Final Evaluation of Sustainable Solutions to Solid Waste Management (SWM) Project in Cox's Bazar District

ACKNOWLEDGMENT

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Project/outcome Information		
Project/outcome title	Sustainable Solutions to Solid Waste	
Atlas ID	0112436	
Corporate outcome and output	Output 2.1: More people in Bangladesh, especially the most vulnerable and marginalized, have increased capacities, knowledge, and skills to adopt sustainable consumption behaviours and lead in climate action Output 3.3 – Civil society, private sector and government actors work together to put the country on a path of sustainable and green development by providing efficient oversight functions for environmental policies and legal frameworks, identifying finance 3.4.1: Innovative nature-based and gender-responsive solutions developed, financed and applied for sustainable recovery	
Country	Bangladesh	
Region	Asia and the Pacific	
Date project document signed	29.03.2022	
Project dates	Start	Planned end
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Total committed budget	5,030,815	
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Evaluation information	
Evaluation type (project/ outcome/thematic/country programme, etc.)	Sustainable Solutions to Solid Waste Management Project in Cox's Bazar District
Final/midterm review/ other	Final Evaluation

[1] This is the entity that has overall responsibility for implementation of the project (award), effective use of resources and delivery of outputs in the signed project document and workplan.

Period under evaluation	Start	End
	2019	2022
Evaluators	DM WATCH	
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3R's	Reduce, Reuse, Recycle
AC Land	Additional Commissioner Land Office
CfW	Cash for Worker
CiC	Camp in Charge
CoB-	Constitute of Bangladesh
CXB	Cox's Bazar
DC	District Commissioner
DDP	District Development Plan
DPHE	Department of Public Health and Engineering
EETWiG	Environment and Energy Technical Working Group
EIA	Environment Impact Assessment
EPR	Emergency Preparedness Response
FGD	Focus group Discussion
FSS	Food Security Secto
HHs	Households
HP	Hygiene Promotion Technical Working Group
IDI	In-depth Interview
IEC	Information Education Communication
IOM	International Organization Migration
ISCG	Inter-Sector Coordination Group
KAP	Knowledge Attitudes and Practises
KII	Key Informant Interview
LGED	Local Government Engineering Department
MoEFCC	Ministry of Environment, Forest and Climate Change
MoU	Memorandum of Understanding
MRF	Material Recovery Facility
PAB	Practical Action Bangladesh
PPE	Protective Personal Equipment

PS	Private Sector
PSA	Public Service Announcement
RRRC	Refugee Relief and Repatriation Commissioner
S	Sanitation
SCP	Secondary Collection Point
SD	Scrap Dealers
SIDA	Swedish International Development Agency
SMEP	Site Maintenance and Engineering Project
SMS	Site Management Sector
SOPs	Standard Operational Procedures
SREDA	Sustainable and Renewable Energy Development Authority
SREPGen	Sustainable and Renewable Energy Power Generation
SWM	Solid Waste Management
TDS	Temporary Disposal Site
TWiG	Technical Working Group
UNDP	United Nations Development Program
UNO	Upazila Nirbahi Office
UP	Union Parishad
USD	United States Dollar
W2R	Waste to Resource
WASH	Water, Sanitation and Hygiene Sector
WATSAN	Water and Sanitation
WFP	World Food Program

EXECUTIVE SUMMARY

As a result of the Rohingya refugee influx to Bangladesh, the population of two Upazilas (sub-district) of Ukhiya and Teknaf in the southern part of Cox's Bazar has risen to around 1.5 million people. This has strongly contributed to existing health and environment challenges, including underfunded and under-resourced solid waste management (SWM). Before the implementation of the project, it was estimated that the two Upazilas without a properly functioning SWM system generated over 22,000 cubic meters of waste per month.

UNDP with funding from the Swedish International Development Agency (SIDA) has implemented the project called "Sustainable Solutions to SWM". This project was a response to the Rohingya crisis in Bangladesh and the pressing SWM needs both in the host communities and refugee camps. The project targeted the protection of women and children, the prevention of diseases, as well as the promotion of hygiene and proper sanitary standards. This project was implemented in the host communities within five Unions in Ukhiya and Teknaf, and in the refugee camps, for a three-year implementation phase, and extended for 10 more months up to June 2022.

The evaluation was aimed to assess the progress of the SWM project to date, the performance and achievements of the project, and the validity of its overall approach and quality; and provide recommendations for adjustment and lessons learned that will inform the development of the next phase. The evaluation team used Organisation for Economic Co-operation and Development (OECD) evaluation framework including environmental sustainability and governance criteria to analyse the results of the study. The evaluation also places particular emphasis to evaluate the extent to which the project has contributed to balancing gender, protecting the environment, and strengthening governance.

The study team adopted a mixed-method approach, combining both qualitative and quantitative approaches to collecting data. Between 26 and 29 April 2022, the study team collected quantitative data from the proposed union/municipality from the two Upazilas in the Chittagong district. A total of 250 household heads and 134 shop owners were surveyed.

The report is divided into four sections. Section one discussed the detail of the background, objectives, and overview of the project activities. Section two elaborated on the methodology of the study. Section three contains the findings of the qualitative and quantitative surveys. Section four consists of the conclusion and recommendations as per the findings.

Key Findings of the Evaluation

Relevance

The study team determined that the project was highly pertinent to current national priorities and focus areas, which centered on waste management. This project was found to be relevant

to national policies and action plans. Apart from being relevant to waste management-related Bangladesh national priorities and policy landscape, this project was found relevant to international policies and strategic plans. Before the implementation of the project, Ukhiya and Teknaf was producing over 10,000 tons (22,000 m3) of waste per month. Inadequate waste management harms the environment. The proposed UNDP activities under this project aimed to restore human dignity to vulnerable people in the region. Following that the Project's activities and outputs were found relevant to the overall goal and objectives. The evaluation found that the project implementation was relevant to the Theory of Change as well. The project is expected to see that the successful implementation of this project will make improvements to the management of waste, and a cleaner local landscape will be visible.

Effectiveness

In October of 2018, the chairman of 5 Union identified the primary locations deemed critical due to the production of large quantities of solid waste. As a result, thirteen (13) market areas were selected as project focus areas. Early in October 2020, these 13 locations in 5 Union Parishads underwent an initial cleaning campaign, which was followed by the establishment of a fundamental SWM service. In 2019 in the refugee camps, a massive cleaning campaign was designed to cover all 27 camps with the coordination support of the WASH, SMS, and the implementation of BRAC and SMEP. Consequently, this final evaluation found that nearly all project beneficiaries (99%, N=384) in the host community study area were aware of the project's cleaning campaign. In Teknaf Municipality, BRAC engaged 20 CFW for the cleaning campaign as a part of the cleaning program's implementation partners. Also, In Unions, the SWM was established in January 2021. UNDP/BRAC managed the Sanitary landfill in Ukhiya Camp 20Ext, The established SWM systems in Union Parishads and Teknaf Municipality have resulted in the collection and safe disposal of 47,775m3 of waste by February 2022.

In total, the project has distributed 21,210 pairs of bins to all beneficiaries in 5 Unions and Municipalities. The study found around 97% (N=384) of the respondents agreed that they received the waste bins from this project. Around 90% (N=250) of the beneficiary households now use at least 2 waste bins to store their household waste and around 61% (N=134) of the beneficiary shop owners do the same., In Teknaf and Ukhiya Upazila, Following a few field visits and aerial image scanning, the project identified some lands feasible for a landfill in camps but not yet in host communities. All SW facilities have been subjected to an EIA, which will be submitted to the Department of Environment (DoE). [2] Sanitary landfills have been constructed in Teknaf and Ukhiya Upazilla.

In late 2018 and early 2019, the project conducted a recycling value chain analysis to describe the local recycling sector in Teknaf and Ukhiya Upazila. The project incorporated all of the findings and based the intervention in this output on assisting the local sector to overcome

these obstacles. The project initiated a Grant program which was disseminated among stakeholders in 3 Cohorts.

This study found that approximately 88% (N=250) of the household beneficiaries were aware of the two-month community engagement campaign. Around 80% (N=384) of respondents from both households and shops responded that they received training from the project on Solid Waste Management (SWM). In this case, around 84% and 87% (N=69) of the respondent living in Ukhiya Upazila replied that they got training on "waste segregation at source" and "how to store and sell recyclable items". On the other hand, 86% and 83% (N=236) of the respondents from the Teknaf municipality replied that they got training on the same topic. In the Municipality, organic waste and inorganic waste are separated at the source. The study also found that around 87% (N=78) of the respondent in Ukhiya Upazila and 76% (N=254) respondents in Teknaf Upazila answered correctly regarding the color of the bin to store the organic waste. This shows that the project was able to disseminate information properly regarding the use of colored bins. This study revealed that over 87% (N=293) of respondents in Ukhiya Upazila and Teknaf Upazila place their waste in household waste collection bins. In the case of shop owners, approximately 75% of both Upazilas use their shop dustbins to store solid waste.

In both Teknaf and Ukhiya Upazila, 74% (N=278 and 88) of respondents gained knowledge about waste segregation from the project. Nearly 95% (N=250) of the household beneficiaries were aware of the solid waste segregation technique. While approximately 87% (N=134) of the store owners were aware of waste segregation. Nearly 81% (N=134) of shop owners dispose of their waste regularly. this is an indication of the availability of regular waste collection services in the study area. Regarding waste collection services in the project area, around 80% (N=91) of the respondents in Ukhiya and 83% (N=293) of respondents in Teknaf Upazila said that they have a regular waste collection service in their area.

Practical Action also ran a two-month public awareness campaign that included a variety of events to raise awareness about sustainable solid waste management and the 3R (Reduce, Reuse, and Recycle) process. The study found that around 59% (N=207) of the household respondents in Teknaf Upazila have perfect knowledge regarding 3R activities and 24% (N=86) of the shop owners have perfect knowledge. In Ukhiya Upazila this rate is high for the household beneficiaries around 72% (N=43) and for the shop owners it was only 31% (N=48).

Impact

The implementation of the UNDP SWM project decreased the health risks posed by solid waste. Due to the implementation of this project, vulnerable households from refugee and host communities have greater access to appropriate SWM services and infrastructure and live in cleaner, healthier, and more humane conditions. This project had a great impact in changing the perception and awareness of the community people, the perceptions of project

beneficiaries regarding the environmental impact of solid waste have increased because of the project intervention. Because of this intervention, in Ukhiya Upazila around 88% (N=43) households and 36% (N=48), shop owners are concerned about the solid waste affecting their natural environment, in Teknaf Upazila around 97% (N=207) households and 49% (N=86) shop owner shared the same concern about their environment. This concern, in turn, leads to good practices of solid waste disposing, segregation, reduce, reuse, and recycle in the project area. This evaluation reveals that around 92.6% (N=91) of respondents in Ukhiya Upazila were concerned about the harmful health impact of waste, in Teknaf Upazila around 83% (N=293) of the respondent shared the same concern. According to this evaluation, 93.8% (N = 384) of respondents stated that the frequency of these diseases has decreased in the community over the past four years. After the implementation of the UNDP SWM project, wastes generated daily in the community and market areas were collected on time. Consequently, the surrounding neighborhood and market environment became clean. The collected wastes were then disposed of via composting, recycling, and landfilling based on their characteristics, such as organic waste for composting, non-organic but recyclable waste for recycling, and non-organic inert waste for landfilling. Thus, it reduced environmental impact and generated income for the community through job creation (such as cash-for-workers programs) and the sale of recyclable scraps.

Through the interventions, the project has fostered the growth of 41 scrap dealers and provided more than twenty training on various SWM-related topics. Prior to the implementation of the project, eight (8) beneficiary scrap dealers in Ukhiya Upazila employed a total of 44 workers in their shops; since then, this number has increased to 114, and 70 new jobs have been created. Furthermore, the number of workers employed by nine scrap dealers in Teknaf Upazila has increased from 61 to 85, and 24 new jobs have been created. Teknaf and Ukhiya's 16 scrap dealers have contributed to the creation of 94 new jobs. It demonstrates that the project was effective in improving livelihoods and creating new opportunities.

Efficiency

The prime purpose of the project was to capitalize on the use of recovered materials and livelihood associated, curtail the volume of waste requiring ultimate disposal, and improve waste management in the longer term. A number of basic UNDP concepts had been included in UNDP's waste management policy. Given the sensitive and complicated issues confronting this region, UNDP took a "do-no-harm" approach, carefully assessing risks and openings before taking action. All of the activities of this project adhered to UNDP's high ethical and moral standards for its employees and project design. Before implementing the project, UNDP had done several gap analysis studies and local stakeholder engagement sessions to build a better and more efficient Solid Waste Management (SWM). Through the ISCG coordination framework, UNDP engaged with other UN agencies as well as local and international NGOs

operating in Cox's Bazar regularly. UNDP also coordinates bilaterally to guarantee active engagement toward common goals.

According to the project completion report, funding was quite consistent, and the project was able to complete on time and within budget. The initial budget was revised in September 2019 to reflect the changing circumstances, and again in February 2020 as part of the COVID-19 response plan. In July 2021, a new budget modification was completed, and the project was granted a non-cost extension until August 2022. The evaluation team assessed that the project followed its implementation strategy throughout its implementation phase and the project was able to execute and plan all of its activity timely, although the recent COVID-19 pandemic had halted some of its activity, the implementing partners were able to achieve the targeted goals and outcomes in the long run. The evaluation found that the monitoring and evaluation mechanisms appeared to be well-planned and implemented the study's findings indicate that the majority of the project's activities, as mentioned previously in this section, were completed on time, apart from some exceptions.

Sustainability

The Sustainable SWM project has succeeded in instilling a sense of ownership in targeted communities in project intervention areas. Before the establishment of SWM collection services in host communities, all project direct beneficiaries (5,101 HH & 5,184 market shops) were oriented and provided with a set of two bins and informational and educational materials (IEC) about the importance of segregating domestic waste and how to do so. During the project implementation period, the project conducted an intensive community engagement and communication campaign on the 3Rs to consolidate knowledge and practices of waste segregation at the source, as well as to raise awareness about the significance of waste management. The project's design has been influenced by the UNDP's dedication to and track record of success in promoting the localization of its initiatives to promote the ownership of results and activities at the grassroots level. Throughout the 2018 pilot project, the project was designed after preliminary consultation with district and sub-district authorities and civil society groups. This is also reflected in the concern for sustainability, which entails building the capacity of local partners so that they can one day move forward without UNDP assistance. In the intervention areas, the solid waste management responsibilities of each level of local government were informal and undefined when the project was initiated. The project developed and proposed a SWM model in consultation with all relevant local authorities, outlining the roles of various levels of government and the private sector in developing and maintaining solid waste infrastructure and services.

However, in Unions, in particular, households respondents were found to be unaware of and uninterested in paying for SWM-related services. At the time of this evaluation, the municipality of Teknaf was found to be very involved in the project's interventions, and the

study revealed some positive indicators that the municipality authority has already developed a sense of project ownership. Although, due to a lack of staff, the Teknaf municipality's conservation department has yet to reach a fully operational and embodied state. The project found that the sustainability aspects of this project at the union level are still quite weak. Throughout the intervention, the UNDP has attempted to mobilize and activate WATSAN committees; however, their functioning and participation in union-level SWM decision-making remain very weak.

Livelihood development is essential to ensure long-term sustainability and is an integral part of the proposed project. Some workers have been recruited to supervise the SWM system, collect waste from households and businesses, segregate wastes, and work in the compost plant in the intervention areas as part of the Cash for Work program. Existing system viability is one of the most essential methods for ensuring the durability of solid waste solutions. To achieve this, the project introduced a Public-Private Partnership with the Teknaf Municipality based on a model implemented by the International Committee of the Red Cross for the Fecal Sludge Management System. The Project has developed a private sector engagement and mainstreaming strategy along with a business plan that balances costs and benefits.

Coherence

UNDP partnered with BRAC and Practical Action Bangladesh to carry out different parts of the project in the intervention areas. It was revealed that the coordination mechanism between UNDP, BRAC, and PA was highly effective and efficient. However, they were unable to organize the public awareness campaign as effectively and on time as intended. During an interview with a representative of Practical Action, it was found that, due to the ongoing pandemic and the prolonged lockdown, it was not possible to organize activities requiring a large gathering. It would have been possible to avoid these communication gaps if better coordination with stakeholders besides partners had been developed. The coordination between UNDP and the WASH sector has also been an integral part of the project. UNDP has co-led the SWM Technical working group and the Inter-sector technical working group as platforms to highlight the significance of mainstreaming SWM within the wash and other sectors. This close coordination increased the effectiveness of the project's implementation. UNDP and SMEP/IOM collaborated to establish the construction of the Temporary Solid Waste facility (Sanitary Landfill) in the Rohingya camps as part of the Sustainable Solutions Solid Waste Project.

Gender is a fundamental and essential aspect of all UNDP projects, and this is especially true when working with populations that are already disproportionately poor and disadvantaged. Reports from all UN agencies involved in the Rohingya response have consistently emphasized the heightened risk of gender-based violence in the region, which is frequently linked to drug use, human trafficking, and the economic exploitation of vulnerable Rohingya women and girls. Before the project started, a study was conducted to identify potential gender and child-

related issues. Through consultation with local partners, the study found that women were included as equal if not priority recipients of opportunities whenever possible. Women were encouraged to participate and benefit from all project activities, although Cox's Bazar is a religiously and socially conservative region in Bangladesh.

Key Findings

- To facilitate waste management at the source, 16982 waste bins have been distributed to households and shops as part of the project intervention. 90% (N=250) of beneficiary households and 61% (N=134) of beneficiary shop owners currently use at least two rubbish bins to store solid waste. During the study, it was discovered that waste bins were not being utilized effectively in many shops, and that in some shops, one or both bins were missing or broken. It was mainly because, either they did not need one of the bins entirely because of the type of waste that shop generates or the learnings were not sustainable.
- The Project has successfully initiated private sector engagement and mainstreaming strategy along with a business plan that balances costs and benefits in urban area. The project has fostered the growth of 41 scrap dealers and provided more than twenty trainings on topics such as business development, linkage, sorting various types of waste, preventing littering, value chain, and safe monitoring, among others.
- In the intervention areas, the solid waste management responsibilities of each level of local government were informal and undefined when the project was initiated. The project developed and proposed a SWM model in consultation with all relevant local authorities, outlining the roles of various levels of government (Union, Upazila, City Corporation, etc.) and the private sector in developing and maintaining solid waste infrastructure and services.
- Community areas' environmental and health quality had improved as a result of this project's implementation. According to this evaluation, 93.8% (N = 384) of respondents stated that the frequency of diseases (diarrhoea, dysentery, dengue, typhoid, ringworm, scabies, cholera, malaria, cough, asthma, and skin diseases) has decreased in the community over the past four years. 95.0% (N = 384) of respondents believed the UNDP SWM project was responsible for the disease reduction.
- While the institutional setup and management in Teknaf municipality were found efficient, however, in the Union level, the frequency of WATSAN meetings and the topics of discussion remain troubling. The project attempted to mobilize WATSAN committees and activate them over the last years, but their functioning and participation in union level SWM decision-making remains very weak due to a variety of factors including a lack of promoters/facilitators, local budget shortages, and political regime changes at the union level. Participation of beneficiaries in activities

and changes in knowledge and practice were observed; however, institutional structure and administration remained a weak link in the value chain.

- Due to the pandemic and the prolonged lockdown, it was discovered that it was difficult to organize activities requiring a large gathering. Representatives from Garbage Man, the Municipality, and various other stakeholders were dissatisfied with the planning of awareness-raising efforts. The initiative failed to organize the public awareness campaign as planned and on time.
- In Unions, the respondents were found to be unaware of and uninterested in paying for SWM-related services. only 11% of recipients from Teknaf Upazila and only 5.8% of recipients from Ukhiya Upazila could recall the messages regarding "willingness to pay" for waste collection service.
- Physical observations and interviews revealed that the temporary sanitary landfill developed for the municipality of Teknaf is nearly at capacity.
- The study found that there have been challenges in constructing a new landfill facility. Despite the project's best efforts to locate adequate land for this purpose, there have been challenges with land allocation process. There is a lack of adequate land, and the bureaucratic process between different departments in government and local government has proved problematic.
- One of the essential components of the SWM project was the local recycling sector, which consists primarily of scrap dealers. The SWM project has supported the formation of two cooperative scrap dealer associations in Ukhiya and Teknaf, the first cooperative scrap dealer associations in Bangladesh. Prior to the implementation of the project, eight (8) beneficiary scrap dealers in Ukhiya Upazila employed a total of 44 workers in their shops; this number has since increased to 114, and a total of 70 jobs have been created. In addition, in Teknaf Upazila, the number of workers employed by nine scrap dealers has increased from 61 to 85, and 24 new jobs have been created.
- The project's gender engagement was tailored to the local cultural context; for instance, waste sorting businesses are highly profitable ventures that allow women to stay at home with their children while fulfilling their familial obligations and earning an income. Following the vision outlined in the Rohingya Joint Response Plan, the project has made the challenge of improving conditions for the poorest and most vulnerable women in Cox's Bazar a central priority for all proposed programming in the region.

Recommendations

- Further sensitization of shop owners to practice the learnings regarding waste segregation and use of bins is recommended.

- Prior to a large-scale implementation like distribution of bins, a proper needs assessment and pilot program should be conducted which then can guide in determining the required number/size of bins based on the category of shops.
- The establishment of a network and means for coordinating, monitoring, and evaluating (Integrated monitoring framework) for the SWM strategy's implementation over time can be proved effective to sustain the positive results of the project.
- To activate the entire value chain and maximize the impact of project interventions, the institutional framework at the Union level must be strengthened.
- The project may advise presenting the study's findings to the local government in order to resolve the difficulties concerning dedicated funds and human resources.
- To improve the project outcome, more promoters/facilitators associated with the SWM value chain must be introduced at the Union level.
- The project should continue developing and distributing communication materials at least for 2 years which will remind people to continue the positive behavior.
- Communities at the union level must be educated on the significance and requirements of sustainable waste management. Additionally, they should be aware of the SWM value chain in order to comprehend why their payment for the service is vital.
- The project can assist the Upazila parishad in implementing a financial plan and structure to make the project's results sustainable at the union level.
- It is proposed that another landfill is built for Teknaf municipality. Considering the capacity of the present landfill site the land acquisition process should be started well before head. The project might advocate the municipality to establish necessary liaison with related departments and resolve the issue regarding land allocation.

1. INTRODUCTION

1.1 Background

Waste is merely raw material in the wrong place. However, solid wastes are considered as useless and unwanted materials generated from human and animal activities. It is considered an overwhelming burden in the Municipals of developing countries like Bangladesh (Halder et al., 2014; Yousuf & Rahman, 2007). The appropriate and safe management of these wastes is mandatory. Otherwise, it leads to environmental pollution and public health hazards. Developed countries are managing these wastes in a supervised manner, while waste management in Bangladesh faces many challenges due to its dense and large, rapidly growing population (Ashikuzzaman & Howladar, 2019; Halder et al., 2014). There is an increasing rate of waste generation in Bangladesh and it is projected to reach 47, 064 tonnes per day including 0.75 kg/capita per day by 2025 (Alam & Qiao, 2020; Paes et al., 2019).

An average 55% of solid waste remains uncollected in urban areas of Bangladesh. A significant percentage of the population has zero access to appropriate/ safe waste disposal services, leading to mismanagement of waste which subsequently creates several environmental hazards (Karim & Nawshin, 2014; MOEFCC, 2010). One of the most adverse impacts of poor waste management is the incidence and prevalence of diseases such as malaria, hepatitis, and respiratory problems, as well as other illnesses through the contamination of groundwater (Hasnat & Sinha, 2010; Waste Concern, 2014). In addition, such wastes are often disposed of in the sewage system or drain. Such poor sanitation has serious consequences for the health of the residents and a report suggests that "most of the child mortality could be related to poor sanitation problem" (Matter et al., 2013). With regards to the living standards, solid waste leads to blockage in the drainage system which leads to flooding in the streets. Consequently, mosquitoes and bad odor are among the negative impacts that resulted (World Bank, 2017). Disease transmission, fire hazards, odor nuisance, aesthetic nuisance, and economic losses are also the results of solid waste mismanagement (Ashadudzaman & Bodrud-Doza, 2019; Matter et al., 2013).

As a result of the Rohingya refugee influx to Bangladesh, the population of two Upazilas (sub-district) of Ukhiya and Teknaf in the southern part of Cox's Bazar has risen to around 1.5 million people. This has strongly contributed to existing health and environmental challenges, including underfunded and under-resourced solid waste management (SWM) services (UNDP, 2021; UNHCR, 2021). It was estimated that over 10,000 tons or around 22,000 m^3 of waste per month were being generated in the two Upazilas which did not have a well-functioning SWM system prior to the implementation of the project (Ashadudzaman & Bodrud-Doza, 2019; Ashikuzzaman & Howladar, 2019).

Solid waste discarded by refugee and host community households including shops and resulting from the distribution of humanitarian support at random sites is lacking management and disposal. The lack of formal waste management practices and disposal systems is likely to lead to outbreaks of waterborne diseases such as cholera, typhoid fever, diarrhoea, and malaria (Ashadudzaman & Bodrud-Doza, 2019; Hasnat & Sinha, 2010). Uncontrolled solid waste cause contamination to surface and groundwater sources. The situation will deteriorate during the cyclone and monsoon season (Ashikuzzaman & Howladar, 2019).

UNDP with funding from the Swedish International Development Agency (SIDA) is implementing a project called Sustainable Solutions to SWM. This project is a response to the Rohingya crisis in Bangladesh and the pressing SWM needs both in the host communities and refugee camps. By establishing basic SWM services of waste collection and changing the perception and the way waste is managed, the project is targeting the protection of women and children, the prevention of diseases, as well as the promotion of hygiene and proper sanitary standards. This project has been implemented in the host communities within five Unions in Ukhiya and Teknaf, and in the refugee camps, for a three-year implementation phase, and extended for 10 more months up to June 2022.

The evaluation is aimed to assess the progress of the SWM project to date, the performance and achievements of the project, and the validity of its overall approach and quality; and provide recommendations for adjustment and lessons learned that will inform the development of the next phase. The evaluation also places particular emphasis to evaluate the extent to which the project has contributed to balancing gender, protecting the environment, and strengthening governance. As the project is near its end, it was essential for UNDP to conduct the final evaluation of the project and see its overall impact on the community along with other criteria.

UNDP, PAB, BRAC, and local governments are the primary audience of this report, apart from them other NGOs and INGOs who are working with SWM are a potential audience for this evaluation. From this evaluation report, they will be able to understand how a SWM at the municipality and Union level works, and ways to avoid complications.

The evaluation team focused on evaluating the two outcomes of this project, outcome 1: Developing waste management system and outcome 2: Changing behaviours and attitudes. These outcomes consist of several outputs which have several interventions.

The below report is structured following the OECD-DAC criteria, following the introduction chapter, this report talked about evaluation scopes, objectives, approach, and methodology. After that, the report talks about the data analysis process for the report. The finding section is comprised of a subchapter where relevance, effectiveness, efficiency, sustainability, and coherence are discussed in line with project outcome and output. After that, the report talked

about gender mainstreaming. In the end, the report has a conclusion chapter where risks, challenges, lessons learned, and recommendations are shared.

1.2 Description of the interventions

The purpose of the evaluation is to assess the progress of the SWM project to date, the performance and accomplishments of the project, and the validity of its overall approach and quality; and to provide recommendations for adjustments and lessons learned to inform the development of the next phase. The evaluation also places special emphasis on determining the project's contribution to gender equality, environmental protection, and governance strengthening.

The objective of the final evaluation is to critically assess and identify what has worked well in the project, what obstacles have been encountered, and what lessons have been learned to improve future programming. In addition to generating knowledge for broader application, assessing the feasibility of scaling up the current project, and serving as a quality assurance tool for both upward and downward accountability, the evaluation will generate knowledge for broader use.

This evaluation will provide credible, useful, evidence-based information that will allow UNDP and other key stakeholders to incorporate its findings, recommendations, and lessons into their decision-making processes in a timely manner.

Utilization

UNDP will be the primary user of the evaluation results, but they will also be useful to relevant GoB Ministries/Local Governments, development partners, and donors.

UNDP will consider all useful findings, conclusions, and recommendations from the evaluation, prepare a systematic management response for each recommendation, and implement follow-up actions in accordance with the guidelines and policies of the UNDP Evaluation Resource Centre.

Strategy

UNDP's waste management strategy has been designed with a number of core UNDP principles in mind. Given the sensitive and complex problems facing this region, it is critical that UNDP adopt a "Do-no-harm approach" that will carefully assess risks and opportunities before acting. All of the following activities will conform to the high ethical and moral standards that UNDP expects of its staff and project design. Furthermore, UNDP's commitment to, and strong track record in promoting localization of its initiatives, to promote grassroots ownership of results and activities, has also helped shape the design of this proposed project. The project has been designed in preliminary consultation with district and sub-district authorities, as well as civil society groups throughout the 2018 pilot project. This is also

reflected in a concern for sustainability, to building the capacity of local partners to one day move forward alone without further UNDP assistance. Finally, a focus on gender issues will also be prominently supported throughout the project, in recognition of the unique pressures faced by women and girls in the camps and in host communities.

2. EVALUATION SCOPE AND OBJECTIVE

2.1 Evaluation purpose

The evaluation is aimed to assess the progress of the SWM project to date, the performance and achievements of the project, and the validity of its overall approach and quality; and provide recommendations for adjustment and lessons learned that will inform the development of the next phase. The evaluation also places particular emphasis to evaluate the extent to which the project has contributed to balancing gender, protecting the environment, and strengthening governance.

2.2 Evaluation objectives

The specific objectives of the evaluation are:

- to assess the extent to which SWM Project has contributed to addressing the needs and problems identified during the project design.
- to measure the extent to which the project interventions have contributed to achieving the outcomes of the project.
- to assess challenges and opportunities (including external factors/ environment/ COVID-19 pandemic) that have facilitated and/or hampered progress in achieving the intended outcome of the project.
- to assess the effectiveness and efficiency of the project in influencing and contributing solid waste management system and how would this be sustained beyond the end of this project.
- to assess the extent to which gender and environmental approaches of the project have made changes for the intended beneficiaries and area of intervention.
- to identify causes of success and/or failure, extract lessons learned, and recommendations for the way forward.

2.3 Scope of evaluation

This final evaluation covers the SWM project implementation from September 2018 to August 2021 and an extended period up to June 2022.

2.4 Evaluation criteria and questions

The evaluation team used the OECD evaluation framework including environmental sustainability and governance criteria to analyse the results of the study. In addition, the evaluation team found out the lessons learned and the way forward also. For this evaluation, the evaluation team covered the extent to which the intervention objectives and design respond to beneficiaries, global, country, and partner needs. Also, investigated the

compatibility of the intervention with other interventions in a country, sector, or institution. The evaluation team also looked into intervention achievements and positive and negative effects on the beneficiaries.

2.5 Cross-cutting issues

The study team followed the UNDP-proposed UNEG's Guidance on 'Integrating Human Rights and Gender Equality in Evaluation' during conducting this assignment. The evaluation questions were determined based on the project outputs/ outcomes. The evaluation covered the extent to which gender and child protection had been mainstreamed in all phases of the project, also the evaluation looked to what extent gender equality and women's empowerment had been addressed in the project design. This evaluation also looked into how the project had benefited the poor, vulnerable, and physically challenged women and other disadvantaged and marginalized groups.

3. EVALUATION APPROACH AND METHODS

3.1 Evaluation approach

The evaluation employed a holistic approach, combining secondary and primary research of relevant data and findings to achieve the objectives of the final evaluation of the project. The evaluation approach was set consisting of six stages as described in Figure 1.

Conceptualization	• Kick-off meeting with UNDP • Collect and review relevant documents • Finalization of methodology
Desk review & development of data collection tools	• Secondary documents review and outline of design approach • Evaluation design and data inverntory development • Development of data collection tools • Development of draft Inception Report
Finalization of Inception report	• Finalizing the household survey questionnaire and stakeholder interview checklists • Finalization of Inception report
Data collection, data analysis and findings synthesize	• Collect primary data through structured questionnaire survey, KII, FGD and case study • Analysis of data and triangulation of findings through the lens of the OECD and UNEG criteria based evaluation • Compilation of findings and raw data submission to UNDP
Draft report submission and feedback incorporation	• Prepare draft evaluation report including 3 case study reports • Share and recieve feedback from UNDP • Incorporate feedback and again share with UNDP
Evaluation Report finalization & submission	• Submit final evaluation report • Present findings to UNDP and partner stakeholders

Figure 1 The evaluation approach for the final evaluation of sustainable solutions to the solid waste management project

3.2 Evaluation matrix

A detailed study matrix for the evaluation of the result framework of the SWM project is given in Annex 1, where evaluation criteria, questions/ indicators, method, and stakeholders/ sources of information were set according to the project indicators and study objectives. This evaluation matrix helped the evaluation team to develop the study tools for each of the stakeholders by serving the needs for each of the outputs and outcomes of the SWM project.

3.3 Evaluation methodology

The study team adopted a mixed-method approach, combining both qualitative and quantitative approaches for collecting data, including Key Informant Interviews (KIIs), In-depth Interviews (IDIs), Focus Group Discussions (FGDs), Case stories, Physical observation, and Structured questionnaire survey. DM WATCH also conducted a desk review of relevant project documents such as project proposals, implementation manuals, and project progress reports, to respond to specific evaluation questions.

The data collection process of KII was participatory engaging senior government officials, implementing and donor partners, project concerns, key stakeholders (district and local government representatives, implementing partners), and a wide cross-section of staff (project and implementing partners); and then IDI, FGD, and structured questionnaire survey were conducted among the project beneficiaries incorporating a gender equity approach. Physical observation was done in solid waste facilities of host communities.

In addition, the study team identified 1 case story to look into the qualitative changes in beneficiaries and key stakeholders made by the project. Case stories were elaborated in the evaluation report together with infographics and photos.

3.3.1 Data Collection

3.3.1.1 Secondary document review

A thorough and detailed review of secondary documents was carried out to achieve the relevant objectives of the study. The review included the relevant project documents of UNDP and documents from SIDA. In addition, scholarly articles, reports of other relevant international and national organizations, and policy documents were studied to analyse the results. Moreover, the guidelines that the project followed were also reviewed and used for comparing the issues in theory and in practice for the project. A detailed list of secondary documents reviewed is given in Annex 6, Table 48.

3.3.1.2 Primary data collection methods

Details about the primary data collection methods, their approach, stakeholder, and purpose are given in Table 1.

Table 1: Primary data collection methods

Tools	Approach	Stakeholders	Purpose of the methods
Structured questionnaire survey	One-to-one interview with the respondents of the study area using a structured questionnaire.	Respondents were SWM project beneficiaries including representatives of households (male and female) and shop owners	The structured survey ultimately answered the major questions/ indicators set out for the project. This helped to understand the overall status of the beneficiaries regarding what worked well in the project, and what challenges were faced.
In-depth Interview (IDI)	Involves conducting intensive individual interviews with a small number of respondents to explore their perspectives on a particular idea, program, or situation. A semi-structured checklist was used to conduct IDI.	Respondents were compost unit operators, MRF operators, scrap dealers, and landfill operator	In-depth interviews were conducted to understand the SWM process and activities. Also, it helped us to understand the occupational health and safety measures and environmental hazard and risk mitigation measures in place of the SWM facility and its surrounding areas.
Focus Group Discussion (FGD)	Participatory group activity that included close interactions with the respondents. A semi-structured checklist was used to conduct FGD.	Sustainable SWM project beneficiaries include household representatives, shop owners, and cash-for-workers (CFW)	To understand the impact of sustainable SWM project on developing Waste Management Systems and Changing Behaviours and Attitudes.
Key Informant Interview (KII)	Informant interviews involved interviewing people who had particularly	Chief Engineer of DPHE, Deputy Director of DoE, Secretary of	The key informants related to the projects were interviewed to get historical and practical

Tools	Approach	Stakeholders	Purpose of the methods
	informed perspectives on different aspects of the project. A semi-structured checklist was used to conduct KII.	Municipality, Chairman of WATSAN Committee, WASH Sector coordinator in Host communities, Project implementing partner, Project field staff, and Project staff	information on the project that helped find answers to set objectives and questions/ indicators. They also helped complement results found using other methods. We could also understand whether the activities of the project were relevant, efficient, accountable, and coherent throughout. What lessons had been learned to improve future programming?
Physical observation	Field visits were done with an open-ended checklist; the evaluation team visited the location physically.	Solid waste facilities	This helped us to understand the key practices (waste segregation at source or in the facility, waste production, recycling method, etc) at the household level and the general cleanliness of the surrounding areas.
Case story	A case story is a research approach that is used to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context	Project beneficiaries	Case story was done to look into the qualitative changes in beneficiaries of the project.

3.3.2 Sample size and sampling technique

3.3.2.1 Quantitative sample distribution

The quantitative data were collected using a structured questionnaire survey from a population of 5093 households and 5390 shop owners (following a representative sample selection technique), who were direct beneficiaries of the UNDP sustainable SWM project.

For calculating the appropriate representative sample size for the study, the study team used Cochran's famous equation (equation 1) for determining sample size.

$$n = \frac{P(1-P)(Z_{95\%})^2}{e^2}$$

Where, P = Proportion to be estimated

e = Margin of error

$Z_{95\%}$ = Z-value at the 95% statistical confidence level

n = Size of sample

With a confidence level of 95% and an acceptable margin of error of 5 with 50% expected prevalence gives a sufficient sample size of 384 for a structured questionnaire survey of project beneficiaries (household and shop). The total sample was proportionately distributed in each Union and Municipality based on the available sample. Respondents were selected using a simple random sampling method. Therefore, the devised sample size had a highly significant statistical robustness and representativeness. To get gender representative data, this sample size was segregated into male and female by following the purposive sampling method.

Between 26 and 29 April 2022, the study team collected quantitative data from the proposed union/municipality. The detailed distribution of sample size is given in Table 2.

Table 2: Sample size and category-wise respondent distribution

Name of union/municipality	Household representative		Shop owners	Total
	Male	Female		
Hnila	10	12	24	46
Whykong	7	8	14	29
Baharchora	6	6	10	22
Rajapalong	17	16	30	63
Palongkhali	5	5	21	31
Teknaf	79	79	35	193
Total	124	126	134	384

3.3.2.2 Qualitative sample distribution

Respondents for the qualitative data collection were selected purposively considering the relevance and representation. Between April 24 and April 28, 2022, the study team conducted KIIs, IDIs, FGDs, and observations. Table 3 shows the distribution of the qualitative sample.

Table 3: Qualitative sample distribution for the evaluation

Methods	Stakeholders	Number of participants
KII	Executive Engineer of DPHE: Cox's Bazar, Teknaf and Ukhiya Upazila	3
	Deputy Director of DoE Cox's Bazar	1
	Secretary of Teknaf Municipality	1
	Chairman of WATSAN Committee: Union level	2
	WASH Sector coordinator i	2
	Project implementing partner (BRAC team, Practical Action team, Garbageman)	3
	UNDP project and field staff	2
IDI	Compost unit operator in Teknaf Municipality	2
	Material Recovery Facility (MRF) operator	1
	Landfill operator (1 host and 1 camp)	2
	Scrap dealer	2
FGD	Households	2
	Shop owners/ Market committees	2
	Cash for workers	1
Case story	Project beneficiaries	3
Physical observation	Solid waste facilities at Ukhiya	4
	Solid waste facilities at Teknaf	3
Total		36

3.3.3 Data collection and quality assurance process for the evaluation

3.3.3.1 Preparing and finalizing study tools

In realization of the project objectives and deliverables of the assignment, the following data collection instruments were used in this evaluation.

- Secondary document review
- Structured questionnaire for survey
- IDI checklist
- FGD Checklist
- KII Checklist
- Case story (Checklist)
- Physical observation (Checklist)

3.3.3.2 Data collection (Digital data collection method)

For the structured questionnaire survey of this study, advanced digital forms were developed in the KoboToolbox (https://www.kobotoolbox.org/) for Android using the pre-developed questionnaire. The survey was carried out using a modern Tablet-based survey instrument. The system also recorded the geographical location of the target populations (GPS coordinates), which ensured the transparency in data collection method. The GPS coordinate location could be tracked in the web application in real time. The evaluation team shared access with the project team so that the progress of the data collection team could be tracked in real time.

Moreover, KoBoToolbox was committed to protecting the data of its users. It employed industry-standard best practices (both technical and administrative) to protect against unauthorized access to users' data. To protect from loss of data, it did frequent system and incremental backups which were stored encrypted in various locations.

Although a general practice for building digital forms is to use the defined web-form builders, this approach has many disadvantages. However, unlike others, DM WATCH uses the advanced approach using “XLSForm”. XLSForm is a form standard in MS EXCEL that can be converted to an "ODK XForm", a popular open form standard, that allows the form developers to author a form with complex functionality like skip logic in a consistent way across several webs and mobile data collection platforms. Importantly, users can use multiple languages in the same form, which the users/enumerators can switch anytime depending on their needs. This facility ensured the use of mother-tongue by the enumerators, and thus, reduced the chances of mistakes because of the language barrier. Because a clean dataset could be obtained either in English or in Bangla, it reduced the amount of time needed for data cleaning significantly.

3.3.3.3 Pre-test of tools

A pretest was conducted using the app to look for any bugs and further adjustments. The feedback from the pretest was recorded to use in the final adjustment of the questionnaire and, hence troubleshooting.

3.3.3.4 Guideline/ Preparation of field plan

After finalizing the checklists and interview questionnaires, a comprehensive guideline was developed for Research Associate (RA), Field Coordinator (FC), and Enumerators for conducting interviews, which described important definitions, terminology, question objective, data input instructions, skipping, etc. This guideline was easy to use and helpful in the data collection process.

3.3.3.5 Enumerator recruitment and training

A pool of Enumerators was recruited based on their knowledge of collecting information on similar projects. In addition, their prior experience in collecting data in the similar domain was given higher consideration.

The recruited enumerators were given two days of training from April 24 to April 25, 2022, after which their ability to conduct surveys was validated through several verbal practice sessions.

3.3.3.6 Field mobilization

In process of field mobilization, the researchers familiarized themselves with the local authority before the data collection. A detailed schedule with the date, time, and the venue was prepared and shared with the local authority before the survey. Also, before commencing the fieldwork, permission from UNDP was collected.

3.3.3.7 Ethical guidelines and risk mitigation measures

3.3.3.7.1 Evaluation of ethical *guidelines*

DM WATCH conducted this evaluation following the principles outlined in the UNEG 'Ethical Guidelines for Evaluation'. DM WATCH safeguarded the rights and confidentiality of information providers, interviewees, and stakeholders through measures to ensure compliance with legal and other relevant codes governing the collection of data and reporting on data. DM WATCH also ensured the security of collected information before and after the evaluation and protocols to ensure anonymity and confidentiality of sources of information where that was expected. The information knowledge and data gathered in the evaluation process were solely used for the evaluation and not for other uses with the express authorization of UNDP and partners. The signed 'Pledge of Ethical Conduct in Evaluation of the United Nations System' is attached in the Annex of the final evaluation report. The evaluation team referred

to UNDP's Dispute and wrongdoing resolution process and contact details of Section 4: Evaluation Implementation and Use of UNDP Evaluation Guidelines (2021).

3.3.4 Evaluation limitations

FDMN camps were excluded from qualitative and quantitative data collection due to time constraints and the laborious process of obtaining permission from RRRC for access, which made it difficult for the study team to conduct a thorough analysis of camps and the host community. Additionally, this project lacked proper baseline and midterm information according to their project log frame. To overcome the limitation, the study team did a rigorous secondary document review(project documents, progress reports, etc). Also, the study team used recall methods in the quantitative and qualitative data collection. However, all these methods have their drawbacks.

3.3.5 Data management

3.3.5.1 Quantitative data management

After every day's survey work the tablet data were exported to the local server from each survey station for further management. It is always our commitment to ensure quality data collection to facilitate a high level of database functionalities. The field survey team ensured the quality of data; several validation checks were conducted during data collection:

- ***Accompany check***: The field Coordinator reviewed the process of the interview by accompanying the enumerators.
- ***Daily check:*** The research associate checked the data every day to make sure that the data had been entered correctly. The research associate did a logical check of the database.

3.3.5.2 Qualitative data management

- ***Note keeping:*** During interviews (KII, IDI) and FGDs with relevant stakeholders, Research Associates kept the notes during the discussion. These were used later to prepare transcripts.
- ***Observation:*** Report-making based on observation of daily activities to keep the team on track.
- ***Feedback:*** Research Associates discussed with the team leader and experts in the research team on the findings at the end of each field day.

3.3.6 Data processing

3.3.6.1 Data cleaning and editing

After collecting data from filed corrupt or inaccurate records were identified from the record set, table, or database. Consequently, these identified data were referred to as incomplete,

incorrect, or irrelevant which were finally replaced, modified, or deleted. Hence respective respondents were contacted again to collect those missing data.

Both raw data and processed quantitative and qualitative data were saved in CSV, excel, and SPSS formats respectively to share with the UNDP and other stakeholders. In addition to the datasets, DM WATCH also submitted the relevant codes and analyzed outputs to UNDP and other stakeholders along with interviews, images, notes, lists of persons interviewed, and informed consent.

3.3.6.2 Screening of the data and coding

After cleaning and editing the collected data, a final screening was performed which ensured the usability, reliability, and validity of testing. Besides, in-need basis data were transformed into suitable code for computer-aided analysis.

3.3.6.3 Triangulation of data

Triangulation involved the conscious combination of quantitative and qualitative methodologies as a powerful solution to strengthen a research design where the logic was that a single method could never adequately solve the problem of rival causal factors. The quantitative data collected from questionnaire surveys were triangulated within themselves and with the qualitative data collected from KII, IDI, FGD, physical observation, and case stories.

4. DATA ANALYSIS

4.1 Data analysis plan

This study used data from both secondary and primary sources. Qualitative tools provided the basis for both content and analysis. Nevertheless, primary and secondary data were investigated based on the objectives. To critically review and identify what had worked well in the project, what challenges had been faced, and what lessons had been learned to improve future programming, the evaluation team analysed both the qualitative and quantitative data.

Quantitative data acquired through the questionnaire survey were analysed through SPSS and MS Excel software. For analytical convenience, the questionnaires were framed where respondents' responses were recorded in numeric expression majorly. Generated cross-tables, later on, were transferred to MS Excel for producing graphs. For the quantitative data, some descriptive statistical values including frequency counts, contingency tables/cross-tabs, percentage, min value, max value, and average were calculated to explain indicators. Inferential statistics such as the Chi-square test or binary logistic regression were used to find out any potential difference between each respective location of the SWM systems impact on the beneficiaries and stakeholders that were analysed. Findings from the SWM project and behavior and attitude change analysis were added in the final evaluation which helped the evaluation team to identify what had worked well in the project, what challenges had been faced, and what lessons had been learned to improve future programming.

As a cross-cutting issue, a comprehensive gender analysis was conducted to measure gender-specific changing behavior and attitudes. The assessment team proposed the following framework (adapted from the Harvard Analytical Framework) for gender analysis (Figure 2).

Figure 2 Gender analysis framework for the evaluation

4.1.1 Content analysis

To check the consistency of specific and factual data items, qualitative data collected from different types of stakeholders were organized in four steps.

- Thematic coding of data according to content and specific categories;
- Compiling data by themes to systematically analysis of qualitative data;
- Compiling case study findings by themes and selecting issues and appropriate quotations; and

- Analysis of the findings with research assistants and supervisors who were involved in qualitative data collection;

For FGD, KII, IDI, Physical observation, and case story, thematic coding of the data according to OECD and UNEG evaluation criteria and thematic areas were done. This compilation aided in the systematic analysis of the findings of the qualitative data, with affirmations from the field evaluation team. The primary and secondary data were analysed based on the objectives, outcomes, evaluation questions and specific indicators set out by the UNDP team. As an analytical framework, the final evaluation was made through the lens of the OECD evaluation framework and UNEG Guidance. A detailed figure showing the analysis plan is given in Figure 3.

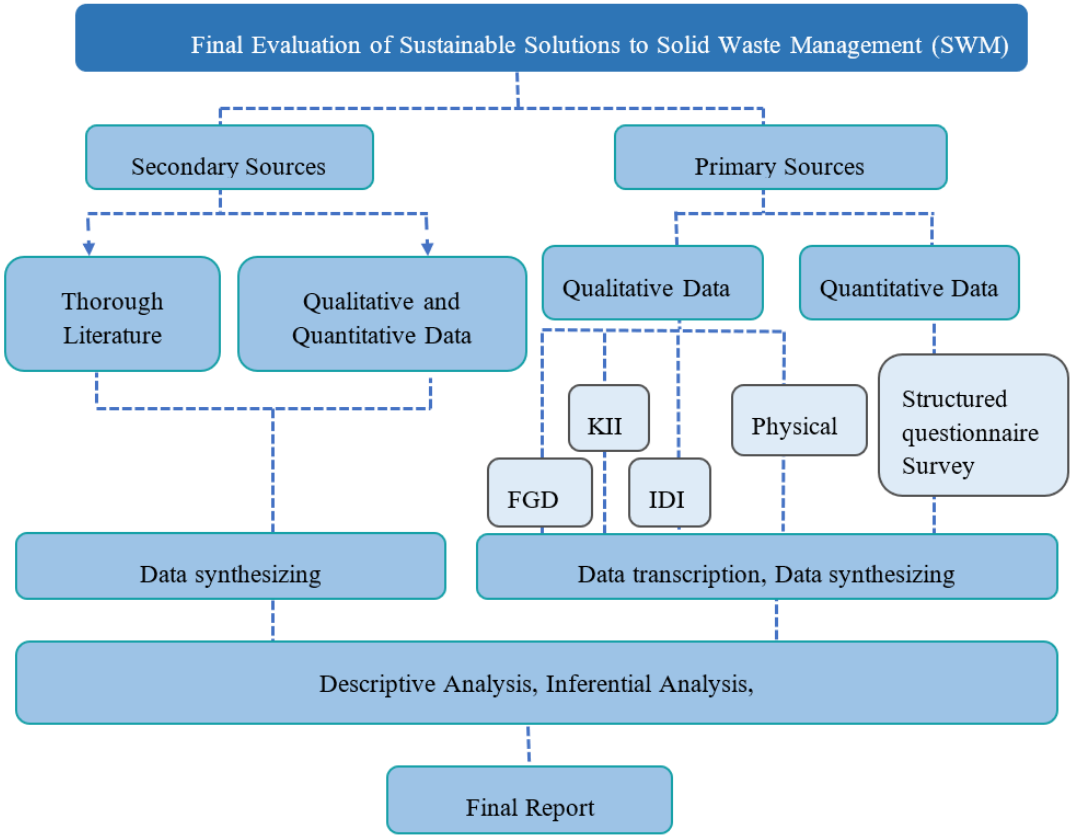

Figure 3 Data analysis plan

5. FINDINGS

5.1 Relevance of the Project

Relevance refers to the degree to which the intervention's aims and design adapt to the beneficiaries' requirements, policies, preferences, geographical features, and partner/institutional capacity, and continue to do so even as circumstances change. Overall, the interventions from Sustainable solutions to the SWM project in Cox's Bazar were found relevant, taking into account the existing needs of the local community, the international framework, and the government's intervention priorities.

Relevance to current Bangladesh policy context

UNDP's Solid Waste Management project was designed to contribute to an improved environment, recycling, health, water quality, sanitation, livelihoods, and human dignity in areas of Cox's Bazar District affected by the Rohingya crisis. The UNDP's Solid Waste Management project aimed to improve the environment, recycling, health, water quality, sanitation, livelihoods, and human dignity in Rohingya-camp areas of Cox's Bazar District. The project targeted two outcomes:

1. **Developing Waste Management Systems:** Vulnerable households from refugee and host communities have enhanced access to appropriate waste management services and infrastructure, and live in cleaner, healthier, and more humane conditions.

2. **Changing Behaviours and Attitudes:** Local waste management behaviours and practices are reformed to be more environmentally and health-conscious, to prompt a sustainable change in how waste in the affected regions is created, stored, and managed.

The study examined the project's interventions, objectives, and intended outcomes in relation to Bangladesh's current policy context. Several national policies, ordinances, and strategies were evaluated to comprehend national priorities and focus areas. The study team determined that the project was highly pertinent to current national priorities and focus areas, which centered on waste management. Table 4 displays the framework of pertinent waste management policy directives and focus areas.

Table 4: Framework of relevant waste management policy directives and national priorities

National policies, ordinances & strategies	Waste management relevant focus areas
1. Constitution of Bangladesh (CoB) 1972 (Part Principles, Fundamental State, of the	A positive aspect of the fifteenth amendment is that Article 18A of the CoB focuses on the improvement of the environment and natural resources for future generations (Article 18A).

National policies, ordinances & strategies	Waste management relevant focus areas
Constitution of the People's Republic of Bangladesh, 1972)	• Implementing partners: the Government of Bangladesh
2. The Environmental Pollution Control Ordinance (1977) (*The Environment Pollution Control Ordinance, 1977*, n.d.)	The following actions are included in this ordinance: 1. Establishes the Environment Pollution Control Board, which will consist of representatives from various public bodies. 2. Permits the Board to develop policies for the control, prevention, and abatement of environmental pollution. • **Implementing partners:** Government of the People's Republic of Bangladesh -Department of Environment (DoE), Ministry of Environment and Forest (MoEF)
3. National Environment Policy 1992 (*National Environmet Policy 1992*, n.d.)	The following objectives are included in this policy to ensure environmental sustainability: 1. Aim to provide environmental protection and sustainable management; 2. Maintain ecological balance and overall development through environmental protection and improvement. 3. Identify and regulate polluting and environmentally degrading activities; 4. Ensure environmentally sound development; 5. Ensure the sustainable and environmentally sound use of all-natural resources; and 6. Remain actively involved in all international environmental initiatives. • **Implementing partners:** Ministry of Environment and Forest, A National Environment Committee chaired by the Head of Government
4. National Environmental Management Action Plan (NEMAP), 1995 (NEMAP, n.d.)	To achieve the following goals, this action plan focuses on sanitation, solid waste management, water supply, and environmental awareness among citizens. 1. Enhance the institutional capacity of local government for integrated policy planning

National policies, ordinances & strategies	Waste management relevant focus areas
	2. Improve housing for the urban population, including the poor and middle class 3. Properly manage urban sewage and solid waste/household waste disposal • **Implementing partners:** Ministry of Environment and Forest (MoEF), Local Governments, and NGOs
5. Environment Conservation Rule, 1997 (*The Environment Conservation Rules, 1997*, n.d.)	The Environment Conservation Rule is primarily concerned with the following: Specifies the inclusion of the following: i. Pollution Under Control Certificate, ii. Environmental Clearance Certificate Fees, etc.
6. National Policy for Water Supply and Sanitation, 1998 (*National Policy for Safe Water Supply & Sanitation 1998*, n.d.)	This policy includes the following waste management provisions: 1. Special emphasis on the private sector and non-governmental organization participation in urban water supply and sanitation 2. Authorization for local governments to transfer collection, removal, and management of solid waste to the private sector when practicable. 3. Encourage private sector maximum waste recycling and use of organic waste materials for composting and biogas production **Implementing partners:** Government of the People's Republic of Bangladesh, Local Government and Rural Development, private sector and NGOs
7. Dhaka Declaration on Waste Management by SAARC countries during 10–12, October 2004 (*Dhaka Declaration 2004 on Waste Management*, n.d.)	The following issues were addressed in the Dhaka Declaration on waste management: 1. Immediately cease open dumping 2. Replace open dump sites with safe disposal alternatives (controlled landfill sites). 3. encourage NGOs and businesses to establish a community-based composting program. b. Source-

National policies, ordinances & strategies	Waste management relevant focus areas
	separation of waste; c. Separation, collection, and resource recovery from wastes with an emphasis on composting; • Implementing partners: SAARC countries.
8. Solid Waste Management Action Plan for Eight Secondary Towns in Bangladesh 2005 (Enayetullah, n.d.)	This action plan was developed by Waste Concern following the 4 R principle i.e. reduce, reuse, recycle, and recover waste. It emphasized the promotion of waste-to-resource activities in particular. • **Implementing partners**: Local Government Engineering Department
9. National Renewable Energy Policy 2008 (*RENEWABLE ENERGY POLICY OF BANGLADESH*, 2008)	This policy contains directives on the generation of energy from waste and addresses the following key issues: 1. Sources of electricity generated by biomass gasification, such as rice husk, crop residue, wood, jute stick, animal waste, municipal waste, sugarcane bagasse, etc. 2. Defines biogas produced primarily from animal and municipal waste as a likely promising renewable energy source for Bangladesh. **Implementing partners:** The Sustainable Energy Development Agency (SEDA), the business community, academics and/or representatives from Bangladesh Solar Energy Society, NGOs, financial institutions
10. 2010, National 3R Strategy (*National 3r Strategy*, n.d.)	This strategy aims to alter the consumption and production patterns of waste by: 1. Instructing local governments to develop their action plans with quantifiable targets, and instituting a waste tax. 2. Promoting the recycling of organic waste through composting, biogas, and refuse-derived fuel. The objectives include 20 percent reduction in waste Reutilization and recycling Within 2015, reduce waste

National policies, ordinances & strategies	Waste management relevant focus areas
	disposal in open dumps, rivers, flood plains, and landfills by at least 20 percent. • **Implementing partners:** MOLGRD, MOEF, MOI, MOH
11. The Bangladesh Environment Conservation Act, 2010 (*The Bangladesh Environment Conservation (Amendment) Act, 2010*, 2014)	This act was amended in 2010 and contains the following provisions pertaining to waste management: 1. Includes numerous crucial environmental issues, such as the preservation of wetland habitats, hill cutting, ship dismantling, and hazardous waste disposal. 2. The discharge, disposal, and dumping of waste can have negative effects on the environment, and certain types of waste can be considered environmental pollutants. 3. It also emphasizes a. conservation of the environment, b. improvement of environmental standards, and control and mitigation of environmental pollution. • **Implementing partners:** Government of the People's Republic of Bangladesh, NGOs, Private Sector
12. National Urban Sector Policy, 2011 (Roy et al., n.d.)	This policy addresses the issues listed below: 1. Encourages sustainable urbanization by means of decentralized development and a hierarchically structured urban system 2. Reduce the cost of solid waste management by emphasizing recycling and securing government support for recycling 3. Focuses on the improvement of urban infrastructure quality and maintenance technology 4. Includes routine maintenance, periodic maintenance, emergency maintenance, and rehabilitation under the routine maintenance policy • **Implementing partners:** Government of the People's Republic of Bangladesh, Local Government and Rural Development and Cooperation

National policies, ordinances & strategies	Waste management relevant focus areas
13. National Strategy for Water Supply and Sanitation, 2014 (*National Strategy for Water Supply and Sanitation 2014*, n.d.)	This national sanitation strategy: 1. Aims to ensure safe and sustainable water supply, sanitation, and hygiene services for all 2. Adopts 17 strategies (with strategy 6 focusing on MSW management), which are broadly categorized under three themes: a. Increasing interventions in water, sanitation, and hygiene (wash) b. Addressing emerging challenges c. Improving sectoral governance • **Implementing partners:** Government of the People's Republic of Bangladesh, Department of Public Health and Engineering, Local Government Division, Local Government Engineering Department, Dhaka Water Supply and Sewerage Authority, and NGOs
14. Eighth Five-year plan (FY2016-2020) (*8th Five Year Plan (2020-2025)*, 2020)	The eighth five-year plan includes several directives for action with the following objectives: To ensure that a proper MSW management system is in place to protect the environment. 1. To implement the emissions, waste, and effluent management strategy. 2. Invests the Local Government Division with the following responsibilities: a) managing all matters pertaining to drinking water; b) developing water supply; c) sanitation and sewerage facilities in rural and urban areas) managing waste management matters. 3. To implement 3R (Reduce, Reuse, and Recycle) in accordance with the National 3R Strategy for Waste Management to implement Solid Waste Management Regulations. **Implementing partners:** Government of the People's Republic of Bangladesh, LGED, Public-Private agencies, NGOs

Relevance to UNDP priority areas

Apart from being relevant to waste management-related Bangladesh national priorities and policy landscape, this project was found relevant to **i. Rohingya Joint Response Plan** (Objective 2: Ensure well-being and dignity of Rohingya refugees and affected host communities.), **ii) United Nations Development Assistance Framework 2017- 2021** (Outcome No 2: Planet: Enhance effective management of the natural and man-made environment focusing on improved sustainability and increased resilience of vulnerable individuals and groups.), **iii) Country programme document for Bangladesh** (Outcome 3: Enhance effective management of the natural and man-made environment focusing on improved sustainability and increased resilience of vulnerable individuals and groups; Output 2.1(Mendatory): More people in Bangladesh, especially the most vulnerable and marginalized, have increased capacities, knowledge, and skills to adopt sustainable consumption behaviours and lead in climate action; Output 2.3: Government actors, the private sector and civil society demonstrate enhanced commitment and capacities to provide efficient oversight functions for environmental policies and legal frameworks, identifying financing solutions, and prioritizing; Output 2.2: Institutions have strengthened capacities to develop, manage and deliver policies, strategies, and actions to improve ecosystem health and manage dynamic risks, such as climate change, disasters, pandemics, and humanitarian crises) and **iv) UNDP strategic plan** (Output 3.4.1: Innovative nature-based and gender-responsive solutions developed, financed and applied for sustainable recovery) (UNDP, 2018b).

Relevance to needs of the population

Waste generation scenario: UNDP's most conservative estimate indicates that 0.13Kg/day of solid waste in camps and 0.2-0.25 kg/day of solid waste in HCis produced per person per day in Rohingya crisis-affected areas. This is a significantly lower rate than the national average of 0.45 kg of waste per person per day in Bangladesh, and it is based on the assumption that refugees and locals have limited access to disposable goods and supplies. Bangladeshis in Cox's Bazar Municipality (Cox's Bazar town only) produced between 0.33-0.45kg of waste/person/day, according to a UNDP (June 2018) report, with consumption patterns varying during the dry and wet seasons. The two Upazilas most prominently affected by the crisis, Ukhiya and Teknaf, still produce over 10,000 tonnes (22,000 m^3) of waste per month, even at the relatively low estimate of 0.25 m^3. Since neither has a functional waste management system, a large portion of this waste (and likely more than the current estimate) has been abandoned in public areas, on the sides of roads, under bridges, in the few remaining open spaces, and in the local water supply (UNDP, 2018b)

Health issues: The sheer volume of waste has created vast breeding grounds for disease-spreading rodents and insects. Water trapped in the waste can cause outbreaks of cholera, typhoid fever, and diarrhoea. The breeding of mosquitoes transmits malaria, dengue, and

chikungunya. Meningitis and leptospirosis can be transmitted by rats and vermin. During cyclone and monsoon seasons, these diseases can spread more rapidly due to the spread of waste by floods, landslides, and high winds. Heavy precipitation or flooding can transport waste to agricultural regions, contaminating the soil and crops.

Glass, needles, medical waste, and toxic materials pose a threat to public health and safety in and around camps and host communities. Children who play near trash heaps, which are frequently the only open spaces, are susceptible to injury. Infections, blood poisoning, scars, and complications can result from serious cuts or waste exposure.

Inadequate waste management has an adverse impact on local air quality, as locals in Bangladesh frequently resort to incinerating waste when local refuse levels become intolerable. Even a small number of waste fires can pollute the air for thousands of refugees, host communities, and international responders. As deforestation increases and the cost of firewood increases, locals are burning plastics and other unsuitable materials. There are severe health risks associated with housewives cooking over toxic plastic fires. Appropriate solid waste management systems are required to decrease the availability of waste for such fires and alter harmful behaviors, thereby improving the health of over 1,300,000 people in the region.

Water, Sanitation, and Hygiene (WASH): The water table has already been severely impacted by the proliferation of waste in the camps and host communities. Debris and garbage visibly clog local water sources, frequently forming layers so thick that it is impossible to see the water's surface. The waste also contaminates the water, altering its color and texture and rendering it unfit for consumption or use in the kitchen or laundry. Unplanned and open waste disposal has caused extensive damage to local aquifers, as improvised waste disposal pits have not been constructed at a safe distance from water sources or using proper techniques, and toxins are leaching into the soil and water supply. This leeching can have a devastating effect on the environment, but it is especially hazardous when it occurs near local wells and sources of drinking water, which are used by tens of thousands, if not hundreds of thousands, of people. As stated previously, a recent UNDP study found that 83% of all tested camp and host community drinking water contained bacterial or toxic contamination (UNDP, 2018b) Proper waste disposal and infrastructure construction techniques are urgently required in the region and can have a transformative effect on refugee and host communities access to clean water and basic sanitation.

Protection, Human Rights, and Dignity: Rohingya refugees have lost most, if not all, of their possessions through decades of oppression and took a perilous journey to Bangladesh. Extreme poverty doesn't always imply a lack of dignity. It's easy to assume that refugees become accustomed to high levels of uncontrolled waste in their environment, but practical experience shows that both refugees and host communities are aware of their unsanitary and sub-optimal conditions. Many residents of host communities and refugee camps are aware of these conditions and alter their daily routines to avoid foul odors and local garbage. Due to a

lack of effective community services, such awareness brings shame or frustration, but it may also exacerbate the helplessness many already feel. Without effective management and support, many locals may feel helpless in the face of complex sanitation and health challenges.

Human dignity was not identified as a distinct emergency relief activity area in the Rohingya Joint Response Plan. The proposed UNDP activities under this project aimed to restore human dignity to vulnerable people in the region, recognizing that this is just as transformative and valuable as better sanitation and a cleaner environment.

Support to Women and Girls: To aid vulnerable women and girls, it is essential to understand their context. In the camps, the refugee crisis appears to be particularly gendered: women and girls outnumber men and boys by a significant margin (56% of the total refugee population and 55% of those aged 18-59), and refugees report widespread sexual and gender-based violence in Myanmar during their flight (Ms. Pramila Patten, 2017). Women and girls' access to services and ability to work are significantly impacted by conservative cultural and religious practices, such as purdah (the obligation of women to remain covered or separate in the presence of men). According to the UN Joint Response Plan, "lack of income-generating opportunities and transferable skill development has catalyzed the exploitation of adolescent girls and women through forced marriage, survival sex, trafficking for commercial sexual exploitation, drug smuggling, and forced labor." Projects that aim to engage or train women for employment should acknowledge these important restrictions and be sensitive to assisting women in effectively navigating them.

UNDP has made the improvement of conditions of the poorest and most vulnerable women in Cox's Bazar a central focus of this project. Direct engagement of women in cash-for-work activities was difficult due to local culture and camp security, but UNDP strived to maximize the participation of women and girls by incorporating them into CfW schemes as well as in other parts of the value chain for livelihoods and waste management.

Relevance of activities and outputs to overall goal and objectives

Developing Waste Management Systems (Outcome 1)

Output 1.1: Quick-Impact Waste Removal Projects

UNDP proposed implementing a series of cash-for-work initiatives in host communities and refugee camps negatively impacted by recent waste mismanagement. Providing effective community services is especially important in host communities, where many do not perceive any benefit from the international response. Providing them with concrete and highly visible improvements to their communities was the quickest and most visible method for gaining the goodwill of the host community. In doing so, UNDP responded to the Joint-Response Plan's request that host communities be "supported directly through structured interventions across

sectors at District, community, and household levels, and to include appropriate quick-impact projects to relieve immediate pressure."

Output 1.2: Basic Waste Management System

In Teknaf Municipality, the project began in June 2019 with a cleaning campaign, followed by regular waste collection. Initially the campaign covered three wards, however the project was subsequently expanded in stages and now encompasses the entire municipality. In Unions, the SWM were established in January 2021, and secondary collection points/segregation points

Figure 4 Temporary Solid Waste Facility at Ward 7, Teknaf Municipality

(21 SCD and 6 decentralized compost plants) were constructed between 2020 and 2021.

Following the cleaning campaign, a basic system was needed to maintain the cleanliness of the rehabilitated areas within the host communities and camps. Though this system was likely to start with UNDP support at the community level, it needed to be linked to government-led waste management systems. The project began in Teknaf Municipality in June 2019 with a cleaning campaign, followed by regular waste collection. The initiative began in three wards and has since grown in phases to the point where it now covers 100% of the HH. In Unions, the SWM was created in January 2021, and secondary collection locations/segregation points (21 SCD and 6 decentralized compost factories) were built in 2020-2021. In January 2021, thirteen (13) new SWM systems were installed in thirteen (13) market areas of five (5) Union Parishads as part of the project. To maintain Rehabilitated Areas, the project distributed waste bins and regularized waste transport (every alternate day). During this evaluation period, the

project did not construct any additional facilities at the project site, except for a temporary segregation point in Teknaf Municipality.

Output 1.3: New Waste Management Infrastructure

While preference was given throughout the project to promote the recycling of appropriate materials and organic waste to produce compost, some waste typically cannot be recycled and will need to be safely disposed of. The Rohingya Joint Response Plan acknowledges a pressing need for new infrastructure, calling for "a solid waste management system to be established including possible installation, operation, and maintenance of a shared landfill". Therefore, this project has done a feasibility study and conducted EIA, to decide about the best and most relevant to the context solution.

This project built a temporary SW Facility (Sanitary landfill) in Ukhiya camp (Camp 20Ext). The landfill's capacity has been increased from 8,500 (Phase I) to 22,000 (Phase II) m^3 to support the SWM system for a longer period of time. A new agreement has been signed to initiate Phase III, which will increase the landfill's capacity to 40,000 m^3 in order to meet the disposal needs of the camps.

Figure 5 Temporary Solid Waste Facility (Landfill) at Camp20ext

Currently, Teknaf Municipality, Palong Khali, and Raja Palong have access to a Sanitary Landfill, allowing them to dispose of residual waste that cannot be separated and recovered. The Teknaf Municipality has acquired land and with UNDP assistance has constructed a landfill with a leachate accumulation pond and a compost plant. The area of the landfill is 255' x 95'

(24,225 ft^2) or 2250.58 m^2, but the main functional unit, excluding the recycling center, is 70m x 23m (1610 m^2. Expanding the primary door-to-door collection to the entire municipality will divert all organic waste directly to the compost plant while only inorganic waste will be transferred to the landfill. However, solutions are being identified for the Teknaf Unions of Baharchara, Nhilla, and Whykong, locations where final waste after segregation is currently disposed of at a temporary disposal site (TDS).

Changing Behaviours and Attitudes (Outcome 2)

Output 2.1: Recycling and Livelihoods Development

Livelihood development is essential to ensure long-term sustainability and is an integral part of the proposed project, providing economic incentives for permanently altering behaviours and habits. Recycling, repurposing, and reselling waste can be a lucrative industry with transformative potential for disadvantaged individuals and communities. To maximize the reuse of recovered materials and improve waste management over the long term, the UNDP and its partners considered several livelihood restorations and support projects with the potential to alter local incentives for waste management and disposal. Under the scope of the project, Scrap Dealers Associations were formed. The project increased the two Associations' administrative and managerial capabilities. In addition, activities to provide initial capital outlay and mentoring to existing and start-up businesses in the form of grants, training, and technical support were arranged to promote recycling activities and ensure stakeholders' livelihood.

Output 2.2: Local Government Engagement and Capacity Building

This project envisaged facilitating the development of an effective, demand-driven, and government-owned solid waste management model that would inform a long-term waste management master plan. In urban areas, official responsibility for waste management is assigned to urban local government institutions, such as Pauroshova (municipal governments) in Teknaf. In rural areas, the Union Parishads (the lowest level of rural local government) and Upazila Parishads are formally responsible for improvements to sanitation, drainage systems, and the water supply (sub-district level rural local governments). Union and Upazila Parishads both have (Standing) Committees on "Public Health, Sanitation, and the Supply of Pure Drinking Water" and "Environment," which are closely related to waste management. However, these do not always translate into visible actions on the ground. A significant part of local governments lacks the capacity and resources to implement regular or structured waste management systems and require immediate assistance to develop this capacity.

In this regard, the project's activities were designed to engage and strengthen local government. Upazila local government authorities received two introductory trainings in Teknaf and Ukhiya on integrated solid waste management systems in November 2019. One Field visit exchange was arranged to bring local government officials to Malang, Indonesia, to

observe their ISWM system, which included a landfill facility. However, the trip was canceled due to the COVID-19 pandemic. The UNDP has organized a series of meetings to activate seven WATSAN committees in project sites and Upazilas. Moreover, a consultative process started in September 2021 with all SWM stakeholders in Unions and Pauroshova, including the government, to approve the continuation of the SWM systems and the financial model to sustain them (appx. 5 meetings in each location).

Output 2.3: Household Engagement for Improved Segregation and Recycling of Waste

The household-level was the most important unit to consider when addressing solid waste management, as it is at this level that most waste is produced. Behavioural and attitudinal change was the most important at the household level, to sustainably change the ways by which local people interact with waste.

In Teknaf Municipality, Raja Palong, Palong Khali, Nhilla, Whykong, and Baharchara, the project has surveyed and gathered basic information, including the GPS locations of 5,251 households and 5,390 stores. Additionally, orientations on the use of the two buckets and the significance of waste segregation have been conducted.

Output 2.4: "3 Rs" Awareness Campaign (Reduce, Reuse, Recycle)

Justification: The "3Rs" represent a sustainable approach to waste management issues. The project considered awareness-raising campaign based on these principles to inform, educate, and motivate through the use of radio and the participation of local religious and community leaders in disseminating the message.

Beginning in October 2021, a communication campaign based on the 3Rs was implemented across all project locations in host communities in Teknaf and Ukhiya. To support the project's activities and increase population awareness, communications materials have also been produced. New materials for the 3R campaign that are consistent with the communication campaign have been developed.

Relevance of project implementation

The Theory of Change

Solid waste challenges do not dissipate independently. In the affected Upazilas of Cox's Bazar, waste accumulation in the water supply and many public spaces are already critical, and without a comprehensive strategy, this waste will only increase. Investing in sustainable solid waste management systems now will be significantly less expensive and more cost-effective than if these issues are allowed to worsen.

Proper solid waste management is multidisciplinary; as described previously, the proposed UNDP project will link innovative solid waste activities to well-defined environmental, health, WASH, site management, and protection goals (both under the Joint Response Plan and the

SDGs), with significant additional anticipated benefits to livelihoods, social cohesion, gender equality, and human dignity in Cox's Bazar District. To effectively address pressing and urgent waste removal needs in the short term, this will be accomplished through a planned phased approach. Under outcome 1, the project considered "Output 1.1 Quick impact waste removal project", "Output 1.2 Basic waste management system" and "Output 1.3 Construction of SW facilities", where different activities in phases were designed to achieve the intended short-term objective.

The project will then transition from quick-impact responses to longer-term recycling, livelihoods, campaigns, capacity development, and government engagement activities to develop and expand a local solid waste economy. This is consistent with the vision outlined in the Rohingya Joint Response Plan, which states that at the current "stage of the response, solid waste management programs will be supported by Cash-Based Interventions for waste collection" and that "over time, a solid waste management system will be established, including the installation, operation, and maintenance of a shared landfill." The activities associated with this section are related to project outcome 2, whose outputs were "Output 2.1 Recycling and livelihoods development activities" and "Output 2.2 Strengthened local government engagement and enhanced capacity within key functions."

Households, including vulnerable women and children, will be prominently engaged as the most critical local unit, as the majority of current waste is produced at the household and family level, and solutions must be implemented at this level. Under outcome 2, the project considered "Output 2.3 Household engagement for improved segregation and recycling of solid waste" to achieve this intended change. The development of new infrastructure and assistance to recycling businesses will transform the current waste management options on the ground. Adjusting the financial incentives for household recycling and waste disposal will bring about permanent changes in local behaviour, waste disposal, recycling patterns, and waste management systems. This will improve the local environment and health for everyone in affected communities by removing potential sources of toxins and danger to the water supply, the physical landscape, and the air (by preventing the burning of trash), as well as providing economic benefits. To ensure that this transformation occurred, the project designed activities around "Output 1.3 Construction of SW Facilities" under outcome 1 and "Output 2.1 Recycling and livelihoods development activities" under outcome 2.

The project expected to see that the successful implementation of this project will make improvements to the management of waste, and a cleaner local landscape will be visible. Demonstrable improvements in conditions for local communities will be evident and it will reinforce social cohesion by making it clear to host communities, in particular, that the Rohingya crisis has the potential to benefit everyone.

5.2 Coherence

Internal Coherence

This project is based on UNDP's previous Waste Management pilot project in Cox's Bazar, during which UNDP implemented a series of quick-impact activities to collect and manage waste, improve sanitation, and provide employment in one host community and two refugee camps. Rapid, positive, and highly cost-effective community response to this pilot program. UNDP partnered with BRAC and Practical Action Bangladesh to carry out different parts of the project in the intervention areas.

BRAC mainly worked in quick-impact waste removal and basic waste management system development (Output 1.1 and Output 1.2, within project outcome 1). In host communities, BRAC was involved in recovering recyclable materials from collected waste before disposal. This number is added to the total of 7,171 kilograms of recyclables recovered and transferred to scrap dealers during the project's duration. In camps, UNDP/BRAC oversees the Sanitary Landfill in Ukhiya Camp 20Ext, which is accessible to all 27 camps in Ukhiya Upazila. BRAC will construct new MRFs in Raja Palong and Nhila as part of the Union Parishads project, which will increase the current 23 percent of waste recovery and reduce the need for final disposal.

Practical Action has been involved in the Project in Ukhiya and Teknaf between July 2019 and February 2022. Practical Action contributed to the accomplishment of Output 2.1, the organization and development of the informal recycling sector (IRS), Output 2.3, the mapping and engagement of households and market stores in all project locations, and Output 2.4, the implementation of a public awareness communication campaign.

As part of the project's objectives, Practical Action, in consultation with the UNDP, has designed a Mass Awareness Campaign in Cox's Bazar district's Ukhiya and Teknaf Upazilas. This campaign was conducted to educate the beneficiaries of the SWM project as well as community members about the No-littering, Segregation, Reduce, Reuse, and Recycle (RRR) approach to ensure a sustainable solution for the proper management of solid waste. The campaign was intended to reach project beneficiaries such as households and shops, as well as members of the community.

Practical Action has conducted a two-month campaign to raise public awareness about sustainable solid waste management and the 3R (Reduce, Reuse, and Recycle) process through a variety of activities. As part of the project, the following activities were done by the Practical Action:

- The opening ceremony for the Mass Awareness Campaign.
- Sticker and Festoon distribution.
- Sticker application on the rear of an auto/battery vehicle.
- Banner displaying.

- Localized Miking.
- Mass gathering and Education session.
- Mobile Message and Voice Message.
- Television Scroll Message
- Radio campaign Installation of billboards

It was revealed that the coordination mechanism between UNDP, BRAC, and PA was highly effective and efficient. However, the representatives from Garbage Man, the Municipality, and several other stakeholders complained that Practical Action fell behind in its activities. They were unable to organize the public awareness campaign as effectively and on time as intended. During an interview with a representative of Practical Action, it was found that, due to the ongoing pandemic and the prolonged lockdown, it was not possible to organize activities requiring a large gathering. It would have been possible to avoid these communication gaps if better coordination with stakeholders besides partners had been developed.

External Coherence

UNDP is collaborated with SREDA (The Bangladesh Sustainable and Renewable Energy Authority) to investigate methods for converting solid waste in Bangladesh into energy and fuel. This was a component of the Sustainable and Renewable Energy Power Generation (SREPGen) project of the UNDP. That project classified different types of solid waste, including plastic, paper, metal, glass, organic/ vegetable, and "other", finding that Bangladesh has a market for most types of waste already, even though formal systems to remove or transport waste are lacking. The findings helped UNDP to design interventions for this project.

Given the high rate of deforestation in this project's intervention areas affected by the Rohingya crisis, which is largely attributable to the high demand for cooking fuel, a facility capable of converting organic waste into an alternative fuel source could be of critical environmental importance and address multiple urgent issues. Before committing to any expansion, the UNDP will evaluate the results of the Kustia pilot, so a similar activity is not proposed in this project. (UNDP, 2018b)

In addition to considering similar projects and previously established findings, UNDP coordinates closely with actors on three levels for the successful implementation of this project:

- Camp/community level via CICs in camps and Union Parishad representatives in host communities.

- District Level via Additional Deputy Commissioner's Office (ADC) for host communities; RRRC for camps.

- The United Nations Intersectoral Coordination Group.

To maintain external coherence, the project also considered the different levels of risks and took measures accordingly. UNDP carefully tailored its government engagement strategy to make the most of its relationship with key government agencies and expand its connections in other areas to develop strong partnerships built on mutual trust**.** The Project worked through a network of implementing partners and used a low-key approach. As much as possible, local government counterparts were involved. The process of selecting beneficiaries was transparent, participatory, and conflict-sensitive.

The study team determined that there are opportunities for the project to create a better example of external coherence in certain areas. In an interview with the MRF operator of Palongkhali, who is a member of the Bangladesh Red Crescent Society, a situation presenting concerns about the continuity of project activities at the Palongkhali union was found as well. According to him, the UNDP hired them to collect waste from the entire Palongkhali union and maintain the dump site and MRF facility. However, due to budget constraints, they had to cease operations. They were not provided with any guidelines by the project to continue working, and even though they have their guidelines, they cannot use that as well. However, the UNDP project team has confirmed that both BDRC and UNDP were responsible for waste collection and operation of SWM facilities in Palongkhali (MRF and one dumping site). UNDP proposed an SOP for managing the MRF, but BDRC never approved it. Importantly, the project team observed the activities at the MRF and dumping site in Palongkhali during a site visit, but the dumping site was inactive due to budgetary constraints, according to the BDRC representative. All activities at Palongkhali are supposed to be transferred to BDRC at this time; however, for the long-term sustainability of the project, a more effective coordination mechanism among all stakeholders of the project is essential to prevent such threats.

UNDP and SMEP (IOM) collaborated to establish the construction of the Temporary Solid Waste facility (Sanitary Landfill) in the Rohingya camps as part of the Sustainable Solutions Solid Waste Project. During the period of implementation, the IOM Site Management and Engineering Project (SMEP) contributed to the processing of over 10,000 cubic meters of waste in the landfill, achieving the project's objective in full. In addition, SMEP completed all construction and surface drainage repairs.

To continue strengthening the capacity of the sector in Teknaf and Ukhiya, UNDP partnered with Garbageman Limited, which assisted the two Association of Scrap Dealers in improving and consolidating the business mode and marketplace of the sector, as well as the recognition and visibility of the association members in the community. Garbageman Limited's primary objective was to promote the growth of the Association of scrap dealers and affiliated members in Teknaf and Ukhiya Upazila.

5.3 Effectiveness

Effectiveness relates to the degree to which an intervention has accomplished or is expected to achieve its objectives and outcomes, including any differences in outcomes between classes. This section discusses the extent to which the project's efforts met its objectives as evidenced by the outputs.

Output 1.1: Quick impact waste removal project

Initial Assessment:

In October of 2018, the chairman of 5 Union identified the primary locations deemed critical due to the production of large quantities of solid waste. As a result, thirteen market areas were selected as project focus areas. Early in 2021, 13 locations in 5 Union Parishads underwent an initial cleaning campaign, which was followed by the establishment of a fundamental SWM service. In Teknaf Municipality, the SWM service was strengthened in 2019 in three wards and expanded to all nine wards in 2021 (60% coverage of primary waste collection). Cleaning campaigns were conducted on 3 main occasions in the municipality. In the refugee camps, a massive cleaning campaign was designed to cover all 27 camps with the coordination support of the WASH, SMS, and the implementation of BRAC and SMEP.

Also, before the project began, in addition to consulting with the Chairmans, SWM assessments were conducted in the camps and the host community (baseline study). In addition to SWM Practices in camps and the HC survey, an analysis of the Recycling Value chain was conducted. These four reports are the project's baseline and provide information on what was constructed.

Cleaning Campaign

This final evaluation found that nearly all project beneficiaries (99%, N=384) in the host community study area were aware of the project's cleaning campaign. After the announcement of the cleaning campaign, waste collection operations were initiated in the project areas. Around 95% (N=248) of the household project beneficiaries and nearly 89% (N=133) of the shop owners stated that they observed cleaning operations in their neighborhood. More than 66% (N=384) of the beneficiaries reported that there were between one and four cleaning operations in their respective areas, while 27% (N=384) of the beneficiaries reported that there were more than four cleaning operations in their respective areas.

In Teknaf Municipality, BRAC engaged 20 CFW for the cleaning campaign as a part of the cleaning program's implementation partners. The cleaning campaign in Teknaf municipality began in June 2019. All of the CFW was chosen from a list of cleaner panels maintained by the municipality. Officials from the municipality oversaw the entire procedure. Eight women and twelve men made up the entire number of cashflow workers. Following the recruitment

process, BRAC hosts a one-day training workshop for the CFW to improve the campaign's effectiveness. As part of the health safety concern, BRAC has arranged a vaccine (TDS) campaign for all CFWs. The instruction addressed the waste-collecting and disposal procedure as well as the transportation system. During the cleaning effort, Practical Action held an information session for market shop owners in the locations where the cleaning was taking place. Also, In Unions, the SWM was established in January 2021, and secondary collection points/segregation points (21 SCD and 6 decentralized compost plants) were constructed between 2020 and 2021. In the refugee camps, the cleaning campaign of solid waste started in October 2019 and ended in July 2020, this was a tremendous success. The project has developed Standard Operating Procedures following the campaigns. Overall, the study found that the cleaning campaign implemented by the project was effective and also well known among the beneficiaries.

Output 1.2: Basic waste management system

In camps: UNDP/BRAC manages the Sanitary landfill in Ukhiya Camp 20Ext, which is accessible to all 27 camps in the Ukhiya Upazila. The sanitary landfill adds the final step of the safe disposal of residual waste to the camps' waste management systems. To provide the same service to refugee camps in Teknaf Upazila, UNDP, with the assistance of the WASH sector and RRRC, is searching for suitable land for the construction of a similar infrastructure. In Camp 27, one land has been identified. The team is working to obtain the necessary paperwork to begin construction. Simultaneously, the project is piloting camp 15 for the collection of recyclables by the Association of Scrap dealers. This initiative aims to formalize truck access to camps and collect large quantities of recyclables that are currently transported by vans or tomahawks. From the interview of the land field operator in camp 20, it was found that the landfill open in October 2019, UNDP through SMEP mainly did the construction work, and BRAC looked after the maintenance of the landfill, and also SMEP provides operational support. BRAC monitors the waste trucks that enter the landfill, if the waste is not segregated properly, they sent back the truck for proper segregation, and cash for workers segregated the recyclable waste and store them. Scrap dealers collect recyclable waste from landfill. No harmful or hazardous waste is allowed inside the camps also.

In host communities: In January 2021, thirteen (13) new SWM systems were installed in thirteen (13) market areas of five (5) Union Parishads. As part of the Exit strategy, the project worked during the reporting period to optimize the SWM systems to improve performance and reduce operating costs.

The established SWM systems in Union Parishads and Teknaf Municipality have resulted in the collection and safe disposal of 47,775m^3 of waste by February 2022 (which is more than 100 percent of the project's target of 34,000 m^3). This accounts for 82% of the total waste produced by 5,236 HH and 5,390 market shops. 23% of the collected waste was recovered prior to

disposal: 6,025 m^3 of organic waste was converted into compost and 126 m^3 of recyclables were transferred to recycling dealers. Before the project, all of the beneficiaries' waste was literally dumped into open spaces or rivers because they had no other option.

Organic waste: The collected organic waste resulted in the production of 7,419 kilograms of compost, which was initially given away for free and then sold to the local community or farmers.

Recyclable waste: HHs are encouraged to sell their recyclables to recycling dealers directly. However, not all HH follow this practice, and recyclables are also collected by the waste collectors and transferred to the recycling sector, where the project has recovered 7,151 kg or 126 m^3 (these account only for 1% of the total estimated).

Residual waste: 41,750 m3 of residual waste were collected and disposed of in a secure manner at the sanitary landfill in Teknaf Municipality, the temporary disposal site in Unions, and the sanitary landfill in refugee camps In terms of perceptions, 92% of direct beneficiaries are satisfied with the waste collection service; 82.3% believe that a clean and healthy environment would improve their overall standard of living. Regarding the continuity of service, 83% of respondents would pay for a waste management system and permit daily waste collection from their location (HH:82.5% and shop:83.9%). In terms of material recovery, the CFW was directed to recover as much recyclable material as possible from the waste collected during cleaning campaigns and transfer it to the recycling sector.

One of the key informants pointed out that several types of waste had become a problem for them, like e-waste, medical and chemical waste, for which the landfill doesn't have a proper facility to store.

Distribution of waste bins

In total, the project has distributed 16,982 pairs of bins to all beneficiaries in 5 Unions and the Municipality of Teknaf. In September 2021, the project distributed additional 1,100 pairs of bins in the Teknaf Municipality market area to improve the waste collection system. It has been proved that individual bins for HHs and shops are more effective in terms of ownership and usage than shared bins. These markets were the first areas the project started, and many shared bins were broken and lost, which required the implementation of a new approach.

This study sought the effectiveness of this intervention (bin distribution), the study team tried to find the waste bin usage trend among beneficiary households and shops before the project started. The study found that, before the project, around 76% (N=250) of the households did not have any waste bins, and only 19% of the households had a single waste bin. In the case of shops, it was found that almost 87% (N=134) did not have any waste bin, while only around 12% used a single bin for their waste storage. The below table represents the household and

shop owner-wise segregation of the number of waste bins in households and shops before and after the project.

Table 5: Number of waste bin in household/shop before and after the project

Upazila	Respondent type	Number of waste bins in households/shops before the project			Number of waste bins in households/shops after the project started		
		0	1	2	0	1	2
Ukhiya	Household	60.5%	32.6%	4.7%	4.7%	7.0%	88.4%
	Shop owner	81.3%	18.8%	0.0%	2.1%	22.9%	75.0%
	Total	71.4%	25.3%	2.2%	3.3%	15.4%	81.3%
Teknaf	Household	79.7%	16.4%	3.4%	1.9%	7.2%	90.3%
	Shop owner	90.7%	8.1%	1.2%	23.3%	23.3%	53.5%
	Total	82.9%	14.0%	2.7%	8.2%	11.9%	79.5%
Total		80.2%	16.7%	2.6%	7.0%	12.8%	79.9%

The current scenario suggests that the usage of bins amongst beneficiaries improved significantly as 90% (N=250) of the beneficiary households now use at least 2 waste bins to store their household waste and around 61% (N=134) of the beneficiary shop owners do the same. As mentioned earlier the project has distributed 16982 waste bins (1 set of 2 bins) to all the beneficiaries, the study found around 97% (N=384) of the respondents agreed that they received the waste bins from this project. However, nearly 16% of shop owners still do not use any waste bins to store their generated waste. To find the relation between bins received from the project and current usage of the bin for the project beneficiaries, it was found that there is a significant association ($p<0.05$) between those who received waste bins from the project and usage of waste bins. From the focus group discussion with the household beneficiaries in Teknaf municipality, it was found that, before the project started, there was no proper solid waste management in their area, but after the project started, they got a waste bin from the project, where they can store their organic and inorganic waste separately.

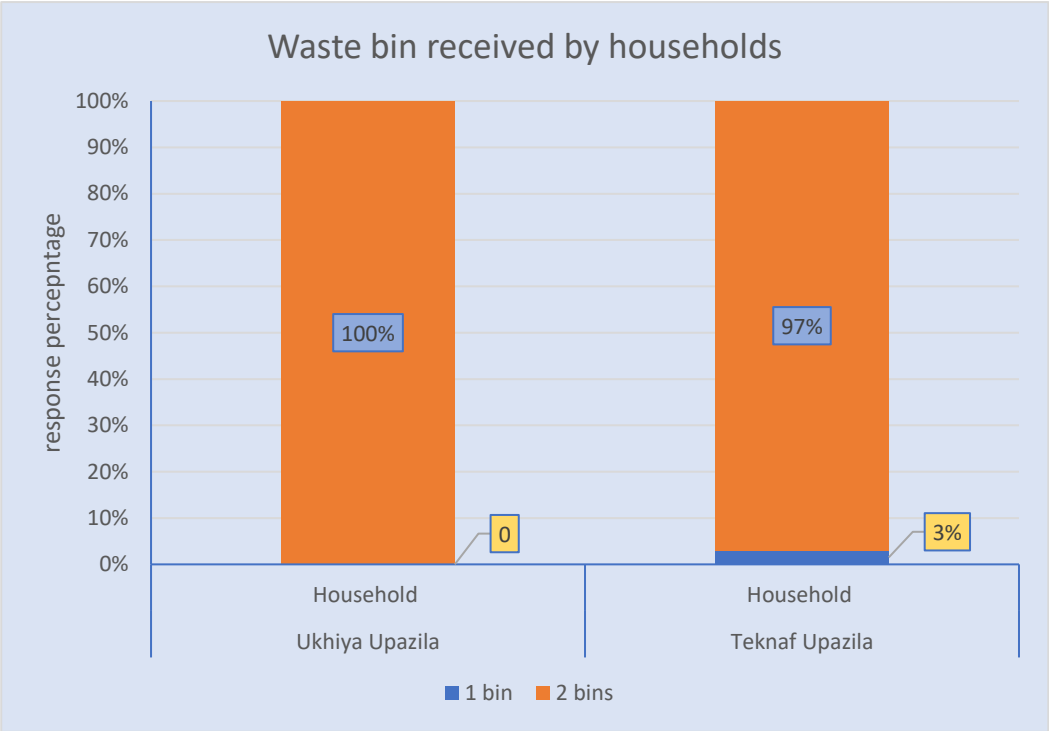

Figure 6: Waste bin received by the household from project

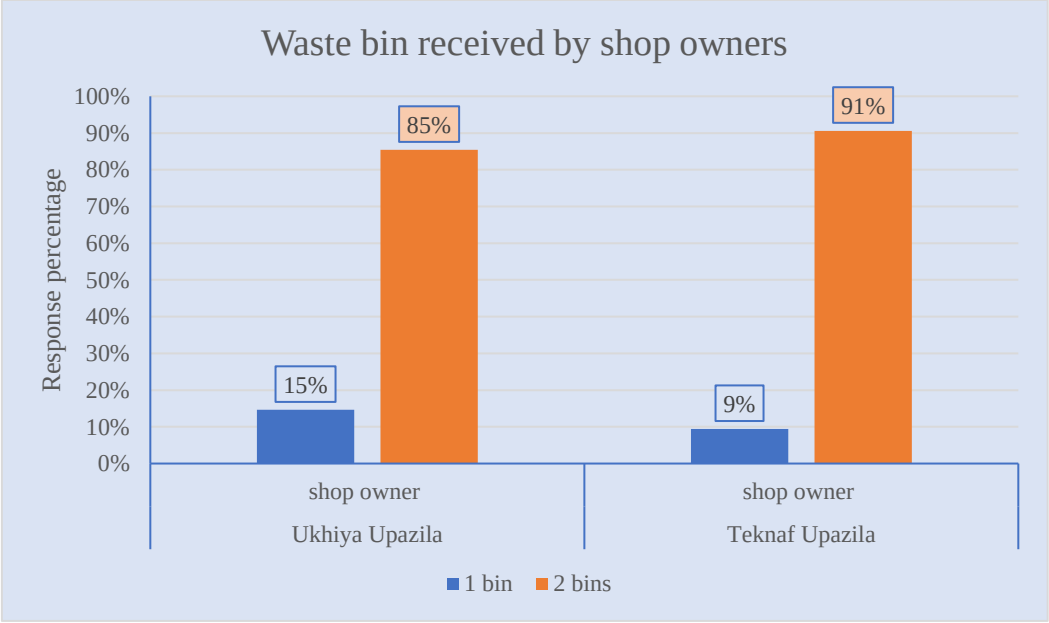

Figure 7 Waste bin received by shop owners from project

Output 1.3 Construction of SW facilities

Land identification process

In Teknaf and Ukhiya Upazila, it was difficult to locate appropriate government Khas land for landfill. As both Upazilas have a hilly topography, the best land for a landfill would be a hilly area where the landfill can be aligned with the landscape and valleys can be filled without the need to dig large trenches. However, this type of land is predominantly forest land, so it would not be suitable for a landfill. Regarding plain government Khas land, no viable land could be finalized because the majority of identified or suggested land was adjacent to rivers or water bodies and therefore inappropriate for such construction. Few other Khas lands were identified by the project, but those are being held by local authorities for more strategic investments.

Following a few field visits and aerial image scanning, the project finally identified two potential sites in the Teknaf municipality and camps 20 ext. for constructing a Sanitary landfill. In the Teknaf camps, the use of new land has been approved by the commander-in-chief, and the Army forces will open a gate to allow the circulation of trucks.

Environmental Impact Assessment

All SW facilities constructed as part of the project, particularly the Sanitary Landfill in Ukhiya camps and the Sanitary landfill in Teknaf municipality, have been subjected to an EIA, which will be submitted to the Department of Environment (DoE). The EIA process has concluded, and the final report is currently being drafted.

Construction of long-term Sanitary Landfill

The project originally envisioned a single large landfill for all Teknaf and Ukhiya camps and Host communities, but after initial assessments and studies, it was determined that the landfill must be decentralized because the distances are so great that it might make the operation much more complex and expensive.

Therefore, 2 Sanitary landfills have been constructed in Teknaf and Ukhiya Upazilla. One for Ukhiya refugee camps, currently also used temporarily by Raja Palong and Palong Khali Unions and the other one has been constructed in Teknaf Municipality.

Because of the project intervention, Teknaf Municipality, Palong Khali, and Raja Palong have now access to Sanitary Landfills, allowing them to dispose of residual waste that cannot be separated and recovered. However, solutions are being identified for the Teknaf Unions of Baharchara, Nhilla, and Whykong, locations where final waste after segregation is currently disposed of at a TDS.

Output 2.1 Recycling and livelihoods development activities

Recycling Value Change Analysis study

In late 2018 and early 2019, the project conducted a recycling value chain analysis to describe the local recycling sector in Teknaf and Ukhiya Upazila. The study identified the key stakeholders, the materials, costs, and roles at each stage, as well as the obstacles that impeded their activity. The project incorporated all of the findings and based the intervention in this output on assisting the local sector to overcome these obstacles

Association of scrap dealers

The project has successfully facilitated the formation of two scrap dealers' associations in Ukhiya and Teknaf Upazila, which is one of the major accomplishments of the "Sustainable Solutions to Solid Waste management" project. Earlier in 2019, the project conducted a field survey in both Upazila in order to identify local scrap dealers operating in the project areas. In total, approximately 75 scrap dealers were identified. After collecting various types of data through a needs assessment and baseline survey, the project identified 45 scrap dealers who had all the required documentation, such as a business license, national identification card, etc. Several orientations and training were provided to help them comprehend the significance of their business in managing waste management activities and how they fit into the system. As a consultant for solid waste, Garbageman provided advanced training to the SD members of both Upazilas. In addition, they received instruction on writing business proposals and determining their future goals in accordance with their business's operations, volume, and resources.

Reducing barriers/transaction costs to boost profit

The project facilitated the written authorization for the collection of recyclables from the MRFs of five refugee camps. These camps are Camps 9, 15, 16, 17, and 19 in Ukhiya, and Camp 24 in Teknaf. CIC of Camp 22 verbally authorized Teknaf SDA to collect. The original permission letters are stored at the respective association offices, and the association presidents have been instructed to distribute copies of the letters to the association members. Recyclables from MRFs in Camp 15 (CARE) and Camp 24 were collected (DSK).

According to Garbageman's final report, the field officers have contacted CICs and MRFs from other camps. The team has travelled to Camps 1E, 1W, 4, 9, 10, 15, 16, 17, 18, 19, 22, and 24. These camps were chosen for association based on the availability of materials in MRFs and association preference. The primary reason shoed by CICs who did not grant permission was that they require RRRC authorization first. Smooth coordination, in this case, is necessary among beneficiaries, legal authorities, and service providers.

To ensure recognition and increase visibility, the project has developed communication materials (leaflet, brochure) and a website for the SD Associations to increase the visibility, formality, and acceptance of the local recycling business and its stakeholders.

To facilitate market connections with Recycling sectors, the project arranged for recycling companies to visit SD Association members in order to assess the potential for direct commercialization agreements.

Initial capital outlay and monitoring

Cohort 1 - The first cohort included grants for 20 scrap dealers (SD) in Teknaf and Ukhiya, distributed over three installments. The initial payment was made in December 2019.

Cohort 2 - A grant program was initiated to support the Association of professionals in the Teknaf and Ukhiya recycling industries. The two SD Associations submitted their candidacies, which were accepted. The Palong-Raja Ukhiya Scrap Dealers' Association opened a bank account, to secure a grant of 3,15,000 BDT and the Teknaf Scrap Dealers' Association opened a bank to secure a grant of 3,15,000 BDT.

Cohort 3 –The Waste 2 Resource (W2R) grant program has been established to identify innovative solutions for dealing with valueless waste and/or as a replacement for single-use plastics. In December 2021, three candidates out of twenty-six were invited to participate in *a Learning Journey* to Cox's Bazaar. The participants were invited to a workshop on Market Assessment, Supply Chain, and Business Development, and later they presented their proposal at The Grant Proposal Pitch. The judges selected Go Green Bangladesh as the winner and awarded them $10,000 along with mentorship from YY Ventures to help them create the supply chain and prototype.

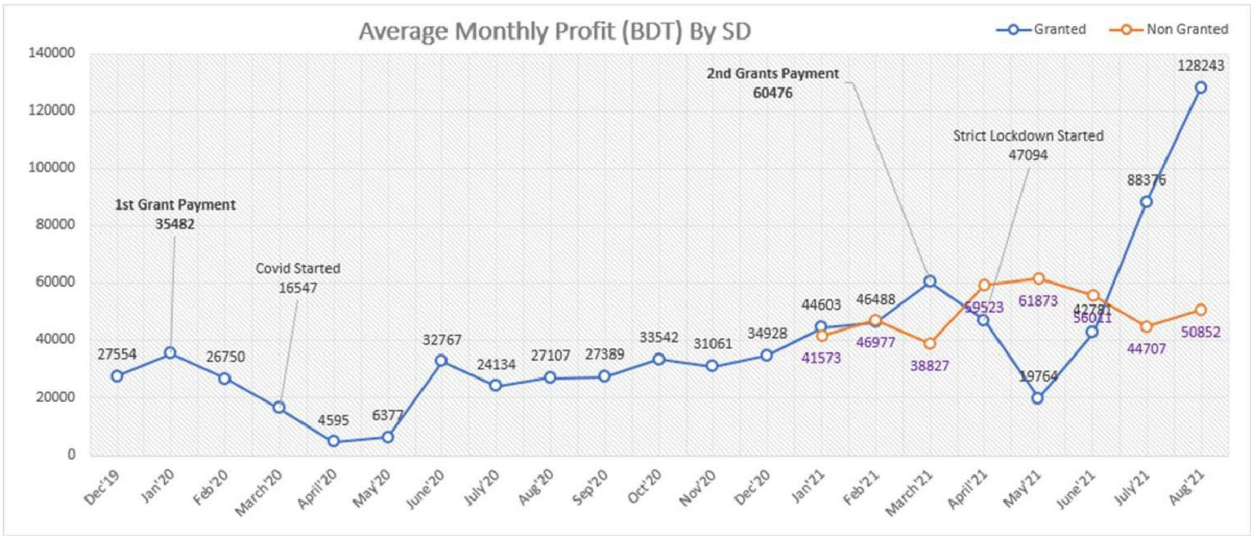

Figure 8: Dealers' monthly average profit (Dec'19 to Aug' 21)

Figure 9 depicts the profit development of the dealers (granted-blue and non-granted-orange) from the first grant payment in December 2019 to the present. The graph represents the three payments and Covid/Lockdown periods encountered over the previous two years.

In addition to bolstering the business of scrap dealers, the project generated new local job opportunities. Prior to the implementation of the project, eight (8) beneficiary scrap dealers in Ukhiya Upazila employed a total of 44 workers in their shops; this number has since increased to 114, and a total of 70 jobs have been created. In addition, in Teknaf Upazila, the number of workers employed by nine scrap dealers has increased from 61 to 85, and 24 new jobs have been created. The 16 scrap dealers in Teknaf and Ukhiya have contributed to the creation of 94 new jobs.

Output 2.3 Household engagement for improved segregation and recycling of solid waste

Household Organization and training

In October 2021, a two-month community engagement campaign was launched to reinforce SWM practices, particularly those related to source-separation of waste, storage of recyclables, Ferri-wala linkage, cash-for-trash approach, and awareness of willingness to pay for waste collection service. Eighteen trained volunteers (8 in Ukhiya and 10 in Teknaf) were deployed to distribute information door-to-door in two rounds. Before the project implementation, community people in the project area didn't have proper knowledge on this matter, but now because of the project intervention they are aware of these matters, one of the respondents from the household focus group discussion said

"UNDP has given training about keeping wastes separately, what is the problem of wastes here and there. They prohibited us not to throw waste in the drains. Now, we can see roads and drains are clean because people do not throw away waste. We have not faced any problems in waste segregation and scrap selling after getting training."

Household beneficiaries both in Teknaf and Ukhiya Upazila are now selling their recyclable waste to scrap dealers as the respondent said during FGD-

> *We have learned about 3Rs from UNDP. We can reduce and reuse wastes, for example - make flowers tub. We can sell scraps for recycling. We regularly practice 3Rs at home*

Door to Door Message Dissemination Service

This study found that approximately 88% (N=250) of the household beneficiaries were aware of the two-month community engagement campaign. 86% (N=134) of the shop owner beneficiaries agreed. To assess this activity, respondents were asked if anyone from the project implementing partner visited their household and spoke about waste management. For this activity, 97% (N=250) of the household beneficiaries confirmed that they received such services, while 94% (N=134) of the shop owners said the same. The evaluation team found that there is a significant relationship ($P<0.05$) between respondents who knew about the campaign and who were visited by the door-to-door service.

To gain a deeper understanding of the effectiveness of this message dissemination service, the study asked the beneficiaries to recall the topics/messages that were delivered to them. According to the results, the door-to-door message dissemination service to improve the knowledge of beneficiaries about household and shop waste management was a successful intervention, as all of the respondents remembered at least two of the messages they had received through this intervention. Approximately 83% (N=283) of respondents in Teknaf Upazila remembered "source-separation of waste" and "storage of recyclables." However, only 11% of recipients from Teknaf Upazila could recall the messages that they have to pay for the waste collection services. This message was delivered after getting permission from the chairman, and implementing partners used a tom-tom vehicle and mic to disseminate the messages. From Ukhiya Upazila, approximately 93% (N=86) could recall "waste segregation at the source" and "store recyclable items." However, only 5.8% of recipients from Ukhiya Upazila could recall the messages regarding "willingness to pay for waste collection service."

The study asked the respondents if they received any training from the project on Solid Waste Management (SWM), to which around 80% (N=384) of respondents from both households and shops responded affirmatively. The respondents who confirmed that they received training were further asked about what they learned from the training sessions. In this case, around 84% and 87% (N=69) of the respondent living in Ukhiya Upazila replied that they got training on “waste segregation at source” and “how to store and sell recyclable items”. On the other hand, 86% and 83% (N=236) of the respondents from the Teknaf municipality replied that they got training on the same topic. But very few beneficiaries said that they were introduced to the concept of trash for cash concept: sell recyclables to the feriwallas., or the training has increased their willingness to pay money for waste collection. This scenario is the same while the study team was conducting Focus Group Discussions with the household beneficiaries in Ukhiya Upazila. Household beneficiaries in Palongkhali Union are reluctant to pay any kind of money for the waste collection, even if the project ends, they want other NGOs to continue the project. During the discussion, they were asked if they think a clean environment is important for them, they feel that a clean surrounding is important for their health, but if they do not get the free service of waste collection, they will start dumping waste

here and there. Household and shopkeepers during the focus group discussion have said that regular waste segregation and management have become their day-to-day habits because of the training and campaign from the project. Shop owners in Teknaf municipality said that the waste collectors aren't able to collect waste properly as only 4 waste collectors work daily in their area, they emphasized increasing the manpower so that all of the wastes are collected daily. Recently the Municipality is thinking about starting a new decentralized SWM model at the ward level where the private sector will be engaged in waste management and fee collection.

Waste Segregation

In Teknaf Municipality, organic waste and inorganic waste are separated at the source, which means that people who live in homes or own shops do this. To dispose of inorganic waste, people use blue bins. Inorganic waste is picked up by volunteers in vans and taken to secondary collection points, where it is dumped by city workers with city trucks and taken to an improved sanitary landfill. The CfW stored recyclables at the HHs or shops, where they are picked up by recycling entrepreneurs and/or separated at the Sanitary landfill.

In Union Parishads, the SWM systems were set up mainly to target market stores and nearby households. Organic waste is separated from inorganic waste at the source (green and blue buckets). The non-biodegradable waste is taken to the secondary collection points that have been built in each market area. Recyclables are kept in households or shops and picked up by the recycling entrepreneurs or they are separated at the secondary collection point and linked to the recycling sector. While waiting for permanent land to be given by the Union chairman to build MRFs, inorganic waste is put in temporary dump sites.

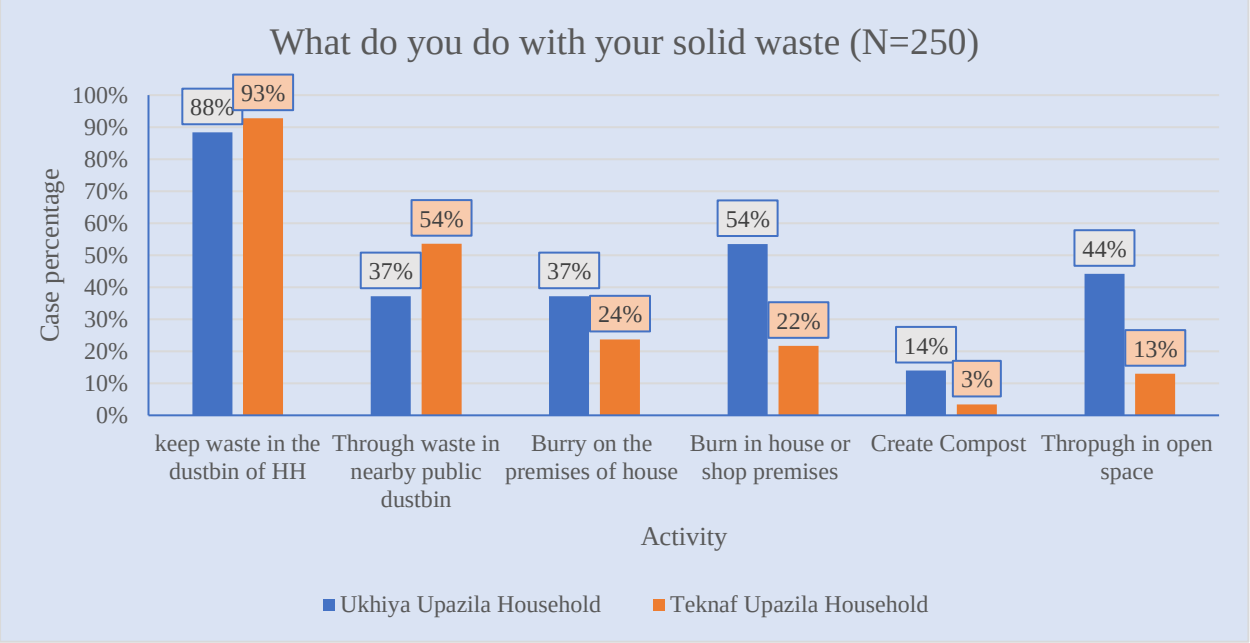

Figure 9 Solid waste management at the household level

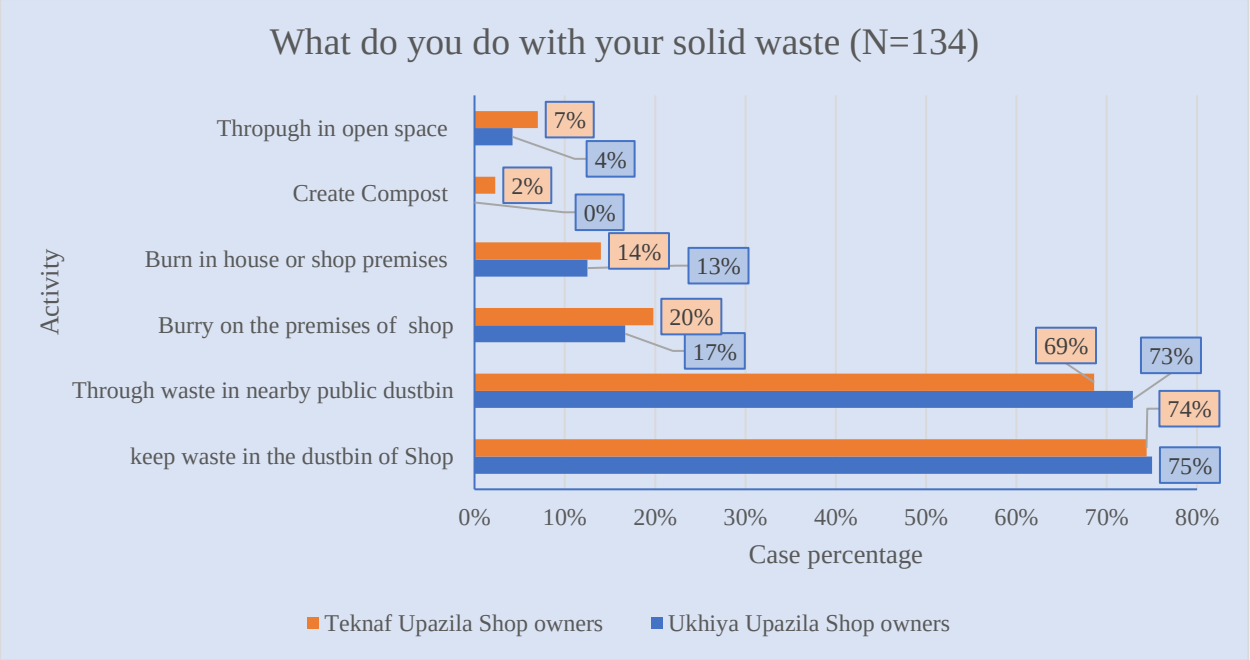

Figure 10 Solid waste management at the shop level

Before investigating the waste segregation and recycling practices of beneficiaries in the study area, the research team attempted to comprehend what beneficiaries at the household and store do with solid waste. This study revealed that over 87% (N=293) of respondents in Ukhiya Upazila and Teknaf Upazila place their waste in household waste collection bins. Beneficiaries in the Teknaf Upazila area use their waste bins more frequently (53.6% vs. 37.2%), which shows that beneficiaries in urban areas adopted the learnings more effectively. Another significant difference was found in the proportion of beneficiaries who dispose of their waste in open areas. Approximately 44.2% (N=43) of household beneficiaries in Ukhiya Upazila dispose of their household waste in open areas, which is three times the proportion of beneficiaries in Teknaf Upazila. At the time of data collection, it was evident to the research team that households routinely dispose of their waste outside their homes, primarily in open areas devoid of structures.

In the case of shop owners, approximately 75% of both Upazilas use their shop dustbins to store solid waste. The primary difference between household beneficiaries and shop owners is that, while a small percentage of household beneficiaries practice composting their organic solid waste at the household level, shop owners do not engage in this practice at all.

Approximately 97% (N=230) of household beneficiaries said they store their solid waste in household bins, while 91% (N=100) of shop owners use bins to store their solid waste.

After a preliminary evaluation of their solid waste management, the beneficiaries were questioned about their knowledge of the different types of solid waste. Beneficiaries were only taught about the organic and inorganic waste types that are commonly produced in

households and stores, as this was the only information that the project's implementing partners were able to disseminate. This project sought to separate waste into organic and inorganic materials; consequently, training was centered on this topic. 97.2% (N=250) of the household respondents were aware of organic and inorganic waste types, while 91.8% (N=134) of the store owners were aware. Nearly 90.5% (N=42) of Ukhiya Upazila household respondents learned about waste types through training provided by the project's implementing partners. In both Teknaf and Ukhiya Upazila, 74% (N=278 and 88) of respondents gained knowledge from the project.

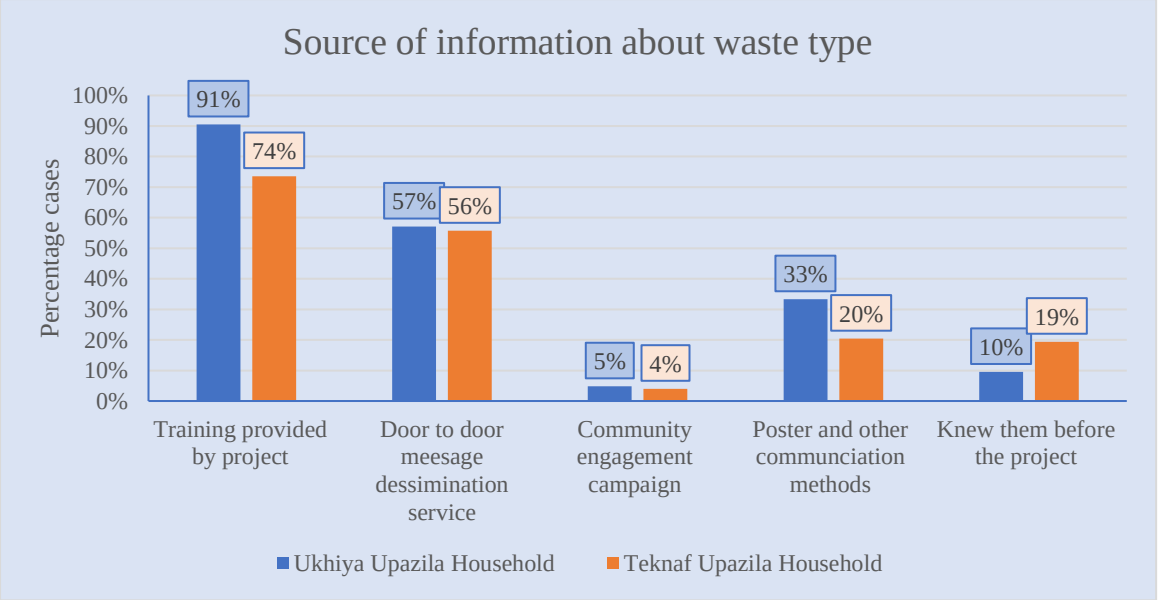

Figure 11 Source of information about waste type for household

From the focus group discussion with the households and shop owners in Ukhiya Upazila, it was found that households and shop owner beneficiaries are now able to separate waste properly, they know about the use of the green and blue buckets. As one of the household beneficiaries said

"Now we know how to keep them separately, we keep the organic waste in the green bucket and inorganic waste in the blue bucket, they told us how to separate them when they gave us the bucket. But overall, we didn't face any problem"

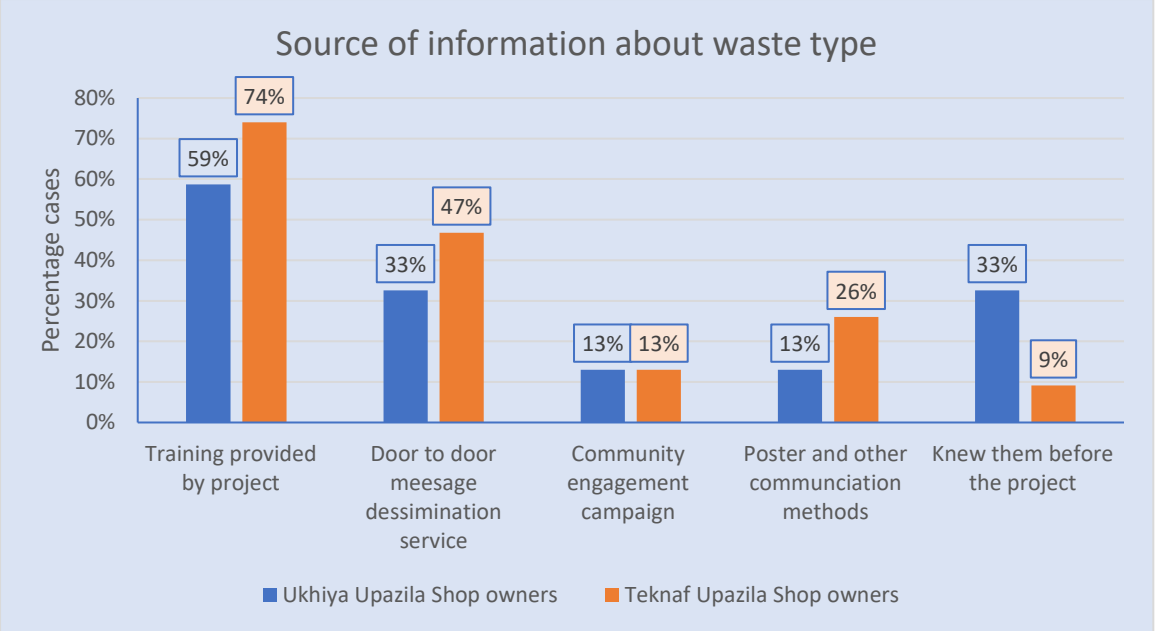

Figure 12 Source of information about waste type for shop owners

During the household interview, the respondents were asked if they know about organic and non-organic waste, around 79% (N=384) replied that they knew about organic and inorganic waste types, but the evaluation team further wanted to assess the knowledge of the respondents regarding the waste type, for that the respondents were asked to identify organic and inorganic waste from the question. For one correct answer for each set of question the respondent got a score of 1, if one respondent score 2 then his or her knowledge level is low, more than 2 but below 4 scores is categorized as medium knowledge and more than 4 is regarded as high knowledge level regarding waste type. From the analysis, it was found that around 36% (N=207) of households' beneficiaries in Teknaf Upazila had high knowledge about the waste type, and only 12% (N=86) of shop owners had a high level of knowledge of the waste type. Similarly, in Ukhiya Upazila around 40% of (N=43) of household beneficiaries had perfect knowledge whereas only 27% (N=48) had a high level of knowledge, overall, around 18% (N=384) had a low level of knowledge regarding waste type meaning they were able to identify less than 2 items correctly from the organic and inorganic questionnaire checklist.

Nearly 95% (N=250) of the household beneficiaries were aware of the solid waste segregation technique. While approximately 87% (N=134) of the store owners were aware of waste segregation. Among those who knew about waste segregation, approximately 97% (N=238) of household beneficiaries and approximately 94% (N=116) of shop owners practice waste segregation at the source. The study found that only 59% (N=332) of households practiced waste segregation before the start of the project after asking beneficiaries about their waste segregation practices. The primary reason project beneficiaries did not source-separate waste was because they only had one waste collection bin at their homes or businesses. The

evaluation team found significant relation ($p<0.05$) between the respondents who knew about the waste type and those who practices waste segregation in their households or shop.

Among the project beneficiaries (N=332) who separate waste at the source, nearly all respondents said they separate non-organic waste into bins of different colors. 73% (N=230) of household beneficiaries and 94% (N=102) of shop owners correctly identified blue as the color of the non-organic waste collection bin. One of the cash for workers said that green and blue buckets were provided to families throughout the municipality, with organic waste going in the green bucket and inorganic waste going in the blue bucket. All houses and markets were given two buckets, with instructions to segregate organic and inorganic waste into two buckets.

All respondents are aware that non-organic waste must be separated into recyclable and non-recyclable materials. Nearly 59% (N=216) of the household respondents sell their recyclable non-organic waste for-profit, compared to 32% (N=91) of the shop owners. At the household level, only 24% of respondents indicated that their recyclable non-organic waste is collected by a recycling entrepreneur, compared to 58% of business owners. At the household level, respondents earn an average of 152 Taka BDT per month and sell approximately 5 kg of material to sellers, while shop owners earn an average of 600 Taka BDT per month and sell approximately 30 kg of recyclable non-organic material each month.

As the project created vast opportunity for household beneficiaries and shop owners to sell their recyclable non-organic materials to scrap dealer, the percentage of respondents selling these materials are high in the project areas. However, despite being able to earn extra money by selling recyclable waste, the household beneficiaries in the Union areas were found reluctant to spend money on waste collection services. From the Focus Group Discussion, the study revealed that the beneficiaries are still not interested in spending money on waste collection services. The project or the local government institutes that ever continues the SWM in the Union level must focus on raising awareness among beneficiaries regarding the importance of sustainable solid waste management practices.

The study also found that around 87% (N=78) of the respondent in Ukhiya Upazila and 76% (N=254) respondents in Teknaf Upazila answered correctly regarding the colour of the bin to store the organic waste. This shows that the project was able to disseminate information properly regarding the use of coloured bins. Regarding organic waste disposal, nearly 72% (N=230) of the household respondents correctly identified the appropriate bin colour when disposing of organic waste. Although this rate is significantly higher for shop owners, approximately 93% (N=102) of them provided the correct response. This indicates that the project was able to carry out its intervention regarding the dissemination of information about coloured bins and their use, resulting in a substantial amount of solid waste being separated at the source.

Furthermore, 75% (N=78) of respondents in Ukhiya and 76% (N=254) of respondents in Teknaf Upazila store the organic waste in green bins so that project volunteers can collect them. The CfW collect the organic waste and transfer them to compost plants. Approximately 69% of households in Ukhiya Upazila use compost for tree planting, whereas 38.5% use compost for agriculture and7 7% of households in Teknaf Upazila use compost for agricultural purposes among the project beneficiaries.

Waste Disposal

Regarding household and shop waste disposal the study found that around 83% (N=91) of the beneficiaries in Ukhiya Upazila and 76% (N=293) beneficiaries from Teknaf Upazila dispose of their solid waste daily, while 21.2% said they dispose of their waste twice per week. Nearly 81% (N=134) of shop owners dispose of their waste regularly. this is an indication of the availability of regular waste collection services in the study area. Additionally, 63% (N=384) of respondents said that they don't have any fixed time for disposing of their household and shop waste, with 69% of household beneficiaries and 52% of shop owners indicating the same. 34% (N=384) of the beneficiaries in both Upazila prefer to dispose of waste between 8 a.m. and 12 a.m., making this the preferred time frame for waste disposal also, the majority of household respondents 74% (N=230) reported that project volunteers collect their household solid waste, whereas 78.2% (N=102) of shop owners reported the same. The respondents were also asked if they face any problems while they dispose of their generated waste, 49% (N=43) of the respondents in Ukhiya Upazila said that they don't have any communal bin in their area also, and 17% said the place where they dump waste is quite far away and 23% said that the dumping place is smelly, furthermore, more than 56% (N=48) shop owners said that there is no problem during waste disposal, as from the qualitative data it was found that the project supplied large bins for three or more shops to dump their waste in the markets, similarly in Teknaf Upazila around 74% (N=86) of the shop owners said the same.

Waste collection

Regarding waste collection services in the project area, around 80% (N=91) of the respondents in Ukhiya and 83% (N=293) of respondents in Teknaf Upazila said that they have a regular waste collection service in their area. Almost all of the respondents who knew about waste collection services utilize the service in the project area. Furthermore, around 80% (N=316) of the respondents said that door-to-door service is available in their area. This was further ensured when one of the cash for worker in Teknaf Upazila said that they were involved in collecting waste from households, they use hand gloves during waste collection and collect the waste separately in their waste-carrying van. Regarding collecting waste separately from the household, this was ensured from the household survey where 86% (N=316) of the respondents from both of the Upazila said that the waste collectors store waste separately in their vans. Furthermore, 44% (N=272) of the respondents ensured that before the project the

waste collectors didn't collect waste separately, which shows that the project was able to effectively maintain waste segregation from source to disposing site. From the household survey, the study team found that 68% (N=50) of the respondents in Ukhiya Upazila said that waste collectors collect waste daily and 26% of them said waste collectors collect waste twice per week. Similarly, in Teknaf Upazila 56% (N=182) said about the daily collection and 31.3% of them said that the waste collectors collect waste twice per week.

Output 2.4 3R awareness campaign

Education and radio/ TV Campaign:

One of the most effective ways to contribute to a change in attitude and practice is through a campaign. Practical Action also ran a two-month public awareness campaign that included a variety of events to raise awareness about sustainable solid waste management and the 3R (Reduce, Reuse, and Recycle) process. These activities included an opening ceremony, festoon and sticker distribution, banner, local level miking, mass gathering and awareness session, mobile and voice message, TV and radio campaign, and billboard installation.

Mass Awareness Communication Campaign about 3R's: In December 2021 started a 2-month Mass communication campaign focused on 3R's (Reduce, Reuse, Recycle), no littering, and segregation in Teknaf and Ukhiya Upazila. In total, there were 10,000 stickers distributed at HHs & shops level, 600 festoons distributed at shops and Bazar level, 15 billboards installed in key locations, 750 stickers posted in vehicle tom-tom body, 70 days of local miking sessions conducted, 10,000 mobile messages shared, 60 days broadcast cable TV scroll messages (100,000 individuals reached in total) disseminated, 92 mass gatherings arranged and 3,015 individual briefed in Ukhiya and Tekhaf locations, and 1-month radio program forecasted.

Radio Program: Designed to provide 60 times public service announcement (PSA); 2 nos. of spot reporting on solid waste management present scenario, some interviews of Bazar committee, shop owners, cash for workers, etc; 2 nos. of success stories of cash for workers/ municipal workers; 2 nos. of the live program where they plan to invite the Mayor of Teknaf Municipality, Chairman of one union in Teknaf and UNO of Ukhiya / Teknaf; in another live program they will invite CFW, supervisor, sweeper or other waste workers, Secretary of Teknaf Municipality and others. The campaign also included on-air drama on Solid Waste

This evaluation study tried to assess the effectiveness of the 3R campaign that was implemented in the study area, these campaigns included education campaigns, bins in public places, radio tv/campaigns, and local consultation. Almost 55% (N=91) of the respondents in Ukhiya Upazila said that they knew about the mass awareness campaign whereas around 68% (N=293) of the respondents in Teknaf Upazila knew about the awareness campaign. To evaluate the effectiveness of these activities respondents' knowledge level of reducing, reusing, and recycling was assessed during the household survey, during the survey the

respondents were asked to identify activities related to reduce, reuse and recycle in their community. For one correct answer for each set of questions, the respondent got a score of 1 and for 2 negative answers the respondent got a score of negative 1 marks, so the total analysis was done by combining the score for three sets of questions (reduce, reuse and recycle) and respondents knowledge level was scored (1= good, 2=very good, 3=perfect, and 0=no learning).

From the below table we can see that around 59% (N=207) of the household respondents in Teknaf Upazila have perfect knowledge regarding 3R activities and 24% (N=86) of the shop owners have perfect knowledge. In Ukhiya Upazila this rate is high for the household beneficiaries around 72% (N=43) and for the shop owners it was only 31% (N=48). Out of the total respondents around 35% (N=384) respondents in Teknaf and 42% (N=384) in Ukhiya Upazila didn't have proper learning from the 3R campaigns led by the implementing partners, which shows that the campaigns were somewhat effective in increasing the knowledge level and awareness of the household and shop owner regarding reduce, reuse and recycle in the project area.

Table 6:Respondents' knowledge level regarding 3R

Knowledge level	Teknaf Upazila			Ukhiya Upazila			Grand Total
	Household Head	Shop owner	Total	Household Head	Shop owner	Total	
Good	3%	12%	6%	5%	2%	3%	5%
No learning	27%	55%	35%	23%	58%	42%	37%
Perfect	59%	24%	49%	72%	31%	51%	49%
Very good	11%	9%	10%	0%	8%	4%	9%
Grand Total	100%	100%	100%	100%	100%	100%	100%

This finding is in line with the focus group discussion with the household beneficiaries in Ukhiya Upazila, during the discussion The respondents were talking about what they learned from the training, mostly about segregation of waste, they were present in the training, but not more than once, they have seen some of the information about solid waste management in billboards and TV, which were issued by BRAC. Regarding the 3R, one of the respondents said that they learned about reducing waste, like not taking many bags when doing shopping, and using old buckets to reuse as planting trees, but unfortunately, not all of the respondents were able to talk about the 3R activities that they learned or know about.

From figure 13 it is seen that around 45 % and 43 % (N=91) of the respondents in Ukhiya Upazila learn about reduce, reuse and recycle from the project awareness-raising campaign and the poster, whereas only 22% of them learned from radio and TV program. Also, in Teknaf

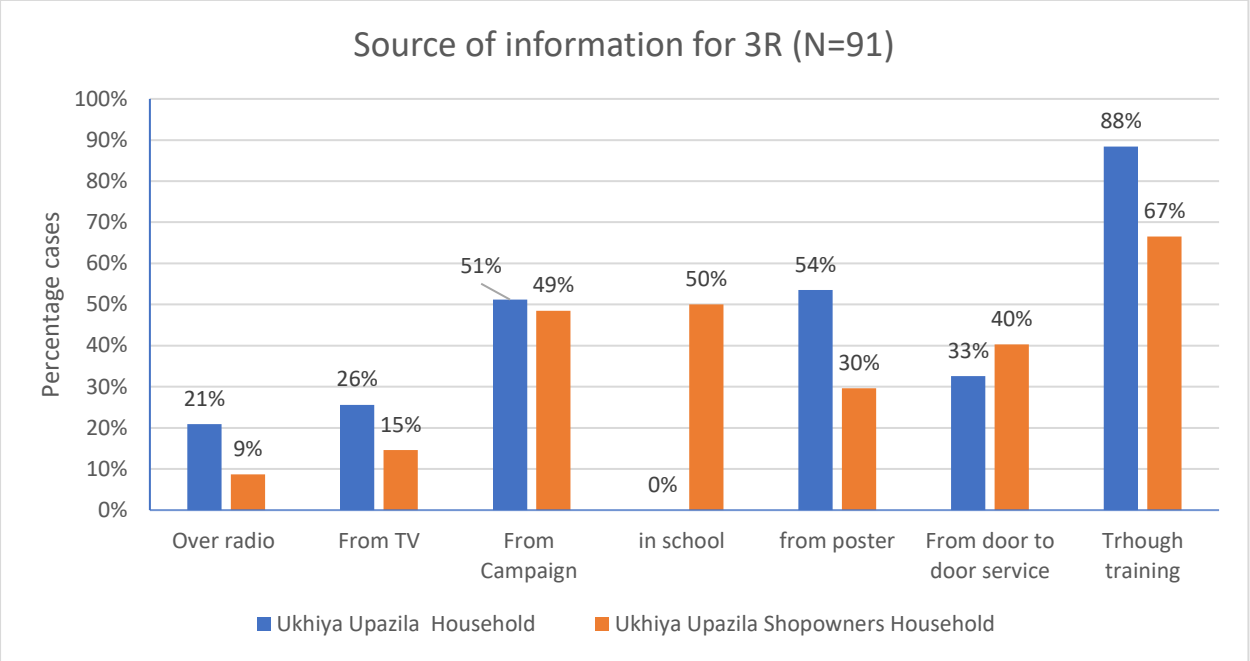

Figure 13 Source of information for 3R for households

Upazila 43 % and 32 % (N=290) of the respondents learned from the campaign and poster. It is evident from this finding that campaign and poster initiative is reaching more people than any other means of increasing the knowledge level of beneficiaries regarding 3R practice.

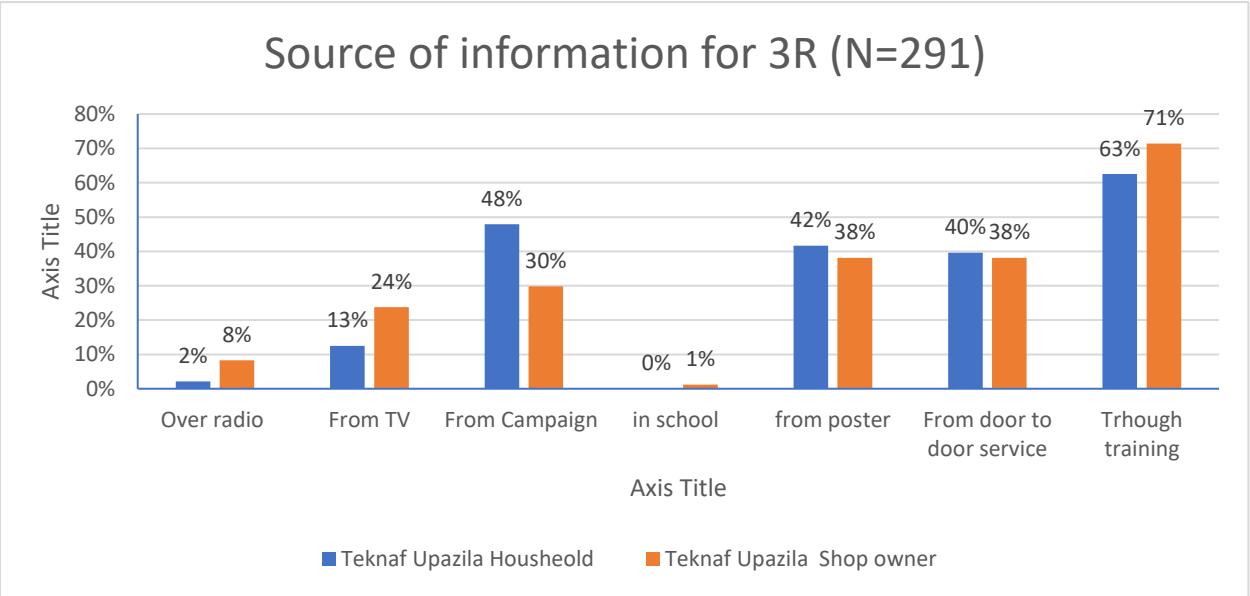

Figure 14 Source of information for 3R for shop owners

During the evaluation period, the project initiated a school program to promote the 3Rs and best SWM practices. In the 5 Unions and Municipalities, 15 schools were selected for ToT, and a Garbage bank was installed in each school to increase the number of recyclables collected. This program is based on a comic created by the project that will also be disseminated via social media to reach a large audience in Bangladesh's education community.

5.3 Efficiency

Efficiency can be explained as "The extent to which the intervention delivers, or is likely to deliver, results in an economic and timely way" in the 'Revised Evaluation Criteria Definitions and Principles for Use' by the OECD/DAC Network on Development Evaluation. Following the guideline, the study team looked at inputs relative to the entire results chain (outputs, outcomes, and impacts), in line with good evaluative practice. It is recognized that analyzing the entire results chain, and in particular, looking at the efficiency of inputs to impacts is methodologically challenging. The lack of relevant information often makes the process of examining the efficiency of the project challenging in terms of financial analysis. Due to the frequent absence of benchmarking data, the study team often used the reference to effectiveness, impacts, and sustainability apart from using information obtained through interviews conducted with key informants. The below sub-section includes a discussion of cost-effectiveness related to project interventions. Subsequent sub-sections deal more explicitly with the implementation strategy and execution, institutional set-up and M&E system, fund availability, and timeliness of UNDP's SWM project.

Value for Money

To assess the projects' efficiency in terms of Value for Money, this study employed the DFID-developed 4E framework, which is particularly applicable to adaptive programs. According to DFID, Value for Money (VfM) represents a balance between economy, efficiency, effectiveness, and equity. Each E is given a precise definition, which was typically framed as a question:

• Economy: Are we (or our agents) buying inputs of the appropriate quality at the right price?

• Efficiency: How well are we (or our agents) converting inputs into outputs? ('Spending well'.)

• Effectiveness: How well are the outputs from an intervention achieving the intended effect? ('Spending wisely'.)

• Equity: How fairly are the benefits distributed? To what extent will we reach marginalized groups?

('Spending fairly'.)

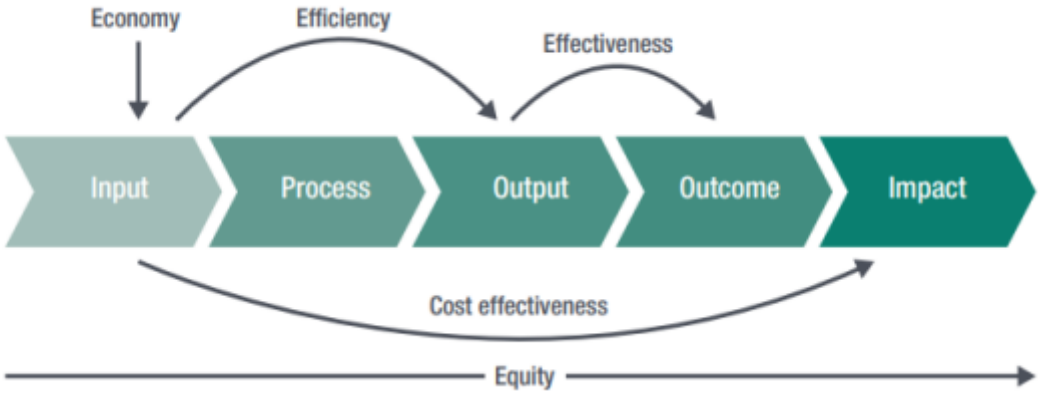

Figure 15 DFID's 4E Value for Money Framework

Cost-effectiveness was added as a fifth dimension in some iterations of the framework and was typically defined in terms of the intervention's ultimate impact on poverty reduction relative to the inputs invested.

The study used the "VFM SYSTEM MATRIX", which is part of the VFM Guide created by People in Need (People in Need, 2021). This process of evaluating the VfM of the project will require the review of the project documents, and internal procedures as well as discussions with program and support staff. This qualitative tool presents a method for assessing the Value for Money using the "E" categories: Economy, Efficiency, Effectiveness, and Equity. The analysis of each "E"is divided into sub-categories of the different stages of a project:

– Identification and Planning

– Implementation and Monitoring

– Evaluation and Learning

Each sub-category includes several standards to be assessed. A score is given to each standard and calculated for each of the 4E 's: 1 = No / Not implemented, 2 = Partly / Partly implemented, 3 = Yes / Fully implemented.

For instance, in the effectiveness section of the VfM matrix, the analysis sought to answer the question "How well are the outputs from an intervention achieving (or likely to achieve) the desired outcome?"

To determine the VfM value for this category, the study scored the project on several standards, including "If the project team understands what would happen without the intervention; If the interventions align with UNDP's comparative advantage/areas of expertise (or those of their partners); If it is clear who will benefit from the intervention and how much importance they place on the outcome; If the project has a well-defined theory of change that is supported by evidence; If the project's objectives are specific and attainable; If the project team has considered the long-term viability of this intervention; If the project generates significant learning as a result of this intervention; If the project team effectively manages risks as a result of this intervention." The subcategories "Implementation and Monitoring" and "Evaluation and Learning" were evaluated similarly. The analysis described each of these standards and assigned a score based on the project's progress on that particular topic/standard.

The scores for the standards of the "Effectiveness" section were calculated (out of 3) using the results of various indicators learned during the evaluation. The VfM value for "Effectiveness" was determined to be 2.9, indicating that the project achieved very good "Value for Money" in terms of effectiveness. The "Equity" section of the analysis sought to determine whether the project addresses social or economic disparities. The "Equity" part's VfM value was determined to be 3 (out of 3). This also indicates that the project was able to address social and economic disparities in part, thereby achieving very good "Value for Money." The analysis suggests that in the "Economy" part (Is the project buying inputs of the appropriate quality at the right price) the project achieved excellent VfM value (2.8 out of 3). The project did excellent in "Efficiency" (How well do UNDP and its partners convert inputs into outputs?) as well in terms of value for money as it achieved 2.8 (out of 3) here. It is important to mention that this tool was used to evaluate the value-for-money of project management and implementation. The scores have no bearing on the efficiency of project outcomes or accomplishment in terms of produced results.

Table 7: UNDP SWM project budget and expenses

UNDP Sustainable Solution to Solid Waste Management Project Budget	Original Approved		Remaining budget
ACTIVITIES	Total Budget (Plan) target	Total expended budget till August 2021 (Y1+Y2+Y3+Y4 half)	Budget Plan for May 22 - June 22
Outcome 1: Developing Waste Management Systems	2,695,274	1,538,053	323,124
Outcome 2: Changing Behaviors and Attitudes	978,500	1,253,974	
III. Project Management (Staff and Admin Cost)	11,021,323		
III. Project Management (Staff and Admin Cost)	844,500	1,263,944	153,384
TOTAL (USD)	4,518,274	4,055,971	
V. GMS (8%)	361,462	309,239	
GRAND TOTAL (USD)	4,879,736	4,365,210	

From the above table, it is evident that the project was able to achieve its targeted outcomes within its budgets, for outcome 1 the SWM had an allocated budget of 2695274 USD, and for outcome 2 activities it had a budget of 978500 USD. All of the outputs and each of the outcomes were achieved within this budget and from May to June 2022 the project allocated the remaining budget for implementing its activities. The detailed budget is given in Annex 4.

UNDP project implementation strategy and execution:

UNDP and the Swedish International Development Agency (SIDA) formed cooperation to create "Sustainable Solutions to Solid Waste." The prime purpose of the project is to capitalize on the use of recovered materials and livelihood associated, curtail the volume of waste requiring ultimate disposal, and improve waste management in the longer term. A number of basic UNDP concepts had been included in UNDP's waste management policy. Given the sensitive and complicated issues confronting this region, UNDP took a "do-no-harm"

approach, carefully assessing risks and openings before taking action. All of the activities of this project adhered to UNDP's high ethical and moral standards for its employees and project design. Additionally, the UNDP's focus on, and proven expertise in, fostering localization of its programs in order to encourage grassroots involvement in outcomes and operations has influenced the design of this project.

Throughout the 2018 pilot project, the initiative was created in conjunction with district and sub-district administrations, as well as civil society organizations. This was evident in a focus on long-term sustainability or improving the capacity of local partners to continue forward without UNDP help in the future. Finally, because of the special challenges encountered by women and girls in the host communities, a strong focus on gender problems was emphasized throughout the project. After that, the project was planned to shift from immediate responses to longer-term recycling, livelihoods, campaigning, capacity building, and government involvement efforts in order to expand and foster a local solid waste economy.

Before implementing the project, UNDP had done several gap analyses studies and local stakeholder engagement sessions to build a better and more efficient Solid Waste Management (SWM). In the project area Practical Action Bangladesh (PAB) and BRAC implemented the project interventions. Within the project result, BRAC had been primarily working on Output 1.1 and 1.2, which were quick-impact trash removal and basic waste management system development. PAB had been working with output 2.1 which was to organize and grow the informal recycling sector (IRS), Output 2.3 was to map and engage households and market stores in all project areas, and Output 2.4 was to execute a public awareness campaign. The UNDP team was in charge of overseeing the whole project, with a focus on delivering Output 1.3 on the construction of SW facilities, Output 2.2 on local government participation and capacity building, and Output 2.1 on recycling technologies to project areas.

UNDP utilized the current Direct Execution Modality (DIM) provided under its Early Recovery Facility to guarantee a quick and flexible implementation of programs (ERF). UNDP Bangladesh managed this effort, which was overseen by the Country Director and Deputy Country Director, as well as the director of UNDP's Cox's Bazar sub-office. The technical implementation of the project was overseen by a Project Manager, who was assisted by a project team made up of a SWM specialist, Environment/Infrastructure Associate, Social mobilizer associate, Monitoring and Evaluation Specialist, and GIS associate also temporary consultants Garbageman and private sector specialist were available, more over many other specialist and consultant is involved in this project. UNDP assembled a Project Board at the start of the project. The board provided the Project with high-level policy guidance and monitoring. The Project Board's overarching responsibility was to assist the UNDP Country Office in carrying out their oversight responsibilities, particularly with regard to annual plans, strategic planning, overall quality assurance, and risk management requirements as they relate to project outcomes, as well as

to influence the project's course. The PB was led by the UNDP Country Director, with representatives from key government agencies, development partners, and UN organizations among the attendees. Representatives from the donors were asked to join the Project Board. At least once every six months, the Project Board called a meeting.

Through the ISCG coordination framework, UNDP had engaged with other UN agencies as well as local and international NGOs operating in Cox's Bazar on a regular basis. UNDP also coordinates bilaterally to guarantee active engagement toward common goals. The Project Team was stationed in Cox's Bazar at the UNDP Sub-Office. In addition, two full-time national technical professionals assisted UNDP in implementing the project in Cox's Bazar.

The evaluation team assessed that the project followed its implementation strategy throughout its implementation phase and the project was able to execute and plan all of its activity timely, although the recent COVID-19 pandemic had halted some of its activity, the implementing partners were able to achieve the targeted goals and outcomes in the long run.

Efficiency related to institutional set-up and management:

The local government system provides adequate scope to assist the design and execution of SWM within its administrative framework. As Union Parishad, Upazila Parishad, Zila Parishad, and Pourashava are the Local Government Institutions under the umbrella of the Local Government Division (LGD) and two important departments LGED and DPHE. Almost all of these institutions have provisions for forming Standing Committees made up of diverse stakeholders, such as NGOs and specialists. They can help with SWM service planning, oversight, and implementation. Different committees comprised of a local administrator, public representative, appropriate department personnel, and civil society representatives are responsible for the development and enhancement of water and sanitation-related services at the local level, according to a government circular. Those may be viewed through two channels, one of which being DPHE and another is LGED, Urban Governance and Infrastructure created the LGED channel for Pourashava Infrastructure Improvement (Sector) Project (UGIIP) to enhance SWM through a performance-based budget allocation system. Among the formal stakeholders,' the key stakeholders are (1) Union Parishad, (2) Upazila Parishad, (3) Pourashava (Municipality), (4) Zila Parishad, (5) DPHE, (6) LGED, (7) NGOs and (8) Development Partners, etc. WATSAN committees of different levels have direct roles in water supply and sanitation in their jurisdiction including solid waste management.

Most of the time, the municipal secretary and mayor are directly in charge of SWM, and there is no full-time personnel dedicated entirely to SWM operations such as community mobilization, trash collection and transportation management, and landfill/compost plant administration. It does, however, have a shortage of drivers, cleaners, and supervisors, which is insufficient to satisfy the regular cleaning need. The UNDP has been assisting Teknaf Municipality with SWM through BRAC and PAB with CFW, as well as project employees. With

the issuing of an official order from the Mayor, the UNDP project has permitted the first ever SWM section / SWM counterpart for the project. UNDP also assisted in the formation of the first-ever Municipal WATSAN committee in Teknaf, with the goal of establishing and monitoring an SWM system while maintaining institutional consistency with DPHE, LGED, and other stakeholders.

In addition to WATSAN committees, union levels have Bazar committees and other groups. However, the frequency of WATSAN meetings and the topics of discussion remain troubling, according to a senior official from the DPHE's CXB EE office. UNDP attempted to mobilize WATSAN committees and activate them over the last year, but their functioning and participation in union-level SWM decision-making remain very weak due to a variety of factors including a lack of promoters/facilitators, local budget shortages, and political regime changes at the union level.

The coordination between UNDP and the WASH sector has also been an integral part of the project. UNDP has led the SWM Technical working group and the Inter-sector technical working group as platforms to highlight the significance of mainstreaming SWM within the wash and other sectors. This close coordination has proved vital for the project's success. It also ensured an efficient sectoral coordination mechanism.

Fund availability and Timeliness of activities

According to the project completion report, funding was quite consistent, and the project was able to complete on time and within budget. The initial budget was revised in September 2019 to reflect the changing circumstances, and again in February 2020 as part of the COVID-19 response plan. In July 2021, a new budget modification was completed, and the project was granted a non-cost extension until August 2022. In December 2021, the budget was changed once again and extended until June 2022. Between September 2021 and February 2022, overall project expenditures totaled 884,520 USD, compared to a total budget of 5,061,120 USD. In comparison to the entire project budget, the current project delivery rate is 81 percent. Concerning the project's timeliness, the study's findings indicate that the majority of the project's activities, as mentioned previously in this section, were completed on time, apart from some exceptions.

From the project budget and expenditure plan, it was found that the project was able to achieve all most all of its output and outcome within the extended budget frame, outcome, and output-wise allocated budget, target, and progress against the target and budget spent for the outcomes and outputs are given in the annexed table named UNDP SWM project budget and achievements

Monitoring and Evaluation

The Project Manager is responsible for planning, implementing, and monitoring field operations in the field, as well as reporting progress and finances to the UNDP SWM team. UNDP will hire a Monitoring and Evaluation Officer to keep a careful eye on beneficiary selection and registration, as well as work on sites and payment locations. Community members will also be involved in and participate in monitoring visits with the UNDP team. Due to a lack of adequate municipal labor, the monitoring management of the UNDP project's waste collection activity is considerably better than municipal monitoring. Steering Committee, Private Sector/Contractor, and Recyclers are all involved in the planning, operation, and monitoring of the project. IT tools were used to track all of the UNDP's activities. Various methods and approaches are used to gather, store, analyze, and present various SWM system/monitoring information from Teknaf and Ukhiya. The following applications are used: ArcGIS, QGIS, ArcGIS Online, Tableau, Kobo Toolbox, ArcGIS Survey 123, GPS, SPSS, MS Office, and Google Earth Pro. The evaluation found that the monitoring and evaluation mechanisms appeared to be well-planned and implemented.

5.4 Impact

The impact of any project intervention can be defined as the direct or indirect positive or negative change that any intervention brought to the beneficiaries of the said project or in its surrounding community. For UNDP's SWM project, the evaluation team tried to observe and identify such changes that are visible and found through talking with project direct beneficiaries and the important stakeholders. As there are several project interventions under different aspects of the project, the below section of the report will try to depict the intervention's impact on different themes.

Impact on Environment and Health

The most prevalent Solid Waste Management (SWM) system consisted of dumping wastes in the nearest drain, roadside, vacant land, and canal/river to waste generation points. Community members would never consider the importance of SWM in terms of environmental and health impacts. The illegal and unsorted disposal of mixed solid wastes would pose significant health risks. The sheer volume of garbage has generated vast breeding grounds for rodents and insects, which function as disease vectors across most of the afflicted region. Waterborne illnesses such as cholera, diarrhoea, and typhoid can be spread by stagnant water trapped in the garbage, malaria, dengue fever, and chikungunya are all spread by mosquitos. Haemorrhagic fevers, as well as illnesses like meningitis and leptospirosis, can be transmitted by rats and vermin. If the region's condition worsens during the cyclone and monsoon seasons, these illnesses might spread even faster, as garbage can be dispersed further by floods, landslides, and high winds. Waste can be carried out to agricultural regions by rain or water in

the event of heavy rains or flooding, posing a danger of contamination of agricultural land and crops. The chemical reaction caused by the sun's heat altered the properties of the illegally dumped wastes. These wastes are channeled to drains, canals, and rivers, causing an odor problem in the water flow and an oxygen deficiency for aquatic life.

The presence of glass, needles, medical waste, or poisonous items in the host communities poses a clear and genuine threat to health and security. Children are especially prone to injury when they play near local garbage dumps (which are sometimes the only available open places). Infections, blood poisoning, or long-term scarring and problems can all result from serious wounds or waste exposure. Insufficient waste management has a significant influence on local air quality since local people in Bangladesh frequently choose to burn waste when local refuse levels become unpleasant and other waste management choices are insufficient. Even a tiny proportion of waste fires can poison the air for thousands of people, posing serious health risks for host populations, as well as foreign rescuers.

However, the implementation of the UNDP SWM project decreased the health risks posed by solid waste. Due to the implementation of this project, vulnerable households from refugee and host communities have greater access to appropriate SWM services and infrastructure and live in cleaner, healthier, and more humane conditions. Due to project interventions, 81.3% (N=91) of beneficiaries in Ukhiya Upazila and 87.4%(N=293) of the beneficiaries in Teknaf Upazila uses bins in their household and shop to store their generated waste. Only a fraction of the beneficiaries now throws waste in the open place. This is a great improvement compared to the baseline study done by UNDP in 2019, where it was found that in the Ukhiya Upazila, there was no proper solid waste management in place, and for that reason, residents threw waste in open spaces, in the side of river banks and the market area, also more than 40 % of the produced waste from household and shops were thrown outside in the open place. The study team also learned the same from the BRAC field coordinator in Teknaf, who said that before the project started there was no proper SWM in the area, so wastes were thrown here and there, and the overall environment was not that good, but after the project intervention, beneficiaries and community people started disposing of waste in bins and waste segregation.

During the interview with Teknaf Upazila Whykong Union chairman, it was found that the beneficiaries over there were happy and satisfied with the environment as it is now cleaner. As the Union chairman said

"Before there was no SWM system and it would create huge health hazards due to spreading wastes here and there, now people are so much satisfied because the environment is clean, People are noticing UNDP fields workers are continuously providing services"

Around 56 % (N=134) of the beneficiary shop owner responded that they have a public bin near their shop but 52 % (N=75) said that they have seen shop owners use these communal bins to store waste. During the FGD with shop owners in Ukhiya Upazila, it was found that at

Figure 16 Community bin for shop owners

the start of the project after the door-to-door message dissemination and training shop owners did dispose of their waste in the respected bins but as time passed by, thes

e bins became dirtier and unusable, slowly shop owners stop using these bins. It was also found from the shop owner knowledge level analysis that almost half of the shop owners in both the Upazilas didn't learn about proper 3R practice. The below picture show the current situation of bins in the shop areas.

It was also found that around 90% of the shop owners in Ukhiya Upazila and 93% of shop owners in Teknaf Upazila said that it was difficult to put the waste inside bins due to waste and litter spread around the bin, which we can see in the above picture. For this project to change the surrounding environment in the marketplace, they must have a mechanism to change and maintain the community waste bins which the shop owners use, which will in turn ensure a clean environment in the project areas.

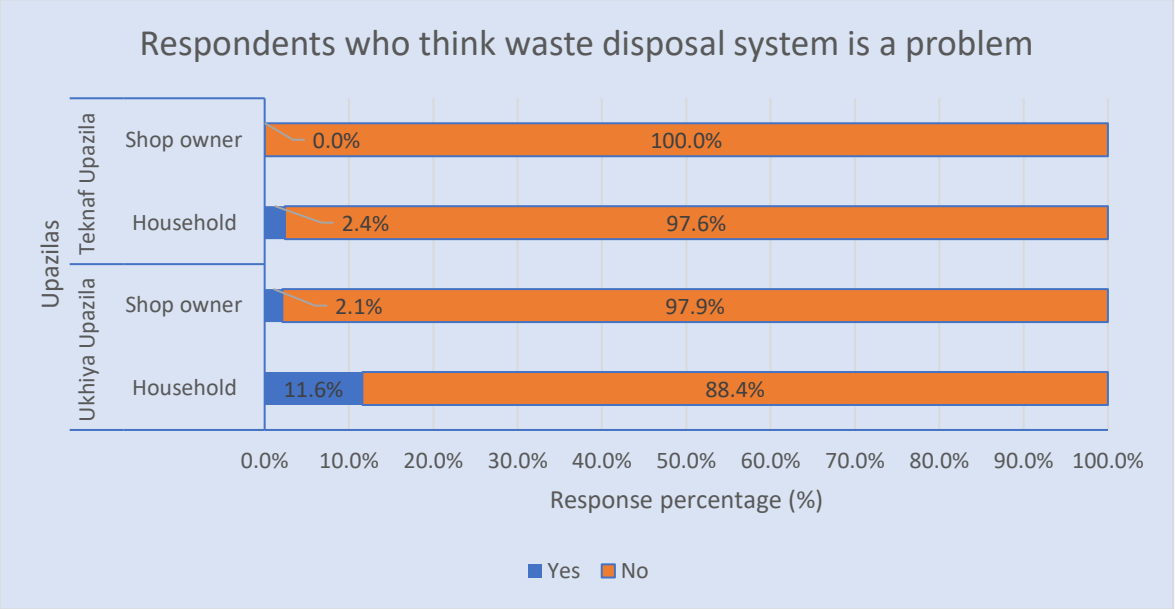

Figure 17 Respondents who think waste disposal system is a problem in their community

From the above figure, it is found that more than 97% (N=483) of all the beneficiaries (household and shop owners) in Teknaf and Ukhiya Upazila believe that the current waste disposal system in their community is proper for their community, and it is not a problem. This project had a great impact in changing the perception and awareness of the community people, because of the project interventions, they are now seeing scattered waste as a problem. They are now aware of the environmental impact of solid waste.

The perceptions of project beneficiaries regarding the environmental impact of solid waste, in Teknaf Upazila 90% (N=207) household beneficiaries are aware of impact of solid waste on

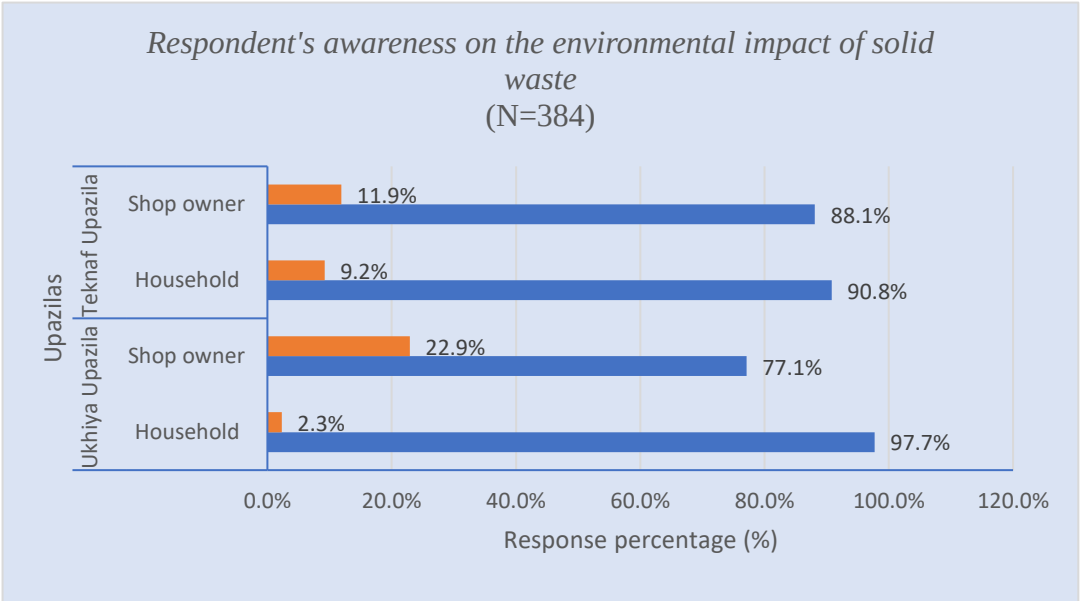

Figure 18 Respondent's awareness on the environmental impact of solid waste

the environment, whereas around 94% of (N=86) shop owners were aware of this. In Ukhiya Upazila around 97 % (N=43) of household beneficiaries and around 77% (N=48) of shop owners were aware of the harmful impact of solid waste on the community and environment. This awareness has increased because of the project intervention, it can be seen from the Practical Actions assessment report done in 2021, around 86.9% of the respondent reported that they had seen messages and information on waste management and the impact of solid waste, from those campaigns they have learned about waste type, waste management system, RRR, and importance of waste management. Because of this intervention, in Ukhiya Upazila around 88% (N=43) households and 36% (N=48), shop owners are concerned about the solid waste affecting their natural environment, in Teknaf Upazila around 97% (N=207) households and 49% (N=86) shop owner shared the same concern about their environment. This concern, in turn, leads to good practice of solid waste disposing, segregation, reduce, reuse, and recycle in the project area. According to this evaluation, 92.2% (N = 384) of respondents agreed that solid waste was one of the most significant issues affecting the natural environment

This current evaluation study found that almost all of the household beneficiary respondents in Ukhiya and Teknaf Upazila believe that most of the current environmental issues in their areas can be minimized if the solid waste in their area is managed properly. During the focus group discussion with household beneficiaries in Ukhiya Upazila, it was found that beneficiaries are now enjoying a cleaner environment because of the SWM project. They have pointed out that, before the project people were unable to move on the road comfortably because of the scattered solid waste, which created odour, attracted vermin and pests, sometimes people would fall in the waste fill drains and become injured, and young boys and girls often got sick as they used to play around the waste. But now their lives have changed, the environment is healthy and they are living healthy.

During the discussion, one of the respondents said that they want UNDP to continue the project even after the project period ends, because the overall benefit from managing waste was overwhelming for them and they want to continue this waste management, they think if UNDP continues this project from few more years everyone will adopt the solid waste management strongly and continue the adopted habits and manage their waste, but a good infrastructure is required. This discussion was reflected in the household survey, from below in figure 19 in the case of environmental change due to the implementation of the project, it is observed that in Teknaf Upazila around 94% (N=86) shop owners and 93% (N=207) household beneficiaries believe that the quality of the environment in the community had improved over the previous five years, ago. Also in Ukhiya Upazila 91% (N=48) and 99% (N=43) believe the same. More than 94% (N=91) of beneficiaries in Ukhiya Upazila believes that environmental degradation because of solid waste is harmful to them and their family, and 96.4% (N=293) of beneficiaries in Teknaf Upazila said the same.

The level of environmental impact knowledge varies across the nation. According to this evaluation, 88.0% (N = 384) of respondents believed that sufficient information was available regarding the environmental impacts of solid wastes in the community and market areas. In the community, solid waste was not the only environmental concern.

It is a moral obligation to ensure that future generations inherit a safe and sustainable environment. It is one of the fundamental determinants of sustainable development. According to this evaluation, 99.3% (N = 384) of respondents believed it was important to leave a better environment for future generations.

Regarding the health impact of solid waste management, respondents were asked if they know about health problems that are caused by solid waste mismanagement, Solid waste

mismanagement and illegal disposal have direct and indirect health effects. This evaluation reveals that around 92.6% (N=91) of respondents in Ukhiya Upazila were concerned about the

harmful health impact of waste, in Teknaf Upazila around 83% (N=293) of the respondent shared the same concern.

Diseases such as diarrhoea, dysentery, dengue, typhoid, ringworm, scabies, cholera, malaria, cough, asthma, and skin diseases are prevalent among community members. According to this

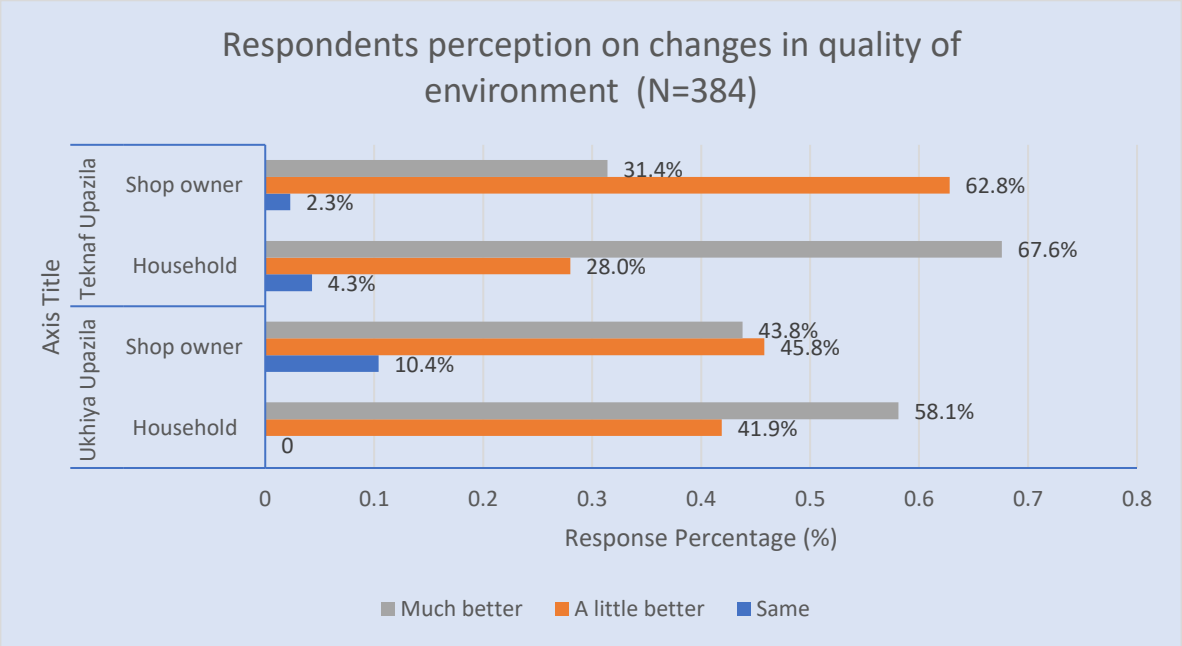

Figure 19 Respondent's perception on changes in quality of environment

evaluation, 22.1% (N = 384) of respondents stated that their family members had suffered from these diseases within the previous six weeks, whereas 77.9% (N = 384) of respondents stated that they did not suffer from these diseases. There may be multiple causes for these diseases. However, this evaluation revealed that 60.4% (N = 91) of respondents in Ukhiya

Upazila believed that these diseases were caused by poor solid waste collection and around 54.3% (N=293) respondents in Teknaf Upazila said the same.

A remarkable percentage of solid waste is illegally dumped in Bangladesh, which is a very common occurrence throughout the country. In the case of illegal dumping of solid wastes, this evaluation revealed that 30.7% (N = 384) of respondents had observed solid wastes on roads, land, or public places, while 69.3% (N = 384) respondents had never witnessed such illegal dumping.

The ultimate destination of illegal solid waste disposal is water resources. 72.4% of respondents (N = 384) observed solid wastes in water resources such as rivers, lakes, and seas, while 27.6% of respondents (N = 384) did not observe such occurrences in project-implemented areas.

Burying was the most common method of solid waste disposal, particularly in rural areas. This evaluation revealed that 75.3% (N = 384) of respondents noticed solid wastes being buried in public places, while 24.7% (N = 384) did not.

Community areas' environmental and health quality had improved as a result of this project's implementation. According to this evaluation, 93.8% (N = 384) of respondents stated that the frequency of these diseases has decreased in the community over the past four years, while 6.3% (N = 384) disagreed. The project intervention significantly contributed to the enhancement of community health. This evaluation revealed that 95.0% (N = 384) of respondents believed the UNDP SWM project was responsible for the disease reduction.

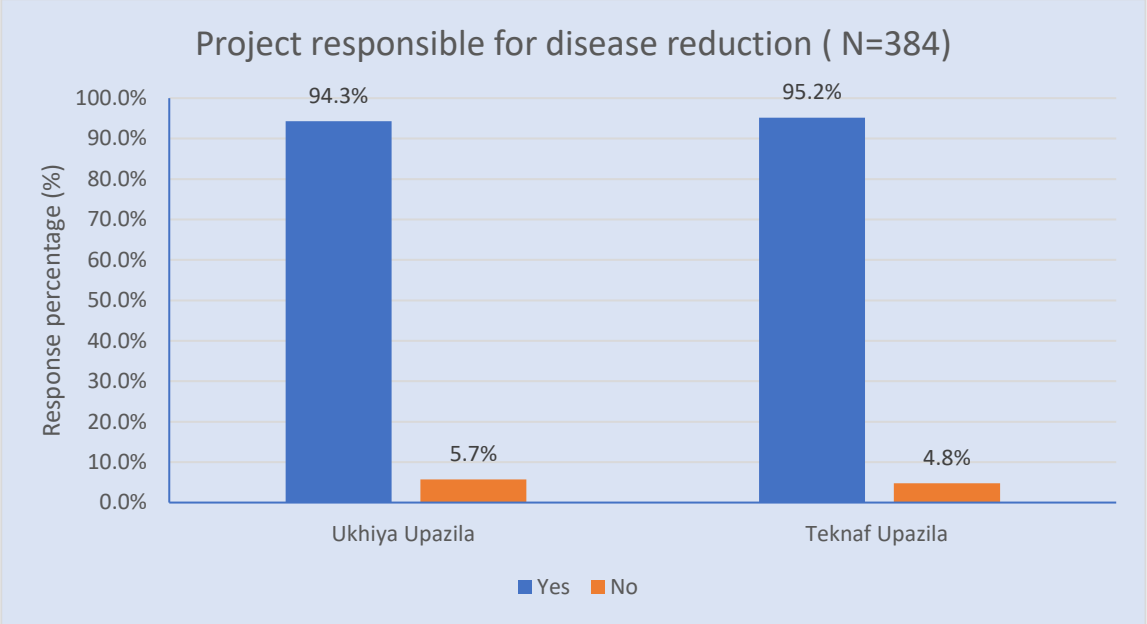

Figure 20 Project responsible for disease reduction in the community

Perception towards waste and recycling

Prior to the implementation of the UNDP SWM project, members of the host community never considered the significance of solid waste management. After implementing a cleaning campaign in the host community and providing training to households and shop owners, the community's perception of SWM changed drastically. The community's perception of solid waste management was also altered as a result of the program's efforts.

The implementation of the UNDP SWM project in the host community resulted in mostly positive changes in personal and community life. The positive changes were remarkable, including the development of waste source segregation, the use of separate bins, the storage of recyclable scraps, and composting practices for organic waste. People in the community began using organic waste compost for homestead vegetable gardens and plantations, thereby reducing their reliance on chemical fertilizers.

In developing countries such as Bangladesh, community participation is essential for the sustainability of SWM projects. Due to their low SWM budgets, these nations cannot ensure an effective and sustainable SWM system. After this project's intervention, community members realized the significance of SWM and perceived it as their responsibility. Beneficiaries in the project area now know about solid waste types, how to segregate them, and how to reduce, reuse and recycle them as discussed in the effectiveness chapter of this report. A representative from one of the implementing partners stated that previously community people didn't have any idea about waste management, but now they have Bazar level waste

management committee and community people now have significant knowledge of waste management.

Perception of the community has also changed for the waste collectors and businesses that are built surrounding the waste in the Upazilas, during the discussion with shop owners of the Ukhiya Upazila, the respondents acknowledged the importance of the SWM program and the social significance of the waste collectors. The SWM project has two major impacts on the community, one from a business perspective and another from a social perspective, according to the representative of Garbagemen. He emphasized that the business sector and income source for the community have increased and now the waste collectors and scrap dealers have their own identity in society as wear high vis vests all the time.

The cost recovery mechanism has yet to be determined, according to discussions with the Teknaf municipality. As a result, the municipality's expenses for solid waste management services are funded by the general revenue tax. The project was successful in establishing a cost recovery scheme for solid waste management services after a series of discussions and consultations with the target families. Each target family has been contributing 50 BDT per month since October 2019. The money is collected monthly and deposited into the municipality's account using a record book. BDT has been retrieved so far. As the UNDP's project support stopped in 2020, this money will be used to cover the cost of solid waste management services. More personnel and supervisors are being hired as part of the project's scaling up in the three wards and market regions. As a result, it is critical to recover expenses for the provision of solid waste management services from users. The potential cost recovery from households is anticipated to be 98,150.0 BDT per month. Similarly, the project's target market area's cost recovery potential is assessed to be 121,000.00. It should be highlighted that the planned cost recovery scheme should be adequately disclosed, negotiated, and agreed upon with the municipality and intended beneficiaries. Before launching/ introducing this campaign, a survey of the target beneficiaries' satisfaction with solid waste management services should be conducted.

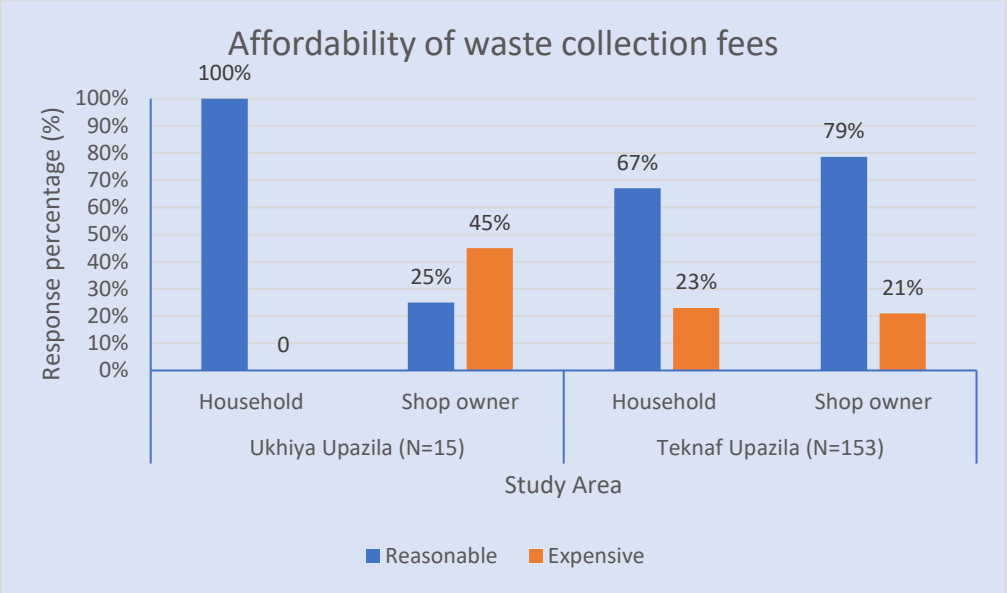

Figure 21 Affordability of waste collection fees

From the above figure, it is observed that almost all of the household respondents in Ukhiya Upazila who are paying for the household waste collection service found the collection fee reasonable, but the shop owners in this area found the collection fee expensive. In the case of Teknaf Upazila, around 67% of the respondent who is getting the service found the collection fee reasonable and 79% of the shop owner said the same. According to this evaluation, the HH and shop owners were interested in paying Taka 40 and 110 Taka per month for waste collection services, whereas in the Unions community people were not interested in paying for solid waste collection services.

Change in target beneficiaries, their communities, and duty bearers

In reality, there was no effective solid waste management system in the host community before the project started. In Teknaf and Ukhiya Upazila, mismanagement or illegal disposal of solid waste caused enormous environmental damage. For instance, drainage obstruction and flash flooding during the rainy season. Community members were unaware that illegal dumping and open burning of solid waste contributed to greenhouse gas emissions. Consequently, the previous SWM system of the community contributed continuously to environmental degradation. However, neither the local government nor the community took action to protect the natural environment and ecosystem.

This project constructed many medium- and small-scale SWM infrastructures within the community. This project initiated the Environmental Impact Assessment (EIA) for two Sanitary Landfills in Ukhiya refugee camps and Teknaf Municipality, as well as the construction of several small Solid waste infrastructures. The Sanitary landfill served three essential functions: 1) the cleaning of 27 camps, 2) the regular waste disposal of 23 camps, and 3) the emergency waste from three campfire incidents affecting five camps in 2021 and 2022. In total,

approximately 12,461 m^3 of waste had been disposed of safely at the Sanitary landfill, preventing additional environmental and health risks. Regarding capacity, the project had completed the extension of the landfill capacity from 8,000m^3 (original) to 22,000m^3 (completed on September 15, 2021) and had begun the work to increase it to 40,000m^3 (with SMEP support as the main construction partner).

After the implementation of the UNDP SWM project, wastes generated daily in the community and market areas were collected on time. Consequently, the surrounding neighbourhood and market environment became clean. The collected wastes were then disposed of via composting, recycling, and landfilling based on their characteristics, such as organic waste for composting, non-organic but recyclable waste for recycling, and non-organic inert waste for landfilling. Thus, it reduced environmental impact and generated income for the community through job creation (such as cash-for-workers programs) and the sale of recyclable scraps. This project intervention reformed local waste management behaviours and practices to be more environmentally and health-conscious, to effect a lasting change in how waste is created, stored and managed in the affected regions. This was evident from the discussion with the shop owners in Teknaf Upazila, they have expressed their gratitude towards the implementing partners of the SWM project, they are now aware of the proper way of waste management, the benefit that comes from waste management, and the harmful impact of waste to environment and health. They have also shared their knowledge on waste segregation and how they store recyclable and non-recyclable waste. A Focus group discussion with a household member of the Teknaf Upazila revealed that they are now adopted the new clean environment and they want this cleanliness to continue, some of the household members are willing to pay for the waste collection service. The household participants shared that they "want UNDP to continue the project as the municipality will not do proper waste collection and the previous scenario will come back to the municipality. Union Chairman of Rajapalong Union stated regarding the change of behaviour of community people, he said

> *Community people are becoming more aware of the solid waste; they are dumping the waste in selected places*

5.4 Sustainability

Sustainability refers to the continuation of benefits from a development intervention after major development assistance has been completed.

Sense of ownership in communities

The act or degree to which a community adopts ownership and responsibility for any initiatives or activities done within the community is referred to as community ownership. Community ownership entails taking ownership of and accountability for any programs that eventually empower communities.

The Sustainable SWM project has succeeded in instilling a sense of ownership in targeted communities in project intervention areas. Before the establishment of SWM collection services in host communities, all project direct beneficiaries (5,101 HH & 5,184 market shops) were oriented and provided with a set of two bins and informational and educational materials (IEC) about the importance of segregating domestic waste and how to do so. During the project implementation period, the project conducted an intensive community engagement and communication campaign on the 3Rs to consolidate knowledge and practices of waste segregation at the source, as well as to raise awareness about the significance of waste management.

Also, according to the findings, knowledge dissemination services to improve the learning of beneficiaries about household and shop waste management was a successful intervention, as all of the respondents remembered at least two of the messages they had received through this intervention. However, in Unions, in particular, the respondents were found to be unaware of and uninterested in paying for SWM-related services. only 11% of recipients from Teknaf Upazila and only 5.8% of recipients from Ukhiya Upazila could recall the messages regarding "willingness to pay" for waste collection service. Focus Group Discussion with household beneficiaries in Ukhiya Upazila revealed a similar scenario. It was discovered that they are unwilling to pay anything for waste collection. They suggested that even if the project is terminated, other NGOs may continue it. This is an aspect about which project and local government stakeholders should be concerned. When the interventions will be transferred to local government institutions, it may affect the sustainability of the project's outcome in terms of continuity of good practice.

As mentioned earlier the project has distributed 16982 pairs of waste bins to all the beneficiaries. The current scenario suggests that the usage of bins amongst beneficiaries improved significantly as 90% (N=250) of the beneficiary households now use at least 2 waste bins to store their household waste and around 61 % (N=134) of the shop owners do the same. The significant improvement in household and store sustainable waste management practices

suggests that beneficiaries are adopting the interventions effectively and gaining an appreciation for the significance of such practices.

Level of stakeholders' ownership

The project's design has been influenced by the UNDP's dedication to and track record of success in promoting the localization of its initiatives to promote the ownership of results and activities at the grassroots level. Throughout the 2018 pilot project, the project was designed after preliminary consultation with district and sub-district authorities and civil society groups. This is also reflected in the concern for sustainability, which entails building the capacity of local partners so that they can one day move forward without UNDP assistance.

To create a functional and sustainable solid waste management system, it is necessary to develop and agree upon a SWM model that reflects a division of local responsibilities (governance architecture). In the intervention areas, the solid waste management responsibilities of each level of local government were informal and undefined when the project was initiated. The project developed and proposed a SWM model in consultation with all relevant local authorities, outlining the roles of various levels of government (Union, Upazila, City Corporation, etc.) and the private sector in developing and maintaining solid waste infrastructure and services.

Existing SWM system within the Municipality of Teknaf

At the time of this evaluation, the municipality of Teknaf was found to be very involved in the project's interventions, and the study revealed some positive indicators that the municipality authority has already developed a sense of project ownership. Although, due to a lack of staff, the Teknaf municipality's conservation department has yet to reach a fully operational and embodied state. It was found that, in most cases, the municipal secretary and mayor directly manage and take decisions regarding SWM. At the beginning of the project, there was no full-time staff to handle routine SWM activities such as community mobilization, waste collection and transportation management, and landfill/compost plant management. The project successfully persuaded the municipality to provide land for landfill operations, assign one new truck, and recruit a Conservancy inspector for solid waste management. Nonetheless, the municipality still lacks enough drivers, cleaners, and supervisors to meet the standard cleaning demand. This project also supported the formation of the very first Municipal WATSAN committee in Teknaf to to establish and monitor a SWM system while ensuring institutional coherence with DPHE, LGED, etc.

The study team found the municipal authority to be very enthusiastic and proactive regarding the project's interventions, as positive changes are visible after three years. In an interview with the municipality's chief executive officer, he seemed optimistic about the interventions and

outcomes thus far, but he expressed concern about the motivation of the community to maintain the good practices developed by this project.

"Motivating people to participate in the Solid Waste Management system is a difficult task. This project has not yet been able to inspire so many individuals. If the project is extended, it will have more time to focus on this issue, and people may be more motivated."

He also discussed incorporating third parties into the SWM value chain to increase the system's effectiveness and efficiency. He believes-

"If Municipality markets and household waste collection fee collection is leased to the private sector, a large amount of revenue will be collected. This revenue can be used to develop a sustainable waste management system."

According to him, the municipality has developed an operation and business plan for waste management based on the collection of service fees from households and businesses in order to ensure the sustainability of the project's outcomes.

Existing SWM system within the Unions

The project found that the sustainability aspects of this project at the union level are still quite weak. In addition to WATSAN committees, the project involved Bazar committees and other organizations in SWM interventions at the Union level. Despite these efforts from the project, the officials of DPHE's Cox's Bazar office are still concerned about the frequency and topics of WATSAN meetings. Throughout the intervention, the UNDP has attempted to mobilize and activate WATSAN committees; however, their functioning and participation in union-level SWM decision making remain very weak, and a number of factors could be associated with this trend, including the absence of a promoter or facilitator, a lack of local budget, changes in political positions at the union level, etc. Some unions express a strong desire to continue and expand the SWM system with fee collection, as evidenced by Whykhong WATSAN's declaration that they will continue waste collection by appointing additional personnel and organizing a bazaar.

However, the Chairman of the Rajapalong union presented a different scenario with an illustration. He expressed regret that people continue to dump garbage near the Sohid Minar in his union, resulting in a foul odor and an unhealthy environment. He stated,

It is crucial to dispose of trash in a designated area, just as it is in municipal areas. Waste workers (waste collectors) would have been more motivated if there was a designated location for waste

He was unaware of what waste collectors do with his union's collected waste when questioned by the study team. He suggested that the project could assist him in establishing a permanent location for solid waste disposal. He expressed concern about the sustainability of project outcomes in the union level. As he added,

> *As is common knowledge, the Union Parishad has a modest budget. Consequently, there is a chance that when UNDP and implementing partners will leave the project, solid waste collection will cease. Therefore, we recommend that another NGO or third party continue the project*

However, the Union Parishad is responsible for providing land for the construction of landfills and other solid waste management facilities, as the project is not able to buy any land to establish the such facilities. The Union Parishad, in consultation with the Upazilla authority, may request the necessary human and financial resources for solid waste management in order to rectify the issue.

The study revealed that the project held a meeting titled "ISWM operations management at Union Level" at which the organogram of ISWM, roles & responsibilities of various actors (Volunteers, supervisors, monitoring team, management team), as well as other important topics, were discussed. To ensure the success of the project's activities and outcomes, a robust SWM system with a well-defined coordination mechanism must be established. There is a high likelihood that this project will not be sustainable at the union level if it is discontinued at this time. This is why the project has hired established NGOs to carry on the business. Sustainability is therefore not yet ready, but Brac, BDRC, Oxfam, and NGOF will have to keep the systems running.

Ensuring livelihood development

Livelihood development is essential to ensure long-term sustainability and is an integral part of the proposed project, providing economic incentives for permanently modifying behaviours and habits. Recycling, repurposing, and reselling waste can be a lucrative industry with transformative potential for disadvantaged individuals and communities. To maximize the reuse of recovered materials and improve waste management over the long term, the UNDP and its partners considered a number of livelihood restoration and support projects with the potential to alter local incentives for waste management and disposal.

Even though all actors in the solid waste value chain are subject to the ups and downs of the market, upstream actors (waste collection part) are less resilient to adverse effects on their

livelihoods than downstream actors. Waste collectors are unquestionably in the most precarious position.

To address this issue, some workers have been recruited to supervise the SWM system, collect waste from households and businesses, segregate wastes, and work in the compost plant in the intervention areas as part of the Cash for Work program. This project trained the recruited CfW members on waste collection, segregation, and other sustainable solid waste management issues. According to the municipal secretary, the UNDP-supported daily CFW's performance in the primary collection, compost plants, and landfill management is comparable in terms of work productivity and duration to that of conventional municipal cleaners. Now that the project is ending, these CfWs will work under lessees who took responsibility over for the entire SWM system in each ward. The Local Government Institute will administer this entire process.

During a focus group with Cash for Workers in the municipality of Teknaf, participants expressed satisfaction with the project's entire system. They were satisfied with their compensation as well. Before joining the CfW team for this project, the workers were engaged in other income-generating activities. For instance, one of the employees owned a grocery store that was damaged in an accident. Now that he is a CfW member, he can support his family with the earnings from this job. Several of the female members previously worked as housemaids before joining this project as CfWs. However, the earnings were insufficient. They asserted that this project has improved and secured their means of subsistence and helped them achieve economic stability. When informed that the municipality will take over the entire process, however, they expressed concern regarding the continuation of the good practices.

In terms of community perceptions, 92% of direct beneficiaries are pleased with the existing waste collection service introduced by the project; and 82.3% believe that a clean and healthy environment would improve their overall standard of living.

One of the essential components of the SWM project was the local recycling sector, which consists primarily of scrap dealers. The SWM project has supported the formation of two cooperative scrap dealer associations in Ukhiya and Teknaf, the first cooperative scrap dealer associations in Bangladesh. Through the interventions, the project has fostered the growth of 41 scrap dealers and provided more than twenty training on topics such as business development, linkage, sorting various types of waste, preventing littering, value chain, and safety monitoring, among others. Practical Action has also linked scrap dealers, feriwalas, shops, and households, resulting in a dramatic increase in scrap trading revenues.

Prior to the implementation of the project, eight (8) beneficiary scrap dealers in Ukhiya Upazila employed a total of 44 workers in their shops; this number has since increased to 114, and a total of 70 jobs have been created. In addition, in Teknaf Upazila, the number of workers employed by nine scrap dealers has increased from 61 to 85, and 24 new jobs have been

created. The 16 scrap dealers in Teknaf and Ukhiya have contributed to the creation of 94 new jobs. It demonstrates that the project was successful in enhancing livelihoods and creating new opportunities.

Financial sustainability

Existing system viability is one of the most essential methods for ensuring the durability of solid waste solutions. To achieve this, the project planned to implement a Public-Private Partnership with the Teknaf Municipality based on a model implemented by the International Committee of the Red Cross for the Fecal Sludge Management System. The Project has developed a private sector engagement and mainstreaming strategy along with a business plan that balances costs and benefits. It developed this strategy with input from Teknaf municipality, a (Public-Private Partnership) PPP consultant, UNDP, BRAC, PAB, and municipal employees. It may be followed by a large number of development professionals where the SWM is started from Zero. Zero means that there were no instructions or systems in place for proper waste discharge, sorting, collection, transportation, disposal in a landfill or composting, or recycling. This management contract model was developed in response to the demand, expectation, and local context for contributing to the SWM's sustainability.

Based on this objective, a business plan was developed, and municipal employees were provided with training in education and skill development. The business plan was also developed collaboratively, incorporating the opinions of all relevant entities as suggested by the municipality. It is comprised of four (4) distinct components, including Income Forecast, Service Management, Organization and Management, and Financial Management. In the 'Income Forecast,' all potential sources of income and their preliminary quantifiable values are outlined. Service Management includes the number of beneficiaries or service recipients as well as the associated costs in various sectors (e.g., identification or generation of costs on transportation, equipment, and materials, etc.) for the total service. In the heading Organization and Management, the total itemized administration and operation costs are enumerated and outlined. In the financial management component, the fixed asset, working capital, various profits (e.g., gross, net, operating profit), and losses are identified and evaluated. This contract could be modified slightly for use in various regions of Teknaf and Ukhiya. Over time, additional development or revision may be required for implementation and use by any development partners, local government, or stakeholders seeking to positively contribute to the sustainability of the local SWM.

The municipality of Teknaf is attempting to increase its total revenue collection through various means, including trade licenses, tax collection, and service fee collection, among others. However, it was discovered that they require additional time to build management capacity and rationally utilize the budget. Without operational and management guidelines and local policies, public expenditures are complex. Implementation of the devised business

plan involving all necessary stakeholders can be proved effective and may play a key role in improving the chances of sustainability of the project outcomes.

In Union Parishads, through the same consultative process with the SWM stakeholders, a business plan was developed. Guidelines on waste collection and fee collection mechanisms were detailed and agreed upon with all stakeholders and signed by the respective Chairmans. However, unlike municipalities, unions are experiencing a funding crisis, but by incorporating SWM into their annual plan, they can secure funding from government spending. Baharchara union WATSAN committee desires to continue and expand the waste collection and transportation system, as well as maximize the collection of fees. Despite all the efforts, the study team did not find any strong evidence that the union-level stakeholders are ready to take over the established mechanism and run it sustainably. The cost-recovery mechanism put in place is intended to reduce the cost of operations (primarily concentrated on covering the basic costs: salaries, tools, and vehicles), but additional funding from Unions/Governments is required to include human resources who can own the process and improved and adequate budget to invest in maintenance.

To continue supervising and funding the systems, the project is engaging NGOs active in the relevant sectors and project regions. In Raja Palong, Palong Khali, Nhilla&Whykong, and Baharchara, BRAC, BDRC, NGOF/Oxfam, and NGO have been involved, respectively.

Environmental sustainability

The sustainable solid waste management project was designed to rehabilitate areas of the local environment that have been damaged by improvised and unplanned waste disposal, improving the local water quality and restoring key natural areas.

Cox's Bazar district is known domestically for its numerous environmental assets and scenic beauty, as well as its rich biodiversity. It has numerous tourist attractions, including the world's longest uninterrupted beach at 120 kilometers. The beach is also home to five species of sea turtles, while the nearby forests are home to Asian elephants and numerous bird species. Cox's Bazar District is home to small patches of forest that are home to fifty percent of all wildlife species in Bangladesh. Biologists refer to the Teknaf Wildlife Sanctuary as "Bangladesh's most important ecosystem" (UNDP, 2018a) for this reason, but the expansion of host communities and refugee settlements threatens to upset this delicate balance.

In addition to the disturbance to the bio-diversity balance, the water table has already been severely impacted by the proliferation of waste in the camps and host communities. The wastes contaminate the water, altering its color and texture and rendering it unfit for consumption or use in the kitchen or laundry. Unplanned and open waste disposal has caused extensive damage to local aquifers, in both camp and host areas, as improvised waste disposal pits have not been constructed at a safe distance from water sources or using proper techniques, and toxins are leaching into the soil and water supply. This leeching can have a devastating effect

on the environment, but it is especially hazardous when it occurs near local wells and sources of drinking water, which are used by tens of thousands, if not hundreds of thousands, of people. As stated previously, a recent UNDP study found that 83% of all tested camp and host community drinking water contained bacterial or toxic contamination (UNDP, 2018b).

The objective of the project was to mitigate the environmental sustainability risks of the intervention areas through the construction of new infrastructure and assistance to recycling businesses to transform the existing waste management options on the ground. The objective was to improve the local environment and health of everyone in affected communities by removing potential sources of toxins and danger to the water supply, the physical landscape, and the air (by preventing the burning of trash) and by bolstering the local economy.

As the project involves the construction of environmentally sensitive structures and facilities, the study team found that following the primary findings of EIA, the project developed and maintained an environmental management plan. The environmental activities and management measures for this project are outlined in the table that follows:

Table 8: Environmental Management Plan of the Proposed Projects

Activity	Possible Environmental Impact	Mitigation measures
Construction		
Landscaping, access road, and site preparation	Removal of topsoil material may deteriorate soil quality	Use the excavated soil material as a cover for the landfill site
	Soil compaction may lead to an increase in stormwater	Soil compaction may lead to an increase in stormwater
	Slope erosion, silt deposition on waterways, dust	Slope stabilization work will be done including retaining wall and plantation of vertiver (*Chrysopogon zizanioides*) and other plant species
	The elevated noise level of the ambient construction site may increase	Proper scheduling of transportation of materials. All vehicles and equipment used in the sites shall be maintained regularly to minimize noise level Drivers will be instructed not to make excessive hooting and drive at a low speed (<30km/hr)

Activity	Possible Environmental Impact	Mitigation measures
Operational Phase		
Loading and transportation of solid waste	The workers may be exposed to elevated levels of dust and offensive odor Traffic accidents may occur due to trucks movement Physical injury to employees Dispersion of solid waste during transportation	Temporary dump sites in Union Parishads have a liner foundation and are enclosed to prevent environmental impact and animal access. As a result of waste separation before disposal, only a small amount of organic waste is discarded, and leachate production is reduced. Environmental Assessments were conducted on three facilities: the Temporary Landfill in Ukhiya, the Compost Unit, and the Improved Landfill in Teknaf Municipality. Plan for the Environmental Management of the Temporary Solid Waste Facility (landfill) in Camp 20 Extension An Environmental Impact Assessment (EIA) and Environmental Management Plan are being conducted for all SWM facilities of the project.
Unloading and compacting the solid waste	The workers may be exposed to high noise levels	Aware workers on occupational health and safety Provision of ear muffle
New cell construction, unloading and covering the cell	The workers may be exposed to high levels of dust Bad odor may interfere with public health	Sensitization of workers on occupational safety and health

Activity	Possible Environmental Impact	Mitigation measures
Disposal and dispersion of solid waste	Visual impacts Improper handling of solid waste may lead to bad odor Source segregation and recovery of organic waste	Source segregation and recovery of organic waste Apply soil cover material after waste disposal practices Plantation of indigenous tree plants
Leachate Generation	May pollute surface and groundwater	Construction of a leachate collection and treatment facility

The study conducted a key informant interview with the Deputy Director of the Department of Environment in Cox's Bazar to determine the project's coordination with the Department of Environment. He suggested that a better coordination between the project and the Department of the Environment in Cox's Bazar would be necessary to maximize the project's effectiveness in addressing environmental issues and to prevent the possibility of environmental hazards caused by SWM facilities constructed under project interventions. However, according to the UNDP project representatives, DoE Cox's Bazar was involved in the project from its beginning. The project conducted initial IIE in collaboration with DOE Cox's Bazar and arranged for DoE representatives to visit the landfill. The DoE was also involved in EIA-related activities. Representatives from the Department of Environment (DoE) attended multiple meetings in 2020 to discuss solutions for SWM with the project team and other stakeholders.

The study found that the intervention areas already have a cleaner and healthier environment, so the changes are visible. The compost plants or Secondary collection points in the absence of compost plants, are operating effectively, the MRF facilities are operational, and there are two active landfills. Community members' knowledge and practices have been found to have increased. However, it will be very difficult to assert that the project interventions will result in rapid and lasting change in the intervention areas. Long-term monitoring will be required to conclude that the project has resulted in sustainable environmental changes. But the information gathered through this evaluation depicts a positive scenario, indicating that the outcome of this project may have long-term sustainability, provided that the activities continue under the supervision of local government institutions and the communities receive regular awareness-raising and knowledge-building sessions.

5.6 Gender mainstreaming

Gender

Gender is a fundamental and essential aspect of all UNDP projects, and this is especially true when working with populations that are already disproportionately poor and disadvantaged. Reports from all UN agencies involved in the Rohingya response have consistently emphasized the heightened risk of gender-based violence in the region, which is frequently linked to drug use, human trafficking, and the economic exploitation of vulnerable Rohingya women and girls.

Through consultation with local partners, the study found that women were included as equal if not priority recipients of opportunities whenever possible. Women were encouraged to participate and benefit from all project activities, although Cox's Bazar is a religiously and socially conservative region in Bangladesh.

This presented a very serious dilemma for programming, as UNDP did not want to train women for positions where they could face severe repercussions, particularly when the justice system and legal recourse mechanisms in the region were already overburdened. As a result, UNDP's gender engagement was tailored to the local cultural context; for instance, waste sorting businesses are highly profitable ventures that allow women to stay at home with their children while fulfilling their familial obligations and earning an income. Following the vision outlined in the Rohingya Joint Response Plan, the UNDP has made the challenge of improving conditions for the poorest and most vulnerable women in Cox's Bazar a central priority for all proposed programming in the region.

The involvement of women in this project is demonstrated by the following facts:

- 40% of the SWM team are women (2 out of 5 people).
- 16% of the National external consultants (1 out of 6 people).

Cleaning campaign:

- 80% of CfW for the cleaning campaign in Teknaf Municipality were women (41 out of 52 people).
- 0% of CfW for the cleaning campaign in Union Parishads were women (0 out of 208 people).
- 0.2% of CfW for cleaning campaigns in Refugee camps were women (2 out of 950 people).

Regular waste collection:

- 35% of CfW for daily waste collection in Teknaf Municipality are women (17 out of 48 people).

- 15% of CfW for daily waste collection in Union Parishads are women (15 out of 159 people).

Construction of Secondary collection points/ compost units/landfill in Camp 20Ext:

- 0% of CfW for construction of SW facilities in host communities are women (0 out of 229 people).
- 10% of CfW for the expansion of Camp 20Ext sanitary landfill (23 out of 241 refugees).

WATSAN SWM participants:

- 9% of trained WATSAN Committee members are women (22 out of 229 people).
- In camps, the availability of female CFWs at the Camp level was very rare. BRAC could not deploy female CFWs in cleaning campaigns in the Camp zone and Construction work in host communities.

Case story

Pinky (23 years old) was the volunteer supervisor for the Teknaf municipality. When the UNDP launched piloting the project, no one expressed interest in becoming a waste collector. Pinky showed her willingness despite being female. The UNDP team was surprised because the community of Teknaf is still quite conservative. However, she joined Ward 8 as a supervisor in 2019. As a student at the time, she did her job well while also pursuing her studies. As she accompanied a man who collected waste from homes and shops, she was treated to insults by local people. But she didn't pay any heed to them and continued her work smoothly.

At the project's end in 2021, the UNDP has planned to gradually reduce the number of volunteers and supervisors (52 volunteers and 8 supervisors in total). It was agreed that the municipality would be responsible for waste collection following the project is completed. Finally, all of the volunteers and supervisors lost their jobs. The same thing happened to Pinky. The municipality chose to implement the lease-based initiative. Pinky was the only female applicant for the position of lessee. The ward councilor and community members in her area both recommended her highly. In May 2022, she was selected as the lessee of her ward. She is now effectively managing her responsibilities. In the coordination meeting with the municipality's stakeholders, chaired by the mayor, she is praised for her outstanding management skills. Her area's waste collection rate is 80-90%, whereas the male lessee's rate is 40-50%. She is now able to make a deposit after managing all of her ward's expenses. On the other hand, male lessees are facing difficulties managing the costs.

A few days ago, a male lessee quit getting a better opportunity. UNDP, as well as the municipality together, decided to give this ward's responsibility to Pinky also. Pinky accepted their decision wholeheartedly. Her husband also is helping her to do her job properly and was also the supervisor of the project.

Pinky proved that a woman can overcome the social barriers of a conservative society if she has the self-assurance and desire to succeed. She simultaneously pursued her studies and career and has now attained the advancement she deserves.

5.7 Living No One Behind

The transformative promise of the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs) is to Leave No One Behind (LNOB). It stands for the unwavering resolve of all UN Member States to end all forms of poverty, put an end to discrimination and exclusion, and lessen inequities and vulnerabilities that keep people behind and limit their potential as a human being. In addition to helping the most vulnerable people, LNOB calls for addressing the underlying causes of prejudice, rising inequality within and between nations. Persistent kinds of discrimination, such as gender discrimination, which marginalizes and excludes individuals, families, and entire communities, are a major factor why certain people fall behind[2]. UNDP SWM project was able to address these issues by empowering women and marginalized population in the project area. This project created income opportunities in these rural areas. Cash for workers, profit from selling recyclable waste, land fill operations and other forms of income generating opportunities has helped project beneficiaries to get out of the strong clutch of poverty and become empowered.

[2] https://unsdg.un.org/2030-agenda/universal-values/leave-no-one-behind

6. Conclusion, Recommendations and Way Forwards

6.1 Conclusion

UNDP's Solid Waste Management project was designed to contribute to an improved environment, recycling, health, water quality, sanitation, livelihoods, and human dignity in areas of Cox's Bazar District affected by the Rohingya crisis by following Bangladesh's current policy context. This project maintained its relevancy throughout its design and activities.

Before the start of the project, the project team did many consultations with the local government to find out a suitable place for landfill and MRF and conducted several baseline studies to understand the need of the population. The project developed and proposed an SWM model in consultation with all relevant local authorities, outlining the roles of various levels of government (Union, Upazila, City Corporation, etc.) and the private sector in developing and maintaining solid waste infrastructure and services. This project also did an excellent value chain analysis of the recycling sector and helped to build new livelihood opportunities for the community people. One of the most significant achievements of this project is, this project was able to disseminate all waste bins to all of its beneficiaries and was able to reach them properly to increase their awareness regarding waste segregation and 3R. The implementing partners were able to clean a large quantity of waste from the project area, which increased the environmental quality of the project area. This endline evaluation found that household and shop owners are practicing waste segregation at source at a satisfactory level, though some shop owners were reluctant to follow this. Regarding the door-to-door message dissemination service, the implementing partners did an excellent job, overall, most of the respondents were able to call what they learned from this service and community workshop. This study also found that the cleaning campaign was well organized and was conducted in a regular manner. The study team found the project to be effective in all of its target activities, achieving its set objectives.

Although the project initially targeted building one new landfill in the study area they have built two new landfills in each of the Upazilas. This study also found that most of household and shop owners were practicing reduce, reuse and recycling and were earning some profit from selling recyclable materials. Overall the project was able to change the behavior and perception of its targeted beneficiaries regarding waste management. This was prominent when most of the project beneficiaries showed that they are now worried about their natural environment and want to protect it by maintaining proper waste management in their community, they now understand the impact of solid waste management on their health and environment. As most of the beneficiaries said that because of this project they are now living a healthy life and the environment is far better than in previous years, this is a significant achievement for the project.

In the case of efficiency of the project, the study team found that the project was able to complete all of its activities within the set budget. This project was very good value for money also, it was able to address social and economic disparities in the study area. The coordination between UNDP and the WASH sector has also been an integral part of the project. UNDP has led the SWM Technical working group and the Inter-sector technical working group as platforms to highlight the significance of mainstreaming SWM within the wash and other sectors. This close coordination has proved vital for the project's success.

It was found that the project was ready to be sustainable at the municipality level but was not ready to sustain at the union level, so more attention is needed at the union level to sustain the SWM system

6.2 Overall challenges

- Access to land had been an important challenge of the project which postponed the interventions in unions.
- Lack of local government capacities and awareness of SWM created challenges in the acquisition of land as well as the future sustainability of the project as a whole
- The election period also delayed the implementation of the exit strategy
- The proper and adequate financial mechanism to maintain the SWM operations in the Unions could not be developed.

Challenges faced in awareness campaigns

The project has encountered a few obstacles in conducting the Mass awareness campaign. The difficulties are described as follows:

1. In December 2021, schools were not open for general students. Due to the SSC and HSC examinations, they were unable to organize a campaign at the school level.

2. Maintaining Covid-19 and social distancing protocol among beneficiaries during large-scale gatherings.

3. People from the Bazar committee and the WATSAN committee were never available for mass gatherings because they were always engaged in important business and tasks.

4. Election in Teknaf Municipality interrupted the continuous execution of the Mass Awareness Campaign.

5. It was not possible to organize a mass gathering in the Teknaf Municipality's HHs due to their well-defined boundaries and the unwillingness of their residents to congregate in a common area.

6.3 Lessons learned

The project has yielded new lessons applicable to the project and the sector as a whole, which are outlined below.

Any SWM system cannot be completed without a solution for residual waste that is environmentally friendly. Up to 90% of waste could be recovered through the project, but there will always be waste that cannot be recycled or composted. This is the primary limitation of the SWM systems developed in Teknaf and Ukhiya Upazila, where there is currently no sanitary landfill for the host communities.

Without devising a financial mechanism to cover the expense of SWM operations, the viability of the services is at risk. The Unions and municipalities require additional assistance from external agencies to manage and fund the consolidation of these services.

Creating a new SWM culture requires a continual emphasis on the need for proper waste management and the implementation of functional SWM systems. To incentivize and prioritize the SWM agenda at the district level, the role of the central government in new policies and regulations is also essential.

During the fire incident response in March 2021, the high demand for the Sanitary landfill to dispose of debris and other accumulated waste in drains from affected camps raised the issue of the urgent need to identify land for waste segregation and alternative disposal sites. In the event of an event that generates a large amount of waste, such as a natural disaster or the cleaning of waste from drains, the camps cannot properly manage waste without causing additional environmental damage. There is a need to define a protocol in which agencies' responsibilities, cash workers for waste removal, resources such as machines, open sites, and logistics are clearly defined to deal with waste in a manner that prioritizes aid delivery and camp reconstruction.

Regular information sharing on SWM approaches, activities, and issues between WASH partners and other Sector partners/agencies such as WFP led to a common understanding, improved performance, and the creation of synergies between partners and sectors during regular operations and emergencies.

WASH-SMS: drain cleaning; WASH-FSS: reduction of emergency food distribution packages and compost distribution for gardening; WASH-HEALTH: medical waste management; UNDP-WFP: Upcycling centre; SMEP-UNDP: cleaning campaign; and construction of the sanitary landfill, etc. As a result, SWM has become a clear cross-sector issue, and an Intersectoral SWM Group composed of WASH, FSS, SMS, HEALTH, etc. sectors and partners has been established.

Demonstrating and experiencing well-operated solid waste facilities and functional SWM systems facilitates the understanding and motivation of local authorities and communities to develop proper solid waste management services. This is the case of RRRC's visit to the Sanitary

landfill at Camp 20 Extension, the Union Chairman's visit to the SWM system in Teknaf Municipality, and the Market committee members and community's willingness to pay for waste collection services in all project locations.

Building a new culture on solid waste management in which a minimum level of awareness of the importance of proper waste management predominates and where good practices on waste segregation and no littering are consolidated requires more than the duration of a project. Building financial models to minimize the cost of SWM operations through the collection of service fees necessitates time, supervision, and additional funds for infrastructure, tools, and vehicle maintenance. New seeds are sprouting in the direction of this new waste culture, but the project locations and surrounding Unions will still require ongoing support after the project concludes.

In June, the work was halted for several days due to the heavy rains. The progress of the project was hindered by the large amounts of mixed waste from the fire-ravaged camps. Covered vulnerable areas with tarps and increased the number of laborers. IOM assigned a portion of the team to separate the waste in a plot adjacent to the landfill to address this situation. The Camp in Charge (CiC) was asked for permission to implement this temporary measure for no more than 30 days.

6.4 Identified risks, challenges, and responses

Table 9: Identified risks, challenges, and responses

Identified Risk/Challenges	Type of Challenge	Response	Status
Local Government may not extend their support to the Project	Strategic	UNDP meticulously tailored its government engagement strategy to maximize its relationship with key government agencies and expanded its connections in other areas to establish mutually trusting partnerships.	The RRRC fully supported UNDP SWM camp activities. Local government Unions and Municipalities also appreciate the assistance with their SWM systems.
Security in and around the camps may deteriorate, access to the project sites might be limited	Security	The Project employed a network of local implementation partners and a low-key strategy. Local government counterparts will be present and involved to the greatest extent possible. The procedure for selecting recipients was open, inclusive, and conflict-sensitive. In addition, UNDP adhered to the advice of UN security experts at UNDSS and consults with them regularly to ensure that the project does not attract the ire of dangerous actors and that UN staff and implementing partners are not put in danger.	After the COVD19 lockdown was lifted in August 2021, access to the camps and HC was reestablished.
Elections alter the implementation	Strategic	The UNDP respects the political process in	Early in 2021, the third government of RRRC

Identified Risk/Challenges	Type of Challenge	Response	Status
environment. Possibility of using the Project for political gain by external actors		Bangladesh and intended for the Project's activities to remain explicitly apolitical. The UNDP promoted a message of tolerance and inclusion that was acceptable to all parties.	since the beginning of the project was elected. No significant issues were identified. Local elections for Union and Municipality were held late in 2021, delaying the implementation of certain activities. The duration of the project was extended by two months.
Lack of coordination and/or significant differences within and between Local Government partners		Since the responsibility for waste management is not clearly defined or assigned to a single institution within the local government, the UNDP assumed that a variety of perspectives and approaches would emerge. To overcome roadblocks, UNDP engaged with all relevant stakeholders, facilitated inclusive consultation and cooperation, and ensured that all actors were included in the process.	The UNDP project is being executed in coordination with District, Upazila, Union Parishad/Municipality, and RRRC for camp activities.
Difficulty with land allocation for the landfill	Operational	Construction could be delayed if locating a suitable site for the landfill proves challenging. This mitigation measure consisted of early engagement and agreement	Difficulties in acquiring public land for landfills continue to impede the waste management conditions of camps and host communities.

Identified Risk/Challenges	Type of Challenge	Response	Status
		on multiple potential landfill sites. If possible, the local government was asked to present two to three options. At the Upazila level, the possibility of constructing a landfill was discussed with local government representatives. As soon as the project commences, the process of land selection and environmental and health risk assessment of locations commences, building on this initial engagement.	
Gender restrictions limit women and girls from accessing the project's benefits	Social	In the proposed project, a commitment to gender equality was spelled out, and it was continuously monitored with reference to target indicators. However, due to the nature of the project, the UNDP anticipated that it might not be culturally sensitive to employ women in all activities, especially those involving waste or heavy labor. Therefore, women were to be targeted primarily for segregation and recycling-related economic activities.	In refugee camps, cultural factors hindered the participation of women in SW activities. In camps, no women could be hired as volunteer waste collectors. In contrast, the participation of women as volunteers and workers was greater in host communities.

6.5 Recommendations

The main recommendations in this study to address the issues are summarized below as short-midterm interventions and long-term interventions.

It is important for the beneficiaries to adopt and continue the current good practices and SWM systems introduced and promoted by the project. The following elements must be effectively incorporated into this strategy:

Effectiveness

Throughout the timeline, the project has effectively intervened in developing waste management systems and changing behavior and attitude of different level of stakeholders regarding solid waste in Teknaf and Ukhiya. Two major findings under effectiveness criteria are:

To facilitate waste management at the source, 16982 waste bins have been distributed to households and shops as part of the project intervention. 90% (N=250) of beneficiary households and 61% (N=134) of beneficiary shop owners currently use at least two rubbish bins to store solid waste. During the study, it was discovered that waste bins were not being utilized effectively in many shops, and that in some shops, one or both bins were missing or broken. It was mainly because, either they did not need one of the bins entirely because of the type of waste that shop generates or the learnings were not sustainable.

The Project has successfully initiated private sector engagement and mainstreaming strategy along with a business plan that balances costs and benefits in urban area. The project has fostered the growth of 41 scrap dealers and provided more than twenty trainings on topics such as business development, linkage, sorting various types of waste, preventing littering, value chain, and safe monitoring, among others.

In the intervention areas, the solid waste management responsibilities of each level of local government were informal and undefined when the project was initiated. The project developed and proposed a SWM model in consultation with all relevant local authorities, outlining the roles of various levels of government (Union, Upazila, City Corporation, etc.) and the private sector in developing and maintaining solid waste infrastructure and services.

Impact

Community areas' environmental and health quality had improved as a result of this project's implementation. According to this evaluation, 93.8% (N = 384) of respondents stated that the frequency of diseases (diarrhoea, dysentery, dengue, typhoid, ringworm, scabies, cholera, malaria, cough, asthma, and skin diseases) has decreased in the community over the past four years. 95.0% (N = 384) of respondents believed the UNDP SWM project was responsible for the disease reduction.

Efficiency

1. While the institutional setup and management in Teknaf municipality were found efficient, however, in the Union level, the frequency of WATSAN meetings and the topics of discussion remain troubling. The project attempted to mobilize WATSAN committees and activate them over the last years, but their functioning and participation in union-level SWM decision-making remains very weak due to a variety of factors including a lack of promoters/facilitators, local budget shortages, and political regime changes at the union level. Participation of beneficiaries in activities and changes in knowledge and practice were observed; however, institutional structure and administration remained a weak link in the value chain.

Sustainability

1. Due to the pandemic and the prolonged lockdown, it was discovered that it was difficult to organize activities requiring a large gathering. Representatives from Garbage Man, the Municipality, and various other stakeholders were dissatisfied with the planning of awareness-raising efforts. The initiative failed to organize the public awareness campaign as planned and on time.
2. In Unions, the respondents were found to be unaware of and uninterested in paying for SWM-related services. only 11% of recipients from Teknaf Upazila and only 5.8% of recipients from Ukhiya Upazila could recall the messages regarding "willingness to pay" for waste collection service.
3. Physical observations and interviews revealed that the temporary sanitary landfill developed for the municipality of Teknaf is nearly at capacity.
4. The study found that there have been challenges in constructing a new landfill facility. Despite the project's best efforts to locate adequate land for this purpose, there have been challenges with the land allocation process. There is a lack of adequate land, and the bureaucratic process between different departments in government and local government has proved problematic.
5. One of the essential components of the SWM project was the local recycling sector, which consists primarily of scrap dealers. The SWM project has supported the formation of two cooperative scrap dealer associations in Ukhiya and Teknaf, the first cooperative scrap dealer associations in Bangladesh. Prior to the implementation of the project, eight (8) beneficiary scrap dealers in Ukhiya Upazila employed a total of 44 workers in their shops; this number has since increased to 114, and a total of 70 jobs have been created. In addition, in Teknaf Upazila, the number of workers employed by nine scrap dealers has increased from 61 to 85, and 24 new jobs have been created.

Gender Mainstreaming

1. The project's gender engagement was tailored to the local cultural context; for instance, waste sorting businesses are highly profitable ventures that allow women to stay at home with their children while fulfilling their familial obligations and earning an income. Following the vision outlined in the Rohingya Joint Response Plan, the project has made the challenge of improving conditions for the poorest and most vulnerable women in Cox's Bazar a central priority for all proposed programming in the region.

6.6 Way Forward

- The solid waste management project has been very effective overall. It is suggested that a pilot (feasibility) study should be conducted on the replicability/scalability of this project in other areas/cities in Bangladesh. However, from the learnings of this project, feasibility study and needs assessment must be conducted prior to designing the next phase.
- It is possible to avoid any type of communication gaps if better coordination with stakeholders besides partners is developed. During the design of a project, it is proposed that a better coordination mechanism and monitoring framework be used.
- It was a very effective and successful project intervention that contributed to the development of a strong SWM value chain in the municipality of Teknaf and also generated livelihood opportunities. It is proposed to expand and replicate this initiative in other locations.

References

8th Five Year Plan (2020-2025). (2020).

Ashadudzaman, M., & Bodrud-Doza, M. (2019). Solid Waste Management in Rohingya Camps and Host Communities in Cox's Bazar, (November 2020). https://doi.org/10.13140/RG.2.2.18746.82884

Ashikuzzaman, M., & Howladar, M. H. (2019). Sustainable Solid Waste Management in Bangladesh, 35–55. https://doi.org/https://doi.org/10.4018/978-1-7998-0198-6.ch002

Enayetullah, I. (n.d.). Community Based Solid Waste Management Through Public-Private-Community Partnerships: Experience of Waste Concern in Bangladesh. www.wasteconcern.org

Halder, P. K., Paul, N., Hoque, M. E., Hoque, A. S. M., Parvez, M. S., Rahman, H. M., & Ali, M. (2014).

Hasnat, M. A., & Sinha, M. M. (2010). Hazardous Waste Management in Bangladesh: A Country Inventory.

ISCG. (2021). Cox 's Bazar WASH Sector Hygiene Promotion Strategy Guiding Framework, (April).

Karim, R., & Nawshin, N. (2014). Characteristics of Household Solid Waste and its Management Options in the Urban Areas, Jessore, Bangladesh. International Journal of Science and Research, September. www.ijsr.net

Matter, A., Dietschi, M., & Zurbrügg, C. (2013). Improving the informal recycling sector through segregation of waste in the household – The case of Dhaka Bangladesh. Habitat International, 38,150–156.

Ministry of Environment, Forest and Climate Change (MOEFCC). (2010). National 3R (Reduce, Reuse, Recycle) Strategy for Waste Management 2010. http://old.doe.gov.bd/publication_images/4_national_3r_strategy.pdf

Ms. Pramila Patten. (2017, December 12). *Security Council Briefing on Myanmar*. Https://Www.Un.Org/Sexualviolenceinconflict/Statement/Statement-by-the-Special-Representative-of-the-Secretary-General-on-Sexual-Violence-in-Conflict-Ms-Pramila-Patten-Security-Council-Briefing-on-Myanmar-12-December-2017/.

Municipal solid waste and its management in Rajshahi city, Bangladesh: A source of energy. International Journal of Renewable Energy Research, 4(1), 168–175.

National 3r strategy. (n.d.).

National Environmet Policy 1992. (n.d.).

National Policy for Safe Water Supply & Sanitation 1998. (n.d.).

National Strategy for Water Supply and Sanitation 2014. (n.d.).

NEMAP. (n.d.). National Environmental Action Plan (NEMAP).

RENEWABLE ENERGY POLICY OF BANGLADESH. (2008).

Paes, L. A. B., Bezerra, B. S., Deus, R. M., Jugend, D., & Battistelle, R. A. G. (2019). Organic solid waste management in a circular economy perspective – A systematic review and SWOT analysis. Journal of Cleaner Production, 239. https://doi.org/10.1016/j.jclepro.2019.118086

Part Principles, fundamental state, of the Constitution of the People's Republic of Bangladesh, (1972).

Roy, S., Sowgat, T., Uddin, M., Islam, A. S. M. T., Anjum, N., Mondal, J., & Rahman, M. M. (n.d.). *Bangladesh: National Urban Policies and City Profiles for Dhaka and Khulna*.

The Bangladesh Environment Conservation(Amendment) Act, 2010. (2014).

The Environment Conservation Rules, 1997. (n.d.).

The Environment Pollution Control Ordinance, 1977. (n.d.).

UNDP. (2018a). ENVIRONMENTAL IMPACT OF ROHINGYA INFLUX.

UNDP. (2018b). *UNITED NATIONS DEVELOPMENT PROGRAMME PROJECT DOCUMENT BANGLADESH*. https://reliefweb.int/report/bangladesh/report-environmental-

UNDP. (2021). May 2021 Report Use of the Temporary Solid Waste Facility, (June).

UNHCR. (2021). Rohingya Refugee Response _ Bangladesh Factsheet - Water, Sanitation and Hygiene (WASH)

Waste Concern. (2014). Bangladesh Waste Database 2014. http://wasteconcern.org/wp-

content/uploads/2016/05/Waste-Data-Base_2014_Draft-Final.pdf

World Bank. (2017). Business Models for Integrated Waste Management. 1–21.

https://www.innovationpolicyplatform.org/system/files/4 Integrated Waste Manangement_Apr6.pdf

Yousuf, T., & Rahman, M. (2007). Monitoring quantity and characteristics of municipal solid waste in

Dhaka City. Environ Monit Assess, 135, 3–11.