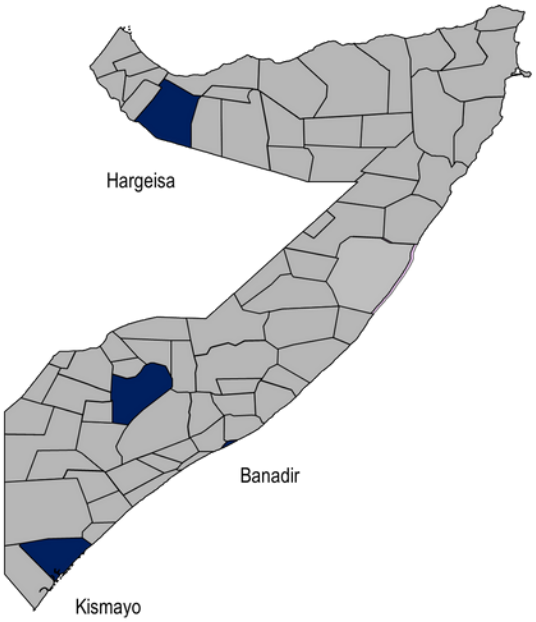
CIRCULARITY IN KISMAYO, BAIDOA, BANADIR AND HARGEISA, SOMALIA/LAND

DECEMBER 2023

BACKGROUND

Acted works towards a '3ZERO' world, Zero Carbon, Zero Exclusion and Zero Poverty. As part of our work towards Zero Carbon, Acted has undertaken a rapid assessment in Kismayo, Baidoa, Banadir and Hargeisa, Somalia/land, to identify opportunities to i) study circularity within the plastic and bio-waste value chains, and ii) develop programming that catalyzes on these opportunities.



METHODOLOGY

The assessment was conducted using qualitative and quantitative research methods, primarily through conducting interviews with key informants, household surveys and focus group discussions. 30 household surveys were conducted from five IDP sites in Baidoa (8 female, 7 male) and Kismayo (7 female and 8 male) using systematic sampling; a total of 9 KIIs were collected: 5 from the private sectors of waste management and 4 local authorities; and 5 focus group discussions were conducted across five IDPs in Baidoa and Kismayo. The assessment was conducted by trained enumerators from the 27th of November to 7th December 2023 across all the target areas in Kismayo, Baidoa, Banadir and Hargeisa. The data was analyzed and reported by Acted's MEAL Unit.

In Somalia/land, the heightened occurrence of extreme climate events has evolved from sporadic incidents to a troubling norm over the past few decades. This has intensified the ecological challenges faced by the country, arising primarily from climate change, land degradation, biodiversity loss, and inadequate environmental governance. These challenges collectively impose significant pressure on Somalia's natural ecosystems, exacerbating the vulnerability of local communities. In the context of this challenging environmental landscape, waste management, particularly concerning bio-waste and plastic waste, becomes a critical component. The Circular Economy emerges as a pivotal tool capable of initiating a sustainable development process in waste management. By promoting waste reduction, resource recovery, and efficient management practices, the Circular Economy not only addresses environmental concerns but also offers a pathway to resilience and sustainable growth amid the ongoing ecological challenges. Through the lens of the Circular Economy, this assessment endeavors to comprehend, scrutinize, and propose research-backed solutions that align with the distinctive environmental circumstances and predicaments encountered by Somalia/land, with a specific focus on effective waste management practices for bio-waste and plastic waste.

KEY FINDINGS

Plastic waste management opportunities

Waste Collection

- Community-Led Collection Initiatives: Encourage community members, including youth and women, to actively participate in waste collection efforts. This can create local job opportunities and ensure that waste is collected regularly within neighborhoods and IDP camps.
- Public-Private Partnerships: Collaborate with private waste management companies to enhance waste collection services. This can involve contracting private companies to collect and transport waste to recycling facilities or disposal sites.

- Incentives for Waste Collection: Implement incentive-based systems where groups are rewarded for collecting and turning in plastic waste. These incentives could be financial or in-kind, such as providing food or other necessities.
- Waste Collection Vehicles: Invest in waste collection vehicles and equipment to improve the efficiency of waste collection operations. Ensure that these vehicles are equipped to handle different types of waste, including plastic.
- Door-to-Door Collection: Introduce door-to-door waste collection services, particularly in urban areas, to make waste disposal more convenient for residents.

Waste Sorting

- Community Sorting Centers: Establish community-based waste sorting centers where community members can sort and separate recyclable materials from non-recyclable waste. Provide training and resources for effective sorting.
- Training and Capacity Building: Conduct training programs for waste collectors and sorters to ensure that they understand the importance of proper sorting and can identify different types of plastic materials.
- Promote Source Separation: Encourage households and businesses to separate recyclable plastic waste from other waste at the source. Provide separate bins or containers for recyclables.

Recycling & Reuse

- Recycling Facilities: Establish recycling facilities equipped with the necessary machinery and infrastructure to process collected plastic waste into reusable materials. Consider mobile recycling units for areas with limited access.
- Promote Local Industries: Support local businesses and entrepreneurs in setting up recycling ventures that can turn plastic waste into products such as construction materials, bags, and furniture.
- Circular Economy Programs: Promote circular economy principles, where products and materials are designed for reuse and recycling. Encourage manufacturers to use recycled plastics in their production processes.
- Market Development: Work on developing markets for recycled plastic products. Create demand for recycled materials by promoting their use in construction, manufacturing, and other sectors.
- Community Engagement: Engage communities in recycling and reusing initiatives. Raise awareness about the benefits of recycling and encourage the purchase of products made from recycled materials.

Bio-waste opportunities

- Local Energy Production: Biogas production from bio-waste offers a sustainable source of local energy. In Somalia, where access to reliable energy can be challenging, this presents a significant opportunity to meet the energy needs of communities. Biogas can be used for cooking, heating, and even electricity generation, reducing the reliance on imported energy sources and alleviating energy poverty.
- Reduction of Deforestation: Somalia faces deforestation challenges due to the use of wood and charcoal for cooking and heating. Biogas provides a clean alternative to wood-based fuels. By promoting biogas production, there is an opportunity to reduce deforestation, mitigate the loss of valuable forests, and combat climate change by decreasing carbon emissions associated with deforestation.
- Waste Valorization: Organic waste, such as cow dung and leftover food, can be effectively converted into biogas. This waste valorization not only addresses the issue of waste management but also creates a valuable energy resource. It transforms what would otherwise be considered waste into a productive asset.

- Sustainable Agriculture: The nutrient-rich digestate generated as a byproduct of the biogas production process serves as an excellent organic fertilizer. This presents an opportunity to enhance soil fertility in agricultural regions of Somalia/land. Farmers can benefit from improved crop yields without relying on chemical fertilizers, which can be expensive and harmful to the environment.
- Economic Opportunities: Biogas production initiatives create economic opportunities at multiple levels. Local communities involved in waste collection, as well as the operation and maintenance of biogas systems, can earn income. Additionally, the savings accrued by households that switch from traditional fuels to biogas can contribute to economic well-being.
- Environmental Sustainability: Biogas production contributes to environmental sustainability in multiple ways. It conserves water resources by reducing the need for water-intensive energy production methods. Biogas plants can also promote green spaces, as they require relatively small land areas. Moreover, by replacing traditional cooking methods, biogas helps in improving air quality and reducing indoor air pollution.
- Social Impact: Bio-waste circularity initiatives, like biogas production, have positive social impacts. They reduce the workload of women and children who often spend hours collecting firewood. Moreover, by providing access to clean cooking fuel and electricity, biogas enhances the overall quality of life in communities.
- Private Sector Engagement: Private sector companies can play a crucial role in advancing biogas production initiatives. They can invest in biogas infrastructure, offer technical expertise, and explore opportunities for biogas-related businesses, such as selling biogas appliances and systems.
- Awareness and Education: Increasing awareness about the benefits of biogas and educating communities about its use can further drive adoption. Outreach programs and training on biogas system operation and maintenance can empower communities to embrace this sustainable energy solution.

PLASTIC WASTE CIRCULARITY

Types of plastic waste at IDP sites

The household surveys reported that single-use plastic bags (97%), plastic bottles (91%), food packaging 69%) and plastic containers (47%) are the types of plastic waste commonly generated at IDP sites.

Waste management at IDP sites

Plastic Waste Handling and Disposal

During the focus group discussions (FGDs), all the respondents recalled various ways in which community members handled plastic waste, including burying, burning it, throwing it away, selling it, or reusing it. In regard to disposing the plastic waste, all (100%) the household respondents reported that the plastic waste related materials were burnt in a hole dug by the camp residents. However, during the rainy seasons, these wastes are buried, and a few others are dumped outside the IDP sites. Only 28% of the IDP residents separate plastic waste from other [LS1] Of the 28% who reported separations reported that they have separate bins (56%) while the remaining 44% reported sorting the plastic waste from other waste materials.

Waste Collection Methods

The KIIs with local authorities revealed the methods employed for waste collection within their region. The findings have shown that waste collection primarily relies on curbside pickup and communal bins. However, a significant limitation identified during these interviews is the absence of designated recycling drop-off points, which presents a substantial barrier to recycling efforts within their area.

Moreover, the KIIs highlighted that open lands

commonly used for waste disposal, raising concerns about environmental pollution, and potential risks to both children, livestock and wildlife. The waste collection process involves the public placing waste in plastic bags or sacks, which are subsequently collected by garbage trucks and workers. In Hargeisa for instance, the collected waste is then incinerated in two pits located in the south and north of the city, releasing toxic gas into the air. While plans to explore recycling as a more sustainable waste utilization method are in place for the future, the current primary approach remains incineration to minimize its environmental impact.

Challenges in Managing Waste

Majority (69%) of the household respondents face challenges in managing waste at home, with 31% not reporting any difficulties. Among the 69% facing challenges, 20% mentioned discovering unexploded devices during waste disposal and the absence of public dumping facilities for burning plastic waste. These challenges pose risks to the community and the environment.

Additionally, 60% cited the absence of public dumping facilities, which forces them to resort to burning plastic waste within their compounds, leading to pollution and health risks. This underscores the need for accessible waste disposal facilities.

Further 20% of household respondents reported lack of proper waste management materials at IDP sites results in the dumping of plastic and other waste outside their compounds, affecting the environment and the safety of domestic animals.

Furthermore, participants in the FGDs also voiced concerns about the lack of alternatives to single-use plastic products, which pose health and environmental risks. Despite these challenges, the community is actively taking steps to reduce single-use plastic products, promote recycling, and enhance waste management practices. However, the absence of viable alternatives often compels them to revert to traditional waste disposal methods, such as open burning or dumping.

Proposed Initiatives and Solutions

Various initiatives were proposed by the KIIs, household surveys and FGs sessions conducted to address these challenges in managing waste. These include awareness campaigns to educate the community about responsible waste management.

Waste reduction strategies are suggested to minimize the generation of plastic waste, and proper disposal methods are promoted to ensure safe waste disposal. In the course of the assessment, nearly half (47%) of the household respondents indicated that their households are actively making efforts to reduce the generation of plastic waste, while 41% have already implemented practices to reuse plastic items within their households. On the other hand, a significant portion, 53%, neither attempt to reduce plastic waste generation nor employ practices for reusing plastic materials within their households.

Increased supervision and monitoring by local authority are recommended to ensure compliance with waste management practices and regulations.

Access to Recycling Facilities

An overwhelming majority of household respondents, representing 84%, expressed that the recycling facilities or collection points for plastic waste within their IDP sites are inaccessible. In contrast, 13% reported that these facilities are somewhat accessible, meaning they are located within the vicinity of their IDPs but still require considerable effort to reach because of distance. This inaccessibility prevents community members from participating in recycling efforts. A mere 3% reported that recycling facilities or collection points are readily accessible.

Moreover, the financial aspect also presents a significant barrier, as respondents mentioned that they must incur transportation costs to reach these facilities. Thus, transportation emerges as a prominent issue hindering access to recycling facilities for these individuals.

Building recycling facilities, distributing machines for recycling plastic waste can be the factors that enhances community's involvement. It thus creates a job opportunity for the IDPs which in turn motivates the community to take part in these initiatives. Other factors could be community awareness and training on recycling and waste management. These factors will encourage the community to reduce plastic waste consumption and choose other alternatives to reduce plastic waste generations.

Community Involvement and Collaboration

Establishing recycling facilities and distributing recycling machines for plastic waste can significantly enhance community involvement in sustainable waste management efforts. These initiatives not only contribute to environmental conservation but also create valuable job opportunities for IDPs, thus motivating and engaging the community in these endeavors. The prospect of employment and income generation can be a powerful incentive for active participation.

Furthermore, community awareness campaigns and training programs focused on recycling and waste management are essential factors in promoting responsible practices. Educating the community about the benefits of recycling and the environmental impacts of plastic waste can inspire individuals to reduce their plastic consumption and opt for alternative materials, thereby mitigating plastic waste generation.

Moreover, the household respondents stated that collaboration among community members is stressed as an important aspect of successful waste management. Community members working together can pool resources and knowledge to develop effective waste management solutions.

Suggestions for Improvement

The FGD respondents reported several suggestions to improve the effectiveness of the plastic waste management system. These suggestions include providing wages for the waste management team, supplying necessary tools such as wheelbarrows and gloves, establishing designated waste management areas, and implementing cash-for-work activities. Capacity building is emphasized, alongside the need for hygiene promotion campaigns and community sensitization efforts are recommended to address challenges related to knowledge and motivation among community members.

The FGD respondents stressed the significance of community collaboration in successful plastic waste management. They all highlighted that collaboration enables community members to share knowledge, raise awareness about plastic waste, and develop effective waste management solutions. By working together, they can pursue common goals and objectives, ultimately increasing community awareness on the impact of plastic waste and facilitating the creation of waste management strategies. This collaborative approach fosters community engagement and active participation in environmental initiatives, nurturing a shared sense of responsibility for the environment.

Additionally, when asked about the methods or platforms that could enhance collaboration and engagement within the community for waste management purposes, the respondents suggested various approaches. These include:

- Establishing a dedicated waste management committee, hiring workers specifically for waste management tasks, conducting regular community meetings, and collaborating with non-governmental organizations. They emphasized the importance of government support, including the provision of necessary waste management materials.
- To raise awareness and educate residents about proper waste sorting, recycling, and disposal techniques.
- The household and FGD participants recommended implementing educational programs and training sessions. Encouraging the community to collect recyclable materials and ensuring proper waste disposal were also seen as important steps.

- The KIIs from local authorities suggested that small-scale projects could be used to demonstrate effective waste management practices, and local leaders could play a role in advocating for these practices within the community.

Figure 1: An undesignated area at the Nasrudiin IDP camp in Kismayo where residents dump plastic waste generated from their households.

Communities' perception on environmental impact

Environmental Awareness

During the FGD, it became evident that community members understand the critical role of effective waste management practices in minimizing disease outbreaks and improving overall health. This awareness reflects a basic understanding of the connection between proper waste disposal and community well-being. In addition, it's crucial because it indicates that the community recognizes the importance of responsible waste management as a means to protect public health.

Adverse Environmental Effects

The FGD participants have a comprehensive understanding of the adverse environmental effects of poor waste management practices, particularly when it comes to plastic waste. The recognition of the release of harmful chemicals, habitat alterations, contributions to climate change, soil and groundwater damage, and impacts on livelihoods and well-being underscores the community's grasp of the broader ecological consequences of irresponsible waste disposal. This understanding suggests that the community is concerned about the long-term sustainability of their environment.

Further, the potential for soil damage, groundwater contamination, and unclean conditions due to plastic waste further emphasizes the health-related concerns associated with improper waste management.

Aesthetic Concerns

The community's concern about the aesthetic impact of waste, especially plastic waste, indicates that they value a clean and visually appealing environment.

The presence of litter in public and private spaces not only affects the appearance of the community but also may deter visitors and potential investors.

The reemergence of buried waste as a result of factors like animal activity or floods highlights the frustration and dissatisfaction that can result from inadequate waste management practices.

The community recognizes that plastic waste poses significant health risks. The household and FGD respondents understand that plastic waste can serve as a breeding ground for harmful creatures like snakes and scorpions, which can

threaten community members' safety. The acknowledgment of air pollution and harmful toxic fumes generated when burning plastic waste underscores the health hazards associated with poor waste disposal practices.

Community Perceptions on Plastic Waste Management

The responses of household respondents shed light on the diversity of perceptions within the community regarding plastic waste management. In this regard, 72% who stated that they are unaware of the magnitude of the plastic waste problem or lack information on how to address it indicate a significant information gap. This lack of awareness may result from limited access to education and awareness campaigns on waste management, 15% expressing indifference may suggest a need for targeted efforts to raise awareness and educate this portion of the community. Their indifference could stem from a belief that individual actions won't make a difference, highlighting the importance of community engagement while, 13% who are proactive in reducing, reusing, and recycling plastic materials demonstrate the potential for positive change within the community. These individuals serve as role models and examples of how responsible waste management can be implemented.

Role of stakeholders in waste management

Stakeholders in Waste Management

During the FGD, participants identified primary stakeholders in waste management (private sector), with a strong focus on the residents of the camp as the main actors in this process. The absence of external stakeholders in waste management was acknowledged.

Further the household respondents reported that the key stakeholders involved in waste management were recognized as national, state, and local governments, research institutions, the public, NGOs, the private sector, funding agencies, and religious leaders. Religious leaders were also seen as important stakeholders.

Collaboration with Stakeholders

KIIs from local authorities reported active collaboration with various stakeholders, including the private sector, NGOs, and communities, to ensure effective waste management. WAMO, a waste management company in Kismayo, plays a significant role in health promotion through waste management. Local government authorities in Hargeisa have formed partnerships with private companies and are exploring recycling initiatives with related companies.

Roles and Responsibilities of Stakeholders

All KII respondents from the local authorities indicated that stakeholders have specific roles and responsibilities in waste management. These responsibilities include mobilizing community members, providing advice on waste collection and management, actively participating in waste collection activities, and overseeing these operations. Stakeholders also provide resources and support, assign daily tasks, and facilitate the transportation of collected plastic waste for proper disposal. They serve as mentors to the community, promoting best practices in waste collection and disposal.

Government's Role in Plastic Waste Management

The FGD respondents unanimously emphasized the critical role that the government should play in plastic waste management. The suggested roles for the government in plastic waste management includes strengthening waste management committees, implementing cash-for-work activities, supplying waste management equipment, designating waste management areas, and providing necessary materials. The government should also enact and enforce comprehensive waste management laws, develop infrastructure, and foster community engagement.

Education and Capacity Building

The FGD respondents stressed the importance of educational initiatives and capacity building in waste management. Suggested initiatives include

providing necessary tools, training community members, incorporating hygiene promotion into schools, forming waste management committees, and conducting hygiene promotion campaigns. Effective education can enhance skills, strengthen education sector management, and offer technical vocational training.

Waste Management Policies and Regulations

The FGD respondents indicated that the IDP community currently lacks formalized policies and support from local authorities for waste management. There are no existing policies specifically designed to address the situation, and there is a lack of adequate techniques, guidelines, human resources, and funding. The community faces challenges with internal and external systems and community engagement.

The KIIs from the local authorities in Hargeisa and Southwest state reported their districts involved in waste management and sanitation activities, including street cleaning and sanitation efforts in IDP areas to prevent outbreak of diseases such as cholera. However, the KIIs from the local authority reported that there were previous attempts to manage plastic waste through recycling, but the recycling machines are currently non-operational due to mechanical issues. In this regard, there are no active waste management projects in progress at present. Nonetheless, it is worth noting that the ministry in Hargeisa has established waste management policies and procedures, including Regulation No. 83/2018, which was passed in 2018. These regulations are intended to guide future waste management initiatives within the jurisdiction.

Future Initiatives and Challenges

The KIIs from the local authorities stated that they are focusing on public awareness and education about waste management and are working on establishing an efficient waste collection system. However, due to financial constraints, some initiatives have not been implemented yet. Despite these challenges, there are plans to reuse waste and generate energy from it, but these plans are still in the planning stages. The authorities are partnering with NGOs for community awareness and waste collection and are considering large-scale plans for waste-to-energy conversion.

In addition, the local authorities in the Southwest State are planning several initiatives to improve waste management. These include acquiring more garbage collecting vehicles, organizing waste disposal programs through local radios, and hiring more waste collecting staff with a focus on vulnerable groups. They also plan to install more dustbins around the town for proper waste disposal. A policy is currently in the draft stage, which will be implemented upon official inauguration. The local government enforces waste management laws and regulations, monitors and evaluates partner companies, and is preparing policies and regulations for waste reduction and recycling.

Inclusivity and Involvement of Marginalized Communities

The KIIs from local authorities in Hargeisa have made efforts to empower marginalized communities and individuals with special needs by ensuring their representation in local government roles, prioritizing their employment in waste management, and including them in water committees. This highlights the government's commitment to inclusivity and empowerment, despite the challenges in waste management. In SouthWest State, the district authorities have given the highest priority to marginalized communities and vulnerable women by hiring them as garbage collectors in the town, which could allow to develop marketable skills and networks, as well as including them in the water committees in the IDP camps and villages. On the other hand, the local authorities in Jubaland reported that there are no ongoing waste management initiatives at the moment to integrate and involve marginalized communities. However, if the local government receives funds for such initiatives, they are willing to involve the local communities and IDPs.

Participation of Community led initiatives

Twenty-two percent of the household surveys reported that they are involved in community-led initiatives related to waste management while most of them (78%) are not involved in any initiatives. Of those involving community-led initiatives (22%) reported that there are a few members from their camp residents who collects on these plastic waste bottles and sold to businessmen and women in the main markets. Additionally, 63% feel encouraged or motivated to participate in community-led initiatives for plastic waste while 38% not are not motivated on these initiatives (which would be on a voluntary basis) therefore showing lack of community conceit and responsibility thus requires community awareness about these initiatives.

Private sector's waste management

The private waste management sector in Somalia is committed to achieving zero waste management (i.e. invest in a circular economy) by collecting various types of waste, including bottle bags, bottle residues, food waste, and plastic bottles. They actively promote recycling, the reuse of materials, and job creation for waste cleaning in the assessed region, underscoring their dedication to environmental sustainability and waste reduction.

Regarding their waste reuse practices, five out of seven private sector entities reported that they repurpose the collected waste to create other products. This include Africa solutions whose products are shown in the figure below.

Figure 4: Africa Solutions repurposed products from the plastic waste.


Figure 2: Waste collection point at Africa Solution Facility in Kismayo.

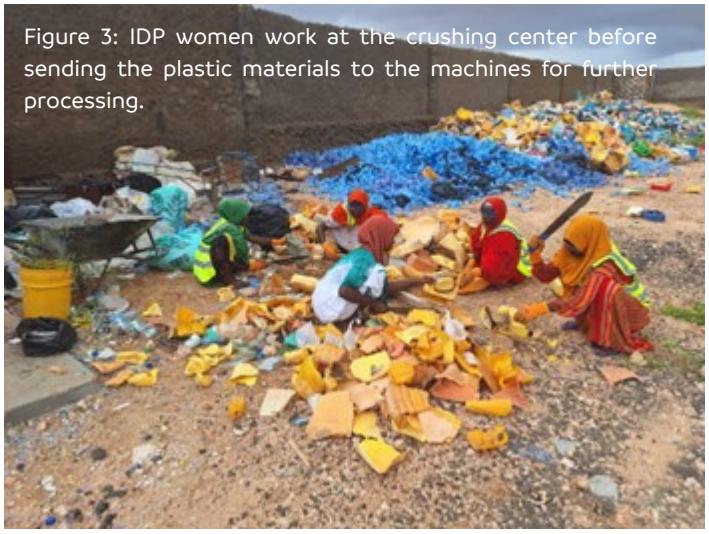


Figure 3: IDP women work at the crushing center before sending the plastic materials to the machines for further processing.

In contrast, the remaining sectors mentioned that they dispose of the waste by burning it after collecting it from the Internally Displaced Persons (IDPs) and host communities.

On average, 15.5 metric tonnes of plastic waste are collected from IDP sites every month in the assessed districts. An overwhelming majority (83%) of private sector entities reported that they frequently observe plastic dumping in their surroundings, and this dumping is notably extensive.

Private sectors, such as Africa Solutions, have emphasized the disproportionate impact of waste on specific areas and communities, including farmers, pastoral communities, and IDPs. They have reported that these communities bear an unequal burden of the environmental consequences resulting from inadequate waste management. Improper waste disposal in these areas leads to issues such as the proliferation of

flies due to dumped waste, increased disease risks, and environmental pollution. However, it's worth noting that this situation also presents income-generating opportunities for vulnerable communities engaged in collecting plastic items for recycling.

Regarding the number of bags sorted at the sorting level each month, the responses from private sector entities varied significantly. 65% of the facilities reported sorting 500-1000 bags monthly, while 25% indicated sorting less than 100 bags, and 10% mentioned handling more than 1000 bags per month.

The responses from private sector entities regarding the percentage of recyclable plastic waste collected showed a range of outcomes. Approximately 66% of the Key Informant Interviews (KIIs) reported that less than 50% of the waste they collect falls into the recyclable category, while another 34% indicated that the majority of the waste they collect, over 75%, is indeed recyclable. These variations in recyclability percentages reflect the diverse nature of the plastic waste being managed by different sectors. The monthly amount of plastic waste sent for incineration varies among respondents, with 50% reporting no incineration, 25% indicating less than 1 ton, and 25% noting more than 1 ton.

Furthermore, the adoption of recycled plastic products within Somalia is generally considered very low by 67% of respondents, while the remaining 33% view it as low. However, majority (80%) of respondents reported that products such as bricks and interlocks made from recycled plastic are in high demand.

The most significant costs for companies are incurred at different stages of the waste management process, including primary sorting, cleaning, collection, transportation, secondary sorting, and recycling. The profitability of these

Figure 5: At Africa Solutions' facility in Kismayo, plastic materials are crushed by machines before being repurposed for other products.

waste management models varies among respondents, with some reporting profitability while others cite low profits. Suggestions for improvement include promoting increased recycling, implementing duty-free incentives for government taxes, securing low-cost energy sources, raising awareness about the use of recycled products, and launching additional recycling initiatives.

Private sector entities reported that they actively engage women and youth in plastic waste sorting and collection efforts. Furthermore, community engagement is achieved through various means such as workshops, community events, and door-to-door awareness campaigns.

The KIIs with private sector entities revealed that the primary challenges they face in plastic waste management include issues related to public awareness, insufficient funding, and a lack of infrastructure. Furthermore, when asked how they monitor and assess the impact of waste reduction and plastic waste management initiatives, they all highlighted the importance of observation, reuse, recycling, community engagement, and collaboration in monitoring and assessing the impact of waste reduction and plastic waste management projects.

BIO-WASTE CIRCULARITY

Jiko biogas is actively dedicated to achieving zero waste management by promoting environmental sustainability and local energy production. They focus on reducing the transportation of gas from outside Somalia by providing locally made energy to vulnerable communities in Banadir and Jowhar regions. Their primary goal is to reduce deforestation, purchase chemical fertilizers using locally produced, affordable energy, and meet the energy needs of households in the region.
For biogas production, Jiko primarily utilizes cow dung and organic food waste, including leftovers and rotten vegetables. These waste materials are efficiently converted into biogas, offering an eco-friendly and cost-effective solution.

Moreover, the waste generated from the biogas production process becomes valuable fertilizer for agricultural purposes, enhancing soil fertility.
However, despite the benefits of biogas production, several challenges persist. One major issue is the lack of pressure pumps for using cylinders and suitable containers for biogas production, which can increase operational costs. Transportation of waste materials, particularly cow dung, can also be costly, doubling transportation expenses.

Additionally, the expansion of biogas production faces financial and resource constraints. The initiative lacks capital for expansion and requires more equipment for training human resources, particularly women and youth. Overcoming these challenges is crucial to expanding production to different areas and improving the skills of the workforce.
Regarding technology and infrastructure, Jiko employs machines for stirring or mixing waste, making the biogas production process more efficient. Control systems or machines are in place to regulate the process, ensuring effectiveness.

However, one limitation is the need for larger capacity storage containers for waste. The current tanks used for waste storage at collection points are small and need to be replaced with larger ones to enhance the capacity of the biogas production system.
Biogas production from bio-waste significantly contributes to environmental sustainability in the Banadir region. It prevents deforestation, reduces drought conditions, and promotes the growth of plants, creating green spaces and conserving water resources.
Furthermore, biogas production improves the cleanliness of the town, leading to a cleaner environment. Additionally, it serves as a source of income for those involved in waste collection, positively impacting the local economy.

The KII stated that various stakeholders are involved in bio-waste management for biogas

production, including IDPs or refugees, the host community, international and United Nations agencies, and the local government in Jawhar. The government's provision of land for biogas production has had a positive social impact by reducing the need for IDPs in Jawhar to collect wood from the jungle, thus lowering associated risks.

To foster collaboration in bio-waste management initiatives, private sectors have shown interest but express concerns about the cost. They have requested the installation of tanks and advocate for lower prices due to the local production of biogas. Collaboration with the government is also necessary, involving permissions and negotiations to expand these initiatives.

Overcoming initial obstacles, such as interference from security forces, Jiko biogas has persevered. However, there remains a lack of awareness about the benefits of their products, especially their use as fertilizers by farmers. To address this, they have implemented strategies like free fertilizer delivery to encourage community testing and increase product adoption.

The beneficial use of bio-waste by-products like fertilizer:

- Environmental Sustainability: Using bio-waste by-products as fertilizer promotes environmental sustainability by recycling organic materials, reducing waste, and minimizing the need for chemical fertilizers.
- Nutrient-Rich Soil: Bio-waste-based fertilizers are rich in essential nutrients like nitrogen, phosphorus, and potassium, which enhance soil fertility and improve crop yields.
- Improved Crop Health: Fertilizers derived from bio-waste contribute to healthier plants with increased resistance to pests and diseases, leading to more robust and thriving crops.
- Cost-Effective Farming: Utilizing bio-waste by-products as fertilizers can help farmers reduce their input costs while increasing agricultural productivity and profitability.
- Reduced Environmental Impact: The use of bio-waste by-products reduces the release of harmful chemicals into the environment, promoting cleaner and more sustainable farming practices.
- Sustainable Agriculture: Incorporating bio-waste by-products into farming aligns with sustainable agriculture principles, ensuring long-term food security and soil health.
- Local Resource Utilization: Communities can harness the potential of bio-waste by-products locally, minimizing the need for external inputs and creating a closed-loop system.
- Community Resilience: Adopting eco-friendly practices like using bio-waste by-products as fertilizers contributes to community resilience by improving agricultural sustainability and food self-sufficiency.

In terms of recommendations for improving the efficiency and sustainability of bio-waste management for biogas production, Jiko biogas highlights the need for support, community training, and awareness creation. Support, including machinery and larger containers, is vital to enhancing the biogas production process. Training the community in the importance of biogas production and creating awareness about product use aims to foster community involvement and adoption.

For future plans, Jiko biogas aims to expand electricity production, demonstrate biogas usage in vehicles, and provide training for the community and technicians. These initiatives aim to increase electricity production, raise awareness about biogas, and improve skills through training. Additionally, they aim to showcase biogas's potential in powering vehicles, promoting its adoption and efficient use.

CONCLUSIONS

Plastic waste circularity

- **Types of Plastic Waste**

Single-use plastic bags, plastic bottles, food packaging, and plastic containers are the most common types of plastic waste generated at IDP sites.

- **Waste Handling and Disposal**

The handling and disposal of plastic waste at IDP sites involve practices like burning, burying, throwing away, selling, or reusing plastic waste. Burning is a prevalent method, especially during the dry season, while some waste is buried or dumped outside the camps. Only 28% of residents separate plastic waste from other types.

- **Waste Collection Methods**

Waste collection primarily relies on curbside pickup and communal bins, with a notable absence of designated recycling drop-off points. Open lands are commonly used for waste disposal, leading to environmental concerns.

- **Challenges in Managing Waste**

Challenges include unexploded devices during waste disposal, lack of public dumping facilities, absence of proper waste management materials, and the scarcity of alternatives to single-use plastic products.

- **Proposed Initiatives and Solutions**

Initiatives include awareness campaigns, waste reduction strategies, proper disposal methods promotion, increased supervision and monitoring, and improved access to recycling facilities.

Bio-waste circularity

- **Environmental Sustainability**

Jiko biogas is committed to achieving zero waste management and promoting environmental sustainability in the Banadir and Jowhar regions of Somalia. Their work significantly contributes to reducing deforestation, improving soil fertility, and promoting local energy production.

- **Use of Local Resources**

By utilizing cow dung and organic food waste, Jiko biogas has established a local and eco-friendly energy source. This reduces the reliance on external gas sources, thereby supporting local communities and the environment.

- **Challenges Faced**

Operational Challenges: The lack of pressure pumps and suitable containers for biogas production increases operational costs. Additionally, the transportation of waste materials, such as cow dung, is a significant expense.

Financial and Resource Limitations: Expansion efforts are hampered by a lack of capital and necessary equipment for training, especially for women and youth.

Infrastructure Needs: The capacity of storage containers for waste is inadequate, necessitating larger tanks to enhance the biogas production system.

- **Benefits of Biogas Production**

Environmental Impact: Biogas production helps in preventing deforestation, reducing drought conditions, and creating green spaces.

Economic Impact: It serves as an income source for waste collectors, boosting the local economy.

Social Impact: The involvement of various stakeholders, including IDPs, the local community, and government agencies, has fostered social cohesion and reduced risks associated with wood collection from jungles (bush).

- **Collaboration and Awareness**

Private Sector Involvement: There is an interest from the private sector, though concerns about costs exist.

Government Collaboration: Necessary for expansion and effective management of bio-waste initiatives.

Awareness and Training: Increasing community awareness and training is crucial for promoting the adoption of biogas and its by-products.

RECOMMENDATIONS

Plastic waste circularity

- **Access to recycling facilities**

Establish recycling facilities and distribute recycling machines for plastic waste to enhance community involvement. This creates job opportunities for IDPs and motivates community participation. Raise awareness and provide training on recycling and waste management.

- **Community Involvement and Collaboration**

Encourage community involvement through job opportunities in waste management. Promote community awareness campaigns and training programs on recycling and waste management. Facilitate collaboration among community members to develop effective waste management solutions.

- **Suggestions for Improvement**

Provide wages for the waste management team, supply necessary tools, establish designated waste management areas, implement cash-for-work activities, and conduct hygiene promotion campaigns. Build capacity and involve marginalized communities.

Providing training for local repair technicians, and/or, allocating funds for replacement mechanical parts, and exploring the establishment of local committees or community-based financing for maintenance and repairs. These actions will ensure equipment reliability and community involvement. Role of Stakeholders

Involve national, state, and local governments, research institutions, NGOs, the private sector, funding agencies, and religious leaders in waste management efforts. Encourage collaboration among stakeholders to ensure effective waste management.

- **Government's Role**

Strengthen waste management committees, implement cash-for-work activities, provide waste management equipment, designate waste management areas, enact and enforce waste management laws, and develop infrastructure. Foster community engagement and active participation.

- **Education and Capacity Building**

Provide necessary tools, training, hygiene promotion in schools, form waste management committees, and conduct hygiene promotion campaigns. Promote education to enhance skills and vocational training.

- **Future Initiatives and Challenges**

Focus on public awareness, education, and efficient waste collection systems. Explore waste-to-energy conversion and partner with NGOs for community awareness and waste collection.

- **Inclusivity and Involvement of Marginalized Communities**

Empower marginalized communities and individuals with special needs by ensuring representation, prioritizing employment in waste management, and including them in community initiatives.

Youth and women should be involved in waste collection, primary sorting of waste materials and involve them in cleaning wastes at the recycling facilitiesParticipation of Community-led Initiatives

Promote community-led initiatives for plastic waste management. Raise community awareness and motivation to participate in such initiatives.

- **Private Sector's Waste Management**

Encourage private sectors to actively engage in recycling and reusing collected waste. Promote the adoption of recycled products and incentivize waste management through duty-free incentives and low-cost energy sources.

- **Challenges**

Address challenges related to public awareness, insufficient funding, and a lack of infrastructure. Monitor and assess the impact of waste reduction and plastic waste management initiatives through observation, reuse, recycling, community engagement, and collaboration.

Bio-waste circularity

- **Enhanced Support**

Provision of machinery and larger containers to improve the biogas production process.

Provide training for local repair technicians, allocating funds for the procurement of replacement mechanical parts, and exploring the possibility of establishing local committees or community-based financing for maintenance and repairs. These measures are essential to guarantee the reliability of equipment and to actively involve the community.

- **Community Training and Awareness**

Educating the community about the importance of biogas production and the beneficial use of its by-products, like fertilizer.