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MERCY CORPS

E-Waste Circular Economy Transition to Scale Project

LEARNING BRIEF: SCALING SUSTAINABLE, COMMUNITY-LED MODELS FOR E-WASTE MANAGEMENT IN DISPLACEMENT SETTINGS

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Table of Contents

Project Overview

In 2022, Mercy Corps, in partnership with the International Organization for Migration (IOM) and with funding from Innovation Norway, piloted the "Greening Humanitarian Responses through Recovery, Repair, and Recycling of Solar Products in Displacement Settings" project. This pilot aimed to address the growing issue of e-waste in refugee settlements generated from distributed solar lanterns and accessories, while promoting environmental protection, sustainable energy access, and employment opportunities. The findings from the pilot highlighted the urgent need to scale e-waste management solutions to mitigate the health and environmental risks posed by improper disposal in refugee settings.

To address this need, Mercy Corps and IOM are currently implementing the E-Waste Circular Economy Scale: Exploring Synergies And Insights Transition-To-Scale Project, designed to test and prove a self-sustaining, financially viable circular economy model for e-waste management in the Bidibidi refugee settlement and the host community in Yumbe District. The project's overarching goal is to generate evidence for scaling, develop a viable business model, and establish partnerships with key e-waste stakeholders. In partnership with Bright Products, a solar company specializing in portable solar lighting and energy solutions, and Acele Africa, a company producing affordable, user-friendly batteries for energy storage, the project aims to provide a proof of concept that can be replicated in other areas.

The project is implemented in Bidibidi Refugee Settlement, home to over 270,000 refugees, predominantly from South Sudan. The settlement lacks access to the national electricity grid. As a result, off-grid solar products such as lanterns, widely distributed through humanitarian aid, serve as the primary energy source. Over time, the distribution of off-grid solar products without a proper disposal system in place has resulted in a substantial accumulation of e-waste, presenting significant risks to the displaced population and the environment.

The project has three targeted outcomes:

1. The financial model is determined and proven to be self-sustaining with sufficient volume of e-waste to ensure economies of scale.

2. The local eco-system is understood, including the avenues to integrate it within the e-waste circular economy solution.
3. Various management models and criteria for selecting flexible management models is tested and understood in different location.

Project progress to date:

The project successfully facilitated the establishment and operationalization of a fully registered a community-led E-Waste cooperative in Bidibidi, comprising trained repair technicians, community mobilizers, and storekeepers managing the e-waste business. Since February 2021, the project has reached 110,920 community members in Yumbe with information on proper e-waste disposal and the availability of repair services. Awareness campaigns have facilitated the collection of 1,559 solar lanterns and the repair of 513. By February 2024, approximately 358 community members had paid for the repair of various e-waste items.

The project has supported the establishment of three satellite hubs for e-waste repairs. Additionally, to enhance community outreach, two mobile (tricycle) e-waste collection and repair services have been introduced. Over a period of two months, cooperative activities—including e-waste collection and repair and has generated $625.60 in revenue.

This learning product presents lessons learnt from the project, providing recommendations for successful approaches that can be replicated or scaled.

E-waste kickoff meeting with stakeholders in Yumbe

Lessons Learnt

1. Establishing a Cooperative business model for E-waste management

To determine the most viable business model for community-led e-waste management, consultations were conducted at the project's inception with key stakeholders, including the District Local Government (DLG), Uganda Cooperative Alliance (UCA), existing e-waste waste project beneficiaries (technicians and community mobilizers, etc), Refugee Welfare Committees, International Organization for Migration(IOM) and the Office of the Prime Minister (OPM).

Following a preliminary assessment—and considering that the e-waste enterprise provides a public good and is seed-funded by public funds—Mercy Corps and IOM identified a cooperative model as the most viable incorporation option. Alternative private ownership models, such as partnerships, companies limited by shares, and companies limited by guarantee, were assessed as contrary to the values of the project.

On this basis, Mercy Corps partnered with the Uganda Cooperative Alliance (UCA) to establish a membership-based, community-managed cooperative, registered as the **Bidibidi E-Waste Multi-Purpose Cooperative Society Limited(BEMCOS)**. This cooperative includes thirty refugee and host community members, and operates under Uganda's legal framework, as regulated by the Ministry of Trade and Cooperatives.

The cooperative is mandated to provide e-waste collection, repair, refurbishment, and resale services across all zones of Bidibidi. UCA provided technical support throughout the cooperative's formation, registration, and operationalization, ensuring compliance with cooperative principles and best practices. On December 17, 2024, the cooperative held its first Annual General Meeting (AGM), during which formal governance structures were established- including committees for production and marketing, quality control, compliance, and audit—were formally established. Additionally, bank signatories were selected to facilitate financial due diligence and operational transparency.

Key Lessons Learned:

i. A community-owned cooperative model fosters inclusivity, sustainability and local ownership.
   - Cooperatives are democratically controlled by their members, ensuring that decision-making and profits are equitably shared.

ii. The cooperative model can strengthen social cohesion and local economic development.
   - By integrating both refugees and host community members, the cooperative promotes social cohesion at the local level and ensures jobs are prioritized for local members

iii. Uganda Co-operative Alliance has long standing experience in advising cooperatives enhance success.
   - Collaborating with UCA provided clear guidelines for structuring the cooperative and helped stakeholders—e-waste center staff and local authorities—gain a strong understanding of cooperative principles from the onset.

iv. The e-waste co-operative struggled to manage inventory and overheads due to thin capitalization. Initial capital investment will determine how quickly a co-operative business can expand.

Recommendations For Scale Up:

i. The cooperative model offers a suitable approach to establishing a sustainable approach to integrating e-waste businesses in refugee-hosting communities. It enables both refugees and host community members to collaboratively address environmental challenges while creating livelihood opportunities. This collaboration also fosters social cohesion and peaceful co-existence.

ii. Ensure concessional finance in the form of a recoverable grant or revolving fund is made available to support the financial sustainability of the co-operative.

iii. Mapping and engaging informal technicians within the community and supporting them in forming a cooperative presents an opportunity to scale their services effectively.

iv. Partnering with UCA, the umbrella organization for cooperatives in Uganda, provides a strategic opportunity for continuous capacity building, national recognition, and connections with other cooperative unions and innovation partners to scale the e-waste initiative.

Cooperative members monthly review meetings

2. Market Assessment Analysis to inform the cooperative pricing structure

A comprehensive market analysis was conducted in November 2024, to understand consumer behavior for the e-waste business enterprise and to determine appropriate marketing and pricing strategies. This assessment incorporated data from a willingness-to-pay study conducted in January 2024 and analyzed consumer demand, competitor pricing, and operational cost structures across all five zones of Bidibidi.

The market analysis revealed a positive consumer attitude and purchasing behavior toward e-waste repair services across all five zones. However, there was a need for awareness-raising to ensure community members fully understand the benefits of repair services, the cooperative business model, and its pricing structure. The assessment revealed that repair of solar lanterns was the most sought-after service, followed by repair of panels and batteries. The majority of respondents (67.3%) paid for e-waste services in cash, while 2% opted for installment payments. However, local repair kiosks lack standardized pricing and do not have a product/service catalog, limiting pricing transparency. Additionally, the supply chain for durable spare parts remains inadequate within the refugee setting. This scarcity results in high repair costs for Sunbell solar lanterns and other solar panel brands.

Based on the market analysis assessment, additional e-waste services were identified to enhance the cooperative's revenue streams, leading to an expansion of service offerings. The cooperative adopted a tiered pricing model, categorizing repair costs based on common fault for solar lanterns, panels, torches, mobile phones and radios. The final pricing structure indicated repair services at between $1.94 to $4.54 and spare parts priced between: $1.08 – $4.05 (factoring in material, labor, and overhead costs)

Key Lessons Learned:

i. Develop tailored awareness programs to create awareness of the advantages of using the cooperative services, in terms of value, price and ease of purchase

ii. Leverage data for business growth. It is very important to track customer preferences and views in designing a sustainable e-waste business

iii. The accessibility of spare parts is a challenge as they cannot be easily sourced locally, adding additional costs. There is a need to map and establish linkages for the E-waste cooperative to acquire alternative spare parts from suppliers within the country, ideally reducing cost and carbon footprint.

Recommendations For Scale Up:

i. Develop the product & service catalogue with standardized prices for e-waste repair services based on a local market assessment

ii. Conduct a Gender Social Inclusion assessment to tailor the market engagement strategy

3. Financial sustainability through the roll out of the Fee based repair Services

To generate revenue for the cooperative, a fee-based repair service for e-waste collection and repair was introduced. Mercy Corps provided support in establishing financial reporting procedures, financial management training, and an inventory database for the cooperative. The cooperative adopted the Biasara business operating system, which includes an inventory database, general ledger, cash and credit sales tracking, sales statistics, expense reports, stock level monitoring, and executive financial reports. Additionally, 18 cooperative members (4 female, 14 male) received training on the tracking system, ensuring transparent financial management practices.

As part of its market entry strategy, the cooperative introduced a 20% promotional discount during its initial operational phase (December 2024) to stimulate demand and assess financial performance. Between December 2024 and February 2025, the cooperative collected 1,389 e-waste items and repaired 513, generating a total revenue of UGX 2,303,000 from repair services. The corporative registered lower sales in the month of February as compared to January. A shortage of spare parts during the month of February limited the number of repairs that could be completed, directly affecting overall sales. Additionally, the removal of the 20% promotional discount in February led to a slight increase in repair costs, which may have contributed to the decline in demand—especially in households facing competing basic needs such as school fees, food, and other essentials.

Key Lessons Learned:

i. Transitioning to a cost-based model Is initially challenging as some households prioritized essential expenses over repairs, highlighting the need for pricing strategies that enhance affordability.
ii. Extensive social behavior change campaigns are needed to address demand-side barriers related to the community's reliance on free services.
iii. Targeted consumer engagement strategies, such as discount incentives, flexible payment plans, and awareness campaigns, can drive adoption of repair services.
iv. Expanding beyond basic repairs to include battery replacements, PCBA repairs, and solar panel maintenance strengthens financial sustainability and market positioning.

v. Technicians require additional training to handle newly incorporated devices, particularly PCBA repairs, advanced solar lantern models, and smartphone components.
vi. Limited access to spare parts remains a challenge. Weak supply chain networks in Yumbe hinder the availability of essential components, affecting turnaround times and service reliability
vii. Explore local manufacturing options to reduce dependency on importation of spare parts

Recommendations for Scale Up:

i. Strengthen market linkages with spare parts suppliers and position the e-waste enterprise as a key supplier for local technicians.
ii. Enhance financial and operational capacity by providing cooperative leaders and members with training in financial management, marketing, and governance.
iii. Introduce financial incentives for e-waste collection, such as commission-based models, buy-back schemes, or rewards for individuals and businesses that return used electronics, improving collection rates.

4. Establishment of E-waste satellite hubs

Mercy Corps and IOM, in collaboration with AceleAfrica, established and equipped e-waste satellite hubs in Zones 3 and 1. These container-based hubs have been furnished with essential infrastructure, including computers for administrative functions, fire extinguishers and other safety equipment for workplace safety, alarm padlocks and secure storage facilities for asset protection, Personal Protective Equipment (PPE) such as gloves and goggles for technicians, Mobile money-enabled phones to facilitate cashless transactions and installation of Solar panels to provide renewable energy for operational purposes. Additionally, the cooperative is testing mobile repair models using tricycles to serve Zones 2 and 5, enhancing last-mile service delivery. The comparative advantages of the physical kiosks and the mobile repair services using the tricycles will be assessed to inform the best approach for scaling in other regions.

The cooperative is implementing various awareness-creation approaches to drive community engagement and promote its repair services including creating awareness about the physical kiosks and the mobile repair services. These efforts include roadshow campaigns, which have so far reached 117,182 community members.

Key Lessons Learned:

i. The design of the e-waste repair kiosks is crucial for weather resistance, safety, and durability. To ensure operational efficiency and compliance with best practices, ACELEAfrica and IOM developed Standard Operating Procedures (SOPs) for energy kiosks and battery re-purposing.
ii. The mobile repair services model using tricycles is proving effective in reaching more remote communities that lack access to physical kiosks.
iii. There is need to increase behavior change campaigns to educate community members on the benefits of e-waste repair and recycling services including sharing the exact points to access the services.
iv. A hybrid model, where mobile units collect and conduct basic repairs while referring complex repairs to the physical hubs, appears to be the most viable approach.

Recommendations for Scale Up:

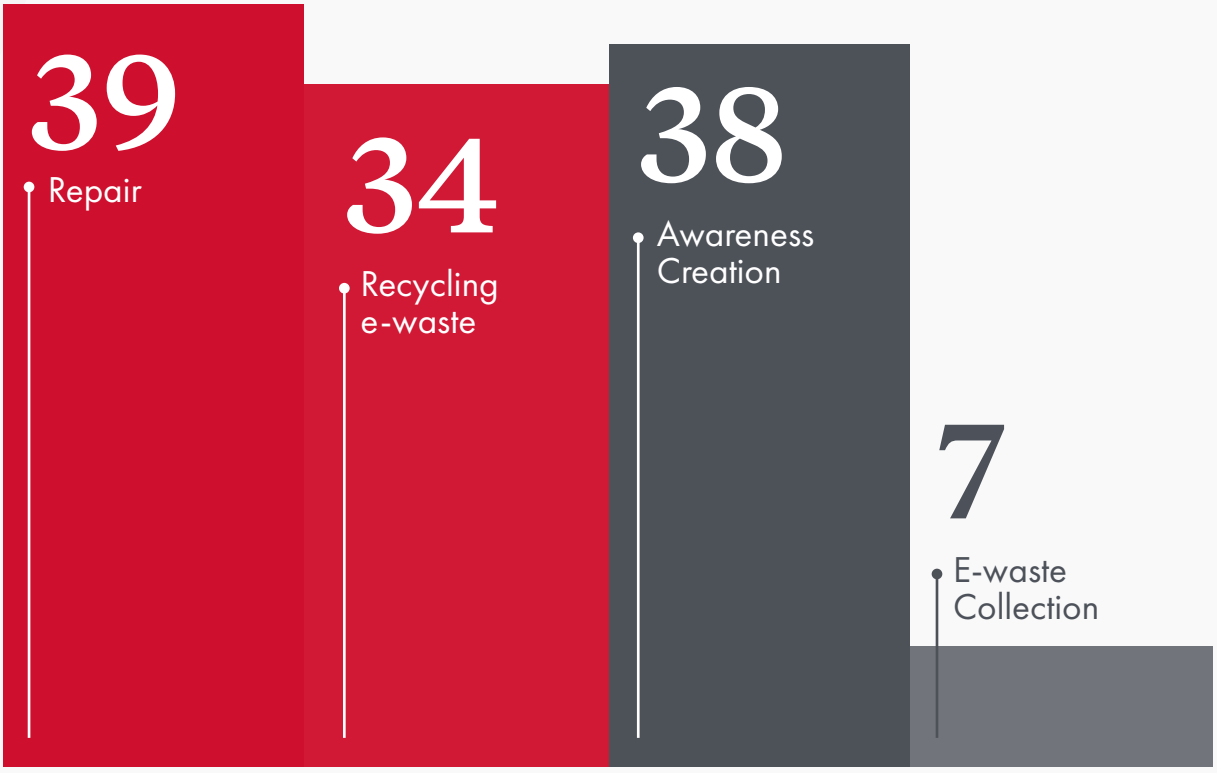
i. Pilot the hybrid mobile collection and repair model; scale based on evidence.
ii. Scale based on a cost-benefit analysis of the mobile and fixed hub models.
iii. Invest in demand activation with sensitisation and social behaviour change campaigns

Bidi Bidi Zone 4: Innovation Center

5. Mapping of the informal and formal e-waste actors for partnerships and collaborations

A comprehensive stakeholder mapping exercise was conducted by Mercy Corps in collaboration with cooperative community mobilizers to identify informal e-waste collectors and repair technicians operating within the e-waste project ecosystem in and around Bidibidi Refugee Settlement. The mapping identified 71 informal e-waste actors (69 male, 2 female), with 19 from the host community and 52 from the refugee community. The analysis assessed their roles, challenges, and opportunities for integration within the cooperative framework. Most of the actors mapped are involved in electronic repairs and recycling, with some providing multiple services across different product categories. The table below shows the number of actors providing different services across Bidi Bidi refugee settlement.

Actors Offering the Service



Most of the actors mapped identified key barriers such as lack of technical capacity to repair advanced solar products and smartphones, limited access to capital to expand their businesses and weak market linkages and lack of visibility for repair services. To enhance service offerings and improve sustainability, the Ewaste Cooperative is

partnering with Bright Products to extend repair and refurbishment services beyond solar lanterns. BRIGHT Products specializes in developing and distributing portable solar light and energy solutions. **In the transition to scale, the program is exploring partnerships with other entities such as Tulima Solar, a supplier of water pumps; ECOCA East Africa, a provider of solar cooking solutions; D.Light, a supplier of solar home systems and lanterns; and POPO Africa, a provider of various solar technologies. This will enable the cooperative to diversify its repair and refurbishment services and foster a sustainable circular economy for solar energy products.** These collaborations will enable the cooperative to diversify its repair and refurbishment services, fostering a sustainable circular economy for solar energy products.

Key Lessons Learned:

i. Informal actors play a critical role in e-waste management but require structured support. Many operate independently without formal training, limiting their ability to handle complex repairs. Integration into the cooperative could improve service quality and standardization.
ii. Technical capacity gaps limit the growth of repair businesses. Technicians struggle to repair advanced solar home systems and smartphones, which are in high demand. Continuous training programs will be necessary to up-skill informal repair technicians.
iii. Most informal actors operate on a small scale, lacking the funds to invest in tools, spare parts, or advanced repair techniques.
iv. Strong partnerships with energy companies are key to scaling e-waste repair services. Expanding repair services beyond solar lanterns to include solar water pumps, home systems, and cookstoves creates new revenue streams.

Recommendations for Scale Up:

i. Formalize collaboration with informal repair technicians. Develop a tiered partnership model where local technicians receive training in advanced solar and electronics repair, access to spare parts at cooperative-run depots and business mentorship to help them scale operations.
ii. Design training sessions on repair of the different electronic waste and offer certification programs to improve credibility and trust among consumers.
iii. Expand service agreements to include after-sales repair contracts with energy

companies.

iv. Advocate for policies that encourage manufacturers to collaborate with local repair ecosystems.

v.

6. Revenue generation potential through the Battery Laboratory (Batlab)

As part of innovative e-waste management efforts, IOM, in collaboration with ACELEAfrica, established a Battery Laboratory (BatLab) where discarded lithium batteries undergo testing, validation, and re-purposing. Technicians identify viable cells from non-functional batteries and assemble them into second-life battery packs, thereby extending battery lifespan and reducing environmental waste. Currently, the BatLab is managed by the BidiBidi cooperative, integrating circular economy principles into the local energy ecosystem. IOM and ACELEAfrica are training BatLab staff on Standard Operating Procedures (SOPs) for battery assembly, testing, disassembly, and safety protocols, ensuring efficiency and sustainability.

The Bat Lab stands out as a pioneering innovation in battery re-purposing, enabling the cooperative to transform non-repairable batteries into valuable energy storage solutions. Managed by the cooperative with technical support from IOM and ACELEAfrica, the Bat Lab is staffed by two local engineers (one male, one female), fostering local employment, breaking gender barriers and skills development. By re-purposing lithium batteries into affordable, sustainable power solutions, the cooperative can tap into growing demand for low-cost energy storage, particularly in off-grid communities.

Over 150 Ecostore batteries have been repurposed and are awaiting certification from the Uganda National Bureau of Standards (UNBS) before commercialization. This will ensure product safety, quality assurance, and ease market entry. Once certified, the cooperative will scale up production, expand market reach, and diversify revenue streams, reinforcing the sustainability of e-waste cooperative. The cost of batteries is estimated to range between UGX 140,000 to 1,200,00. The integration of the BatLab into the cooperative's operations presents a significant opportunity for revenue generation.

Key Lessons Learned:

i. Strategic partnerships with energy service companies and local e-waste repairs and collectors is critical for feedstock supply (lithium batteries) which is critical for scaling battery re-purposing.
ii. The pursuit of UNBS certification for the second-life battery packs (Ecostore and Ecosol) highlights the importance of meeting regulatory standards. Certification not only ensures quality and safety but also enhances market acceptance and trust among stakeholders.
iii. Continuous improvements in technology enhance efficiency and reliability.
iv. Skilled personnel are critical for maintaining quality and supporting the initiative's growth.
v. The integration of the BatLab into the cooperative's operations presents a significant opportunity for revenue generation

Recommendations for Scale Up:

i. Conduct a market assessment to identify high-demand sectors and key distribution channels for repurposed batteries.
ii. Introduce pricing models that make second-life battery solutions competitive in the local market.
iii. Conduct public awareness campaigns on the value, safety, and affordability of repurposed batteries.
iv. Partner with local retailers and distributors to enhance product accessibility and consumer trust.

Mercy Corps E-waste centre at Innovation centre in Zone 4 BidiBidi Refugee settlement

Recommendations

Gaps & Opportunities

Whereas as the model has exhibited potential to improve livelihoods and environmental sustainability, we need to back it up with data. At this stage, we cannot recommend scalability without a Proof of Concept or report assessing the financial viability of the model.

1. **Expansion of the E-Waste Cooperative Model:** The cooperative business model has exhibited potential to improve livelihoods and environmental sustainability. The viability of the model is being assessed in the transition to scale phase and a detailed business plan and financial model will be developed that will inform the replicability to additional refugees settlements.

2. **Scaling the Battery Laboratory (Bat Lab) for Revenue Generation:** The Batlab has potential as an additional income stream, we don't have it's proof of concept. This we can only ascertain once the battery packs have been certified and sold. And we have in place tested and clear strategies on feedstock sourcing and logistics.

   With a proper defined go to market strategy and certification of the battery packs, the Batlab presents a potential for generating high revenue streams for the cooperative, increasing income opportunities while promoting sustainable energy solutions.

3. **Strengthening Partnerships with Energy Service Companies:** Collaborating with solar home system providers, appliance manufacturers, and waste management actors enhances market linkages, improve product repairability, and increase e-waste recovery rates.

4. **Formalizing informal repair networks:** Engaging informal e-waste actors through training, and partnership agreements can improve the quality of repairs and ensure a steady supply of e-waste to the cooperative.

5. **Address demand side barriers to drive uptake of e-waste services by displaced communities:** Leveraging consumer awareness campaigns, flexible pricing models, and pay-as-you-go (PAYGo) financing mechanisms could increase the adoption of repaired electronics and second-life batteries.

Recommendations for scalability and replication

1. **Roll out a toolkit for replicating circular economy models in displacement settings:** A toolkit developed during the pilot phase will be updated and rolled out to share best practices, lessons learned and SOPs to facilitate replication in other humanitarian contexts.**Inject capital early:** Ensure concessional finance in the form of a recoverable grant or revolving fund is made available to support the financial sustainability of the co-operative.

2. **Strengthen supply chains for spare parts:** Develop strategic partnerships with electronics manufacturers and distributors to improve access to high-quality spare parts, reducing repair turnaround times and enhancing service reliability.

3. **Enhance technical training for repair technicians:** Expand training to cover advanced electronics, including smartphones, power banks, and modern solar home systems, ensuring technicians can meet evolving market demands.

4. **Address demand side barriers through tailored engagement strategies:** Conduct targeted outreach to educate communities on the benefits of e-waste repair and responsible disposal practices, improving demand for cooperative services.

5. **Advocate for Policy Support on E-Waste Management:** Engage policymakers to develop enabling regulatory frameworks that encourage sustainable e-waste practices, such as extended producer responsibility (EPR) schemes and tax incentives for repair businesses.

What Next?

The project is undertaking a comprehensive market assessment and financial analysis to evaluate potential revenue streams and optimize go-to-market strategies for the e-waste cooperative. This assessment, to be conducted by Open Energy Labs, will include a detailed review of financial performance, cost structures, pricing models and a business plan to ensure the cooperative's long-term sustainability. Additionally, it will provide data-driven recommendations for scaling the e-waste business enterprise in BidiBidi and other regions.

Battery racks used for testing lithium-ion batteries at the BatLab, located at the Innovation Centre in Zone 4 of the BidiBidi Refugee Settlement.

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About Mercy Corps

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