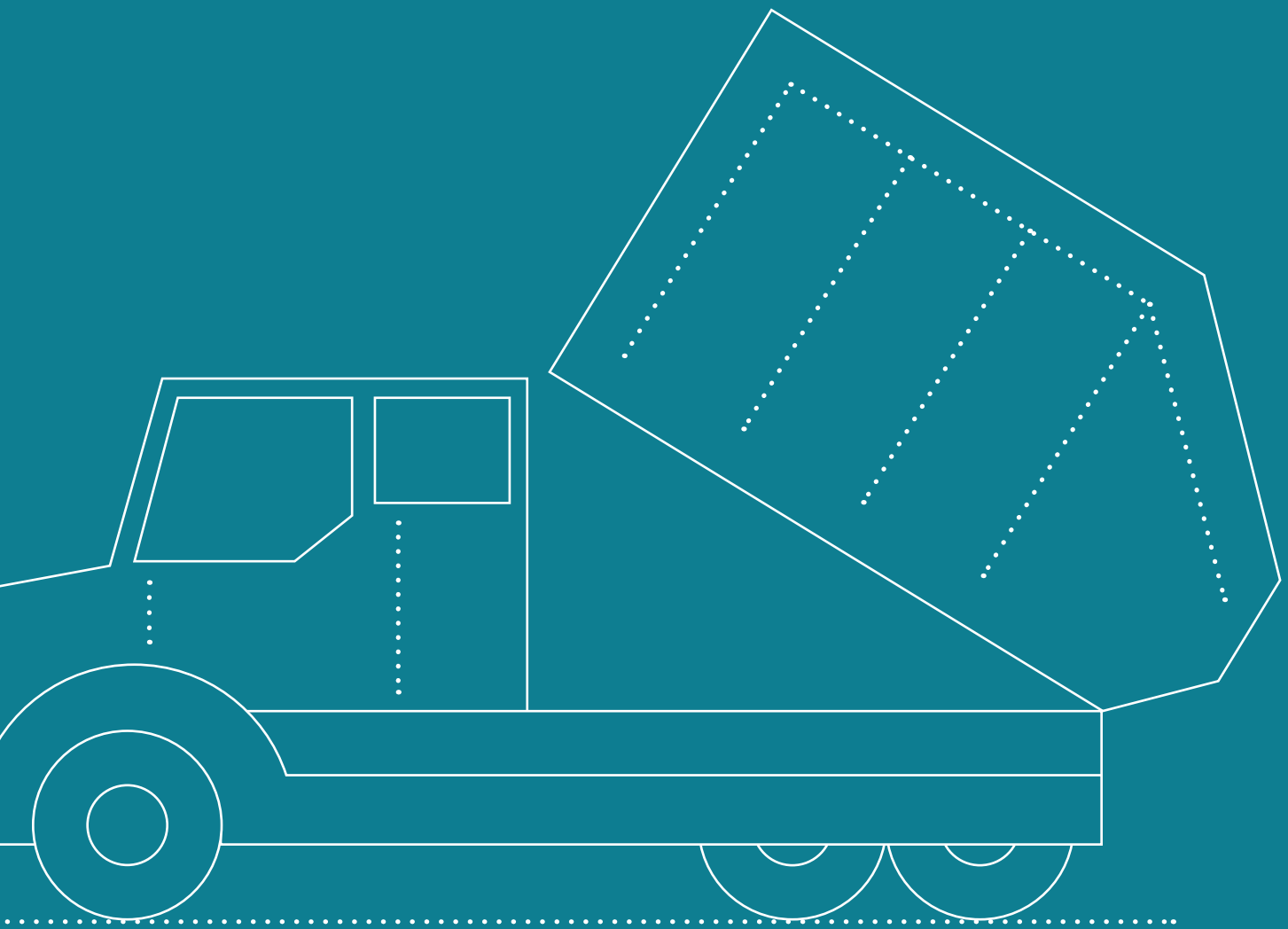
There is no coordinating body or actor to fundraise and mobilise initiatives.

The community members and WASH actors interviewed suggested several specific solutions, including finding ways to recycle, compost and reduce packaged consumption by banning plastic bags (which make up almost 90% of the solid waste in Doolow) and assigning clear responsibility for collecting and disposing of packaging.

This could include 'polluter pays' principles and extended producer responsibility frameworks, which make producers and suppliers of packaging equally responsible for finding solutions to their waste. Stakeholders also thought there should be more partnerships between municipal governments, humanitarian agencies, and local entrepreneurs to turn waste into a managed resource and raise SWM on the priority list of basic services. Unfortunately, these solutions have not taken shape because there is no clear coordinating body to catalyse initiatives and raise funds to make them possible.

6. Opportunities for innovation

In this section, we highlight potential opportunities for innovation that could help directly address the SWM problems we investigated in Uganda and Somalia.



We reviewed the problems and barriers identified during problem exploration to identify these opportunities. We used the 'Checklist to identify opportunities for innovation' in the Exploring Problems to Find Innovation Opportunities methodology, asking ourselves:

- Does the opportunity respond to a real problem with clear potential for impact?
- Would the problem this opportunity addresses benefit from innovation?
- Does the opportunity open the door to many possible (types of) solutions?

Each **opportunity** was proposed based on research insights into **problems** and barriers to solving these. We also developed specific examples for how innovators or innovation funders could capitalise on each opportunity.

This section aims to take a systemic approach to highlight opportunities for innovation and potential challenges associated with these.

To find opportunities, we attempted to look at the problems and consider how they could be flipped into opportunities; for example, rather than viewing solid waste only as a problem that needs to be managed, seeing it as a resource and potential source of livelihood. The aim was to open up the problems we saw in the field to innovators at different places in the system, including those present in the locations where we conducted field research and beyond. Funders could take up some of the opportunities we identified; others might be better 'owned' by alternative actors in the humanitarian sector.

6.1.1 Build a zero-waste vision for humanitarian settings

Problem:

In general, there is a lack of accountability when dealing with solid waste generation. Other problems often arise unless waste becomes associated with immediate threats, such as cholera outbreaks. Roles and responsibilities around SWM are unclear, particularly in humanitarian camp settings. Furthermore, there is widespread complacency about waste in and around camps, and acceptance of waste is being introduced to these settings – as long as it is part of lifesaving response efforts. Complacency may worsen due to the added uncertainty associated with lack of data on waste inflows and outflows, making it hard to figure out where to start addressing SWM because the dimensions of the problem are unclear.

Also see:

Low priority fosters lack of waste disposal responsibility

Lack of coordination and prioritisation to strengthen SWM

The large share of solid waste the humanitarian sector generates

Opportunity:

We must challenge this mindset of complacency and acceptance and reorientate our approach to eliminating waste. There is an opportunity to develop a compelling, practical and actionable zero-waste vision across diverse actors in and around humanitarian response to inspire, align and synergise efforts to rethink SWM from the point of its creation. A zero-waste vision is already well established for non-emergency settings.[38] For emergency settings, building a shared vision of zero-waste camps could help galvanise stakeholders from humanitarian agencies, NGOs, the community and the private sector to focus their political attention on solving the SWM crisis in settlements – but this requires leadership and coordination. In addition, building a zero-waste vision could support the 'mainstreaming' of SWM across all aspects of the humanitarian system, from providing water, food and healthcare, to providing shelter and planning settlement layout and infrastructure.

38 Zero Waste International Alliance: zwia.org

6.1.1 Build a zero-waste vision for humanitarian settings

Specific innovation opportunities:

Design and launch an inclusive, systemic zero-waste campaign

to communicate, conceptualise and develop an awareness of waste-free principles and practices, engaging and convening a range of solid waste stakeholders in ways that people recognise and understand.

Understand, monitor and communicate data on waste inflows and outflows in camp settings

to empower a range of public and private sector actors in different system positions to use this information as a basis for adaptive innovation as waste stream composition and SWM dynamics change throughout an emergency response.

6.1.2 Safe and accessible disposal sites

Problem:

Existing waste infrastructure, systems and practices originally developed to meet host community needs may not be able to accommodate sudden increases in solid waste produced by humanitarian responses. We found evidence of informal disposal sites, sometimes near key freshwater sources. However, these solutions were inadequate because they posed contamination risks; were locked and made inaccessible to potential users; or were too far from the settlement to make their continual use feasible by populations affected by crises. On top of these issues, there are also regulatory and governance challenges. For example, standards for disposal sites are often beyond what local authorities can meet.

Also see:

Insufficient disposal options cause waste to build up in the environment

Poor logistics and inaccessible landfill sites exacerbate informal dumping

Indiscriminate dumping leads to waste building up in the camps

Opportunity:

Addressing barriers associated with this problem will require innovation in regulation, developing technical and operational standards, SWM models and strategies, and disposal site engineering and design. Innovators well placed to respond to this problem could include regulatory policymakers and enforcers in host countries, humanitarian standards developers, and operational staff whose work is governed by relevant regulations and standards. Responses to this opportunity may need to consider how to safely experiment with changing regulations, while at the same time protecting people and environments.[39] Potential approaches could be to identify and integrate learning and practices from the more specialised area of medical waste to mainstream SWM; documented practice[40] in this space may be more advanced due to the elevated hazards associated with medical waste. There may also be opportunities to develop networks or communities of practice to advance action in this space.[41]

39 Centre for Regulatory Innovation (2021) Regulators' Experimentation Toolkit. Government of Canada.
40 Manjengwa (2021)
41 The Network of Regulatory Experimentation: A peer-to-peer community of regulatory experimenters - Dark Matter (darkmatterlabs.org)

6.1.2 Safe and accessible disposal sites

Specific innovation opportunities:

Develop safe, accessible final disposal sites in the vicinity of humanitarian settlements, accounting for location-specific constraints and being sensitive to host community needs.

Propose and trial new methods to address disposal site risks, including ways to support identify, analyse and accept risks associated with site selection, construction, maintenance, management, control, monitoring and use.

Identify and adopt successful SWM approaches from medical waste management, especially for identifying, segregating and safely disposing of hazardous waste.

6.1.3 Sustainable collaboration models for humanitarian agencies and local authorities

Problem:

Local authorities' role is always unclear within the humanitarian-development nexus. This is particularly visible in the SWM arena, where local authorities often have jurisdiction over existing local infrastructure, while humanitarian agencies are in charge of delivering the emergency response. Agencies often intervene in SWM rather than build up local capacity, which is needed for the long term, as issues related to SWM linked to the response can persist through recovery and beyond.

Also, there is a need to increase connectedness with regional SWM systems and existing economies to create better SWM systems that are less dependent on foreign market access, which can be unreliable during crises. Ultimately, through our field and desk research, we found that in many contexts local authorities are responsible for SWM before, during and after a crisis. They may struggle to cope with changing compositions and volumes of waste associated with these emergencies.

Also see:

Low financial and personnel resources mean ineffective SWM systems

Lack of legal frameworks, funding and the municipal government's technical capacity

The humanitarian sector contributes a large share of solid waste generation

6.1.3 Sustainable collaboration models for humanitarian agencies and local authorities

Opportunity:

When addressing SWM, we cannot afford to leave local authorities out of the picture. We need models for better, more sustainable working relations between humanitarian agencies and local authorities around SWM, as their interests often overlap and their roles often blur in this area. This could be catalysed by galvanising the political attention of humanitarian agencies and other stakeholders around a shared vision of a zero-waste settlement (see 6.1.1) or more immediate 'quick wins' such as publishing case studies of successful collaborations. However, this problem deserves more dedicated attention. We need better-defined, practically applicable models to bridge humanitarian agencies' short-term mandates and longer time horizons local authorities must consider when planning SWM service delivery. Who is doing humanitarian agency-local authority collaboration well and what are they doing? We need to know what models work to build trust, reduce uncertainty and contribute to the establishment of working SWM infrastructure beyond immediate humanitarian responses.

How successful are the SWM practices of developing services for host communities operating parallel to those of refugee settlements?

How can humanitarian agencies work with local authorities when refugees or IDPs live with host communities in non-camp settings?

6.1.3 Sustainable collaboration models for humanitarian agencies and local authorities

Specific innovation opportunities:

Identify and codify working models for humanitarian agency–local authority collaboration, particularly around SWM.

This would help bring clarity and transparency to the necessary ingredients for successful working relations between these actor groups. It would also help set the stage for cross-setting adoption and adaptation to scale high-potential collaborative models.

Reimagine localised governance frameworks for collaboration around SWM.

We must go beyond importing public-private partnership models from other contexts and work with host communities to design locally relevant governance frameworks.

Design and trial tools for mutual accountability and trust that help support more effective leadership, clearer division of roles, more transparent decision-making, and better communication between collaborators on both sides of this relationship.

This could include digital platforms and tools, but could also ways to better structure communication and decision-making, collectively allocate resources, and to devolve and share responsibility.

6.1.4 Support potential entrepreneurs to turn waste into a resource

Problem:

Although, in theory, innovators of any scale or location could secure funding to support their work, in reality, awareness of and access to opportunities to apply for support is often restricted to those who are educated, English-speaking, experienced in navigating bureaucracy, and part of formally registered organisations with years-long operating histories and documented track records. Many small, local entrepreneurs who could be well placed to innovate in SWM do not have access to flexible finance; and humanitarian agencies and funders are often not set up to support and account for them as grantees or contractors, even if they would like to.

This makes it hard for waste entrepreneurs to be nimble and experiment with innovations in response to SWM challenges as without adequate resources they may not be able to afford the risk of potential failure that often comes with experimentation. This may lead potential waste innovators to steer away from innovating, and to stick with more established, certain – but not necessarily more effective – ways of working. For example, although they may have experience, insights, and ideas they could put toward innovating waste-to-resource models, poorly resourced waste entrepreneurs may opt to pursue small-scale animal waste composting on an ad-hoc basis, rather than systematising practices so they could scale.

On top of this, potential SWM innovators often need access to sites and infrastructure to capitalise on waste. This access can be limited or restricted for safety and security reasons. Finally, waste entrepreneurs do not always have ready access to markets for recovered materials, as this may not be possible due to the particular security situation. Making a livelihood from waste must therefore fit local economies or adapt to inconsistent access to markets further afield.

Also see:

Poor logistics and inaccessible landfill sites exacerbate informal dumping

Excessive plastics and packaging without recycling options exacerbates waste volumes in the community

Plastics recycling piloted, but found not to be financially viable

6.1.4 Support potential entrepreneurs to turn waste into a resource

Opportunity:

This situation could change if humanitarian agencies and funders viewed waste as a potential source of livelihoods and enabled smaller actors to use waste as a resource, making opportunities and support obvious and accessible.

To make waste-based livelihoods accessible to people who can deliver services, we need innovative models that address issues around funding and financing, partnership and procurement, and (de)regulation that account for local people's interests and existing capacities.

Humanitarian agencies and funders could catalyse new circular business ventures through numerous support mechanisms, including local procurement. There are also opportunities to redesign ways of doing business in SWM that work within local economies rather than relying on inconsistent access to export markets. There is potential to support operations across the waste cycle: preventing, managing, and disposing of biodegradable and non-biodegradable waste, promoting reuse and recycling to work towards a local circular economy. Note that any response to this opportunity would also have to consider and account for worker safety and ethics owing to the hazards associated with handling solid waste.

6.1.4 Support potential entrepreneurs to turn waste into a resource

Specific innovation opportunities:

Develop procurement systems for humanitarian agencies and authorities to contract and support the development of local, grassroots waste entrepreneurs.

Create resilient, localised waste-to-resource business models that support the development of local circular economies are not dependent on access to global markets and provide livelihood access. These could include novel partnership models and solutions that leverage connectivity and mobile technologies like smartphones and sensors.[42]

Support safer access to waste to enable local small-scale enterprises in humanitarian camps and settlements to enter the waste-based economy, while managing health and safety risks.

42 GSMA (2021)

6.1.5 Identify and reduce high-impact waste sources

Problem:

Uncontrolled waste impacts human health, the local environment and infrastructure, such as drainage. It was not always clear where waste in our field settings came from or where and how it was causing impacts. This is a common problem across the humanitarian sector at large; the United States Agency for International Development notes that, beyond medical waste, the humanitarian waste stream and its highest-impact contributions, including widely used items such as poly-woven grain bags and tarpaulins, are poorly understood.[43] We need to identify the highest-volume, most difficult-to-dispose-of waste the humanitarian sector produces and work to eliminate its impact. To do this, we need to better establish the composition of the waste stream across different humanitarian settings.

Opportunity:

Establishing sources of high-impact waste will help identify the targets most in need of packaging, manufacturing, transport and other innovations. Without putting in this work, the sector risks taking an ad-hoc approach, addressing smaller waste streams when there are bigger, more high-impact waste streams that could be targeted. However, efforts cannot stop at waste stream analysis. Once we establish where high-impact waste comes from, we must develop high-impact solutions that curb these sources. Institutional researchers in materials science and engineering, and private sector product designers and developers would be well positioned to respond to this opportunity. Other actors may also have roles to play depending on the waste sources identified. For example, architects, food scientists and suppliers, and transport and logistics companies could all have relevant expertise and insights to respond to this opportunity.

Also see:

Humanitarian sector contributes a large share of solid waste generation

Excessive plastics and packaging exacerbate waste volumes in the community

43 ICF & Cadmus Group (2020)

6.1.5 Identify and reduce high-impact waste sources

Specific innovation opportunities:

Develop context-adaptive protocols for waste stream analysis and waste vulnerability assessment.

This could help identify high-impact waste streams as they emerge, to address them more rapidly and identify the most vulnerable population groups and environmental receptors. Such tools must consider waste in humanitarian settlements and host communities, as waste can easily permeate boundaries between different communities.

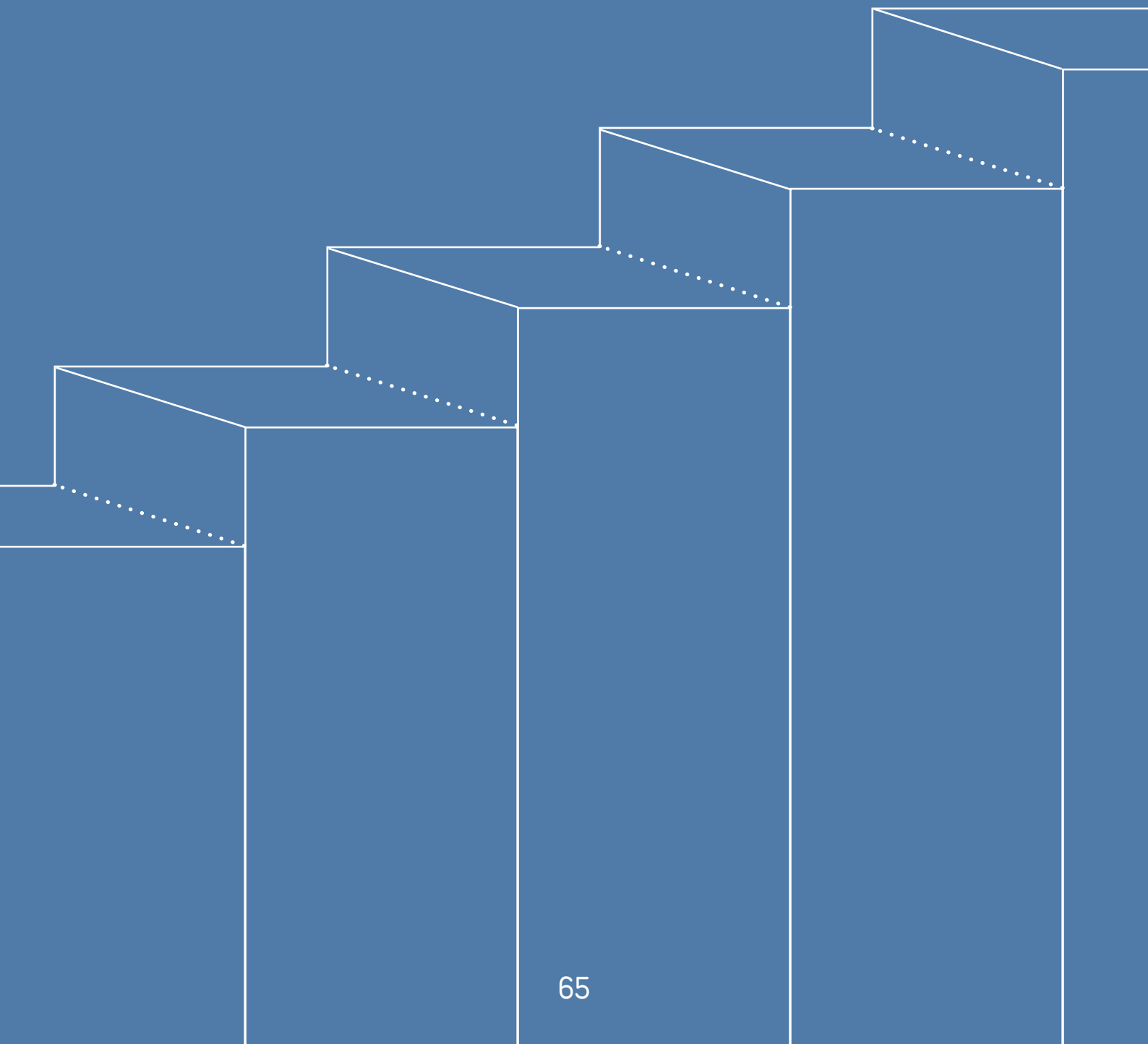
Signpost high-impact and/or high-volume waste sources

to open up these targets for more focused innovation in the product, material, packaging and logistics spaces. This could be done at sector level as certain sources are likely to be shared across different sectors working on the same humanitarian responses.

Once these are known, create affordable low- or no-waste alternatives to high-volume and/or high-impact waste sources.

These could be global or locally based solutions. Some examples include reduced use of small bottled water, reduced packaging, green vegetable waste compositing in feeding centres.

7. Next steps



In creating this report, we have identified specific problems within SWM that the innovation opportunities we have highlighted could address. We see the potential to build on this work in several ways:

- The problems explored could contribute to wider sectoral efforts to map problems within the SWM gap
- Innovation funders, such as the HIF, could open up identified opportunities to support further innovation in the SWM space by launching funding calls that ask innovators to respond to the challenges identified
- Innovators in humanitarian settings with similar problem patterns to the two contexts explored in this report could use this information to identify potential targets for innovation in their contexts that would benefit from their time, attention, skills and resources

The HIF is particularly interested to know how humanitarian SWM stakeholders perceive the opportunities we have highlighted. We would like to hear if you build on these insights in your work! Get in touch by emailing hif@elrha.org.

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Annex 1: Detailed methodology for this report

The approach followed for producing this report was the Exploring Problems to Find Innovation Opportunities methodology. The methodology was implemented over a three-month period. This was the first time piloting this methodology, meaning that the scope and depth of its application were limited.

Initial desk review

The impacts, problems and solutions listed in this document are based on the raw data from Elrha's' WASH Gap Analysis Database. This data was condensed, refined and simplified to provide a resource for those scoping their own problem lists in their fields and locations.

Impacts have been extracted from column AZ of the WASH Gap Analysis Database titled 'Importance'. These highlight the most commonly mentioned consequences of improper solid waste disposal on people's lives. **Solutions** have been extracted from column BA titled 'How Overcome'. While most solutions mentioned in the database centred on increasing quantities of disposal sites and waste facilities, the list below aims to highlight the most innovative solutions that both people affected by crises and WASH practitioners mentioned.

Both impacts and solutions were gathered, grouped into categories and finally arranged thematically. Each impact and solution theme is followed by a description, summarising the impacts and solutions mentioned.

The **problems longlist** has been extracted from column AQ of the WASH Gap Analysis Database titled 'Raw Data Gap'. The description summarises the raw data gaps that make up each problem listed.

Frequencies of problems and impacts are listed as high, medium or low according to how many people mentioned them.

High = 21–40 people

Medium = 6–20 people

Low = 1–5 people

Frequencies denote data from both people affected by crises and WASH practitioners. Solution frequencies were not counted as there were too few duplicate solutions to add up.

Impacts	Description	Frequency
Health	Build-up of waste increases the risk of disease transmission, particularly from water contamination, including cholera, diarrhoea and typhoid, as well as development of eye-related diseases.	High
Environment	Improper solid waste disposal leads to pollution of the environment, including polluting crops, water and air, leading to unpleasant odours and unsanitary and unsafe living spaces. Additionally, rodents and insects, including mosquitoes, become more prevalent as waste disposed of provides perfect breeding conditions.	Medium
Social	Waste building up in communal spaces damages the image of communities, which affects the wellbeing of residents. Furthermore, social inequalities increase as vulnerable people are often at a heightened risk when it comes to being affected by waste problems. Older people, as well as young people and children, have less immunity to diseases that are transmitted through waste. People with disabilities, such as those with visual impairments, face further difficulties in making sure they do not come into contact with hazardous waste.	Low

Problems longlist	Description	Frequency
Lack of places to dispose of waste	There is often no designated safe place to dispose of waste, whether in bins, containers, waste disposal sites or landfill sites.	High
Lack of an effective waste management system	There is often no central organisation to manage collection and treatment of waste. If there is one, waste policies are not effectively implemented on the ground, and there can be a lack of intersectoral coordination for strengthening waste management.	High
Inefficient quantity and proximity of waste bins	There are insufficient bins and waste containers; those which do exist are often too far away and this causes difficulties in accessing them.	High
Lack of waste disposal awareness/education	People are not aware of how to appropriately dispose of waste; nor do they know the benefits of good waste practices such as recycling and using organic waste.	High
Build-up of waste in the environment	Increased accumulation of non-biodegradable waste at household level, and a build-up of solid and wet waste in public settings, lead to a lack of basic environmental sanitation levels.	Medium
Waste collection services are limited and ineffective	Shortage of solid waste cleaners and services leads to slow collection times and often an absence of kerbside waste collection.	Medium
Lack of tools for waste disposal/management	There is a lack of solid waste disposal tools and environmental cleaning materials. These include shovels, rakes, wheelbarrows, sickles and cutting tools.	Medium

Problems longlist	Description	Frequency
Poor domestic waste disposal	Poor SWM at the household level leads to a build-up of waste in areas that should be sanitary such as kitchens.	Medium
Waste is not sorted/ recycled	There is a lack of decentralised WASH services; for example, treatment of biodegradable waste at village/domestic level. There is no management or modality to encourage the local community to segregate or recycle solid waste.	Medium
Lack of well-functioning transport for waste	There are challenges in transporting solid waste to final disposal sites; for example, due to a lack of transportation systems or because the vehicles themselves break down and need repair.	Medium
Lack of bins in latrines	Waste from latrines is difficult to manage, especially when there is a shortage of latrines and/or bins in the latrines. Toilet paper is often poorly disposed of, leading to a build-up of waste in these areas, which should be sanitary.	Low
Lack of medical waste management	There is a lack of medical waste management in health centres and hospitals (in terms of collection, storage, transport and treatment). Different waste containers for the different types of waste – sharps, soft, organic and domestic – are lacking.	Low
Burning of solid waste is often unsafe	There is a lack of waste disposal pits for burning waste products; additionally, such incineration practices are not environmentally friendly.	Low
Waste disposed of around water sources prevents safe access to water	Waste is often deposited around the protected perimeter of water points, and is sometimes put into rivers and other water bodies. This prevents safe access to clean water.	Low

Problems longlist	Description	Frequency
Flooding in waste collection sites prevents proper disposal	Rising water levels make it difficult and often impossible to dispose of household waste, as areas designated as garbage collection areas become flooded.	Low
Lack of capacity in management of industrial waste	Industrial waste, particularly water bottles, is not disposed of properly. There is no recycling of waste water within industrial settings.	Low

Solutions

Community-led	Organisation within communities, such as the setting up of waste management committees, can facilitate greater collective action around solid waste.
Education	Meaningful and effective training can be given to field staff and community members to empower them to understand resource consumption and waste. For instance, spreading awareness about embracing the '7 Rs' (rethink, refuse, reduce, reuse, repair, regift, recycle).
Technological	Technological tools can be used, such as applications to track waste, or waste collection sensors that measure the weight or volume of solid waste in trucks, bins or landfill to optimise waste management processes.
Ecological	Establishing ecological islands for waste. These are waste collection sites that serve the community as well as the environment.
Good waste practices	Sorting all waste would have a great impact, alongside encouraging and implementing recycling projects (such as using waste to make briquettes for fuel). Additionally, adopting effective health and safety measures would reduce waste-related hazards (eg, using safe locked areas to burn waste).

In-country data collection

We endeavoured to collect data directly in the Rwamwanja Refugee Settlement, Uganda, and Doolow IDP Camps, Somalia.

For ease of access and navigation, we convened a group of enumerators – one in Uganda and two in Somalia – who had experience working in our selected contexts. These enumerators sought approval from local authorities and camp management leaders to access the camps and organise interviews and FGDs around the contexts. Enumerators had about 1–2 weeks in each context to interview people and observe SWM practices. Below are details for each context's data collection.

The in-country data collection was led by experienced humanitarian personnel who sought approval from local authorities, community leaders and camp management officials to access the camps and organise interviews and FGDs in each setting. The locations for the focus groups were determined after a risk assessment to ensure the safety of the researcher, enumerators and participants. The research background, aims and its intended use was outlined to participants in a language they understood. Participants took part in the research voluntarily and gave their informed consent verbally, as an initial assessment indicated that signed consent forms could pose a risk to the participants. Appropriate safeguarding processes were in place through the institutional frameworks the enumerators were working under. All responses were safely stored electronically, anonymised at the point of analysis and no personal data has been retained by the researchers. The findings will be fed back to WASH decision-makers in these locations so that the gaps identified may be addressed immediately where possible.

Uganda data collection

In Rwamwanja Refugee Settlement, the enumerator collected information from stakeholders on the ground. Due to time limitations, he used the methods below.

Key informant interviews:

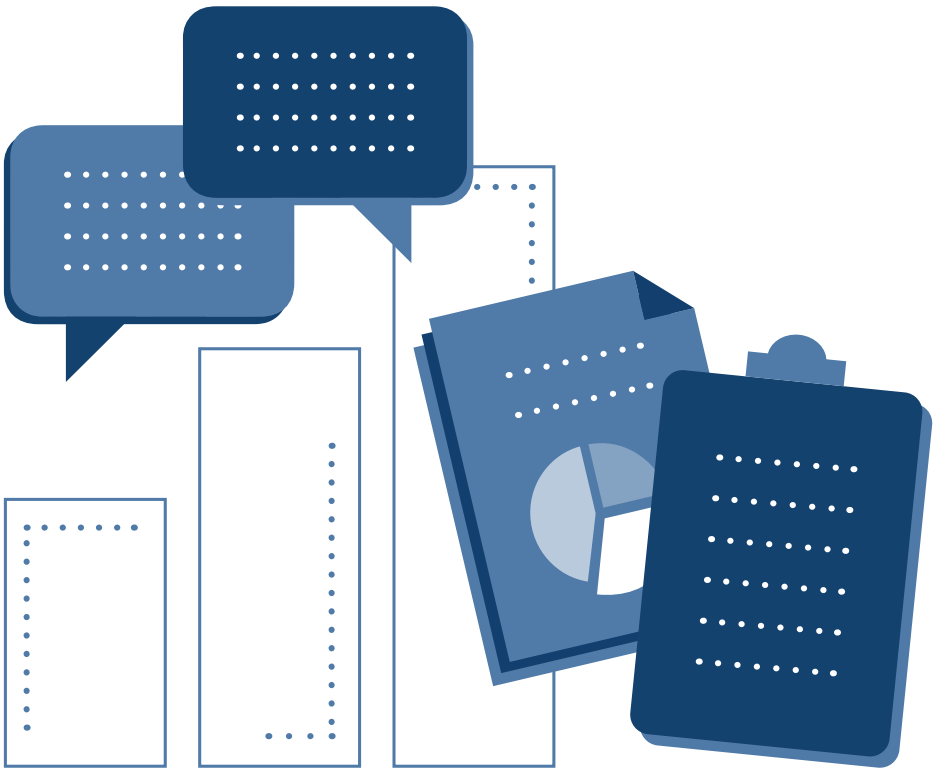
The enumerator held key informant interviews with four organisations working in the WASH sector in the settlement, including Lutheran Fund, Oxfam International, the local district government authority and a WASH expert from local organisation Nsamizi. These groups are WASH professionals based in Rwamwanja who have a good understanding of the humanitarian context and relations with local authorities, the private sectors and IDPs.

Focus group discussions:

The enumerator held two separate FGDs with different groups. The first meeting had five community members (both male and female), and the second had six (male only). Two VHT members helped randomly select the community members. The enumerator was also invited to a meeting with WASH stakeholders, including members of the Office of the Prime Minister and UNHCR.

Observations:

The enumerator led a transect walk and recorded his observations in the refugee settlement and host town. He also visited and noted observations at the landfill site and local government buildings, and on a general tour of the camp site.



Somalia data collection

In Doolow, we focused on the Kabasa and Qansaxley IDP camps to collect information. Enumerators were recruited based on their ability and local experience in accessing the camps and collecting data working within the authorities' restrictions. They used the following methods described below.

Key informant interviews:

The enumerators held KIIs with four organisations working in the WASH sector in the camps, including UNICEF, International Organization for Migration, Norwegian Church Aid and Somali Humanitarian Relief Action. These groups are WASH professionals based in Doolow who have a good understanding of the humanitarian context and relations with local authorities, the private sector and IDPs. A total of six people took part in the KIIs.

Focus group discussions:

The enumerators held three separate FGDs with different groups, including:

- 3 members from the Hanti-Wadaag women's group
- 10 members of the Kabasa IDP Camp's leadership or community groups (mixed gender)
- 6 members from the Qansaxley IDP Camp's leadership or community groups (mixed gender).

Observations:

The enumerators led several transect walks and recorded observations while in the Doolow IDP Camps and host town. They also visited and noted observations in the local market areas, schools and healthcare facilities.

Limitations:

The local authorities control camps sites, and any data collection exercise needs prior approval, which may mean sending the questions and methodology to the local authority for the approval. In Somalia, enumerators were already working with WASH actors in Doolow, and approval was not required. However, they paid a courtesy call to local authorities before data collection and had to follow security risk assessments before going into the field. This was a major challenge in Uganda as the researcher was not attached to an organisation and local authorities asked several questions. In the end, having established contacts in an existing organisation, permission was granted. Based on our work in Somalia, Uganda, and a brief consultation with experts in Bangladesh, 2–3 months are required to obtain permissions, arrange access, plan fieldwork, and train field enumerators.

Annex 2: Initial problem list exploration

This problem list below is based on the problem map from steps 1 and 2 of the Exploring Problems for Innovation Opportunities Methodology.

Problem types	Initial problems list	Impacts	Stakeholders involved
Social/ cultural/ political/ systemic problems	Lack of waste disposal awareness/ education[44,45] Poor domestic waste disposal[46,47] Lack of tools for waste disposal/management Lack of capacity in the management of industrial waste	**Low Impact** Waste building up in communal spaces damages the image of communities, affecting residents' wellbeing. Furthermore, social inequalities are increased as vulnerable people are often at heightened risk of being affected by waste problems. Older people, as well as young people and children, have less immunity to diseases that are transmitted through waste. People with disabilities, such as those with visual impairments, face further difficulties ensuring they do not come into contact with hazardous waste.	• Community members • Emergency beneficiaries • SWM service providers • Municipal government/ authorities • Humanitarian responders
Environmental problems	Lack of places to dispose of waste[49,50] Build-up of waste in the environment[51] Burning of solid waste is often unsafe[52,53] Waste disposed of around water sources prevents safe access to water Flooding in waste collection sites prevents proper disposal	**Medium Impact** Improper solid waste disposal leads to pollution of the environment, including crops, water and air, leading to unpleasant odours and unsanitary and unsafe living spaces. Additionally, rodents and insects, including mosquitoes, become more prevalent as waste disposed of provides perfect breeding conditions.	• Municipal government/ authorities • Community members • Emergency beneficiaries • Hygiene kit creators and distributors

44 Di Bella et al. (2019)
45 UN-Habitat (2018)
46 Di Bella et al. (2019)
47 UN-Habitat (2018)
48 Laude (2020)
49 ICF & Cadmus Group (2020)
50 UN-Habitat (2018)
51 Di Bella et al. (2019)
52 UN-Habitat (2018)
53 Ibid.

Problem types	Initial problems list	Impacts	Stakeholders involved
Technical problems	Lack of an effective waste management system[54] Inefficient quantity and proximity of waste bins Waste collection services are limited and ineffective[55] Waste is not sorted/ recycled Lack of well-functioning transport for waste Lack of bins in latrines Lack of medical waste management		• Solid waste service providers • Humanitarian responders
Health problems	Burning of solid waste is often unsafe[56]	High Impact The build-up of waste increases the risk of disease transmission, particularly from water contamination, including of cholera, diarrhoeal disease and typhoid, as well as development of eye-related diseases.	• Community members • People affected by crisis

54 ICF & Cadmus Group. 2020.
55 UN-Habitat (2018)
56 Ibid.

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