BRAC, HCMP
Contract: BPD/MEAR/2023/PO-6872

MARKET-BASED DEMAND ANALYSIS OF COMPOST/CO-COMPOST IN UKHIYA AND TEKNAF UPAZILLA, COX'S BAZAR DISTRICT

FINAL REPORT

STUDY TEAM

Environmental Engineers Limited

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PREFACE

The BRAC, HCMP in Bangladesh has commissioned Environmental Engineers Limited (EEL) to conduct the study titled: *Market based demand analysis of compost/co-compost in Ukhiya and Teknaf Upazila, Cox's Bazar district*. Although many composting plants have been built in Bangladesh in the last few decades, very few of them are functioning effectively. On the other hand, looking at it critically, the soil health of the country addresses a large amount of organic content, which is below standard in most cases. Cox's Bazar district is no exception, it contains low to medium organic matter (OM%: 1.71-3.4). In such a situation, production, marketing, and application of organic compost can play an important role as a source of organic matter and improve soil health. In addition, there is an accumulation of nutrient-rich fecal sludge that is jointly composted by BRAC and NGOF under the auspices of UNHCR. Therefore, EEL considers this study immensely important to recognize the need for compost and organic matter in the soil of Cox's Bazar district.

In this study, a context specific methodology was developed to estimate the compost/co-compost demand and feasibility was explored with a business model for Cox's Bazar district. For feasibility, the results of laboratory tests along with information from government and private sources were collected through KII/FGDs. This study was conducted within 45 calendar days, which is very short compared to the scope of work, visits, laboratory tests and current circumstances. Therefore, there is a chance that the synthesis of facts (i.e., qualitative) may differ slightly from the original, although this possibility is very small. Comments and corrections are always welcome to improve the quality and legitimacy of this report. However, EEL has endeavored to obtain authentic field data and produce this report in a manner that accurately reflects the objectives and purpose of the client of the study (BRAC-UNHCR).

EEL would like to thank UNHCRBRAC-HCMP, NGO Forum for Public Health, WASH Sector, ISCG-EEN, FAO, BARC, BARI, DAE (Dhaka HQ and Cox's Bazar), SRDI, Forest Division Cox's Bazar, Cox's Bazar Municipality, Cox's Bazar Municipal Compost Plant Operator etc. as well as some local farmers and traders in Teknaf and Ukhiya.

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*Environmental Engineers Ltd. (2023). *Market-based demand analysis of compost/co-compost in Ukhiya and Teknaf Upazila, Cox's Bazar district* (p. 86) [Research Study]. EEL-BRAC-UNHCR.

EXECUTIVE SUMMARY

Background:

Under the auspices of UNHCR, two prominent national NGOs, BRAC and NGO Forum for Public Health, operate twelve (12) Material Recovery Facilities (MRFs) equipped with compost/co-compost plants and fecal sludge treatment plants in Rohingya camps and host communities in Teknaf and Ukhiya Upazilas of the Cox's Bazar district in Bangladesh. They are producing by-products (compost/co-compost) from solid waste and human feces generated in Cox's Bazar to optimize resource utilization. This study report presents a comprehensive demand analysis of compost/co-compost across the entire Cox's Bazar district. It also includes a comprehensive business plan and a business implementation plan addressing underlying procedures and challenges. The study period covered forty-five (45) calendar days between November and December 2023.

The study scope and purpose covered:

This assessment analyzed the market demand for compost/co-compost and provided a business plan with valuable information to help businesses make informed decisions about utilizing, marketing, and improving compost/co-compost. The study identified the targeted market, conducted a competitive analysis, analyzed market trends, estimated demand, and assessed the value proposition and potential risks associated with compost.

Approach & Methodology:

The study employed a mixed-methods approach, combining both quantitative and qualitative data collection. Desk reviews of existing literature were conducted along with key informant interviews, focus group discussions, and field surveys. Additionally, the study team visited the case study location and analyzed existing compost test results. Four (4) compost samples, one (1) co-compost sample, and one (1) dry sludge (field condition) were collected and tested at the labs of SRDI and Dhaka University to assess their quality.

The study evaluated co-compost/compost production in Cox's Bazar district, focusing on Ukhiya and Teknaf Upazilas. It examined demand for the entire district including Rohingya camps. Detailed case studies were conducted on thirteen (13) MRFs equipped with co-compost/compost operated by BRAC-HCMP and NGOF in ten (10) UNHCR project camps.

Stakeholder Analysis:

Three key stakeholders across government, private, and development sectors are identified around co-compost/compost business. They are playing crucial roles in different aspects: testing, certification, demand creation, humanitarian response, business development, competition/collaboration with different user groups. This report provides their contact details with their respective responsibilities.

Market Demand:

The study identified three (3) major compost/co-compost market segments: *agriculture, forestry, and Rohingya camps*. The combined annual demand across these sectors is estimated at 20,526 tons, primarily driven by compost needs. Co-compost demand, specifically for afforestation and reforestation, is estimated at 1,126 tons, highlighting its limited use in the agricultural sector compared to compost.

Type of Compost	Cox's Bazar host communities			Cox's Bazar Camps	
	Agriculture Sector		Forest	Plantation (Afforestation / Reforestation)	Homestead gardening
	Food	Non-food			
Co-compost	-	-	1,000	126	-
Compost	19,293	-	1,000	126	107

Cost Estimation, Revenue and Profitability Analysis

The profitability analyses have been undertaken in following four (4) different ways:

- *Business as Usual:* Current production is 59 tons/month at an operating cost of approximately 75 Tk/kg. Scaling up to 80 tons/month can be achieved at a reduced cost of about 55 Tk/kg, with a compost selling price of 5 Tk/kg.
- *Profitability Analysis with Minor Marketing Cost:* Factoring in subsidies, collection fees, or incentives against each kg of compost production yields a profitability of 77.25 Tk/kg, considering a selling price of 5 Tk/kg.
- *Monthly Cash Flow Analysis:* Incorporating additional marketing and management costs, the operating cost rises to 78.055 Tk/kg at a 5 Tk/kg selling price, with a production volume of 59 tons/month.
- *Yearly Cash Flow Analysis:* Like the monthly analysis, the yearly cash flow considers additional marketing and management costs, resulting in an operating cost of 78.055 Tk/kg at a 5 Tk/kg selling price, with a production volume of 59 tons/month.

The business decision analysis for NPV and IRR based on yearly cash flow reveals that the *business is financially viable under existing conditions with full support covering collection and composting operations.* However, a gradual reduction in support should not exceed 4%. At a 4% support reduction, NPV turns negative. While a 2% reduction results in a positive NPV, the IRR indicates a loss.

Implementation Plan

Compost/co-compost business strategic plan is needed to establish in line with organizational capacities in terms of man-power and resources to be invested in. however, the generic ten (10) items are lists here and details are articulated in the report. (1) Effective Waste Segregation; (2) Separate Waste Collection; (3) Continuous and Efficient Compost Production; (4) Upgrading Compost Plant Infrastructure; (5) Optimized Labor Productivity; (6) Data-Driven Decisions; (7) Registration and Certification; (8) Building Strategic Partnerships: (9) Consumer-Friendly Packaging; (10) Comprehensive Marketing Strategy

Feasibility Recommendations:

Plant Renovation and Functionality: To ensure smooth and efficient operation, compost plants require renovations to increase capacity and user-friendliness. This includes improving operational and monitoring tools, implementing a comprehensive separate waste collection system, exploring semi-mechanization for high-capacity plants like Camp 4, and promoting the use of traditional open windrow composting with triangular windrows for optimal size and layering. These recommendations will contribute to maximizing feedstock availability, minimizing contamination, and ultimately, enhancing the plant's functionality and overall compost production efficiency.

Marketing: Minimizing costs and maximizing income through diverse revenue streams like sales, fees, and incentives is key. Building partnerships to inject compost into government procurement programs and launching public campaigns to promote its use are vital. Additionally, collaboration among MRFs and partnerships with traders will strengthen market reach. Implementing these recommendations will ensure the business's long-term success and environmental benefits.

Nutrient enhancement - Phosphorous(P) & Potassium(K) improvement: To enhance compost quality and nutrient balance, incorporate black soldier fly larvae, add diverse organic materials and aged livestock manure, utilize wood ash responsibly, crush hard materials, maintain a balanced C:N ratio, and monitor nutrient content for adjustments. Additionally, rinse off salt from seaweed and consider residues from specific vegetables for enhanced nutrient diversity.

Co-compost Application: n Bangladesh, mixing fecal sludge with compost to produce co-compost lacks legal regulation, despite international concerns about heavy metal and pathogen accumulation. While co-compost may initially comply with permeability limits of metals, repeated use can lead to exceeding safe levels, posing health and environmental risks. Agricultural scientists recommend limiting its use to non-food-grade plantations like forestry, strictly avoiding food-grade applications. Additionally, dry sludge is advised to be composted separately before mixing with other.

Summary of findings

Despite significant demand (annual 20,526 ton) for compost/co-compost in Cox's Bazar district, its viability remains limited without substantial subsidies or collection fees. While farmers acknowledge the benefits of compost for soil health, including moisture retention, nutrient release, and organic matter retention, market penetration, traditional compost (manure), and profitability remain significant barriers.

Multiple actors participate in compost sales, including traders/marketing companies, dealers, and the BFA. However, the initial delivery to traders requires upfront payment, posing challenges for the private sector and fueling demands for subsidies or collection fees. Transportation costs further hinder financial viability, highlighting the critical importance of local compost production and utilization.

Current plant operations face high operating costs (around 74 – 77 Tk/kg), low production rates, and low efficiency (currently 15%, with potential to reach 20%), rendering them uncompetitive in the market and not viable for doing business (i.e., NPV shows negative value). Currently, the market price at dealer points for compost ranges from 9.75 to 13.75 Tk/kg. To establish a viable business model, it is recommended to appoint an operator to manage all Material Recovery Facilities (MRFs) and centralize compost marketing management. This approach would require financial support (if collection fees are not imposed), potentially through partnerships with marketing companies, traders, or government certification programs.

Limitation of the study:

This study is 45 calendar days where inception, team orientation, mobilization and sample collection have been taking place in the first 15 days. But laboratories have taken a long time to generate the test report, due to this fact we relied on the past test reports.

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List of Acronyms and abbreviations (as used)

BARC	Bangladesh Agricultural Research Council
BAU	Bangladesh Agriculture University
BFA	Bangladesh Fertilizer Association
BRAC	Bangladesh Rural Advancement Committee
DAE	Department of Agricultural Extension
DoE	Department of Environment
EEL	Environmental Engineers Limited
EEN	The Energy and Environment Network
FAO	Food and Agriculture Organization
FDMN	Forcibly Displaced Myanmar Nationals
FGD	Focus Group Discussion
FRG	Fertilizer Recommendation Guide
FSM	Fecal Sludge Management
FSTP	Fecal Sludge Treatment Plant
GOB	Government of Bangladesh
HCMP	Humanitarian Crisis Management Programme
IDI	In-depth Interview
IOM	International Organization for Migration
IP	Implementing Partners
IPNS	The Integrated Plant Nutrient System
ISCG	Inter Sector Coordination Group
KII	Key Informant Interview
KTP RC	Kutupalong Refugee Camp
LGED	Local Government Engineering Department
MRF	Material Recovery Facility
NGOF	NGO Forum for Public Health
NRC	Nayapara Refugee Camp
PCB	Printed Circuit Board (E-waste)
PWD	Public Works Department
SRDI	Soil Resource Development Institute
SWM	Solid Waste Management
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TOR	Terms of Reference
UAO	Upazila Agriculture Officers
UNHCR	United Nations High Commissioner for Refugees
WASH	Water, Sanitation and Hygiene

List of Units and Parameters (as used)

m	month
Tk	Bangladesh taka
kg	kilogram
′	feet
ton	1000 kg
yr.	year
HH	household
IRR	internal rate of return
NPV	net present value

1. INTRODUCTION

1.1 Background

At present, the Bangladesh government is hosting a population exceeding 982,772[1] displaced individuals from Myanmar. BRAC and the NGO Forum for Public Health have been diligently providing Water, Sanitation, and Hygiene (WASH) services, with funding support from the United Nations High Commissioner for Refugees (UNHCR). Both organizations are producing by-products generated from solid waste and human feces in Cox's Bazar to optimize resource utilization and increase revenue that appeals a market demand analysis.

BRAC and NGO Forum, as UNHCR partners, efficiently manage solid waste in Rohingya camps, producing over 40-45 tons of organic compost monthly for free distribution in agricultural areas, even in distant locations like Bhasan Char. However, no market assessments have evaluated the compost's value or the potential of co-composting with dried sludge. Such assessments can inform production strategies, optimize waste management, and promote sustainability. Meanwhile, valuable solid sludge generated by fecal sludge treatment plants remains unused, representing an untapped resource. Evaluating its market potential could enhance resource utilization and environmental benefits. Connecting to this, BRAC - HCMC has circulated TOR inviting tenderer for Market-Based Demand Analysis of Compost/Co-compost in Ukhiya and Teknaf Upazilla, Cox's Bazar District. EEL has been awarded the contract; this document is served as inception report and first deliverable.

1.2 Purpose of The Assignment

This assessment has studied the market demand for by-products from solid waste (compost) and provide information for businesses to make smart decisions about using, marketing, and improving these by-products. Following specific purposes are designated for this study[2]:

- to analyze the market demand of solid waste by-product (compost) informs business decisions on utilization, marketing, and optimization,
- to understand market demand, identifies opportunities and boosts profitability,
- to aligns this practice with sustainability, reducing the need for virgin materials,
- a strategic market positioning with a solution for achieving compliance,
- to contributes to humanitarian sustainability through cost-effective byproduct placement,
- to enhance communication among stakeholders for proper by-product utilization.

1.3 Scope of Work

The scope of work includes data collection and research, identifying the targeted market, competitive analysis, market trends, demand estimation, value proposition, pricing strategy, distribution channel, financial projection, risk assessment, etc. To complete the assignment's scope of work, following specific series of tasks and activities were undertaken[2]:

- Conduct a quality test for compost/co-compost and compare the results to government standards, making recommendations for improvement as needed.

[1]UNHCR. (n.d.). *Bangladesh*. Global Focus. Retrieved November 11, 2023, from https://reporting.unhcr.org/operational/operations/bangladesh

[2] Terms of Reference, Request for Proposal, Hiring Consultant/Consulting Firm for Market-Based Demand Analysis of Compost/Co-compost in Ukhiya and Teknaf Upazilla, Cox's Bazar District.

- Quantifying compost needed for agricultural production in Cox's Bazar District.
- Determine the acceptability of bioproducts by conducting a SWOT analysis on the compost & co-compost production in camps.
- Determine a comprehensive cost estimate for non-plastic packaging materials, along with pricing and packaging category details for the by-product.
- Certification way forward from relevant government authorities
- Analysis of stakeholders: who are involved, what and where they are doing it.
- Analysis of market potential for engaging the private sector in dealing with by-products or compost or co-compost.
- Comparative analysis between factory-made fertilizer and by-product
- Make recommendations on the feasibility of usage in agriculture with comments.
- Development of a business plan.

1.4 Output of the Assessment

- A comprehensive report detailing the findings of the market demand analysis.
- Clearly defined target markets for the by-products, including detailed profiles of the industries and consumers.
- Quantitative estimates of the potential demand for the by-products within each identified target market.
- A clear articulation of the value proposition for the by-products in target markets.
- Suggestions for pricing the by-products based on production costs, and market demand.
- A strategic plan for distributing the by-products.
- A detailed business plan that includes a marketing strategy, branding, messaging, advertising, improvement of the by-product (any additional investment), and promotional activities to create awareness and demand generation for the by-products.
- A step-by-step plan to implement the strategies derived from the analysis.

2. APPROACH AND METHODOLOGY

2.1 Study Location

The assessment primarily included Ukhiya and Teknaf Upazila under Cox's Bazar district in terms of Co-compost/Compost production, but for the demand full Cox's Bazar district is considered. Special emphasis is given in the Rohingya camps where most of the Co-compost/compost/FSM treatment plants are located. Detail analyses with case studies are being undertaken for the Co-compost, Compost plants and Fecal Sludge Plant operated by BRAC, NGOF under UNHCR project. Table 1 provides a list of MRFs for the case studies.

Table 1: List of MRFs for the case study

Type of plant	Camp Location	Operation NGO
Compost	01-E	BRAC
Compost	01-W	BRAC
Compost	02-E	BRAC
Compost	3	BRAC
Compost	4-Ex	BRAC
Compost	21	BRAC

Type of plant	Camp Location	Operation NGO
Compost	26	NGOF
Compost	26	NGOF
Compost	NRC	NGOF
Compost	NRC	NGOF
Compost	KTP RC	NGOF
Compost	5	NGOF
Compost+ Co-compost	4	NGOF
Fecal Sludge	Kutupalong Bazar	BRAC

2.2 Approach and Methodology of the Study

Aiming to ensure the quality and effectiveness of the Study, the Study Team (EEL) adopted a ***holistic and integrated approach***. It means, Team considered multiple interconnected factors and perspectives in around the analysis of compost market demand. EEL- Study Team aims to understand the interactions among various factors such as user groups and all other stakeholders' users' friendliness of selling, buying, transporting and usage of compost, underlying operational challenges, recommendations etc. in line with the TOR.

To maximize the contribution and output of the Study, the EEL - Team was always open; and appreciate and facilitate ***participatory and consultative approach*** among agencies (e.g., BRAC, UNHCR, NGOF etc.) counterpart from the beginning (i.e., team building) to the end of the Study. We mean it as an approach that emphasizes collaboration, inclusivity, and the incorporation of diverse perspectives and knowledge among EEL team and assignment related stakeholders to have common understanding with consensus building.

Throughout the study, we, the study team, used a multi***-disciplinary and mixed-method approach*** that involves both primary and secondary data (viz. qualitative and quantitative) collection tools. The study team collected data through desk reviews, which involved a thorough examination of existing documents and literature relevant to the subject matter. Key Informant Interviews (KII) / In-depth Interviews (IDI) with various stakeholders, including government agencies, donor agencies, and WASH actors will be carried out in the filed survey phase. The study team identified the list of stakeholders for the study. Additionally, Focus Group Discussions (FGD) for compost user groups mainly with the farmers will also be carried out. To gain a deeper understanding of the existing systems related to by-products, the study team visited the case study location. The study team collected four compost samples, one co-compost and one dry fecal to check the quality of the current compost production. The study team also estimated the production of by-products at different locations and assessed their quality and quantity. Compost samples are tested in the SRDI central lab and co-compost, and dry fecal samples are tested in lab of soil, waste and environment department of Dhaka University.

However, due to the substantial time required for compost testing[3], the SRDI central lab was unable to provide the lab test report for four compost samples collected by the study team. The receipt of the compost test has been attached as Annex 6. The study team received the test results for co-compost and FSTP sample and are attached as Annexes 4 and 5, respectively. Therefore, to ensure progress in the study, the study team utilized previous test results provided by BRAC and NGOF. The test results of the compost samples will be shared with BRAC-HCMP upon receipt from the laboratory.

[3] Also, political unrest has impact too.

2.3 Conceptual Framework of the Study

Based on the TOR the study team divided the assessment study into three (3) phases along with corresponding tasks as illustrated in Figure 1 as conceptual framework. They are Inception phase (phase-1), Field survey phase (phase-2), and Analysis and reporting phase (phase-3). Considering the forty-five (45) calendar days timeframe the assignment covered field level survey, field testing, document review, and final reports submission.

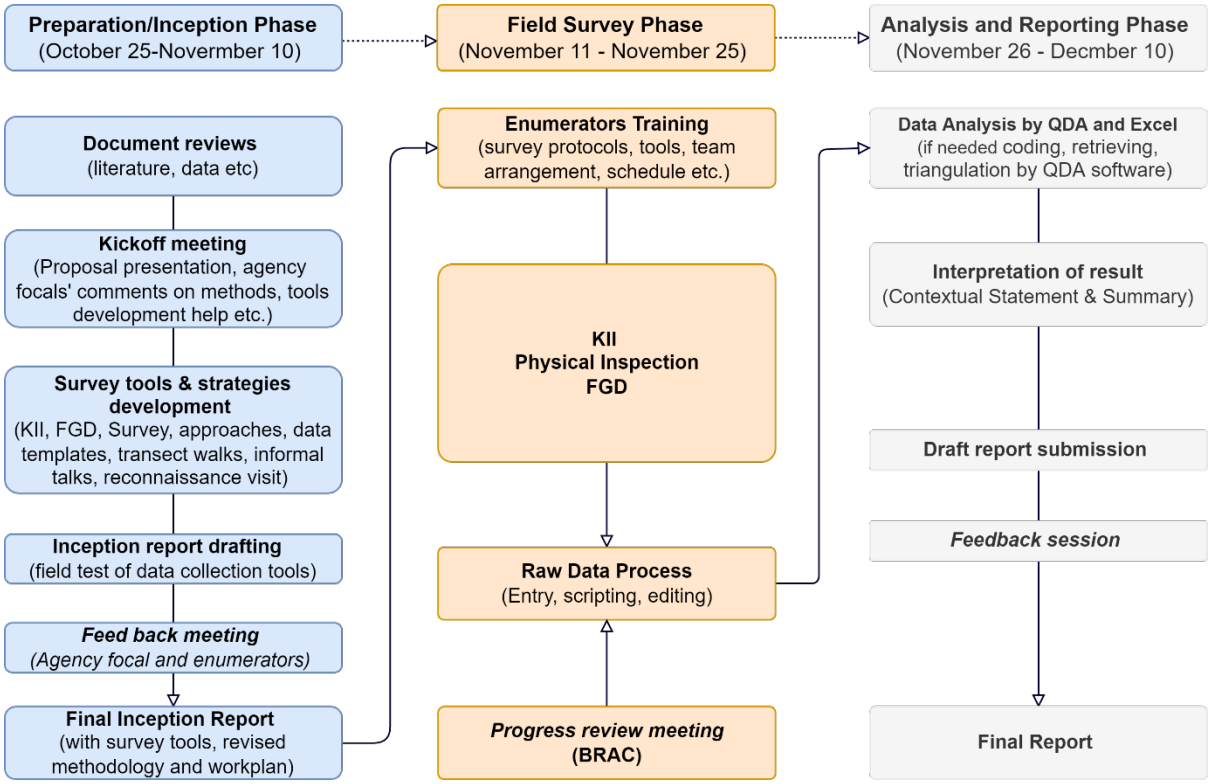

Figure 1: Conceptual Framework of the Study

3. DOCUMENT REVIEW

To gain a comprehensive understanding of the study, the team reviewed various documents to incorporate key insights. These documents include government-published guidelines on compost and FSM, as well as reports from compost studies conducted in Bangladesh. The table below provides an overview of the documents already reviewed by the team.

Table 2: Summery of Document Review

Year	Document Name	Articulation linked to compost demand
2018	Fertilizer Recommendation Guide[4]	The 2018 fertilizer recommendation guide, issued by the BARC in Bangladesh, is essentially an updated iteration of the 2012 FRG. It has been created with the primary purpose of aiding extension personnel in advising farmers on the appropriate **fertilizer dosages to be used**. Unlike a universal prescription, the

[4] BARC. (2018). *Bangladesh Fertilizer Recommendation Guide, 2018*. Bangladesh Agricultural Research Association. Ministry of Agriculture, Government of Bangladesh. https://moa.portal.gov.bd/sites/default/files/files/moa.portal.gov.bd/page/9d1b92d4_1793_43af_9425_0ed49f27b8d0/FRG-2018%20%28English%29.pdf.

Year	Document Name	Articulation linked to compost demand
		FRG centers on the fundamentals of fertilizer application. Additionally, it outlines distinct soil conditions, including soil types, **organic matter content**, and various soil components, with comprehensive mapping.
2020	Composting Constraints and Prospects in Bangladesh: A Review[5]	The study shows a major difference in waste generation between metropolitan areas and small municipalities. It highlights the **underutilization of organic waste for composting, with only 2% of organic waste being recycled.** The research discusses the importance of achieving an appropriate **carbon-to-nitrogen (C: N) ratio for effective composting**. The paper also touches on the **limited availability of compost in Bangladesh due to a lack of authorized commercial composting facilities and the environmental and agronomic benefits of compost**
2015	A simplified guide on compost making[6]	An infographic on composting published by the United Nations Development Programme (UNDP) offers recommendations for processing organic waste. According to the infographic's guidance, **organic waste should be finely shredded or chopped and then arranged in a container,** interspersed with 2 cm-thick layers of soil. The organic waste layers should be approximately 5 to 6 cm in thickness. Additionally, the container should feature perforations at the base and sides to ensure adequate aeration.
2019	Fecal Sludge Management Landscape in South Asia[7]	This study focuses on fecal sludge management (FSM) interventions in cities of Bangladesh, India, and Nepal, both with and without sewerage systems. It aims to identify best practices and lessons learned to **integrate FSM into urban sanitation services.** Notable examples include the Sakhipur fecal sludge treatment plant in Bangladesh. The report describes different aspects of the compost plant such as project initiation, institutional setup, interventions, **financial models, successes, challenges, and a comparative analysis** across the region The municipality, contributing resources like the approach road, land, and desludging vehicle, manages collected tariffs and compost sales. Plant operation and maintenance are a joint effort between the Municipality and WaterAid. Solid waste sorting, constituting around 30% of total O&M costs, was the most expensive activity. In the initial year, O&M costs were USD 20,621 against an income of USD 13,051. **Revenue estimates** were around USD 7,000 from waste collection tariffs and roughly USD 6,000 from compost sales. Since January 2019, a private entrepreneur has handled door-to-door solid waste collection, potentially reducing sorting costs. The **financial sustainability** of this new model is yet uncertain.
2015	Bangladesh Standards and Guidelines for Sludge Management[8]	The guideline offers comprehensive details to every facet of **fecal sludge management**. It is intended for individuals responsible for the operation of water or **wastewater treatment facilities** and **central effluent treatment plants that generate sludge, regardless of the wastewater's source.** These guidelines show diverse approaches for **sludge treatment** and disposal divided in three chapters, which are: General requirements for classification and management (**managing sludge** and the **regulations** that govern its disposal. It specifies the requirements for a sludge management plan that needs to be

[5] Sultana, M. M., Kibria, M. G., Jahiruddin, M., & Abedin, Md. A. (2020). Composting Constraints and Prospects in Bangladesh: A Review. *Journal of Geoscience and Environment Protection*, *08*(09), 126–139. https://doi.org/10.4236/gep.2020.89008
[6] Fangasto Farmer Federation. (2015). *A simplified guide for compost making*. Fangasto Farmer Federation, UNDP, GEF.
[7] WaterAid. (2019). *Faecal Sludge Management Landscape in South Asia: Case Studies*. WaterAid. https://washmatters.wateraid.org/sites/g/files/jkxoof256/files/faecal-sludge-management-landscape-in-south-asia-case-studies.pdf
[8] DoE. (2015). *Bangladesh Standards and Guidelines for Sludge Management*. Department of Environment, Ministry of Environment, Forest and Climate Change.

Year	Document Name	Articulation linked to compost demand
		submitted to the Department of Environment, including details about the producer, the **amount of sludge produced, its origin, and the planned safe disposal or utilization** methods.), (ii) Classification of sludge (**Category A, B and C**) and (iii) **Sludge management option** (management options including design parameters for: Anaerobic and Aerobic digestion, Thermal (co-)incineration, land application, recycling etc.)
2002	Decentralized Composting in Production Of Compost and Its Marketing[9]	This study aimed to develop an **affordable composting method** for municipal solid waste in Dhaka's unique conditions, foster public-private-community collaborations in **waste management** and create job opportunities for the urban poor. Using the **labor-intensive "Indonesian Windrow Technique**," they transform organic waste into compost. The study from 2001 provides insights into technical (methodologies employed for waste management and **compost production**, detailing the technology used, the composting process, and the equipment involved.), operational (day-to-day management, logistics, and infrastructure necessary for **decentralized composting**, potentially covering the systems in place to handle waste, the staffing, and the overall operational framework), financial aspects (significant area of exploration, focusing on the cost analysis involved in **decentralized composting**, including expenses related to waste collection, technology and equipment procurement, operational costs, and the **financial viability**), and marketing strategies (how the produced compost is **marketed** and distributed, discussing **promotional activities, target markets, pricing strategies, and channels utilized** for selling the compost to end consumers or other relevant entities.) Mirpur's decentralized collection and composting scheme succeeded due to **official product approval, policy support, and bulk buyers, offering an effective waste management** alternative and producing valuable **fertilizer** material.
2020	Potential and challenges of organic agriculture in Bangladesh: a review[10]	The study shows **organic farming** provides an ecologically efficient and economically attractive opportunity for agriculture. Local NGOs have played a significant role in promoting organic agriculture in Bangladesh, where strong domestic and export demand exists, especially for products marketed by UBINIG and PROSHIKA. Most Bangladeshi farmers are small-scale, making organic practices more accessible, and government support for organic farming could enhance food and nutritional security. The main challenges are the need for increased awareness, knowledge, and access to organic inputs, credit, land ownership, and market access.
	IPNS	The Integrated Plant Nutrient System (IPNS) is a comprehensive approach that seamlessly integrates various components of soil health, nutrient management, and suitable crop selection. It harmonizes the use of organic and inorganic nutrient sources to ensure balanced and sustainable agricultural practices. IPNS effectively combines soil testing, crop-specific nutrient requirements, and environmentally conscious practices to optimize agricultural productivity while minimizing adverse impacts on the ecosystem.

[9] Zurbrügg, C., Drescher, S., Rytz, I., Sinha, M., & Enayetullah, I. (2002). Decentralized composting in Dhaka, Bangladesh. Production of compost and its marketing. *ISWA Annual Congress, Istanbul July 8-12, 2002.* ISWA 2002 Annual Congress, Istanbul, Turkey.

[10] Ferdous, Z., Zulfiqar, F., Datta, A., Hasan, A. K., & Sarker, A. (2021). Potential and challenges of organic agriculture Bangladesh: A review. *Journal of Crop Improvement*, *35*(3), 403–426. https://doi.org/10.1080/15427528.2020.1824951

Year	Document Name	Articulation linked to compost demand
	BRAC Provided Documents	BRAC has provided some 1 pager documents which show their compost plant information. The information contains the location, the waste collection procedure, segregation method, total compost production, staffs etc.
2022	Improve Environmental Sanitation-FSM Byproducts Reuse Project	The report outlines the results of an extensive agricultural experiment, investigating the impact of various treatments on crop yields, soil nutrients, heavy metal content, and **pathogenic factors**. It focuses on the use of different **compost** types, including PDB and Buried **compost**, in conjunction with **chemical fertilizers** on IPNS basis. The study highlights the favorable outcomes of these **composts** in enhancing crop productivity, improving soil fertility, and ensuring the safety of crops by analyzing heavy metal content and the absence of harmful pathogens. Overall, the report suggests the **potential of these compost** types for sustainable and nutrient-rich vegetable production while considering soil health in Bangladesh.
2015	Fertilizer registration Office Order[11]	The Department of Agricultural Extension in Bangladesh has set the regulation for setting up business of **compost production and sale**. It outlines the necessary steps, including form submission, documentation, fees, verification, and the issuance of a license upon successful completion. There's also a list of required documents, such as the application form, product details, fee receipts, citizenship card, field trial reports, and technical literature.
2021	SWM Rules	The Solid Waste Management (SWM) Rules 2021 in Bangladesh revolve around comprehensive **waste management practices.** The rules also provide the regulation for compost production and sets its parameter such as its standard for the plant, its physical properties e.g., color, physical condition, odor etc., and its chemical properties e.g., pH, organic carbon, nitrogen, potassium etc. It also set the rules of using compost based on its quality.
2023	BRAC provided test result	Before the initiation of this study, BRAC tested their production from the government lab to check and maintain the quality. The study team has collected those test results examined on 10th August 2023, 22nd November 2022, 12th October 2023, 25th August 2022, and 21st June 2022. The test result shows different parameters result and government standard.
2023	NGOF provided test result	NGOF has also provided the test result of their compost done on 27th July 2023 showing achieved results and requirements of the government standards.
2017	Market acceptance study on co-compost as organic fertilizer in Kushtia	This report addresses the waste management challenges in growing medium-sized cities in Bangladesh, focusing on Kushtia Pourashava. With increasing urbanization, the volume of waste, including faecal sludge, is rising. The report explores the potential of converting organic waste, including faecal sludge, into high-value organic fertilizer through co-composting technology. Despite a pilot co-composting plant in Kushtia since 2008, the market acceptance of co-compost faces challenges. The study analyzes market acceptability, recommends initiatives to improve marketability, and proposes an optimum price for co-compost. Recommendations include government initiatives, capacity building, awareness building, research, field demonstrations, and collaboration with stakeholders to promote the use of co-composts for sustainable waste management and agricultural productivity. Approximately **97.44 percent of respondents provided negative responses, indicating they had never used co-compost**.

[11] Office Order of registration or renewal for production, import, storage, distribution, marketing or sale of fertilizers, DAE 12.10.0000.006.40.148/13/10496(83) 2 (2015).

Year	Document Name	Articulation linked to compost demand
		The primary reasons include 75% of respondents lacking awareness of its availability in the market, 18% not receiving any encouragement or advertisement, and 13.63% having a knowledge gap regarding its use. **Barriers in accepting co-compost:** Of the total 44 respondents, 31 respondents (70.05 percent) said they have no economic barriers in accepting co-compost. About 13 respondents (29.72 percent) indicated some sorts of economic barriers in accepting co-compost. About 50 percent of the respondents reported that the high price of co-compost is one of the main economic barriers. The current market price of Aprokashi co-compost was used as a reference price. The second major barrier is inconsistency in price and quantity/quality which was reported by about 35 percent farmers. Transportation cost was identified as a barrier by about 8 percent of the respondents. The unreasonable asking price of dealers, and consistency in the prices of co-compost and other fertilizers were the other economic barriers. Further discussions with farmers revealed that price of co-**compost must be low and should not be more than Tk 12 per kg.** Of the 44 respondents 32 respondents (about 73 percent) reported that they have no social barriers in accepting co-compost. Only 12 respondents (about 27 percent) reported some social barriers in accepting co-compost. Of the farmers who reported there are cultural/ religious barriers, 19 farmers (about 72 percent) reported that their religion did not allow the use of fecal sludge in the crop fields growing food for human consumption. This was mentioned mostly by the older and aged farmers. About 28 percent of them said that there was a sentiment against the use of fecal-based compost. But urban and younger farmers, for example gardeners, had almost no religious barriers in using co-composts. The main health hazard identified by the farmers was "use of co-compost may cause various diseases" i.e., gastric. Some of the farmers also reported that psychological problems may occur, and bad smell may cause headaches. However, some of the farmers who were skeptical of co-compost pointed out that fecal matter can spread diseases such as gastric. **These farmers assumed that consumers would avoid food crops in which co-compost was used. Most of the farmers who were positive about co-compost stressed their particular interest in "organic" fertilizer and indicated that if faecal sludge is well composted, it would be both less health hazardous and less expensive compared to inorganic fertilizers.**
2008	A Guide for Compost Producers in Low and Middle-Income Countries[12]	The 4P information often refers to the marketing mix principles - Product, Price, Place, and Promotion. These are critical aspects for producers to consider when marketing their compost. They encompass how the product is designed, its pricing, the place or distribution strategy, and the promotional activities to be employed to market the compost effectively. Producers need to focus on creating compost that meets the needs and preferences of their target market. Price requires understanding the market demand, competitive pricing, and ensuring that the price set is both competitive and profitable. Place involves understanding distribution channels, logistics, and where and how customers

[12] Rouse, J., Rothenberger, S., & Zurbrügg, C. (2008). Marketing Compost - *A Guide for Compost Producers in Low and Middle-Income Countries*. Eawag.

Year	Document Name	Articulation linked to compost demand
		access the product. Promotions include advertising, public relations, social media, and other promotional activities.
2022	Homestead Gardening Guidelines	The document outlines guidelines for homestead gardening in Rohingya Camps and Host Communities by the FAO, WFP, and FSS. Reforestation and gardening initiatives since 2018 have reduced landslide risks, provided disaster risk reduction, and supported household vegetable production. This addresses nutritional needs, reduces reliance on food assistance, and contributes to local vegetable production. It also aligns with Bangladesh's SDG 2. The initiative aims to increase resilience, dietary diversity, and agricultural skills, supporting health and well-being in the camps. The document also emphasizes environmental considerations, providing guidance on plantation sites and addressing seasonal risks and natural hazards. The Guidelines also provide estimated values for various crop yield methods, including land requirements, cost analysis, pest controls method and more.
2022	Energy and Environment Network (EEN) of the Inter-Sector Coordination Group (ISCG)	EEN and ISCG have provided the study team with five years of data on saplings for reforestation/afforestation in the Rohingya camps. The provided information includes data on the number of saplings planted in each camp and the corresponding area covered in hectares for this sapling planting initiative.
2023	Packaging Information	The study team is reviewing literature on packaging also to aim to provide suggestions for the outlook, and materials of packaging that meet market demands and facilitate an efficient distribution system.

One key information has been collected from the Fertilizer Recommendation Guide (2018) showing in the following table which are different soil variables for the land of Teknaf and Ukhiya. This data was required to understand the soil condition which will help in making decisions to develop business plans and in particular demand estimation of compost.

Table 3: Soil variables for Teknaf and Ukhiya from FRG-2018[5]

Data	Value
Agro Ecological Zones	Northern and Eastern Hill
Land type	High land
Soil reaction	Strongly Acid (pH: 4.5-5.5)
Soil organic matter	Low-Medium (OM%: 1.71-3.4)
Phosphorus	Low (microgram/gm: 6.1-12)
Potassium	Low (meq/100 gm: 0.076-0.15)
Sulfur	Low-Medium (microgram/gm: 9.1-27)
Zinc	Low (microgram/gm: 0.451-0.9)
Boron	Optimum-Very High (microgram/gm: 0.451-0.75)

4. STAKEHOLDER ANALYSIS

It is important to recognize the diverse range of stakeholders associated with this study, both in direct and indirect capacities. These stakeholders encompass various organizations, including government bodies and private sectors. Additionally, local farmers are likely to hold a key position as primary stakeholders within the scope of this study.

The study team has identified and compiled a comprehensive list of these pertinent stakeholders. List of stakeholders and their responsibilities are listed in the tables below.

Table 4: List of Stakeholders

Government	**Private**	**Development Partners**
Testing: • SDRI • ICDDR, B • BARI • BINA • DU (Dept. of Soil, Env. & water) Permission /Registration: • BARC • DOE • DAE Demand Creation • DAE • Local Government • Forrest Office • LGED • PWD	Humanitarian Response: BRAC, ACF, WVB, BDRCS, CARE, DSK, ANANDO, TdH, NABOLOK, NGOF, SHED, Competitor/Collaborator: ACI, Northern Agro services, Mati etc. Business Societies: • Nursery Owners • BFA User groups: • Farmer: • Household: FDMN, Host community households	• WASH sector • ISCG • EEN • FAO • UNHCR • UNICEF • IOM

Table 5: Roles of Stakeholders

Types and Purposes of stakeholders	**Stakeholder Name***	**Roles of Stakeholder**
Government: Compost/Co-compost Testing	SRDI	These government institutions serve as accredited laboratories **responsible for testing compost** samples, ensuring the quality and compliance of the produced compost with government standards. Guided by the recommendations of the Fertilizer (Management) Act of 2006[13], these institutions rigorously test fertilizer (compost/co-compost) to determine its physical quality and chemical characteristics, ensuring that it meets the established government standards. SRDI, BARI, the Department of Soil, Water & Environment, BINA, and BRRI play a pivotal role in safeguarding the quality of fertilizer (compost/co-compost). Their combined efforts promote the production and utilization of high-quality compost that adheres to government regulations, fostering soil fertility, crop productivity, and environmental sustainability. In the fertilizer (compost/co-compost) registration process, producers are required to enter into **a bilateral agreement with these five government-certified institutes** to ensure that their compost products undergo rigorous testing and meet the established quality standards. This mandatory collaboration between producers and these accredited laboratories reinforces the commitment to producing and utilizing high-quality fertilizer (compost/co-compost) in Bangladesh.
	BARI	
	Department of Soil, Water & Environment of Dhaka University	
	BINA	
	BRRI	
	BARC	

[13] The Fertilizer (Management) Act, 2006, Pub. L. No. S.R.O. No. 244-Law/2022, Act No. VI of 2006 16 (2022). http://bdlaws.minlaw.gov.bd/act-934.html

Types and Purposes of stakeholders	**Stakeholder Name***	**Roles of Stakeholder**
Government: Certification / Registration	DAE	**BRAC and DAE play a complementary role in the fertilizer (compost/co-compost) certification process**. These two institutions evaluate the fertilizer (compost/co-compost) producer's compliance with government regulations and production processes.
	DoE	In addition to the rigorous compost testing conducted by accredited laboratories, **producers seeking fertilizer (compost/co-compost) certification must also obtain environmental and industrial clearance** from the relevant government authorities. DoE is responsible for issuing environmental clearance, ensuring that compost production facilities adhere to environmental regulations and minimize their impact on the surrounding ecosystem. Additionally, producers must obtain industrial clearance from either the BSCIC or the DIFE. This clearance verifies that the compost production facility complies with industrial safety standards and operates in a manner that protects the health and well-being of workers.
	BSCIC	
	DIFE	
Government: Demand Creation	DAE	Helping and educating farmers about the benefits of compost through services, training programs, and awareness campaigns
	Local Government	Collaborating with community leaders and organizing awareness campaigns to educate residents about the benefits of compost, encouraging its use in local farming practices and waste management initiatives
	Bangladesh-Forest-Department	Promoting the use of compost in afforestation and reforestation projects, highlighting the benefits of organic fertilizers for soil health and plant growth
	LGED	Integrating compost usage in soil improvement projects for infrastructure development
	PWD	
Private: Humanitarian Response	BRAC, ACF, WVB, BDRCS, CARE, DSK, ANANDO, TdH, NABOLOK, NGOF, SHED,	• ensuring the effective distribution of compost • address immediate needs. • support sustainable practices. • ensuring the effective distribution of compost
Private: Competitor/ Collaborator	ACI, Northern Agro services, Mati etc.	• collaborate on research, innovation, and sustainable practices to strengthen the overall compost industry. • Building strategic partnerships
Private: Business Societies	Nursery Owners	Contribute to the demand for compost as essential organic fertilizer in their nursery operations, influencing market demands
	BFA	Development collaboration, providing industry insights, and contributing to the overall development and growth of the compost business sector
Private: User Groups	Farmer Group	Benefiting from the use of compost for agricultural activities, promoting sustainable farming practice
	Household: FDMN	
Development Partners: Humanitarian Response	WASH-sector, ISCG (EEN), FAO, UNHCR, UNICEF, IOM	Contributing knowledge and support to ensure sustainable and effective implementation of compost-related initiatives

Note. SRDI: Soil Resource Development Institute; BARI: Bangladesh Agricultural Research Institute; BINA: Bangladesh Institute of Nuclear Agriculture; BRRI: Bangladesh Rice Research Institute; BARC: Bangladesh Agricultural Research Council; DAE: Department of Agricultural Extension; DoE: Department of Environment; BSCIC: Bangladesh Small and Cottage Industries Corporation; DIFE: Department of Inspection for Factories and Establishments; LGED: Local Government Engineering Department; PWD: Public Works Department; BFA: Bangladesh Fertilizer Association; NGOF: NGO Forum for Public Health

*The contact details of the important stakeholders are annexed.3

5. MARKET DEMAND ANALYSIS

5.1 Target Market

To analyze the compost/co-compost target market, the study team identified three primary demand sectors: (1) the agriculture sector, (2) the forest sector, and (3) the Rohingya camps. They are further subcategorized and summarized in Table *6* Target market of compost/co-compost.

Table 6 Target market of compost/co-compost

Type of Compost	Cox's Bazar host communities			Cox's Bazar Camps	
	Agriculture Sector		Forest	Plantation (Afforestation / Reforestation)	Homestead gardening
	Food	Non-food			
Co-compost	X	✓	✓	✓	X
Compost	✓	✓	✓	✓	✓

According to data obtained from the Cox's Bazar DAE office, demand for compost in the agriculture sector is concentrated within eighteen (18) cultivated crop categories. In the forest sector, both the north and south forestry divisions of Cox's Bazar are considered potential markets for compost/co-cost as per discussion meeting with forestry office. Compost and co-compost demand in the Rohingya camps is primarily driven by afforestation/reforestation and homestead gardening initiatives.

According to the recommendations from various stakeholders, co-compost is deemed suitable only for use with non-food agriculture. These recommendations are adhered to for demand calculations.

Part of the existing demand of compost is met by different projects of DAE, farmers buy directly from the market-dealers, and some farmers buy cow-dung instead of compost.

5.2 Compost/Co-compost Market Demand Estimation

The demand for organic compost in Bangladesh is growing due to several factors, including increasing awareness of the benefits of organic farming, rising incomes, and government support for the organic sector. The main challenges faced by the organic compost industry in Bangladesh include a lack of awareness among farmers, limited availability of high-quality compost, and high prices. There is a significant potential for growth in the organic compost industry in Bangladesh, given the large amount of organic waste generated in the country and the growing demand for organic products.

The government of Bangladesh is taking steps to promote the use of organic compost, such as providing subsidies to farmers and supporting research and development. However, more needs to be done to increase awareness of the benefits of organic farming and to make organic compost more affordable and accessible to farmers.

5.2.1 Agriculture Demand

Agricultural demand refers to the demand for compost/co-compost used in all types of agricultural crops within the Cox's Bazar district. The study team obtained data on crop types, their cultivation area, recommended compost usage per hectare, and the annual growing seasons for each crop for Cox's Bazar district from the DD, DAE, Cox's Bazar office.

Since the use of co-compost is recommended only for non-food agriculture, only compost is considered for demand calculation in the agriculture cropping (food). Whereas co-compost is estimated for plantation (afforestation/reforestation) which comply non-food agriculture.

Based on DAE Cox's Bazar office data, a total of 18 crop categories have been considered for compost demand calculation: 1. Vegetables, 2. Betel Leaves, 3. Fruits, 4. Ginger, 5. Turmeric, 6. Sugarcane, 7. Flowers, 8. Mustard, 9. Corn & Pepper, 10. Corn, 11. Tobacco, 12. Boro Paddy & Vegetables, 13. Pepper, 14. Onion, 15. Garlic, 16. Coriander, 17. Potato, 18. Boro Paddy.

Among these categories, Vegetables, Betel Leaves, and Fruits currently have active compost demand. Out of the 18 categories, Betel Leaves is a tri-seasonal crop. Fruits, Corn & Pepper, and Boro Paddy & Vegetables are bi-seasonal crops. Flowers are cultivated throughout the year (four-seasonal). Other crops are single-seasonal. The table below presents the area, seasonal, and annual compost demand for each of the 18 crop categories.

Table 7 Agricultural compost demand estimation

Crop (DA_i)	**Area, hector (a_i)**	**Compost/hector (kg) (provided by DAE)**	**Season/yr.**	**Compost/yr. (ton)**
Vegetables (i_1)	8950	741	1	6,632
Betel Leaves (i_2)	3065	494	3	4,542
Fruits (i_3)	455	2250	2	2,048
Zinger (i_4)	71	741	1	53
Turmeric (i_5)	128	741	1	95
Sugarcane (i_6)	100	988	1	99
Flower (i_7)	156	494	4	308
Mustard (i_8)	400	494	1	198
Corn & Pepper (i_9)	202	741	2	299
Corn (i_{10})	350	741	1	259
Tobacco (i_{11})	1015	494	1	501
Boro paddy & vegetable (i_{12})	780	494	2	771
Pepper (i_{13})	2200	741	1	1,630
Onion (i_{14})	90	741	1	67
Garlic (i_{15})	50	494	1	25
Coriander (i_{16})	202	494	1	100
Potato (i_{17})	2050	741	1	1,519
Boro Paddy (i_{18})	300	494	1	148
Annual compost demand for agriculture sector in Cox's Bazar District				**19,293**

Out of the total **annual compost demand of approximately 19,293 tons**, **betel leaves, vegetables, and fruits account for 13,222 tons, representing the active demand compost**; however, the others have strong potential demand which needs exploration or facilitation as suggested by DAE and other stakeholders.

5.2.2 Forest Demand

Forest demand refers to the demand for compost/co-compost used in reforestation and forestry initiatives within the Cox's Bazar district. Based on information provided by Cox's Bazar Forest office,

they procured a total of 1,000 tons of organic compost in 2023 for their forestation projects for both south and north division. This KII also suggests the **annual demand for compost/co-compost for forestation purposes in Cox's Bazar would be around 1,000 tons.**

5.2.3 Rohingya Camps Demand

Rohingya camps demand means the demand of compost and co-compost for afforestation/reforestation and homestead gardening initiatives.

Reforestation:

To support ongoing afforestation and reforestation efforts in the Rohingya camps and host communities, various partners[14] like Arannayk Foundation, BATB, BRAC, CNRS, DCA, FAO, FIVDB, IOM, IUCN, Shushilan, UNHCR, WFP etc. are actively engaged in planting initiatives. Collaborating with the Energy and Environment Network (EEN) of the Inter-Sector Coordination Group (ISCG), the study team analyzed EEN data on plantation[14] activities from 2018 to 2022. This data reveals a total of 2,411,133 saplings planted over five years, averaging 482,227 per year. Additionally, approximately 780 hectares of land were utilized for plantation in the camps during this period, averaging 156 hectares annually. Importantly, based on 2021 and 2022 data, an average of 3,137 saplings per hectare is estimated for the total compost/co-compost demand calculation.

Drawing upon FAO guidelines that recommend 250 grams[15] of compost per sapling, the study team estimated the current compost/co-compost demand for afforestation/reforestation purposes. Based on EEN data, 20,133 saplings were planted in 2022 on 24.343 hectares of host community land. Considering this data alongside the five-year camp plantation average and the updated sapling density, **the current total compost/co-compost demand for afforestation/reforestation is estimated at 126 tons.**

Table 8: EEN's plantation activities form 2018-2022

Year	Total saplings planted (camp)	Total saplings planted (camp)	Total saplings planted (Host C.)	Total NEW area planted (ha) (Host C.)
2022	250216	250216	20133	24.343
2021	380398	380398		
2020	865775	865775		
2019	552088	552088		
2018	362656	362656		
Five Year Total	2411133			
Avg. yearly compost demand for camp plantation (ton)	121	Avg. yearly compost demand for camp plantation (ton)	5	

Homestead gardening:

Based on the FAO's Homestead gardening guidelines, each household in the Rohingya camps is allocated an average of 82 square feet of land for homestead gardening. With a total of 189,747

[14] EEN, ISCG data on plantation activities from 2018 to 2022 (November 2023)
[15] FAO documentation on technical specification for land stabilization and greening the camps in Cox's Bazar south forest division

households across the 34 camps, as reported by UNHCR[16], this translates to 144.55 hectares dedicated to homestead gardening activities.

According to the Department of Agricultural Extension (DAE) in Cox's Bazar, 247 kilograms of compost are needed annually for agricultural purposes, based on this we made assumption and applied three times per year. Applying this recommendation **to homestead gardening calculations, the estimated annual compost demand for the Rohingya camps stands at approximately 107 tons**.

Table 9: Camp-wise area and compost use rate for homestead gardening

Camp Name	Total HH	Camp-wise Total Area for Gardening (Hector)	Compost use rate (ton)
Camp 1E	8634	6.577	4.9
Camp 1W	8328	6.344	4.7
Camp 2E	6105	4.651	3.4
Camp 2W	5481	4.175	3.1
Camp 3	8113	6.181	4.6
Camp 4	7334	5.587	4.1
Camp 4 Extension	1964	1.496	1.1
Camp 5	5671	4.320	3.2
Camp 6	4998	3.807	2.8
Camp 7	8313	6.333	4.7
Camp 8E	6329	4.821	3.6
Camp 8W	6670	5.081	3.8
Camp 9	7195	5.481	4.1
Camp 10	6417	4.889	3.6
Camp 11	6243	4.756	3.5
Camp 12	5508	4.196	3.1
Camp 13	8964	6.829	5.1
Camp 17	3992	3.041	2.3
Camp 18	6226	4.743	3.5
Camp 19	5133	3.910	2.9
Camp 20	1615	1.230	0.9
Camp 20 Extension	2242	1.708	1.3
Kutupalong RC	3129	2.384	1.8
Camp 14	6713	5.114	3.8
Camp 15	10844	8.261	6.1
Camp 16	4555	3.470	2.6
Camp 21	3898	2.970	2.2
Camp 22	4347	3.312	2.5
Nayapara RC	4263	3.248	2.4
Camp 23	717	0.546	0.4
Camp 24	5870	4.472	3.3
Camp 25	1580	1.204	0.9
Camp 26	9028	6.878	5.1
Camp 27	3328	2.535	1.9
Total	**189747**	**144.550**	**107**

[16] https://data.unhcr.org/en/documents/details/103327

Based on the calculations above, **the total annual compost/co-compost demand across the three sectors (agriculture, forest, and Rohingya camps) is estimated to be 20,526 tons.** This total primarily represents compost demand, with **1,126 tons specifically allocated for co-compost** needs in afforestation and reforestation efforts within both the camps and host communities. This allocation reflects the negligible contribution of non-food items in the agricultural sector to the overall co-compost demand.

Table 10: Total Compost/co-compost demand in Cox's Bazar district

Type of Compost	Cox's Bazar host communities			Cox's Bazar Camps	
	Agriculture Sector (DA)		Forest (DF)	Plantation (Afforestation / Reforestation) (Ca_{rf})	Homestead gardening (Ca_{hd})
	Food	Non-food			
Co-compost	X	X	1,000	126	X
Compost	19,293	X	1,000	126	107

From the flowing equations compost/co-compost can be calculated.

$$C_D = \sum_{i=1}^{18} DA_i + DF + DC \quad \text{---------- (1)}$$

$$DA_i = a_i \times d_i \times \sum_{n=1}^{4} t_n \quad \text{---------- (2)}$$

$$DF = f_N + f_S \quad \text{---------- (3)}$$

$$DC = Ca_{rf} + Ca_{hd} \quad \text{---------- (4)}$$

Here,

C_D = Annual total compost demand in Cox's Bazar
DA_i = Annual compost demand for agriculture (i is18 types of crops) in Cox's Bazar
i_1 = Vegetable, i_2 = Betel Leaves, i_3 = Fruits
i_4 = Zinger, i_5 = Turmeric, i_6 = Sugarcane
i_7 = Flower, i_8 = Mustard, i_9 = Corn + Pepper
i_{10} = Corn, i_{11} = Tobacco, i_{12} = Boro Paddy + Vegetable
i_{13} = Pepper, i_{14} = Onion, i_{15} = Garlic
i_{16} = Coriander, i_{17} = Potato, i_{18} = Boro Paddy
DF = Annual compost demand for forest in Cox's Bazar
DC = Annual compost demand in the Rohingya camps
a_i = Cultivated land for i crop in Cox's Bazar
d_i = Seasonal compost demand for i crop in Cox's Bazar
t_n = Annual number seasons of cultivation
t_1 = Single-seasonal, t_2 = bi-seasonal
t_3 = Tri-seasonal crop, t_4 = Four-seasonal
f_N = Annual compost demand for forest land in Cox's Bazar north division
f_S = Annual compost demand for forest land in Cox's Bazar south division
Ca_{rf} = Annual compost demand in the Rohingya camps for reforestation
Ca_{hd} = Annual compost demand in the Rohingya camps for homestead gardening

5.2.4 Existing Compost Production Rate

Considering 78 material recovery facilities (MRFs) equipped with compost plants are currently operational within the Rohingya camps[17]. Data from June 2023 reveals that these facilities collectively produce a total of 52.137[17] tons of compost monthly which is around 5% of total organic waste collection. This figure serves as the estimated monthly production rate for the camps' MRFs. Stakeholders believe this rate has the potential to be increased by 20%.

Additionally, based on information from the compost plant operator of Cox's Bazar Municipality, their facility produces approximately 18-20 tons of compost per month. Combining this with the camps' production, we can estimate **an annual capacity of 841-865 tons of compost from these existing facilities**, which may meet approximately 4% of the total estimated compost/co-compost demand.

Table 11: Monthly compost production of all MRFs of Rohingya camps (June 2023)[17]

Camp ID	#of population Covered by MRF	**Total Amount** of **waste** collected (kg/m)	Amount of **organic** waste collected (kg/m)	Amount of **compost** produced per month (kg/m)
Camp 01E	41533	186278	117741	3242
Camp 01W	39661	87682	33492	3613
Camp 02E	27181	87824	18479	1000
Camp 02W	24921	16812	9808	350
Camp 03	37642	196298	108959	3500
Camp 04	34172	90435	57310	2000
Camp 04 Ext	8989	12466	7256	1200
Camp 05	27244	60115	25720	1000
Camp 06	25771	33889	11405	-
Camp 07	39992	55368	11074	-
Camp 08E	31926	79906	66888	8750
Camp 08W	33200	54737	6272	487
Camp 09	35413	293220	48050	1499
Camp 10	31471	65488	46154	1177
Camp 11	32241	78191	25557	1246
Camp 12	28462	36807	26023	1138
Camp 13	44921	61865	38589	2716
Camp 14	35088	42633	7402	382
Camp 15	56591	77982	37305	1920
Camp 16	22116	38755	1568	90
Camp 17	18990	133311	63336	3000
Camp 18	30040	65500	57684	1301
Camp 19	26575	40754	35514	1050
Camp 20	8385	12780	5312	620
Camp 20 Ext	11457	5200	5314	3100
Camp 21	16548	40387	15143	500
Camp 22	23352	25550	24000	750
Camp 24	26541	64142	15687	670

[17] https://rohingyaresponse.org/sectors/coxs-bazar/wash/

Camp ID	#of population Covered by MRF	**Total Amount** of **waste** collected (kg/m)	Amount of **organic** waste collected (kg/m)	Amount of **compost** produced per month (kg/m)
Camp 25	9148	19357	4400	150
Camp 26	42718	139524	21026	2260
Camp 27	17072	68500	8000	500
Camp KRC	18289	67223	17280	500
Camp NRC	23295	144708	31050	2426
Total	**930945**	**2483686**	**1008797**	**52137**

However, **considering the compost production of 12 MRFs studied which are operated by BRAC and NGOF, around 59 tons of compost are produced per month** (Table 18). The compost production rate is around 15%. Considering this value with the monthly 18–20-ton compost production of Cox's Bazar municipalities' compost **plant yearly 924–948-ton** compost is producing form studied 12 MRFs at this moment, which may meet approximately 4% of the total estimated compost/co-compost demand.
However, there is potential to increase production to a composting rate of at least 20%. If all households are covered and the waste is collected in the catchment areas of the 12 MRFs, the compost production capacity can be increased to 87 tons with an additional 28 tons.

5.2.5 Compost/Co-compost Demand Trend

KII indicates that demand is projected to increase by 15% annually. Based on this information, the following table has been calculated.

Table 12: Compost/Co-compost demand trend

Year	2023	2024	2025	2026	2027	2028	2029	2030
Annual compost demand in Cox's Bazar (Agriculture), (ton/yr.)	19293	22187	25515	29343	33744	38806	44627	51321
Annual compost/co-compost Demand in Cox's Bazar (Forest), (ton/yr.)	1000	1150	1323	1521	1749	2011	2313	2660
Annual compost/co-compost demand in Camp (re-forestation), (ton/yr.)	126	145	167	192	220	253	291	335
Annual compost Demand in Camp (homestead gardening), (ton/yr.)	107	123	142	163	187	215	247	285
Annual total Compost/Co-compost demand in Cox's Bazar, (ton/yr.)	**20526**	**23605**	**27146**	**31218**	**35901**	**41286**	**47479**	**54600**
Annual total Co-compost demand in Cox's Bazar, (ton/yr.)	1126	1295	1489	1713	1969	2265	2605	2995

5.3 Competitiveness and collaboration aspects

According the KII with ACI, Northern Agro there are more than 20,000 tons of running demand in Bangladesh and specific information about the Cox's Bazar district could not be secured. The price varies from 5 to 6 Tk without packing cost and without transportation cost to the dealer points/outlets[18]. There is scope and opportunity that the existing market players may take the bulk of waste ensuring the quality of the compost; however, it depends on various factors such as regular supply, ensuring quantity of supply with quality as well as point of supplies for sourcing etc.

[18] This price information is shared as unofficial and as a rough proposition for conservative estimation.

Currently, ACI and Agro Arina are the key market players. The trade price of organic fertilizer is 390 Tk for 40 kg in general and sell 470 to 550 Tk for 40 kg according to a dealer; however, and for ACI, purchase price for a dealer is roughly about 450 Tk for 40 kg[19]. In such a situation, it may be wise to collaborate with such traders and use their existing marketing and selling channels. They have already established a business network.

5.4 Analysis Between Factory Made Fertilizer and By-product

Factory-made fertilizers are quick-acting and supply specific nutrients, while organic compost is a more sustainable option that improves soil health over time. Many gardeners and farmers use a combination of both, depending on their specific needs and goals for plant growth and soil management.

Table 13 Factory made fertilizer and organic fertilizer comparison

Characteristics	Factory made fertilizer	Organic fertilizer
Composition	These are synthetic or chemical fertilizers that are manufactured in factories. They typically contain a specific balance of essential nutrients like nitrogen (N), phosphorus (P), and potassium (K), along with other secondary and micronutrients. The nutrient content is often indicated on the product label as an NPK ratio (e.g., 10-10-10).	Organic Compost: Compost is a natural soil amendment made from decomposed organic matter, such as kitchen scraps, yard waste, and other organic materials. Compost is rich in organic matter and contains a wide variety of nutrients and beneficial microorganisms. It does not have a standardized NPK ratio but instead contributes to overall soil health.
Nutrient Release	These fertilizers release nutrients **quickly** and are readily available to plants. They can provide a rapid boost of essential nutrients, making them suitable for correcting nutrient deficiencies or promoting fast growth.	Compost releases nutrients **slowly** over time as it continues to break down. This slow-release nature helps improve soil structure, water retention, and nutrient availability in the long term. Compost acts as a soil conditioner, not just a nutrient source.
Environmental Impact	Synthetic fertilizers can have negative environmental impacts if not used properly. Overuse or runoff of these fertilizers can contribute to water pollution, as they may contain chemicals harmful to aquatic ecosystems.	Compost is eco-friendly and sustainable. It recycles organic waste materials and helps reduce landfill waste. Composting also sequesters carbon and enriches the soil, making it a valuable tool for sustainable agriculture.
Soil Health	While synthetic fertilizers can provide quick nutrient boosts, they do little to improve overall soil health. Overreliance on them may lead to degraded soil quality over time.	Compost enhances soil health by improving its structure, increasing microbial activity, and promoting water retention. It also provides a slow and steady supply of nutrients, fostering a healthier and more resilient ecosystem for plants.
Cost	Synthetic fertilizers are often more cost-effective in the short term because they deliver nutrients directly to plants.	Making or purchasing compost can be more labor-intensive and may have a higher initial cost, but it provides long-term benefits for soil health and reduces the need for frequent fertilization.

[19] Dealers and traders not willing to share actual or accurate price of purchase as it varies time to time and on the other hand they want to maintain business secrecy

5.5 Acceptability Analysis of Compost

A detailed descriptive analysis has been conducted on the quality parameters of these 19 samples. After examination of the mean, median, and mode for both physical and chemical properties (excluding phosphorus and potassium) at a 95% confidence level, it is evident that all values closely comply with each other and comply with government standards. This compliance signifies the suitability of both manufacturing and marketing processes for this compost. Additionally, the standard deviation and variation among the samples are minimal, approaching zero in most cases, further indicating the consistency and reliability of the compost quality. Positive kurtosis values, such as those for pH, Nitrogen, C: N, Zinc, Copper, Lead, Cadmium, and Nickel, indicate distributions with heavier tails and more extreme values compared to a normal distribution. Notably, Potassium exhibits a high positive kurtosis (2.52), indicating a distribution with very heavy tails and extreme values. Again, kurtosis values close to zero for Organic Carbon and Sulfur suggest distributions like a normal distribution. Positive skewness values for Phosphorus, Potassium, Zinc, Copper, and Lead indicate rightward skewness, suggesting concentrations of lower values. Sulfur has a skewness value close to zero, indicating a roughly symmetrical distribution. The slight positive skewness for Moisture, pH, Organic Carbon, Nitrogen, Carbon-Nitrogen Ratio, and Nickel suggests mild rightward skewness. Here distribution means distribution of samples collected from 19 camps. According to this lab test's result of 19 samples from different camps, only Phosphorus and Potassium are seen as below the expected range set by the government as per stipulation of Fertilizer (management) Act 2006. The descriptive statistics of the samples are shown in Table 14.

Table 14 Descriptive statistics of the compost samples tested for quality

	Moisture (%)	pH	Organic Carbon (C %)	Total Nitrogen (N (%)	Carbon-Nitrogen Ratio (C:N)	Phosphorus (P) (%)	Potassium (K) (%)	Sulfur (S) (%)	Zinc (Zn) (%)	Copper (Cu) (%)	Lead (Pb) (ppm)	Cadmium (Cd) (ppm)	Nickel (Ni) (ppm)
Mean	**11.78**	**7.57**	**12.08**	**0.80**	**15.28**	**0.39**	**0.40**	**0.37**	**0.06**	**0.01**	**3.51**	**1.42**	**3.33**
Standard Error	0.09	0.04	0.02	0.02	0.37	0.00	0.01	0.01	0.00	0.00	0.30	0.08	0.27
Median	11.80	7.60	12.10	0.83	14.30	0.40	0.38	0.37	0.06	0.01	3.15	1.45	3.10
Mode	11.80	7.70	12.15	0.85	14.30	0.40	0.35	0.38	0.06	0.01	3.15	1.35	2.40
Standard Deviation	0.39	0.16	0.09	0.08	1.62	0.02	0.06	0.03	0.00	0.00	1.29	0.35	1.17
Sample Variance	0.15	0.02	0.01	0.01	2.64	0.00	0.00	0.00	0.00	0.00	1.67	0.12	1.37
Kurtosis	(0.67)	(0.97)	(0.19)	(1.48)	(1.34)	0.15	2.52	(0.22)	(0.76)	0.42	0.64	1.06	(0.69)
Skewness	0.43	(0.29)	(0.53)	(0.41)	0.63	(0.88)	1.69	(0.04)	(1.14)	1.54	1.05	(0.85)	0.56
Range	1.30	0.50	0.36	0.24	4.70	0.08	0.20	0.10	0.01	0.00	4.70	1.40	3.90
Minimum	**11.20**	**7.30**	**11.89**	**0.67**	**13.40**	**0.35**	**0.35**	**0.32**	**0.05**	**0.01**	**1.85**	**0.65**	**1.45**
Maximum	**12.50**	**7.80**	**12.25**	**0.91**	**18.10**	**0.43**	**0.55**	**0.42**	**0.06**	**0.01**	**6.55**	**2.05**	**5.35**
Sum	223.85	143.80	229.58	15.18	290.40	7.45	7.59	7.04	1.09	0.10	66.75	26.90	63.28
Count (sample number, N)	**19.00**	**19.00**	**19.00**	**19.00**	**19.00**	**19.00**	**19.00**	**19.00**	**19.00**	**19.00**	**19.00**	**19.00**	**19.00**
Confidence level (95.0%)	0.19	0.08	0.05	0.04	0.78	0.01	0.03	0.01	0.00	0.00	0.62	0.17	0.56
Government standard	*< = 20*	*6 – 8.5*	*10 - 25*	*0.5 – 4*	*< 20:1*	*0.5 – 3*	*0.5 – 3*	*0.1-0.5*	*<=0.1*	*<=0.5*	*<=30*	*<=5*	*<=30*

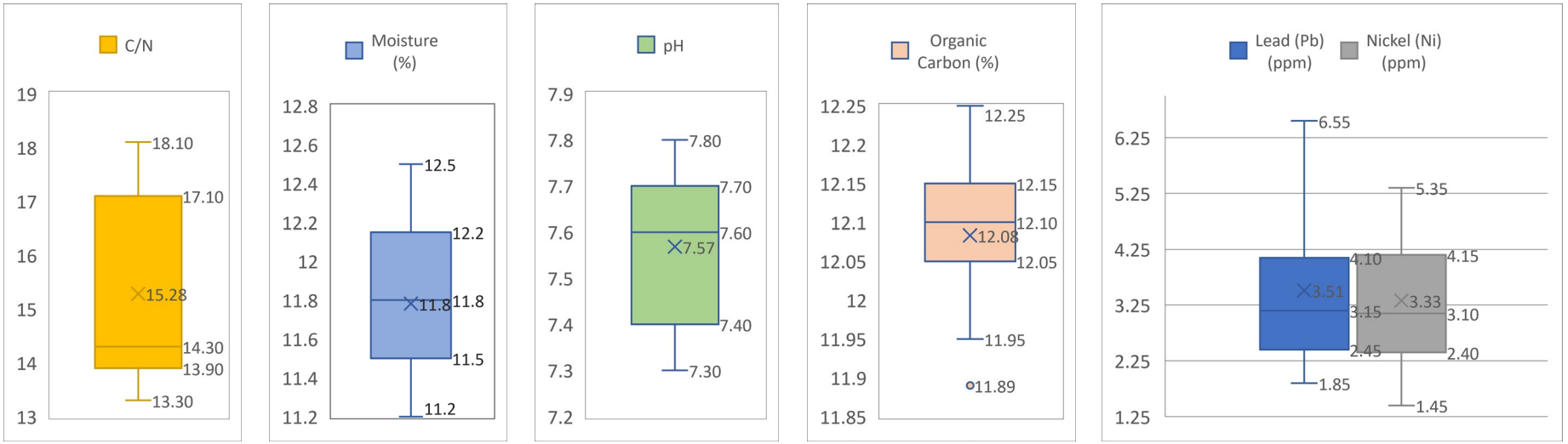

Figure 2 Box and whisker plot for different quality parameters

The sample results encompassing 17 quality indicators (both physical and chemical), including Color, Physical properties, Odor, Inert (%), H20(%), pH, C (%), N (%), C:N ratio, P (%), K (%), S (%), Zn (%), Cu (%), Pb (ppm), Cd (ppm), and N (ppm). Notably, the color, physical attributes, and odor of the compost samples comply to government standards, characterized as Dark Grey, non-granular, and free from foul odor, respectively. Based on the data presented in Table-7, it is evident that all parameters, except for Phosphorus and Potassium, conform to the respective government standards.

Table 15 Compost test results provided by NGOF and BRAC-HCMP (tested at SRDI lab)

Sample Code	IP	Color	Physical	Odor	Inert (%)	H_20 (%)	pH	C (%)	N (%)	C:N	P (%)	K(%)	S(%)	Zn (%)	Cu (%)	Pb (ppm)	Cd (ppm)	N (ppm)
KTP RC	NGOF	DG	NG	AFO	<1	11.5	7.3	12.05	0.75	16.1:1	0.4	0.4	0.35	0.06	0.005	3.15	1.35	3.45
Camp-26, Cud-01	NGOF	DG	NG	AFO	<1	11.2	7.5	12.1	0.72	16.8:1	0.43	0.45	0.38	0.06	0.006	1.85	1.6	3.8
Camp-26, Cug-02	NGOF	DG	NG	AFO	<1	11.2	7.4	12.12	0.68	17.8:1	0.4	0.44	0.38	0.05	0.006	2.45	1.35	2.4
NYP-RC, Block-C	NGOF	DG	NG	AFO	<1	12.15	7.5	11.95	0.7	17.1:1	0.41	0.4	0.37	0.06	0.005	2.15	1.55	2.05
NYP-RC 02	NGOF	DG	NG	AFO	<1	11.4	7.6	12.08	0.69	17.5:1	0.4	0.41	0.38	0.06	0.005	2.1	1.5	2.15
Camp-4	NGOF	DG	NG	AFO	<1	11.6	7.7	12.1	0.67	18.1:1	0.4	0.35	0.32	0.06	0.005	3.5	1.61	4.15
Camp-5	NGOF	DG	NG	AFO	<1	11.8	7.7	12.15	0.7	17.4:1	0.4	0.4	0.38	0.06	0.005	2.3	2.05	1.45
Camp-1 W	BRAC	DG	NG	AFO	<1	12.4	7.6	12.15	0.85	14.3:1	0.4	0.35	0.35	0.05	0.005	6.55	0.68	5.35
Camp-1 E	BRAC	DG	NG	AFO	<1	11.8	7.6	12.05	0.84	14.3:1	0.38	0.35	0.42	0.05	0.005	5.9	1.45	5.21
Camp-2 East	BRAC	DG	NG	AFO	<1	12.3	7.8	12.19	0.89	13.7:1	0.4	0.37	0.32	0.06	0.005	3.85	1.6	3.08
Camp-4 Ext	BRAC	DG	NG	AFO	<1	11.8	7.8	11.95	0.8	14.9:1	0.35	0.35	0.4	0.06	0.005	4.1	1.8	3.2
Camp-3	BRAC	DG	NG	AFO	<1	12.3	7.4	12.1	0.82	14.8:1	0.4	0.52	0.35	0.06	0.005	3.15	1.06	2.8
Camp-21	BRAC	DG	NG	AFO	<1	12.5	7.7	11.89	0.83	14.3:1	0.35	0.38	0.38	0.05	0.006	3.25	1.65	2.58
Camp-1 W	BRAC	DG	NG	AFO	<1	11.7	7.4	12.25	0.88	13.9:1	0.4	0.36	0.37	0.06	0.005	5.5	0.65	5.15
Camp-1 E	BRAC	DG	NG	AFO	<1	11.5	7.7	12.15	0.88	13.8:1	0.4	0.37	0.4	0.05	0.006	4.2	1.4	5.11
Camp-2 E	BRAC	DG	NG	AFO	<1	11.8	7.6	12.15	0.91	13.4:1	0.41	0.38	0.34	0.06	0.005	3.05	1.4	3.1
Camp-4 Ext	BRAC	DG	NG	AFO	<1	11.5	7.7	12.05	0.87	13.9:1	0.36	0.38	0.42	0.058	0.005	3.7	1.65	3.1
Camp-3	BRAC	DG	NG	AFO	<1	11.6	7.3	12.15	0.85	14.3:1	0.4	0.55	0.36	0.06	0.005	2.95	1.1	2.75
Camp-21	BRAC	DG	NG	AFO	<1	11.8	7.5	11.95	0.85	14.1:1	0.36	0.38	0.37	0.06	0.005	3.05	1.45	2.4
Max		DG	NG	AFO	<1	12.50	7.80	12.25	0.91	-	0.43	0.55	0.42	0.06	0.01	6.55	2.05	5.35
Min		DG	NG	AFO	<1	11.20	7.30	11.89	0.67	-	0.35	0.35	0.32	0.05	0.01	1.85	0.65	1.45
Govt. Directives		DG	NG	AFO	<=1	<=20%	6.0-8.5	10.0-25.0%	0.5-4.0%	< 20:1	***0.5-3.0%***	***0.5-3.0%***	0.1-0.5%	<= 0.1%	<= 0.05	<= 30.0	<= 5.0	<= 30

DG: Dark Grey; NG: Non granular; AFO: Absence of Found Oder

Comment from the Government: The samples are deficient in Phosphorus and Potassium as per Fertilizer (Management) Act 2006

5.6 Acceptability Analysis of Co-compost

The acceptance of co-compost has been assessed through three approaches: (1) document review, (2) KII findings, and (3) laboratory test results.

(1) Document Review:

According to the study conducted by the BAU and OXFAM, Co-Compost and Faecal Sludge data have been analyzed. The co-compost samples, including those from PDB and Buried Composts, demonstrated favorable characteristics in terms of pH, nutrient content, organic carbon, moisture, heavy metal concentrations, and pathogen absence. Some of the quality parameter assessment has been given below:

- pH Levels: Co-compost pH ranged from 7.25 to 7.36, indicating a neutral to slightly alkaline nature.
- Nutrient Content: Total nitrogen content in co-composts ranged from 1.59% to 1.79.
- Organic Carbon (OC) and C: N Ratio: OC concentration in co-composts varied from 5.76% to 10.12. C:N ratio ranged from 3.5 to 5.6 in co-composts.
- Moisture Content: Co-compost samples were mature, with a moisture content of 16-17%
- Heavy metal concentrations in co-composts: Heavy metals analyzed included As, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, and Zn.
- Pathogen Presence: Pathogens primarily concerned with health issues in compost fertilizer were absent in co-composts, PDB, and Buried compost.

The study on co-compost utilization in Kushtia revealed significant insights into farmers' knowledge, attitudes, and barriers associated with the adoption of co-compost as an agricultural input.

The study analyzes market acceptability, recommends initiatives to improve marketability, and proposes an optimum price for co-compost. Recommendations include government initiatives, capacity building, awareness building, research, field demonstrations, and collaboration with stakeholders to promote the use of co-composts for sustainable waste management and agricultural productivity.

Approximately **97.44 percent of respondents provided negative responses, indicating they had never used co-compost**. The primary reasons include 75% of respondents lacking awareness of its availability in the market, 18% not receiving any encouragement or advertisement, and 13.63% having a knowledge gap regarding its use.

Barriers in accepting co-compost:

Of the total 44 respondents, 31 respondents (70.05 percent) said they have no economic barriers in accepting co-compost. About 13 respondents (29.72 percent) indicated some sort of economic barriers in accepting co-compost. About 50 percent of the respondents reported that the high price of co-compost is one of the main economic barriers. The current market price of Aprokashi co-compost was used as a reference price. The second major barrier is inconsistency in price and quantity/quality which was reported by about 35 percent farmers. Transportation cost was identified as a barrier by about 8 percent of the respondents. The unreasonable asking price of dealers, and consistency in the prices of co-compost and other fertilizers were the other economic barriers. Further discussions with farmers revealed that the price of **co-compost must be low and should not be more than Tk 12 per kg.**

Of the 44 respondents 32 respondents (about 73 percent) reported that they have no social barriers in accepting co-compost. Only 12 respondents (about 27 percent) reported some social barriers in accepting co-compost.

Of the farmers who reported there are cultural/ religious barriers, 19 farmers (about 72 percent) reported that their religion did not allow the use of faecal sludge in the crop fields growing food for human consumption.

This was mentioned mostly by the older and aged farmers. About 28 percent of them said that there was a sentiment against the use of faecal-based compost. But urban and younger farmers, for example gardeners, had almost no religious barriers in using co-composts.

The main health hazard identified by the farmers was “use of co-compost may cause various diseases” i.e., gastric. Some of the farmers also reported that psychological problems may occur, and bad smell may cause headaches. However, some of the farmers who were skeptical of co-compost pointed out that faecal matter can spread diseases such as gastric. These farmers assumed that consumers would avoid food crops in which co-compost was used. Most of the farmers who were positive about co-compost stressed their particular interest in “organic” fertilizer and indicated that if faecal sludge is well composted, it would be both less health hazardous and less expensive compared to inorganic fertilizers**.**

In summery

- 97.44% of respondents had not used co-compost, with some lacking awareness of its availability and application.
- Around 22.56% of respondents were aware of co-compost and its use in agricultural fields.
- About 75% of farmers cited "unavailability in the markets" as the primary reason for not using co-composts.
- 70.05% reported no economic barriers to accepting co-compost.
- 73% of respondents with knowledge of co-compost reported no social barriers.

Farmers suggested measures for promoting co-compost use, including demonstrations, training programs, better pricing, promotional activities, and improved market linkages.

Other recommendations included ensuring local dealerships, distributing low-priced packages for trial, and providing agricultural extension services.

(2) KII Findings:

- According to the Organic Policy, the use of co-composts is not permissible in the food system. Instead, co-composts are allowed for use in the forest region and for gardening purposes.
- In the co-composting system, it is recommended to avoid the mixing of dry sludge. Instead, the suggestion is to conduct separate composting for better results and management.
- In Bangladesh, there is currently no specific legislation governing the mixing of fecal sludge with compost to create co-compost. While international standards advise against this practice due to potential contaminants like heavy metals and pathogens, there is a lack of local regulations. The repeated use of co-compost could lead to the accumulation of harmful components beyond acceptable levels, posing health and environmental risks. Agricultural scientists recommend restricting the use of fecal sludge-based co-compost to non-food grade

plantations, such as forestry initiatives, to mitigate potential hazards, emphasizing the need for caution in its application.

(3) Laboratory Test Result:

Based on the study team's provided samples of co-compost and fecal sludge, testing conducted by Department of Soil, Water & Environment of Dhaka University revealed that E. coli levels are below 1.0 CFU/g in both co-compost (1:3.5 dilution) and fecal sludge. Additionally, the co-compost (1:3.5 dilution) test results indicate that all parameters, except for physical condition (which is granular form), comply with the relevant government standards stipulated by the Fertilizer (Management) Act 2006. The test results are annexed as Annex 4 and Annex 5.

6. BUSINESS PLAN

6.1 Certification

6.1.1 Certification Process

As per the Fertilizer (Management) Act of 2006[20], a specific certification/registration process must be followed before manufacturing or distributing fertilizers. The Department of Agricultural Extension (DAE)[21] is responsible for approving registrations for making fertilizers and related products.

The following figure provides an overview of the certification/registration process, and detailed steps are outlined in the following Table.

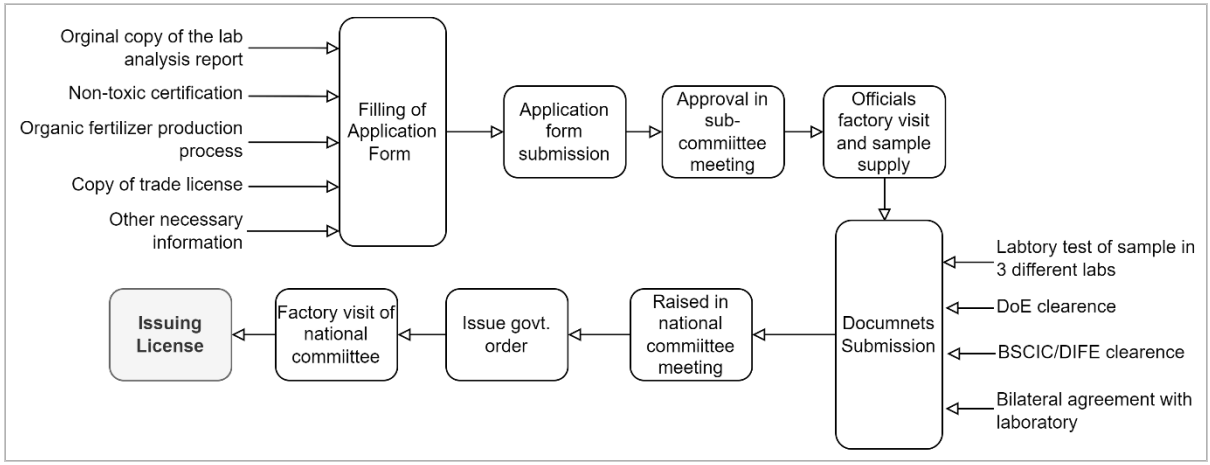

Figure 3: Fertilizer Certification Process

[20] The Fertilizer (Management) Act, 2006, Pub. L. No. S.R.O. No. 244-Law/2022, Act No. VI of 2006 16 (2022). http://bdlaws.minlaw.gov.bd/act-934.html

[21] DAE. (2018). *Agricultural Extension Manual*. DAE, Ministry of Agriculture, GOB. http://www.dae.gov.bd/sites/default/files/files/dae.portal.gov.bd/publications/f39d9608_396b_48c9_bf9e_a3df2183d2fe/2020-08-07-20-39-c25460ef7d6a342a2622c4ffc4ca2a47.pdf

Table 16: Detailed Steps of Fertilizer Certification/Registration Process

Step 1: Apply for Fertilizer Production Registration

- Approach the Department of Agricultural Extension (DAE).
- Fill out the specific application form[22] (Annex 7) with the necessary information.
- Submit the application form along with a list of required documents to the Member-Director (NRM) and Convener, Technical Sub-Committee (Fertilizer), BARC, Farmgate, Dhaka-1215, with a copy to the Additional Director (Implementation), Field Service Wing & Member-Secretary, Technical Sub-Committee (Fertilizer), Department of Agriculture Extension, Khamarbari, Farmgate, Dhaka-1215.

Step 2: Submit Required Documents

- Original copy of the Lab Analysis Report
- Non-toxic Certification
- Production process of Organic Fertilizer (if applicable)
- Copy of Trade License
- Other necessary documents

Step 3: Application Review

- Concerned authority checks the submitted application and document set.
- Application accepted for further processing if all documents are in order.

Step 4: Sub-Committee Review

- Technical Sub-Committee (Fertilizer) reviews the submitted application.
- Sub-committee members conduct a factory visit to the compost production plant for inspection.
- Provide compost samples to the sub-committee members during the factory visit.

Step 5: Sample Testing

- Send the supplied compost samples to three different laboratories for testing based on sub-committee recommendations.
- Forward to further process if two out of three sample results meet government standards.

Step 6: Environmental Clearance

- Obtain environmental clearance certificate from the DoE following proper procedures[23].
- Classification of compost plants into green and yellow categories based on their capacity according to the Environment Protection Rules, 2023[24].
- Green category certification for compost plants with a capacity of up to 5 tons.
- Orange category certification for compost plants with a capacity of more than 5 tons.
- Applications for green category certifications can be processed by the Cox's Bazar district DOE office, while orange category certifications can be processed by the DOE division office[25].

[22] BARC. (n.d.). *Application form for standardization of new fertilizer/bio-fertilizer/plant growth regulator/simulator/others*. Retrieved December 2, 2023, from https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fbarc.portal.gov.bd%2Fsites%2Fdefault%2Ffiles%2Ffiles%2Fbarc.portal.gov.bd%2Fforms%2F1fb1e07a_37ae_436c_85b9_dd2804994518%2FFertilizer_Specification_Form.doc&wdOrigin=BROWSELINK

[23] http://doe.portal.gov.bd/sites/default/files/files/doe.portal.gov.bd/page/71a829c3_6b74_4ee9_90a6_158e2898b228/Environmental%20Clearance%20Procedure.pdf

[24] http://doe.portal.gov.bd/sites/default/files/files/doe.portal.gov.bd/page/5b018a53_25e9_47a3_863f_5a13008aaf83/2023-03-29-06-09-808114a25a969f3154c705d453f3400b.pdf

[25] KII DoE, Cox's Bazar.

- Submit the environmental clearance certificate to the DAE.

Step 7: BSCIC/DIFE Clearance

- Obtain clearance certificate from the Bangladesh Small and Cottage Industries Corporation (BSCIC) or Department of Inspection for Factories and Establishments (DIFE) following proper procedures.

Step 8: Sign Bilateral Agreement

- Sign a bilateral agreement between the applicant and government-certified laboratories.
- There are five government-certified laboratories for compost testing:
    1. Soil Resource Development Institute (SRDI)
    2. Bangladesh Agricultural Research Institute (BARI)
    3. Department of Soil, Water & Environment of Dhaka University
    4. Bangladesh Institute of Nuclear Agriculture (BINA)
    5. Bangladesh Rice Research Institute (BRRI)

Step 9: National Committee Review

- Forward the application to the National Committee meeting after submitting a copy of the agreement.

Step 10: Government Order (GO) Issuance

- Issue a Government Order (GO) upon approval of the application by the National Committee.

Step 11: National Committee Inspection

- Send a three-member team recommended by the National Committee to inspect the organic fertilizer production facility.

Step 12: Fertilizer Production License Issuance

- DAE field service wing issues the Fertilizer Production and marketing License to the applicant after a satisfactory inspection.

6.1.2 Time Frame of the Certification Process

According to the respondents, the time frame for the fertilizer registration process is approximately one year, assuming all steps are completed without any delays and with proper submission and obtaining standard test results for the fertilizer. The main factor affecting the time frame is the frequency of National Committee meetings, which occur twice a year.

6.2 Marketing Strategies

There are several marketing strategies outlined hereinafter like branding activities, private sector engagement, value proposition, distribution channel establishments etc.

6.2.1 Branding Activities

- Organize debriefing sessions with key stakeholders like Upazila administrators, Department of Agricultural Extension (DAE), Department of Environment (DoE), Social Welfare Department, and local government representatives, Forst Department etc.
- Highlight the key benefits of compost, such as improved soil health, increased crop yield, and environmental sustainability. Tailor the message to specific target audiences, emphasizing relevant benefits for farmers, nurseries etc.
- Advertise using print media, radio, and digital platforms. Create engaging and informative advertisements that effectively communicate the benefits of compost/co-compost and promote its adoption. Utilize social media platforms to share informative content, success stories, and tips for using compost/co-compost in diverse applications.
- Implement pilot projects in collaboration with local farmers and DAE. This allows for practical demonstration of benefits and provides valuable feedback for improvement.
- Participate in agricultural fairs and exhibitions to showcase products and directly engage with farmers and other potential customers.
- Offer free compost/co-compost as promotion to encourage farmers.
- Develop educational materials and workshops to provide inspiration and knowledge to the local farmers.

6.2.2 Private Sector Engagement

Private sector engagement can be considered in four scenarios, as outlined in Table 10. For the engagement in various aspects, a common association or platform is suggested to be formed among all Material Recovery Facility (MRF) operating entities through bundling (combining all together).

This platform would then partner with traders or dealers and regularly hand over compost/co-compost. In case of appointing dealers, a dedicated marketing entity would be required for their appointment, or the MRF entities themselves could undertake the marketing tasks.

Another scenario involves engaging a private entity for marketing the compost/co-compost produced by the MRFs. This marketing company may work as a trader or collaborate with a trader. In another case, consider appointing a private operator responsible for the entire operation, encompassing collection, production, and marketing.

Table 17: Business modality options of private sector engagement

Modality Option	BRAC-HCMP or IPs	Private entity	Remarks
Scenerio-1	Marketing by BRAC-HCMP with the dealers' appointment	Dealer	IPs follow govt. registration, Dealers should be BFA member
Scenerio-2	Partnership and hand over the produced compost/co-compost to trader	Trader	Traders follow government regulation and responsible for marketing
Scenerio-3	Appoint a marketing company	Marketing Company	Marketing company may work as a trader or collaborate with a trader
Scenerio-4	Appoint an operator who may have marketing license	Operator	The operator takes over the entire collection, production, and marketing. The operator can appoint/distribute dealers directly or cooperate with existing dealers.

6.2.3 Distribution Strategies

Based on the information provided in the Table 10, the distribution strategies for compost production and marketing can be tailored to fit the specific roles and responsibilities outlined for various entities such as BRAC-HCMP/IPs, Dealers, Traders/Marketing Companies or Private Entities. Here are some suggested distribution strategies for difference cases:

(1) BRAC-HCMP/IP following government registration sell their compost directly to local markets, customers (i.e., DAE, FD) or farmers by appointing or mobilizing distributor and selling representees. The benefit of this strategy allows BRAC-HCMP/IPs to establish a direct connection with consumers, potentially earning higher profits.

(2) BRAC-HCMP/IP handover their produced compost directly to traders who have government registrations. The benefit of this strategy is that BRAC-HCMP/IPs may escape government fertilizer registration burden and avoid direct marketing and selling workloads.

(3) BRAC-HCMP/IP appoint a marketing company/trading company who may not have government fertilizer registration. That entity may work as collaborator with other traders having licenses and distribute BFA/BADC dealers and sub-dealers for selling.

(4) BRAC-HCMP/IPs appoint or partner with an Operator who has license. Operators will oversee full collection, production, and marketing. Operators can adopt a multi-channel approach, combining direct sales, partnerships with dealers, and may collaborate with other marketing companies. The benefit of this strategy is that it provides flexibility and ensures a diversified distribution network, reaching various customer groups. And BRAC-HCMP/IPs only monitor the work of private operators.

6.2.4 Value Proposition

This value proposition is a dynamic statement which can be revised based on local situation time to time. The existing proposition is articulated in the following boxes:

BRAC – Compost/Co-compost Value Proposition

For the of Cox's Bazar districts, BRAC-HCMP-NGOF is making high quality Compost/Co-Compost to maintain the heath of soil and to sustain the local agriculture. Our compost/compost are rich in nutrient and comply with government regulated standards and can contribute to enhance local agricultural production. BRAC compost/co-compost is produced through an enhanced waste management system aimed to control air, water, and soil pollution in Cox's Bazar. Please use it as much as you can to protect agriculture and environment.

Let's buy it before supplies running out and encourage others.

ব্র্যাক- এইচসিএমপি-জৈবসার

কক্সবাজার জেলার মাটির জৈব গুণাবলি বৃদ্ধির মাধ্যমে কৃষিকে সমৃদ্ধ করতে, ব্র্যাক-এইচসিএমপি উন্নত পুষ্টিগুণ সম্পন্ন জৈব সার উৎপাদন করছে। যা সরকার কর্তৃক নির্ধারিত মানমাত্রা নিশ্চিত করে মাটির উর্বরতা বৃদ্ধিতে ভূমিকা রাখবে। কক্সবাজারের বায়ু, পানি এবং মাটি দূষণ নিয়ন্ত্রণের লক্ষ্যে, একটি উন্নত বর্জ্য ব্যবস্থাপনা পদ্ধতির মাধ্যমে এই জৈব সার তৈরি হচ্ছে।

কৃষি ও পরিবেশ রক্ষায় যতটা সম্ভব ব্যবহার করুন।
সরবরাহ ফুরিয়ে যাওয়ার আগে কিনুন এবং অন্যকে আনুপ্রানিত করুন।

6.3 Baseline Information for Business Plan

Based on the information provided by BRAC-HCMP and NGOF, the table (Table 18) shows an overall picture of the input parameters of the business model described later in this chapter. The table shows that in the 12 MRFs studied and operated by BRAC and NGOF, around 59 tons of compost are produced per month. The compost production rate is around 15%. However, there is potential to increase production to a composting rate of at least 20%. If all households are covered and the waste is collected in the catchment areas of the 12 MRFs, the compost production capacity can be increased to 87 tons[26] with an additional 28 tons.

[26] 58.98 ton/m (existing production rate) + 26.85 ton/m (additional production possible)

Table 18 Basic information for business model

Type of plant	Camp	IP	Capital Expenditure of the plant (Tk.)	Volunteer/Plant	Covered number of HH	Total Population	Estimated waste generation (ton/m)	Waste collection (ton/ m)	Collection rate (%)	Organic Waste (ton/ m)	Compost Production, (ton/ m)	Labor productivity (compost, ton/volunteer-r/m)	Composting rate from collection (%)	Composting rate from organic (%)	Additional compost potential (ton/m)
Compost	01-E	BRAC	2,500,000	32	3959	18843	88.185	95	107%	50	4.380	0.137	4.634%	8.830%	26.85
Compost	01-W	BRAC	2,500,000	47	5699	26930	126.032	85	67%	31	4.852	0.103	5.741%	15.751%	
Compost	02-E	BRAC	2,500,000	34	5936	27094	126.800	62	49%	20	1.100	0.032	1.771%	5.416%	
Compost	3	BRAC	2,500,000	61	7994	37633	176.122	168	95%	39	5.887	0.097	3.511%	15.275%	
Compost	4-Ex	BRAC	2,500,000	22	1980	8922	41.755	19	47%	6	1.101	0.050	5.655%	18.350%	
Compost	21	BRAC	1,700,000	30	3647	16539	77.403	27	34%	11	0.528	0.018	1.991%	4.599%	
Compost	26	NGOF	1,500,000	30	6388	30429	142.408	142	100%	57	9.684	0.323	6.800%	17.000%	
Compost	26	NGOF	1,500,000												
Compost	NRC	NGOF	1,500,000	33	4255	23295	109.021	109	100%	44	7.413	0.225	6.800%	17.000%	
Compost	NRC	NGOF	1,500,000												
Compost	KTP RC	NGOF	1,500,000	27	3681	18289	85.593	86	100%	34	5.820	0.216	6.800%	17.000%	
Compost	5	NGOF	1,500,000	21	5734	27244	127.502	128	100%	51	8.670	0.413	6.800%	17.000%	
Compost+ Co-compost	4	NGOF	9,000,000	32	7062	30000	140.400	140	100%	56	9.547	0.298	6.800%	17.000%	
Total			**32,200,000**	**369**	**56335**	**265218**	**1241**	**1060**	**85%**	**399**	**58.983**	**0.160**	**5.566%**	**14.793%**	**26.85**

Source: Adapted from the data provided by BRAC-HCMP and NGOF (November 2023)

6.4 Cost Estimation, Revenue and Profitability Analysis

6.4.1 Business as Usual

Two basic assumptions are made in this condition.
(1) All the produced compost would be sold at 5 Tk/kg and
(2) sensitivity is shown until maximum capacity 80 ton from 59 ton/m

Table 19 Business as usual scenario (baseline condition)

Code	Cost item	Total (Tk/m)	Compost production, t/m	Operating production cost, Tk/kg	Compost sells @5 Tk/kg	Profit or loss per month (W/O Marketing, @ 5 Tk/kg)	Current profit or loss @5 Tk/kg	HH Coverage	Breakeven	Service Charge Tk/HH
Collection	Collection Staff Salary (volunteer, staff)	2,250,800.00	59	74.22	295,000	(4,083,800)	-69.22	56335	0	-72.49
	Collection Maintenance	-	60	72.98	300,000	(4,078,800)	-67.98	56335	0	-72.40
	Fuel	-	61	71.78	305,000	(4,073,800)	-66.78	56335	0	-72.31
	PPE		62	70.63	310,000	(4,068,800)	-65.63	56335	0	-72.23
	Other	130,000.00	63	69.50	315,000	(4,063,800)	-64.50	56335	0	-72.14
Production	Salary (staff & labor)	1548000	64	68.42	320,000	(4,058,800)	-63.42	56335	0	-72.05
	Maintenance	0	65	67.37	325,000	(4,053,800)	-62.37	56335	0	-71.96
	Fuel	0	66	66.35	330,000	(4,048,800)	-61.35	56335	0	-71.87
	Office Stationery	0	67	65.36	335,000	(4,043,800)	-60.36	56335	0	-71.78
	Packaging		68	64.39	340,000	(4,038,800)	-59.39	56335	0	-71.69
	Utilities		69	63.46	345,000	(4,033,800)	-58.46	56335	0	-71.60
	FS Collection	450000	70	62.55	350,000	(4,028,800)	-57.55	56335	0	-71.52
Marketing	Transportation from plant to dealer point		71	61.67	355,000	(4,023,800)	-56.67	56335	0	-71.43
	Staff salary	*0*	72	60.82	360,000	(4,018,800)	-55.82	56335	0	-71.34
	Awareness cost	*0*	77	56.87	385,000	(3,993,800)	-51.87	56335	0	-70.89
	Advertisement	*0*	78	56.14	390,000	(3,988,800)	-51.14	56335	0	-70.81
Total operating cost		4,378,800.00	79	55.43	395,000	(3,983,800)	-50.43	56335	0	-70.72
			80	54.74	400,000	(3,978,800)	-49.74	56335	0	-70.63

Assuming the conditions mentioned before it is seen, there is proportional relationship, with the increase of the production, there a decrease of operating cost or production cost. As per slope of the graph trend line, it is nearly 1 Tk/kg is possible to reduce with per ton increase in compost production, as shown in Figure 4.

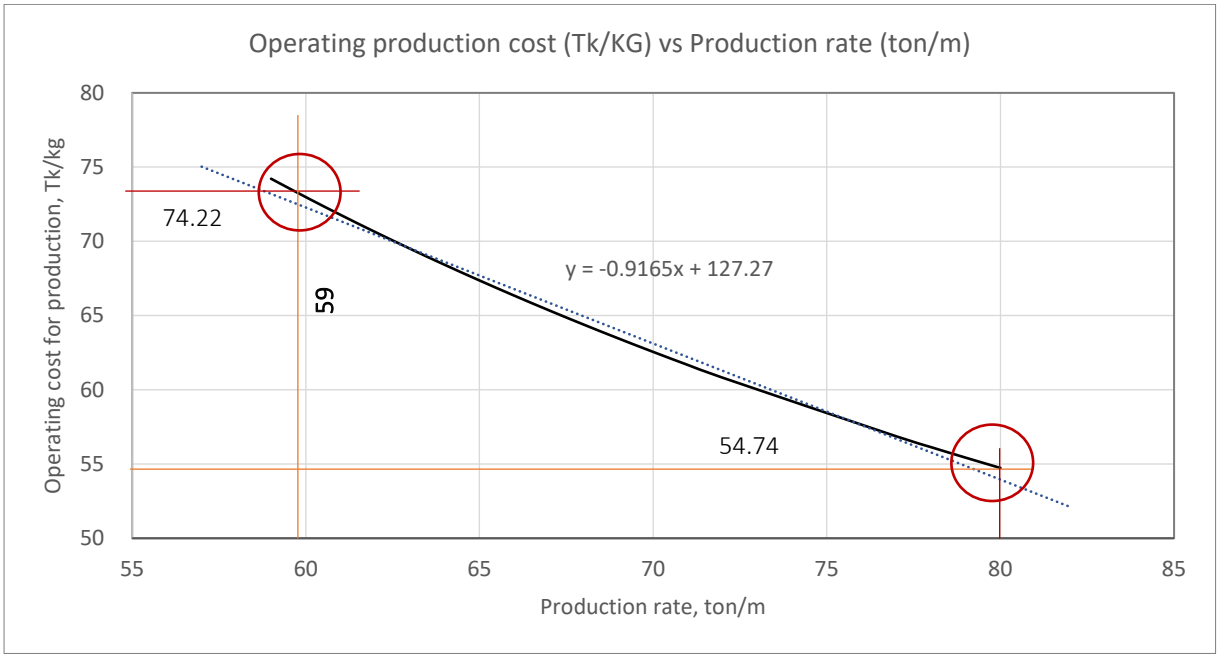

Figure 4 Sensitivity analysis with operating cost for production of compost (Tk/kg) and production rate (ton/m)

6.4.2 Profitability analysis with minor marketing cost

Cost incurring sectors are shown in collection, production, and marketing areas in Table *20*. Additional marketing cost is assumed, and profitability analysis is done considering different assumptions based on the field surveys as shown in the bellow Table.

Table 20 Estimation of itemized cost in collection, production, and marketing segment

Code	Cost item	Unit (Tk/m)	Quantity	Total (Tk/m)
Collection	Collection Staff Salary	8,000 – 10,000*	369	2,250,800.00
	Collection Maintenance			-
	Fuel			-
	PPE			
	Other			130,000.00
Production	Salary (staff & labor)			17,26,000.00
	Maintenance			-
	Fuel			-
	Office Stationery			-
	Packaging			
	Utilities			
	FS Collection			4,50,000.00
Marketing	Transportation from plant to dealer point			
	Staff salary	*15000*	*2*	*30000*
	Awareness cost	*5000*	*10*	*50000*
	Advertisement	*1000*	*5*	*5000*
			Total	4,641,800.00

Note. BRAC spends 8000 Tk/volunteer/m and NGOF spends 10,000 Tk/volunteer/m

There are three different ways of generating revenue: (1) sale of compost, (2) sale of recyclables, (3) collection fees. Based on the KII results, we have assumed a compost sales value of Tk 5/kg excluding marketing and packaging costs. Under the current conditions, there is no revenue from the sale of recyclables, so no data has been included in the estimate.

It is strongly recommended to use the possibility of selling recyclables to increase the income. This can contribute to profitability and reduce the burden of collection fees. However, no collection fee is currently charged, and it is assumed that this is offset by subsidies, or it is indirectly paid by donors. Considering the current situation, the collection fee or subsidy rate per household for collection and composting is estimated to be Tk 77.25 for the 12 MRFs under study break even situation.

Table 21 Revenue estimation composting business

Revenue type	Revenue Source	Quantity/m	Unit	Rate (Tk)	unit	Total (Tk/m)
Sale	Compost sells	59	Ton	5000	Tk/ton	295,000.00
Sale	Recyclable sell	0	Ton	-	Tk/ton	-
Income	Service charge	56335	HH	-	Tk/HH	-
Donation	Subsidies	56335	HH	77.25	Tk/HH	4,351,878.75
					Total	**4,646,878.75**

If we imagine business scenarios 1 to 3, it is difficult to break even just by selling compost. Therefore, if possible, it is recommended to choose scenario 4 (business modality), which does not require any subsidies other than the collection fee.

Various scenarios are possible for profitability analysis. We have examined some of them, which are listed in the following table (Table 22) considering that full collection and operation is handed over to private entity.

According to the respondents, the selling price of the compost is estimated at Tk 5/kg. And at the current compost production rate, at least Tk 77.25 collection fee needs to be collected from each HH. This fee can be adjusted depending on the increase or decrease in compost production rate. Considering the assumption that yearly 5% increase will happen in income and expense, Table 23-28 shows the profitability analysis based on the scenarios 1-6 mentioned in table the table below (profitability scenarios).

Table 22 Example of different profitability scenarios

Scenarios	HH service charge, (Tk/HH)	Monthly Compost production rate (Ton/m)	Compost Sell value (Tk/kg)
S-1	77.25	59	5
S-2	80	59	5
S-3	90	59	5
S-4	100	59	5
S-5	77.25	69	5
S-6	77.25	79	5

Note. Scenarios are developed based on trial and error

Table 23: Business scenario 1 (about breakeven, household service charge @ 77.25 Tk)

	Tk/m	2024	2025	2026	2027	2028	2029	2030
Cost	4,641,800	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890
Revenue	4,646,879	4,879,223	4,879,223	4,879,223	4,879,223	4,879,223	4,879,223	4,879,223
Net income	5,079	5,333	5,333	5,333	5,333	5,333	5,333	5,333

Table 24: Business scenario 2 (household service charge @ 80 Tk)

	Tk/m	2024	2025	2026	2027	2028	2029	2030
Cost	4,641,800	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890
Revenue	4,801,800	5,041,890	5,041,890	5,041,890	5,041,890	5,041,890	5,041,890	5,041,890
Net income	160,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000

Table 25: Business scenario 3 (household service charge @ 90 Tk)

	Tk/m	2024	2025	2026	2027	2028	2029	2030
Cost	4,641,800	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890
Revenue	5,365,150	5,633,408	5,633,408	5,633,408	5,633,408	5,633,408	5,633,408	5,633,408
Net income	723,350	759,518	759,518	759,518	759,518	759,518	759,518	759,518

Table 26: Business scenario 4 (household service charge @ 100 Tk)

	Tk/m	2024	2025	2026	2027	2028	2029	2030
Cost	4,641,800	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890
Revenue	5,928,500	6,224,925	6,224,925	6,224,925	6,224,925	6,224,925	6,224,925	6,224,925
Net income	1,286,700	1,351,035	1,351,035	1,351,035	1,351,035	1,351,035	1,351,035	1,351,035

Table 27: Business scenario 5 (compost production rate 69 ton/m, 77.25 Tk/HH Service Charge)

	Tk/m	2024	2025	2026	2027	2028	2029	2030
Cost	4,641,800	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890
Revenue	4,696,879	4,931,723	4,931,723	4,931,723	4,931,723	4,931,723	4,931,723	4,931,723
Net income	55,079	57,833	57,833	57,833	57,833	57,833	57,833	57,833

Table 28: Business scenario 6 (compost production rate 79 ton/m, 77.25 Tk/HH Service Charge)

	Tk/m	2024	2025	2026	2027	2028	2029	2030
Cost	4,641,800	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890	4,873,890
Revenue	4,746,879	4,984,223	4,984,223	4,984,223	4,984,223	4,984,223	4,984,223	4,984,223
Net income	105,079	110,333	110,333	110,333	110,333	110,333	110,333	110,333

6.4.3 Monthly Cash Flow Analysis

Monthly cashflow is developed to understand balance information at the beginning and at the end of each month with existing as well as assumed income and expense. Hoping to have a positive net cash flow several assumptions are made which are shown in Table 29.

Table 29 Assumption for monthly cashflow analysis of studied 12 MRFs

Assumption component	**Explanation on the assumption**
Compost sells	First month sell, @ 5 Tk/kg, and current compost production, 59 t/m, and constantly increase 2.5% for the rest of the months of first year.
Collection fee, subsidy, donation	Collection service charge, or subsidies per household is estimated 78.055 Tk (total 4,397,228) for 56,335 households monthly, and constantly use the same values for the rest of months of first year.
Recyclable	(1) Recyclables amount is estimated 3.16% of collection based on existing rate, and selling price is assumed 8 Tk/kg which is '0' in current practice Next months for first year, recyclables generation and collection rate is assumed as constant, 3.16%
Plant fixed cost	12 MRF except FSTP-2, the Capex, Fixed cost is estimated as 32,200,000; however, it has not included in the cashflow analysis or business modeling, but small renovation

Assumption component	Explanation on the assumption
	cost is considered. It has considered as free investment without any payback against this fixed cost.
Volunteer salary	Gross monthly volunteers' salary is assumed constant as provided current information (3238000 Tk/m), it is not increased over the months of first year.
Staff salary	Gross monthly Staff salary is assumed constant as provided with current information (560800 Tk/m), it is not increased over the months of first year.
Insurance (health and safety)	Insurance fee is estimated as 12 MRF*6 persons (staff & volunteer) *300 Tk/m; which 21600 Tk/m, and constantly use the same values for the rest of the months for first year.
PPE	hand gloves, apron, gumboots, masks etc. are estimated monthly for 12 plants as 12 MRF*500 Tk/person*4 person, and constantly use the same values for the rest of the months for first year
First Aid Kit refill	Estimated as 12 MRF*(500 Tk/MRF/m) and constantly use the same values for the rest of the months for first year.
Fire extinguisher	Estimated as 11700 for all 12 MRFs and consider only for first month. For the other months of the first year this value is consider as '0'.
Equipment and tools	Estimated as L/S amount 100000Tk/m for 12MRFs for thermometer, moisture meter, weighing machine, shovel, etc., and this is considered only for first month and for the rest of the months of first year this value is consider as '0'.
Repair and maintenance	Estimated as 2000 Tk/MRF/m*12MRF, which is a total of 24000 Tk/m and constantly use the same values for the rest of the months of first year. It is assumed for the template development. However, it can be actualized based on the situation.
Renovation	For all months of first year this value is consider as '0'
Utilities	For solar, water etc., estimated as 300 Tk/MRF/m*12MRF, totaling 3600 Tk/m, and constantly use the same values for the rest of the months of the first year.
Packaging	Per unit packing cost is assumed as 1 Tk/kg and it is directly proportional to the compost production or packing amount
Administrative and office expense	Estimated as (500 Tk/MRF/m)*12MRF, and constantly use the same values for the rest of months of first year.
FS collection	as provided 450000 Tk/MRF (i.e., co-compost plant), and constantly use the same values for the rest of the months of first year.
Transport/distribution	Per unit transportation cost is assumed 1.5 Tk/kg, it is directly proportional to the compost production or distribution amount within Cox's Bazar
Marketing staff (2 person)	Estimated for 2 marketing staff @ 2*15,000 Tk/person/month total 30000 Tk/m, and constantly same for the rest of the months of first year.
Training / workshops	Combinedly 5000 Tk/m is estimated for training of operators and volunteers, workshops for user's groups, farmers, joining DAE training etc. And constantly use the same values for the rest of the months of a year
Awareness cost	Monthly 1000 Tk combinedly estimated and constantly use the same values for the rest of months of a year. Awareness costs are associated with joining environmental fairs, promotional campaigns etc.
Advertisement	Combinedly 500 Tk/m is estimated for miking, printing, social marketing etc.
Regular testing	Estimated as (6300 test fee Tk/sample) *12 MRF totaling 75600 Tk/m, and constantly use the same values for the rest of the months of the year. However, for co-compost test fee will increase to 17,500 at DU lab instead of 6,300 at SRDI lab. SRDI Dhaka central lab rejected Co-compost at this moment. Additional charge for pathogens will be used like E-coli charge @ 3000 Tk/sample at DU lab.
Permission/registration	Challan fee 1500, 3 sample in 3 specific labs costing 6300 Tk/sample*3, EIA cost minimum 100,000, BSCIC/DIFE fee / clearance 10,000; total at 130,400 Tk/yr. first time cost will require. It will be '0' for the rest of the months and year after getting registration. However, this fee is conservative estimation it will fluctuate drastically for EIA. As for example, EIA cost for some consulting companies will be very high and it depends on negotiation.
Registration renewal	It is assumed '0'
other (contingency)	Combinedly 130,000 Tk/m is needed currently and, constantly 5% is increased for rest of the months of a year.

Table 30: Monthly cash flow analysis in Bangladesh Tk

	Months	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24
	Starting balance	0	(4)	260,879	525,541	794,076	1,066,581	1,343,155	1,623,900	1,908,920	2,198,323	2,492,218	2,790,717
Cash inflows	Compost sells	295,000	302,375	309,934	317,683	325,625	333,765	342,110	350,662	359,429	368,415	377,625	387,066
	Collection fee (subsidy)	**4,397,228**	**4,397,228**	**4,397,228**	**4,397,228**	**4,397,228**	**4,397,228**	**4,397,228**	**4,397,228**	**4,397,228**	**4,397,228**	**4,397,228**	**4,397,228**
	Recyclable	267,968	267,968	267,968	267,968	267,968	267,968	267,968	267,968	267,968	267,968	267,968	267,968
	Total inflows	**4,960,196**	**4,967,571**	**4,975,131**	**4,982,879**	**4,990,821**	**4,998,962**	**5,007,306**	**5,015,859**	**5,024,625**	**5,033,611**	**5,042,821**	**5,052,262**
Cash outflow	Plant fixed cost	32,200,000	**0**	0	0	0	0	0	0	0	0	0	0
	Volunteer salary	*3,238,000*	*3,238,000*	*3,238,000*	*3,238,000*	*3,238,000*	*3,238,000*	*3,238,000*	*3,238,000*	*3,238,000*	*3,238,000*	*3,238,000*	*3,238,000*
	Staff salary	*560,800*	*560,800*	*560,800*	*560,800*	*560,800*	*560,800*	*560,800*	*560,800*	*560,800*	*560,800*	*560,800*	*560,800*
	Insurance: health & safety	21,600	0	0	0	0	0	0	0	0	0	0	0
	PPE	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000
	First Aid Kit refill	500	500	500	500	500	500	500	500	500	500	500	500
	Fire extinguisher	11,700	0	0	0	0	0	0	0	0	0	0	0
	Equipment and tools	100,000	0	0	0	0	0	0	0	0	0	0	0
	Repair and maintenance	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000
	Renovation	0	0	0	0	0	0	0	0	0	0	0	0
	Utilities	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600
	Packaging	59,000	60,475	61,987	63,537	65,125	66,753	68,422	70,132	71,886	73,683	75,525	77,413
	Administrative expense	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
	FS collection	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000
	Transport/distribution	88,500	90,713	92,980	95,305	97,687	100,130	102,633	105,199	107,829	110,524	113,287	116,120
	Marketing staff (2 person)	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
	Training / workshops	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
	Awareness cost	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
	Advertisement	500	501	502	503	504	505	506	507	508	509	510	511
	Regular testing	75,600	75,600	75,600	75,600	75,600	75,600	75,600	75,600	75,600	75,600	75,600	75,600
	permission/registration	130,400	0	0	0	0	0	0	0	0	0	0	0
	registration renewal	0	0	0	0	0	0	0	0	0	0	0	0
	other (contingency)	*130,000*	136,500	136,500	136,500	136,500	136,500	136,500	136,500	136,500	136,500	136,500	136,500
	Total outflows	**4,960,200**	**4,706,689**	**4,710,469**	**4,714,344**	**4,718,316**	**4,722,388**	**4,726,561**	**4,730,838**	**4,735,222**	**4,739,716**	**4,744,322**	**4,749,044**
	Net cashflow	**(4)**	**260,883**	**264,662**	**268,535**	**272,505**	**276,574**	**280,745**	**285,021**	**289,403**	**293,895**	**298,499**	**303,218**
	Closing balance	**(4)**	**260,879**	**525,541**	**794,076**	**1,066,581**	**1,343,155**	**1,623,900**	**1,908,920**	**2,198,323**	**2,492,218**	**2,790,717**	**3,093,935**

Note. Since it is considered for monthly, therefore NPV, IRR is not calculated. IRR is calculated for yearly cashflow in the next section, please see next tables.

6.4.4 Yearly Cash Flow Analysis

Yearly cashflow analysis is done to understand balance information at the beginning and at the end of each year with some actual and assumed incomes and expenses. Hoping to have a positive net cash flow several assumptions are made which are shown in Table 29.

Table 31 Assumption for yearly cashflow analysis of studied 12 MRF

Assumption component	Explanation on the assumption
Compost sells	First year sell, @ 5 Tk/kg, and would be 18.2272% of current compost production, 59 t/m, for the rest of the years, assumption is maximum 80 t/m and sells @ 8 Tk/m
Collection fee, subsidy, donation, Tk	(1) Collection service charge, or subsidies per household is estimated 78.055 Tk (total 52766741.1) for 56,335 households. (2) In the successive years, reduction of subsidies is estimated @ 4% and 2 % for NPV & IRR calculation
Recyclable (3.16% collection)	(1) Recyclables amount is estimated 3.16% of collection based on existing rate, and selling price is assumed 8 Tk/kg which is '0' in current practice (2) Next year's recyclables generation and collection rate is assumed as constant, 3.16%
Plant fixed cost	(1) 12 MRF except FSTP-2, the Capex, ***Fixed cost*** is estimated at 32,200,000; however, it has *not included in the cashflow analysis* or business modeling, but small renovation cost is considered. It has considered as free investment without any payback against this fixed cost.
Volunteer salary	Gloss yearly volunteers' salary is assumed constant as provided current information (38856000 Tk/yr.), it is not increased over the years
Staff salary	Gloss yearly Staff salary is assumed constant as provided current information (6729600 Tk/yr.), it is not increased over the years
Insurance (health and safety)	Insurance fee is estimated as 12 MRF*6 persons (staff & volunteer) *300 Tk/m*12m; which 259,200 Tk/yr., and constantly use the same values for the rest of years
PPE	hand gloves, apron, gumboots, masks etc. are estimated for 12 plants as 12 MRF*500 Tk/person*4 person*12 m, and constantly use the same values for the rest of years
First Aid Kit refill	Estimated as 12 MRF*(500 Tk/MRF/m) *12m and constantly use the same values for the rest of years
Fire extinguisher	Estimated as 1700 Tk/MRF/yr.*12MRF, and constantly use the same values for the rest of years
Equipment and tools	Estimated as L/S @ 12MRF*(25000 Tk/MRF/yr.) for thermometer, moisture meter, weighing machine, shovel, etc., and constantly use the same values for the rest of years
Repair and maintenance	Estimated as 1541.67 Tk/m*12m*12MRF which is total 222,000 Tk/yr. for all MRF, and constantly use the same values for the rest of years
Renovation	For the first year, estimated as 12 MRF*20,000 Tk/yr./MRF, totaling 240,000 Tk/yr., and '0' use for rest of the years
Utilities	For solar, water etc., estimated as 300 Tk/MRF/m*12m*12MRF, totaling 43,200, and constantly use the same values for the rest of years
Packaging	Per unit packing cost is assumed as 1 Tk/kg and it is directly proportional to the compost production or packing amount
Administrative and office expense	Estimated as (500 Tk/MRF/m)*12MRF, and constantly use the same values for the rest of years
FS collection	as provided 5,400,000 Tk/MRF (i.e., co-compost plant), and constantly use the same values for the rest of years
Transport/distribution	Per unit transportation cost is assumed 1.5 Tk/kg, it is directly proportional to the compost production or distribution amount within Cox's Bazar
Marketing staff (2 person)	Estimated for 2 marketing staff @ 2*15,000 Tk/person/m*12 m/yr. total 360,000 Tk/yr., and constantly increase 5% for the rest of years
Training / workshops	Combinedly 5000 Tk/m*12 m/yr. as 60,000 Tk/yr. is estimated for training of operators and volunteers, workshops for users' groups, farmers, joining DAE training etc. And constantly use the same values for the rest of years
Awareness cost	Monthly 1000 Tk combinedly estimated for 12 months, and constantly use the same values for the rest of years. Awareness costs are associated with joining environmental fairs, promotional campaigns etc.
Advertisement	Combinedly 500 Tk/m*12 m total 6000 Tk/yr. is estimated for miking, printing, social marketing etc.
Regular testing	Estimated as (6300 test fee Tk/sample) * 3 times/yr.*12 MRF totaling 226,800 Tk/yr., and constantly use the same values for the rest of years. However, for co-compost test fee will increase to 17,500 at DU lab instead of 6,300 at SRDI lab. SRDI Dhaka central lab rejected

Assumption component	Explanation on the assumption
	Co-compost at this moment. Additional charge for pathogens will be used like E-coli charge @ 3000 Tk/sample at DU lab.
Permission/registration	Challan fee 1500, 3 sample in 3 specific labs costing 6300 Tk/sample*3, EIA cost minimum 100,000, BSCIC/DIFE fee / clearance 10,000; totaling 130,400 Tk/yr. first time cost will require. It will be '0' for the rest of the years after getting registration. However, this fee is conservative estimation it will fluctuate drastically for EIA. As for example, EIA cost for some consulting companies will be very high and it depends on negotiation.
Registration renewal	After the registration year, 10,000 Tk/yr. will be required for renewal fee, which may change over time but has not been declared yet by the government.
Other (contingency)	Combinedly 130,000 Tk/m is needed currently and for 12 months estimated as 130,000*12, totaling 1,560,000 Tk/yr. for all MRF. Constantly 5% is increased for rest of the years.

Table 32: Yearly cash flow analysis in Bangladesh Tk

	Years	Jan-24	Jan-25	Jan-26	Jan-27	Jan-28	Jan-29	Jan-30	Jan-31	Jan-32	Jan-33
	Starting balance	0	(0)	5,613,822	10,092,616	13,452,027	15,707,033	16,871,943	16,960,391	15,985,329	13,959,023
Cash inflows	Compost sells	645,243	7,680,000	7,680,000	7,680,000	7,680,000	7,680,000	7,680,000	7,680,000	7,680,000	7,680,000
	Collection fee, subsidy, donation	**52,766,741**	**51,711,406**	**50,677,178**	**49,663,635**	**48,670,362**	**47,696,955**	**46,743,016**	**45,808,155**	**44,891,992**	**43,994,152**
	Recyclable	3,215,616	3,215,616	3,215,616	3,215,616	3,215,616	3,215,616	3,215,616	3,215,616	3,215,616	3,215,616
	Total inflows	**56,627,600**	**62,607,022**	**61,572,794**	**60,559,251**	**59,565,978**	**58,592,571**	**57,638,632**	**56,703,771**	**55,787,608**	**54,889,768**
Cash outflow	**Plant fixed cost**	**32,200,000**	0	0	0	0	0	0	0	0	0
	Volunteer salary	*38,856,000*	*38,856,000*	*38,856,000*	*38,856,000*	*38,856,000*	*38,856,000*	*38,856,000*	*38,856,000*	*38,856,000*	*38,856,000*
	Staff salary	*6,729,600*	*6,729,600*	*6,729,600*	*6,729,600*	*6,729,600*	*6,729,600*	*6,729,600*	*6,729,600*	*6,729,600*	*6,729,600*
	Insurance: health & safety	259,200	259,200	259,200	259,200	259,200	259,200	259,200	259,200	259,200	259,200
	PPE	288,000	288,000	288,000	288,000	288,000	288,000	288,000	288,000	288,000	288,000
	First Aid Kit refill	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000
	Fire extinguisher	20,400	20,400	20,400	20,400	20,400	20,400	20,400	20,400	20,400	20,400
	equipment and tools	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
	Repair and maintenance	222,000	222,000	222,000	222,000	222,000	222,000	222,000	222,000	222,000	222,000
	Renovation	240,000	0	0	0	0	0	0	0	0	0
	Utilities	43,200	43,200	43,200	43,200	43,200	43,200	43,200	43,200	43,200	43,200
	Packaging	708,000	960,000	960,000	960,000	960,000	960,000	960,000	960,000	960,000	960,000
	Administrative	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000
	FS collection	5,400,000	5,400,000	5,400,000	5,400,000	5,400,000	5,400,000	5,400,000	5,400,000	5,400,000	5,400,000
	Transport/distribution	1,062,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000
	Marketing staff (2 person)	360,000	378,000	396,900	416,745	437,582	459,461	482,434	506,556	531,884	558,478
	Training / workshops	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
	Awareness cost	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000
	Advertisement	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
	Regular testing	226,800	226,800	226,800	226,800	226,800	226,800	226,800	226,800	226,800	226,800
	Permission/registration	130,400	0	0	0	0	0	0	0	0	0
	Registration renewal	0	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
	other (contingency)	*1,560,000*	1,638,000	1,719,900	1,805,895	1,896,190	1,990,999	2,090,549	2,195,077	2,304,830	2,420,072
	Total outflows	**56,627,600**	**56,993,200**	**57,094,000**	**57,199,840**	**57,310,972**	**57,427,661**	**57,550,184**	**57,678,833**	**57,813,914**	**57,955,750**
	Net cashflow	**(0)**	**5,613,822**	**4,478,794**	**3,359,411**	**2,255,006**	**1,164,910**	**88,448**	**(975,062)**	**(2,026,306)**	**(3,065,982)**
	Closing balance	(0)	5,613,822	10,092,616	13,452,027	15,707,033	16,871,943	16,960,391	15,985,329	13,959,023	10,893,041

It is seen that even though business support is assumed as usual considering subsidies or collection fees that covers entire operation of collection and composting it may be feasible to run the business continuation of such support and if the compost could be sold all. However, if we imagine that support would be gradually reduced it is seen that it should not be more than a 4% reduction. At 4% support reduction NPV shows negative. At 2% support reduction NPV is positive, but IRR shows a loss as shown in Table 33.

Therefore, it can be concluded that this business is not financially viable at current circumstances without enough service charge collection that can be offset by enough subsidies as shown in monthly cashflow analysis where net cashflow shows positive values with balance.

Table 33: Business decision based on yearly cash flow analysis

Decision parameter	Parameter value (condition 1)	Parameter value (condition 2)
Yearly investment	52,766,741	52,766,741
Yearly reduction of investment	4%	2%
Discount rate	5%	8%
NPV	Negative	Positive
IRR	No need to calculate	-16%
Decision (Yes/No)	No	No
Interpretation	Subsidies or investments yearly is needed for composting business	

However, if operator is appointed the collection fees would be required to subsidized fully.

6.5 Packaging

Compost packs come in different sizes, and larger options, such as 10 – 40 kg packs are more common in rural areas. In urban areas, smaller packs (under 5 kg) are usually offered, with 1-2 kg packs being the best sellers. Woven plastic bags are the recommended option due to their affordability (Tk 40 for 40 kg, Tk 30 for 20 kg, Tk 20 for 10 kg including branding and messages).

Jute bags are environmentally friendly but have difficulty maintaining a constant moisture level. Laminating the inside of jute bags with plastic improves moisture retention, but increases costs and reduces stability, which often leads to tears. Therefore, the study team recommends using woven plastic bags for compost packaging.

Another disadvantage of jute bags is the difficulty of printing the standards of the compost on the surface, which is easily possible with woven bags. However, the study team could not find any standard or specification for compost packaging set by the government.

Figure 5: Existing Packaging of Trico Compost of ACI
Source: EEL Study Team

The study team did not find a viable paper bag for compost or a suitable paper bag for compost on the current market. Paper bags are not recommended due to their susceptibility to wear and tear.

When selecting the packaging material, it should be noted that it must guarantee a constant level of humidity. Seasonal fluctuations, transportation and weather influences can lead to an increase in moisture in the compost if it is not properly packed. Respondents stated that if the marketed compost does not meet the moisture standards set by the government, it can be considered a violation of the law. And in such a case, the government has the right to take regulatory action against the marketing company.

6.6 Business Model Canvas

A business model canvas for compost/co-compost has been developed and presented in the table below.

Table 34 BRAC-HCMP Compost/Co-compost business model canvas

<table>
<tr><td colspan="2" rowspan="2">BRAC-HCMP Compost /
Co-Compost Business Model Canvas</td><td>Designed for:</td><td>Designed by:</td><td>Date:</td><td>Version:</td></tr>
<tr><td>BRAC – HCMP</td><td>EEL</td><td>Dec 2023</td><td>V1</td></tr>
<tr><td rowspan="2">Key Partners

BRAC-HCMP, NGOF, WASH-sector, ISCG, UNHCR,UNICEF, IOM, BFA, ACF, CARE, DSK, ANADO, TdH, NABALOK, SHED,SRDI, DU, BINA, BRRI, BARC, DoE, BSCIC, DIFE, BFD, PWD, LGD, LGED, ACI, Northen Agro services, MATI, etc.Private entity</td><td>Key Activities

Waste collection, segregation, compost/co-compost production Testing, certification, renewal of registration, monitoring, demand creaton, collaboration/ partnership, customer relation marketing, packaging, distribution</td><td rowspan="2">Value Propositions

কক্সবাজার জেলার মাটির জৈব গুণাবলি বৃদ্ধির মাধ্যমে কৃষিকে সমৃদ্ধ করতে, ব্র্যাক-এইচসিএমপি উন্নত পুষ্টিগুণ সম্পন্ন জৈব সার উৎপাদন করছে। যা সরকার কর্তৃক নির্ধারিত মানমাত্রা নিশ্চিত করে মাটির উর্বরতা বৃদ্ধিতে ভূমিকা রাখবে। কক্সবাজারের বায়ু পানি এবং মাটি দূষণ নিয়ন্ত্রণের লক্ষ্যে, একটি উন্নত বর্জ্য ব্যবস্থাপনা পদ্ধতির মাধ্যমে এই জৈব সার তৈরি হচ্ছে। কৃষি ও পরিবেশ রক্ষায় যতটা সম্ভব ব্যবহার করুন। সরবরাহ ফুরিয়ে যাওয়ার আগে কিনুন এবং অন্যকে আনুপ্রানিত করুন।</td><td rowspan="2">Customer Relationships

Farmers group formation, Farmers Training and workshop, DAE meeting, Join DAE training/ workshop, Facebook, awarness with fastoon, Banners, participate agri fares, Take stalls in environmental fare, Send samples other Partners, piloting and demonstraion Plot etc.

Channels
Direct communciation, through dealers, DAE projects, DAE trainings, traders, BFD, Use Key Parners existing netwrok and agri-Projects, within camps with RRRC, and CICs</td><td colspan="2" rowspan="2">Customer Segments

Agriculture: DAE projects, farmer Group,
Forest: BFD-Cox’s Bazar
Rohingya Camp: FAO, ISCG, WA Sector etc.</td></tr>
<tr><td>Key Resources
Human reousrces: social bobilizer, volunteer, plant operator, supervvirsor, mehcanics, marketing staff, dealer/trader
Operational logistics:
collection vehicle, packing machine, packaging material, thermometer, weighing gauge, moisture meter, fire extinguisher, first aid kit, PPE, utilities basic tools etc.
Intellectual resources: brand patent, Copyright, guideline & manual for worker, certifications, MIS,
Financial: campex, opex</td></tr>
<tr><td colspan="3">Cost Structure
Collection: Salary of staff and voluenter, maintaince, fuel, PPE, insurance
Production: Salary of staff and voluenter, maintaince, fuel, PPE, office stationaries, packageing (1 Tk/kg), FS collection, renovation of the exiting facility Whereever needed, utilities, equipments & tools, extinguisher, insurance
Marketing: Transportation (1.5 Tk/kg) from plant to deller/trader point, staff salary, awarness, registration, testing (3 sample at 3 labs @ 6300 Tk), insurnace</td><td colspan="3">Revenue Streams

Compost/Co-compost sale (5 Tk/kg at plant, around 10 Tk at dealer point)
Income from recycleable (if possible, 3.16% @ 8Tk/kg)
Income from service charge (i.e., collection fee or donation/subsidies)</td></tr>
</table>

7. IMPLEMENTATION PLAN

Establishing a sustainable and eco-friendly compost/co-compost business requires a strategic plan. Here's a step-by-step plan to guide towards success:

(1) **Source segregation:**

- Household level: While complete source segregation may not be possible, prioritize community awareness and education campaigns. Promote techniques like using separate bins for organic and inorganic waste as introduced in most of the camps.
- Plant-based segregation: Implement a robust sorting system within the compost plant. Utilize trained plant operators to refine incoming waste with screen.

(2) Separate waste collection:

- Separate collection equipment: Need to establish separate collection equipment like dual chamber for organic and inorganic waste collection.
- Hazardous waste removal: Establish a dedicated hazardous waste collection system with proper storage and disposal protocols aimed at upcoming waste to the compost/co-compost plant free from hazardous substances like batteries, mercury bulb, PCBs etc.

(3) Continuation compost production

- Compost production is suggested a continuous and synchronized process across all Material Recovery Facilities (MRF) utilizing shared benchmarking metrics including mixing, cutting, transporting, watering, turning, screening, maturing, monitoring, and storing. Throughout these processes, consistent efforts must be made to enhance both the quality and quantity of the compost produced. This necessitates increased collection rates, improved collection efficiency, and optimized sorting performance. By implementing these improvements, the compost production process can be optimized for greater efficiency and effectiveness.

(4) Renovating of compost plat

- Upgradation: Conduct a thorough evaluation of existing plant infrastructure, equipment, and capacity. Existing plant capacity seems low or underutilized compared to space and waste generation, collection, and compost production. The study team suggests avoiding box composting with window composting on flat floors with multilayer waste piling. Existing composting methods show difficulties in maintaining temperature, airflow, and moisture.

(5) Labor productivity rationalization

- Labor productivity indicators need to be checked and optimized through proper survey and trial run like labor-hour for per unit of waste collection, or labor-hour/per unit of compost production. Existing productivity seems low compared with plant capacity, labor spend, time consumed, and the compost produced.

(6) Data-Driven Decisions

- Monitoring and Logging: Maintain a comprehensive system to track incoming waste by category (organic, inorganic, inert, hazardous etc.), record compost production volumes, and monitor key parameters like temperature and moisture. Existing record keeping system in most of the plants are found comprehensive, but it needs regular digitization, if possible.

(7) Registration / Certification

- Registration/Certification: Familiarization with relevant regulations and requirements for compost production and trade as stipulated in Chapter 6. And begin the registration and certification process once compost is meeting necessary standards.
- Timeline and Flexibility: It may take 1–2 years for certification. If immediate trading isn't crucial, consider initial partnerships with traders and focus on certification later. If BRAC-HCMP wishes to get certification in such a case, BRAC can follow the detailed procedures (Chapter 6).
- Study team suggests hand over the compost to a suitable trading partner who already have marketing certification[27].

(8) Building Partnerships:

There are three important functional stages that are suggested to follow: internal partnership establishment, Dealers network establishment, and Trader's link establishment. However, modality of the business case may not require following all the stages. Internal partnership is highly recommended along with Trader link establishment. In such a case stage two (ii) might be avoided. After getting registration from the government stage two (ii) may be incorporated.

(i) Internal partnership: 78 MRFs are located within the camps. It might be wise to collaborate among all MRF and make common body under WASH sector with the representatives from IPs so that bulk of compost can be stored in common storing place (s). It will be easy to establish connection with dealers/traders under the approval of RRRC, CiCs etc. authorities.

(ii) Dealer Network: In case of directly accessing to the market, it is necessary to establish relationships with reliable existing dealers, distributors, and marketing personnel.

(iii) Link with Traders: Need to establish linkage with traders in case of trading by others.

(9) Packaging:

- Though there is no specific process or instruction on packing set by the government; however, at the end of certification and before starting the marketing, the government wants to see the packet with content messages.
- Design packaging that reflects brand identity, effectively protects the compost, and provides clear information for consumers on the important properties set by government.

(10) Marketing:

Marketing will involve a wide variety of tasks and they will have to be actualized based on the implementation situation. However, common, and important suggestions are as follows:

- educational campaign (workshops, seminars, farmers training)
- demonstration and trial (e.g., winter vegetables)
- show case evidence for improve crip yield and soil health (e.g., battle leaf garden, *Pan Baraz*)
- collaboration with DAE (e.g., understand their guidelines)
- digital marketing (website and social media) for social business
- continue effective networking.
- customer support

[27] Office Order of registration or renewal for production, import, storage, distribution, marketing or sale of fertilizers, DAE12.10.0000.006.40.148/13/10496(83) 2 (2015).

8. SWOT ANALYSIS OF COMPOST/CO-COMPOST

Table 35 Strength and Weakness of co-compost/compost around acceptability and production in camps

Strength	**Weakness**
(1) Adaptability of abundant Feedstock (2) Environmental Benefits (3) Economic Opportunity (4) Improved Public Health with waste management. (5) Local Market Demand (6) Contribution to SDG Goals and seek support. (7) Creating Employment Opportunities both host communities and FDMNs (8) Promoting sustainable agriculture / organic farming (9) Building stakeholders & community partnership (10) High initial investment is already made	(1) Technical expertise (2) Continuous standard monitoring and maintenance is difficult as per guidance of Fertilizer (Management) Act, 2006. (3) High operation cost (existing) (4) Low productivity or efficiency (existing) (5) Improper segregation (6) Less organic content in waste mix (7) No supplementary income (e.g., recyclable or service charge etc.) (8) Compost process is labor intensive. (9) Less preference of co-compost (10) P, K are than government standards in compost. (11) Capacity is low if individual IP operates. (12) Consumer awareness is low. (13) Not included yet in government procuring material lists (e.g., rate schedule of LGED, PWD, municipality etc.) (14) No clear permission or office order at this moment, to take out co-compost/compost from FDMN camps to use in host communities. (15) Time-consuming and complicated formalization process (e.g., registration, permission, standardization etc.) (16) Existing market players are also having difficulties selling. (17) Competition with chemical fertilizer (18) Fear of health risks / communicable disease vectors (e.g., SRDI central lab does not want to test co-compost) (19) Limited scope of financing / collection fees in camps

Table 36 Strength and Weakness of co-compost/compost around opportunity and threat in camps

Opportunity	**Threat**
(1) Promote co-compost/compost in the camps landscaping. (2) Selling or sharing co-compost/compost to other sector projects within camps and Vashan char camp (3) There is scope to bring composted faecal sludge to the MRFs to make co-composts. (4) Continuous research and development scope (5) Develop partnership with local farmers. (6) Maximize use in reforestation, plantation, and homestead gardening within camps. (7) Explore carbon credit opportunities through the development of carbon accounting model. (8) Develop innovative co-compost/compost with black soldier fly and addition of fertilizing minerals. (9) Develop strong brand identity to save soil health of Cox's Bazar. (10) Capacity building (11) Make partnership with DAE, Universities for production, promotion, and research & development. (12) Since there are many plants (MRF) so good practices and new findings can be disseminated in other parts of the country and world, which eventually enhance acceptability of the co-compost/compost	(1) If co-compost is emphasized without ensuring the sufficient acceptability and awareness of the farmers, it might hinder overall acceptance or compost demand made from organic solid waste. (2) Mismanagement and contamination with pathogenic, heavy metal etc. (3) Labors health risk (4) If the quality is not ensured for compost/co-compost, government will have right to cancel the registration or consider the incidence as 'offense'. As for example, if packaging if not adequate, high moisture % may prevail. (5) Inadequate knowledge and limited market outreach (6) Financial viability is very difficult and price increase of compost is difficult in existing market. (7) Lack of clear policy stipulation for co-compost, as for example, suggestions for pathogenic tests are not mentioned in current compost quality parameters which is very important. (8) If external support withdraws, business might fail eventually. (9) New co-compost/compost will need on due payment to the dealer point which is risky for many entrepreneurs or private sectors.

9. FEASIBILITY RECOMMENDATIONS

Several feasibility recommendations are found in this study, they are summarized in the following.

9.1 Plant Renovation and Functionality

(1) *Plant renovation* for enhanced capacity and smooth functionality (i.e., users' friendly composting process)
(2) Operational and monitoring *tools and logistics* should be sufficient and accurately functional.
(3) Implement a comprehensive *separate collection system* of organic and inorganic waste, maximizing the availability of feedstock for compost production and minimizing contamination issues. Enhance *separation of waste* at sources and segregated collection
(4) Check feasibility of *semi mechanization* where plant has capacity and potential to receive high amount of feed stock like Camp 4.
(5) Encourage to use traditional ***open windrow composting*** by using triangular windrows (where the arms of windrow can be around 1.5′ and length 8′ to 10′). It can be multilayers hips with multiple windows if possible.

9.2 Marketing

(1) The viability of compost business to be enhanced through *minimizing the cost* (e.g., labor, staff etc.) and *maximizing the income* (e.g., compost sell, imposing collection fee or subsidized collection fees, incentives,).
(2) More networking and partnership effort is needed to *inject compost in the government procurements* like forest department, DAE, local governments landscaping etc.
(3) *Local and national level campaigns and social movement*s are needed for incorporating Compost in government procurement. Currently, compost is not listed in the price list (i.e., rate schedule) of the Local Government Engineering Department (LGED) and Public Works Department (PWD). However, there is rate of cow dung in Arboriculture component of PWD rate schedule.
(4) Form *common association / platform among all MRFs' operating IPs* in the mode of bundling (i.e., joining all). And make partnership with traders or dealers, and hand over compost/co-compost regularly. In the case of appointment of dealers, a marketing entity is required to appoint or such marketing jobs to be undertaken by the IPs. Another scenario can be recommended to engage a private operator to market the IPs operated compost/compost who will market as traders. Another approach could be to hand over the plants to a private operator who takes all responsibilities of collection, production, and marketing, but some years of support would be required to provide.

Table 37: Different business modalities

Busine modality option	**BRAC-HCMP or IPs**	**Private entity**	**Remarks**
Scenerio-1	Self-effort marketing & dealers' appointment	Dealer	IPs follow govt. registration, Dealers should be BFA member
Scenerio-2	Partnership and hand over the produced compost/co-compost to trader	Trader	Traders follow government regulation and responsible for marketing
Scenerio-3	Appoint a marketing company	Marketing Company	Marketing company may work as a trader or collaborate with a trader

Busine modality option	BRAC-HCMP or IPs	Private entity	Remarks
Scenerio-4	Appoint an operator who may already have a marketing license	Operator	Operator will take full operation of collection, production, and marketing. Operator may directly appoint/distribute through dealers or collaborate with existing trader.

9.3 Nutrient enhancement - Phosphorous(P) & Potassium(K) improvement

(1) Introduce black solider fly (BSF) in the compost/co-compost plants[28].
(2) Add diverse organic materials organic materials (vegetable waste, leaves etc.) in the compost pile. This diversity can help balance nutrient content. Yard waste, such as leaves and grass clippings, can contribute to the overall nutrient profile of the compost.

Potassium enrich waste	Phosphorus enrich waste
Banana peel, wood ash, potato peels, seaweeds[29], plant residues[30], etc.	Crushed bones, fish bones, eggshells, manure, rice husks etc.

(3) Include livestock manure such as cow or poultry manure. These can be rich sources of both phosphorus and potash. BRAC-HCMP needs to ensure that the manure is properly aged or composted to prevent pathogens and odors.
(4) Using ash from wood or crop residues can be a good source of potash. It is necessary to be cautious about using too much ash, as excessive amounts can raise the pH of compost, potentially making it too alkaline for some plants. Therefore, trail tests are needed batch and MRF wise in different camps.
(5) When adding materials like eggshells or bones, it is recemented to crush or grind them into smaller pieces to accelerate decomposition and nutrient release.
(6) Ensure that the carbon-to-nitrogen (C/N) ratio in compost pile remains balanced (around 25-30:1). A balanced C/N ratio helps microbes break down organic matter efficiently, releasing nutrients.
(7) Turning the compost pile aerates it and promotes decomposition and regular turning also helps distribute nutrients evenly and making nutrients more available to plants.
(8) Continue periodically test of compost/co-compost to check its nutrient content and adjust the balancing as needed.

9.4 Co-compost Application

(1) Currently in Bangladesh, no specific law or policy mandates or prohibits the mixing of fecal sludge with compost to produce co-compost. Nevertheless, international standards advocate for avoiding this practice because of the possibility of accumulation of heavy metal and pathogens.
(2) While co-compost may initially exhibit lower permeability limits for certain components, repeated use could lead to the accumulation of these components beyond acceptable levels, posing potential health and environmental risks.
(3) As recommended by agricultural scientists, fecal *sludge-based co-compost can be effectively utilized for non-food grade plantations*, such as forestry initiatives, while strictly avoiding its use in food-grade applications.
(4) In the co-composting system, the mixing of dry sludge needs to be avoided. Separate composting needs to be done.

[28] Parra Paz, A. S., Carrejo, N. S., & Gómez Rodríguez, C. H. (2015). Effects of Larval Density and Feeding Rates on the Bioconversion of Vegetable Waste Using Black Soldier Fly Larvae Hermetia illucens (L.), (Diptera: Stratiomyidae). *Waste and Biomass Valorization*, *6*(6), 1059–1065. https://doi.org/10.1007/s12649-015-9418-8
[29] Salt water must rinse off otherwise it will hamper the overall process
[30] Tomatoes, peppers, potatoes

9.5 Explore Carbon Credit Opportunity

It is possible to Explore carbon credit opportunities through the development of carbon accounting model after combining all the plant as bundle production in the form of CDM, JCM etc.

10. RISK ASSESSMENT

The risk assessment has been assessed based on identified risk factors. The likelihood, impact, and overall risk of each risk factor were scored into three levels: high (where the probability is high), medium (where the probability is medium), and low (where the probability is low). These scores were determined based on the recommendations of the study team members and stakeholder suggestions.

Table 38 Risk factors to be considered before accessing to the market to sustain the business

Risk Factor	**Risk**	**Likelihood**	**Impact**	**Overall Risk**	**Mitigation Strategies**
Technical Expertise of Plant Operators	Plant operators with insufficient knowledge and skills may struggle to maintain proper composting conditions (i.e., slower decomposition rates, higher moisture levels, increased potential for odor etc.). This can result in a lower quality of compost, which may not meet the standards of The Fertilizer (Management) Act 2006.	Low	High	High	Providing comprehensive training to compost plant operators with the necessary knowledge and skills to operate the equipment and manage the composting process effectively. This training should cover topics such as composting principles, waste segregation, equipment operation, quality control, environmental regulations etc. considering the specific context of Rohingya Refugee camps.
Waste Composition	Fluctuations in waste volume and composition for seasonal variation may be considered a risk for compost production.	Low	High	Medium	Regular waste characterization study, flexible processing capacity, inventory management, continuous monitoring, cross-seasonal collaboration etc. may mitigate this risk.
Improper Waste Segregation	In the Rohingya camps it is very difficult to maintain proper waste segregation. Failure to proper segregation may introduce risk to the compost/co-compost.	Medium	High	Medium	Develop and implement clear and concise guidelines for segregating hazardous waste at the source. These guidelines should be translated into Bangla and Rohingya languages and communicated effectively to all camp residents.
Absent hazardous waste management system	The absence of dedicated handling and disposal protocols for hazardous waste poses a significant environmental and health risk. For example, the unintentional coming of hazardous materials into the compost unit of the Rohingya camp may occur accident/injuries to the compost plant operators during the segregation process.	Low	High	Medium	Along with proper segregation process establishment of a proper hazardous waste management system.

Risk Factor	Risk	Likelihood	Impact	Overall Risk	Mitigation Strategies
Insufficient scoping of value addition	Insufficient scooping of value addition through selling recyclable material may pose a risk to the business viability of the compost/co-compost units.	Low	Low	Low	Explore opportunities to generate revenue from the sale of recyclable materials by partnering with recycling companies and establishing a dedicated recycling operation within the compost/co-compost unit with align with the current practices of the Rohingya camps. Additionally, try to find alternative income streams to enhance the financial sustainability of the compost/co-compost operation.
Revenue	Low revenue generation scope at this moment. However, household charge by FDMN household is not possible except subsidized. Only compost selling is not feasible	High	High	High	Service charge needs to be ensured along with efforts for compost procurement by the other entities. However, efforts are needed as mentioned in business plan
Improper waste collection	Improper primary waste collection or lack of segregated collection systems can risk the production rate and quality of compost/co-compost. For example, if the distance between waste generation source and compost/co-compost unit is so far	High	Low	Medium	Segregated collection needs to be ensured with proper separation at source as much as possible
Insufficient compost plant capacity	Compost/co-compost units that are not designed according to capacity can lead to production limitations, inefficiencies, and potential environmental non-compliance.	High	Medium		Capacity enhancement of the compost/co-compost unit should be undertaken based on a thorough needs assessment.
Suitability of existing technology	Using box-type compost plants in Bangladesh may not be the most suitable approach for optimal composting due to local conditions and waste characteristics.	Medium	Medium	Medium	Encourage to use traditional open windrow composting by using triangular windrows
New market risk	Expanding into new markets can entail uncertainties about consumer preferences, competition, and payment reliability, posing risks for compost/co-compost producers	High	High	High	Establishing a strong partnership with existing local distributors, retailers, or end-users to ensure market access, reliable payment terms, and effective product distribution. A flexible pricing strategy that accommodates market conditions and consumer preferences should be adopted.

Risk Factor	Risk	Likelihood	Impact	Overall Risk	Mitigation Strategies
Compost quality concerns	Inconsistent or poor compost quality due to inadequate processing or control measures can damage the reputation of a compost plant, reduce market demand, and lead to financial losses.	Low	High	Low	Ensuring the production compost/co-compost requires adherence to stringent process protocols and regular laboratory testing to verify compliance with safety and quality standards as per the Fertilizer (Management) Act 2006.
Low purchase or low actual demand	Insufficient actual demand for compost/co-compost though there are high potential demand	Medium	Medium	Medium	Extensive effort is needed for potential customers and marketing strategies. As for example bulk procurement by other sectors, local government, forest dept, EEN
Timing of registration process	Time-consuming registration/certification procedures can be risk factor for the compost/co-compost producer.	High	High	High	Continuous follow up is needed along with persuading central government to have national level meeting. Therefore, instead of marketing, handing over to trading companies is advised.
Popularity or market share	Competition from other compost suppliers	Low	Low	Low	Develop a unique value proposition and competitive pricing strategy along with continuous supply mobilizing BFA and dealers.
Government regulation	Unfavorable government regulations	Low	High	Medium	Stay up to date on government regulations and develop strategies to comply with them. Time to time check quality result and report to government
Transportation and distribution	Transportation and distribution challenges	Medium	Medium	Medium	Develop a robust distribution network and partner with local businesses to distribute compost/co-compost. Bundling all the compost plants/MRF is suggested rather than small capacities few plants. Camp 4 Ext plant may have feasible capacity but other should be bundled.
Awareness of user group	Lack of consumer awareness about the benefits of compost/co-compost	Medium	Medium	Medium	Conduct educational and awareness-raising campaigns to promote the benefits of compost/co-compost through farmers, DAE cox’s bazar and national programs.

11. KEY KII FINDINGS

Based on the KII conducted with various stakeholders, here are the key findings related to compost demand and market situation in Cox's Bazar:

Overall Compost Demand:

- There is a significant demand for compost in Cox's Bazar, estimated at 6,80,000 tons annually, based on fertilizer recommendations[31].
- Currently, farmers primarily use cow dung and vermicompost as organic fertilizers.
- The price of 40 kg compost bag is Tk 470-550, and the average annual sale of organic fertilizer is 40-50 tons.
- The number of compost users is gradually increasing, mainly driven by betel leaf farmers.
- Piloting and awareness programs are needed to further promote the use of compost among farmers.
- Annual 15% demand for compost/co-compost can be projected.

Compost Demand in Specific Sectors:

- Forestry: The annual demand for compost in forest land is approximately 1000 tons.
- Betel Leaf Units: Organic fertilizer is recommended at 15 kg per decimal for betel leaf units. Moheshkhali has around 20,000 betel leaf units and around 1600 hectares of land dedicated to betel leaf units in Moheshkhali[32].
- Homestead Gardening: Approximately 6 kg of organic fertilizer is applied per decimal throughout the year, at least 3 times annually.

Factors Influencing Compost Demand:

- Quality: Farmers are hesitant to use compost due to concerns about its quality and effectiveness compared to chemical fertilizers.
- Price: The price of compost remains a barrier for some farmers, especially when compared to subsidized chemical fertilizers.
- Awareness: Many farmers are not fully aware of the benefits of using compost and require additional information and education.
- Accessibility: The availability of good quality compost remains limited in some areas.

Recommendations:

- Improve compost quality: Ensure that camp-produced compost meets all government-mandated parameters and receives approval.
- Raise awareness: Conduct awareness programs through UAOs and other channels to educate farmers about the benefits of compost.
- Promote pilot projects: Implement pilot projects to demonstrate the effectiveness of compost in increasing crop yields.
- Ensure accessibility: Improve the distribution network for compost to make it readily available to farmers.
- Explore alternative markets: Consider non-food grade applications for co-compost, such as forestry initiatives. Invest in research and development: Conduct further research to improve the quality and affordability of compost.

[31] Deputy Director, DAE, Cox's Bazar mentioned in line with Fertilizer Recommendation Guide, 2018
[32] Upazila Agriculture Officer, Moheshkahli, Cox's bazar

Additional Information:

- Fertilizer registration process: The process takes approximately 1 year.
- Co-compost limitations: Co-compost is not permitted for food production due to the potential presence of heavy metals and pathogens.
- Fecal sludge use: Avoid mixing fecal sludge with compost.
- Compost testing: Pathogen testing should be included in government regulation for organic fertilizer testing.
- Compost plant operations: The existing compost plant in Cox's Bazar Municipality produces approximately 18-20 tons of compost per month[33].
- Conduct further research to quantify the demand for compost in different sectors.
- Develop a comprehensive marketing strategy to promote the use of compost.
- Identify potential partnerships with private sector entities to scale up compost production and distribution.
- Implement pilot projects to demonstrate the effectiveness of compost in increasing crop yields.

12. KEY FGD FINDINGS

Six focus group discussions (FGDs) were conducted in various areas of Teknaf and Ukhiya in Cox's Bazar district to gain insights into local farmers' perspectives on compost and co-compost usage. The key findings of these FGDs are listed below.

Table 39 FGD Summary on compost/co-compost demand, acceptability and usage status

FGD Participants	Summary of response
Local Farmers of Himchori Pechar Dwip, Ukhiya	• Betel leaves are primarily cultivated in their area. • They have approximately 300 betel leaf units, with each unit covering an area of 10-15 decimals. • Currently, they do not have a fertilizer dealer and need to purchase from Kuniyapalong and Moricca Bazar. • They have found that using compost is beneficial for betel leaf production. • For each decimal area of betel leaves, they use 3-4 kg of compost. • Compost is more effective than cow dung. • The rate of compost for each acre is around 2000-2500 Tk. • Rohingya refugees sell packaged compost (not produced in the camp) in Moricca Bazar. The rate for that compost is cheaper. Some farmers use this compost in their betel leaf units. • Do not familiar with co-composts. Not interested in using it. • Fertilizer usage rate per bigha for Betel leaves: Urea - 120 kg; TSP - 80 kg. • Fertilizer usage rate per bigha for Paddle: Urea - 50 kg; TSP - 40 kg; MOP - 20 kg.
Local Farmers of Inani, Ukhiya	• Vegetables are primarily cultivated in their area. • They need to buy fertilizer from Kot bazar. • They are using cow dung rather than compost. • If compost is available at a low price, they will use compost. Sub-dealers need to be appointed in their nearest area. • Do not familiar with co-composts. Not interested in using it. • Fertilizer usage rate per bigha: Urea - 30 kg; TSP - 20 kg; MOP - 20 kg. Cow dung: 200 kg.
Local Farmers of Inani, Ukhiya	• Vegetables are primarily cultivated in their area. • They need to buy fertilizer from Kotbazar. • They are using cow dung rather than compost. • If compost is available at a low price, they will use compost. Sub-dealers need to be appointed in their nearest area. • Do not familiar with co-composts. Not interested in using it.

[33] Cox's Bazar Municipal Compost Plant Operator, Mr. Yunus.

FGD Participants	Summary of response
	• Fertilizer usage rate per bigha: Urea - 30 kg; TSP - 20 kg; MOP - 20 kg. Cow dung: 200 kg.
Local Farmers of Inani, Ukhiya Local Farmers of Roikhong, Teknaf	• Vegetables are primarily cultivated in their area. • They need to buy fertilizer from Kotbazar. • They are using cow dung rather than compost. • If compost is available at a low price, they will use compost. Sub-dealers need to be appointed in their nearest area. • Fertilizer usage rate per bigha: Urea - 30 kg; TSP - 20 kg; MOP - 20 kg. Cow dung: 200 kg. • Do not familiar with co-composts. Not interested in using it.
Local Farmers of Moheshkhali.	• This area is famous for betel leaf units. • One bigha of betel leaf usually has 40,000 seedlings. • Usually, fertilizer needs to be applied four times in the betel leaf units. • Around 15-18 kg of cow dung in a sack cost 250-280 Tk per sack. • They usually bring cow dung from Satkania. • Do not familiar with co-composts. Not interested in using it. • In betel leaf units, they typically use cow dung, oilcake, and chemical fertilizer. • Each time, 10 sacks of cow dung need to be applied to each decimal of land, and both coco peat and chemical fertilizer need to be applied separately at 80 kg each. • They also use organic fertilizer. • Although cow dung is more expensive than organic fertilizer, they use cow dung because its effects last for 3-3.5 months, while the effects of compost last only 15 days. • Their current buying price for organic fertilizer is 550 Tk for 50 kg. • The average sale from 1 bigha betel leaf unit is 15-30 lakh Tk, with an average of 20 lakh Tk. • They will use camp-produced compost if its quality is good and government-approved. They also request piloting, which will help them decide before using. • As they are closer, transportation costs will decrease, and ultimately the price of compost is expected to decrease.

13. CONCLUSION

The viability of compost/co-compost produced in the camp in Cox's Bazar district is currently limited unless sufficient subsidies or collection fees are imposed, despite the existence of significant demand which is estimated as annual 20,526 ton (for Cox's Bazar). While few farmers recognize the benefits of compost for soil health, including moisture retention, nutrient release, and organic matter retention, low market penetration, traditional compost (manure), and profitability remain major challenges.

Several actors are involved in compost sales: traders/marketing companies, dealers, and the BFA. However, initial delivery to traders requires due payment, which can be difficult for the private sector initially which appeals subsidies or collection fees. Additionally, transportation costs significantly hinder financial viability. Therefore, local production and utilization of compost within the region are crucial.

Existing plant operations suffer from high operating costs (around 74 – 77 Tk/kg), low production rates, and low efficiency (currently 15%, with potential to reach 20%) which is not at all market competitive and not viable for doing business (NPV shows negative value). The current market price at dealer points the compost ranged from 9.75 to 13.75 Tk/kg. Appointing an operator to manage all Material Recovery Facilities (MRFs) and centralize compost marketing management is recommended. This approach would require financial support (if collection fee is not imposed) to establish a viable business model, potentially through partnerships with marketing companies, traders, or government certification programs.

Annex 1. List of Meetings (KII & FGD) and Key Findings

Sl. No.	Name	Affiliation	Meeting Type	Purpose	Key Findings
1	Mr. Liton Debnath	District Training Officer, DAE, Cox's Bazar	KII	Overall compost demand in Cox's Bazar	• 1. 10 MT per hector per cropping (40 kg/decimal) • 6,80,000-ton compost demand/requirements in Cox's Bazar as per Fertilizer recommendation guide • Farmer are using Vermicompost. • Cow-dung is also used. • It is not being used as chemical fertilizer. • Nutritious garden project: 2 decimals (15 kg to 20 per decimal per project) • Organic content about 1 % but not reference • 2 kg / decimal commercial company is very low. • Urea 700 – 800 gm / decimal • The recommendation guide talks about cow dung or poultry but not compost directly. • 1 kg urea 46% N • Rapid action is not observed after the application of compos. Also, price is high according to farmer. • Moheshkahli, Ramu, Ukhiay (Battle Leaf)
2	Md. Sarwar Salam	CEO, Cox's Bazar Municipality	KII	Status of compost plant of Cox's Bazar	• There is a compost plant for Cox's Bazar Municipality. • The DOE handed it over to Municipality. • Now it is controlled by Municipality. • Municipality has assigned a vendor to manage it. • The vendor collects waste from selective restaurants (12 in total) using it. • Municipality's provided collection vehicle. • The capacity of the compost plant is 12 tons/day. (input waste) • The estimated waste generation in Cox's Bazar Municipality is 160-200 tons/day. • The compost plant is not operating at full capacity at the moment. • The monthly compost generation rate is 5 tons.
3	Md. Anwar Hossain Sarker	Divisional Forest Officer Cox's Bazar North	KII	Compost demand in forest land	• 10,000 hectors, 2500 saplings, 250 gm/plant • PWD, LGED cost schedule not included compost.

Sl. No.	Name	Affiliation	Meeting Type	Purpose	Key Findings
					• 1000-ton compost supplied last year. So, demand of compost use in Cox's Bazar for forest department can be considered approx. 1000 ton/year
4	Mr. Saiful Islam	AD, DOE, Cox's Bazar	KII	Environmental clearance process[34]	• Green can be certified within several weeks; District office can certify. • Yellow code needs several weeks, District office can certify. • Orange code need 4 weeks, Division needs to certify • Red > 3 months, Central office need to certify
5	Md. Aminur Rahman	BRAC, HCMP	FSTP-2 visit	Field inspection	• Coverage area of FSTP: Both the host community (from Palongkhali to KTP Bazar) and the selective camps. • Collection process: Integrated fecal sludge network and vacuum truck (3,000-liter capacity). • BRAC has an agreement (though not official) with DPHE to collect fecal waste from host communities, including institutions. • Host community collection is mainly on a needy basis. • Daily collection is 150,000 cubic meters. • Daily capacity is 180,000 cubic meters. • Different studies have found a fecal sludge generation rate of 1-1.5 liters per person.
6	Md. Rokibul Islam Rabbi	BRAC, HCMP	Filed visit compost plant, Camp 1E	Field inspection	• The recent 10-month average total waste collection is 94,302 kg, with 49,394 kg being organic waste. • The total waste collection for the last 3 months is the same as the previous 7 months, but organic waste has drastically reduced by around 50%. • After the screening process, 40% of the final compost is obtained
7	Mr. Imran	NGOF	Field visit, compost and Co-compost plant, Camp 4	Field inspection	• The temperature for 7-10 days is found at 60-70 degrees Celsius. • Shuffling is done 12-15 days later. • The moisture is found at 40-60%. • They adhere to the UNDP compost guidelines. • The total number of boxes is 45, with 290 cubic feet per box. Each cubic foot is equivalent to 15-20 kg. • They process 5 tons of input waste daily, yielding a daily output of 950 kg of final compost with zero waste. • Each day, one bed is filled with waste.

[34] http://doe.portal.gov.bd/sites/default/files/files/doe.portal.gov.bd/page/71a829c3_6b74_4ee9_90a6_158e2898b228/Environmental%20Clearance%20Procedure.pdf

Sl. No.	Name	Affiliation	Meeting Type	Purpose	Key Findings
					• According to last year's survey, they managed to collect 60% of the total waste generated. • After screening, 20% of the final product (compost) is obtained. • They conducted a pilot using dry sludge for co-composting and found positive results with a 1:3 ratio. • To reduce costs, the number of volunteers and supervisors can be reduced.
8	Md. Rokibul Islam Rabbi	BRAC, HCMP	Field visit, compost plant, Camp 4E	Field inspection	• The average daily total input waste into the plant is 500 kg. • The total number of households covered by the plant is 2042. • 90% collection rate of the total waste generated. • The waste collection process includes communal collection, household (HH) collection, and shared bin collection (120L/20HH). • The temperature is maintained at 60-65 degrees Celsius for the first couple of days. • After screening, 70-80% of the final product (compost) is obtained. • Compost production in the last 10 months is 9560 kg. • The monthly cost of operating this plant is roughly 1,18,000 Tk.
9	Farmer Group	Local Farmers of Himchori Pechar Dwip, Ukhiya	FGD	To understand farmers thought	• Betel leaves are primarily cultivated in their area. • They have approximately 300 betel leaf units, with each unit covering an area of 10-15 decimals. • Currently, they do not have a fertilizer dealer and need to purchase from Kuniyapalong and Moricca Bazar. • They have found that using compost is beneficial for betel leaf production. • For each decimal area of betel leaves, they use 3-4 kg of compost. • Compost is more effective than cow dung. • The rate of compost for each acre is around 2000-2500 Tk. • Rohingya refugees sell packaged compost (not produced in the camp) in Moricca Bazar. The rate for that compost is cheaper. Some farmers use this compost in their betel leaf units. • Fertilizer usage rate per bigha for Betel leaves: Urea - 120 kg; TSP - 80 kg. • Fertilizer usage rate per bigha for Paddle: Urea - 50 kg; TSP - 40 kg; MOP - 20 kg.

Sl. No.	Name	Affiliation	Meeting Type	Purpose	Key Findings
10	Md. Habibur Rahman	Compost user in betel leaves unit	KII	To understand farmers thought	• He bought compost sold by Rohingya from Moriccha Bazar. • The rate for a 5 kg compost packet is 120 Tk. • He applied 50 kg of compost in his 20 decimal betel leaf unit in April and May. • The production rate increased after using compost.
11	Farmer Group	Local Farmers of Inani, Ukhiya	FGD	To understand farmers thought	• Vegetables are primarily cultivated in their area. • They need to buy fertilizer from Kotbazar. • They are using cow dung rather than compost. • If compost is available at a low price, they will use compost. Sub-dealers need to be appointed in their nearest area. • Fertilizer usage rate per bigha: Urea - 30 kg; TSP - 20 kg; MOP - 20 kg. Cow dung: 200 kg.
12	Farmer Group	Local Farmers of Jaliyapalong, Ukhiya	FGD	To understand farmers thought	• There are many betel leaf units in this area. • Additionally, rice, vegetables, pepper, watermelon, etc., are cultivated in this area. • They mainly use chemical fertilizers and cow dung. • Compost is primarily used in the betel leaf units. • JhaliaPalang union has about one lakh betel leaf units. • One bigha of betel leaf usually has 40,000 seedlings. • They spend 20,000 Tk on cow dung for one bigha in a year. Moderator calculated that if they use compost instead of cow dung, this expense will decrease to 7,000-8,000 Tk per year • They buy compost fertilizer retail from Shaplapur market. • They also purchase compost from Rohingyas in the market. Typically, they buy compost from Rohingyas at Tk 20 per kg. • There used to be a fertilizer sub-dealer in their area, but currently, no one is available. • They are willing to use compost produced in Rohingya camps if the manure is of good quality and odorless.
13	Mr. Shohel Dhar	Proprietor, Puja Bij Vandar. Shaplapur Bazar. Teknaf. Fertilizer sub-dealer	KII	Compost demand and current market situation	• Currently, a 40 kg bag of compost costs Tk 470 for wholesale and Tk 550 for retail. The retail selling price is 20 Tk per kg. • He sells approximately 400 to 500 sacks throughout the year. • The number of compost users is gradually increasing. • He brings fertilizers from Teknaf to Shaplapur market, where there are about 50 dealers in Teknaf.

Sl. No.	Name	Affiliation	Meeting Type	Purpose	Key Findings
					• Local farmers mostly use chicken droppings as organic fertilizer, priced at 30-40 Tk per liter. However, they may not realize that it can be very harmful to the soil. • About 50 sacks of chicken droppings are required for one bigha, whereas only three sacks of compost are needed, costing only 2000 Tk. • To create demand for compost among farmers, an awareness program through UAOs needs to be conducted. If farmers understand the benefits of compost, they will be more likely to use it, though it will take time. • Piloting needs to be done. If farmers can practically see the growth of their crops by using compost, it will motivate them more. • They will use camp-produced compost if its quality is good and government-approved. As they are closer, transportation costs will decrease, and ultimately the price of compost is expected to decrease.
14	Mr. Farid Shawdagar	BCIC Deller, Shaplapur Bazar, Teknaf	KII	Compost demand and current market situation	• The sale of organic fertilizer is very low. • The sale of urea is around 100 tons, while organic fertilizer is only 5 tons throughout the year. • Mainly, he sells organic fertilizer of ACI. • Farmers are not willing to use organic fertilizers.
15	Farmer Group	Local Farmers of Waikong, Teknaf	FGD	To understand farmers thought	• Vegetables are mainly cultivated in their area. • The use of organic fertilizers has reduced costs and increased paddle production. • Farmers need more training to use organic fertilizer. • They buy organic fertilizer from Rohingya refugees (packaged compost, not produced in the camp). • They are eager to use the compost produced in the camps and obtaining it through a dealer would be preferable.
16	Farmer Group	Local Farmers of Roikhong, Teknaf	FGD	To understand farmers thought	
17	Md. Nasurul Alam	UAO, Moheshkhali, Cox's Bazar	KII	Compost demand information	• 80% of farmers use cow dung. • For the betel leaf unit, 15 kg of organic fertilizer is recommended for each decimal. • Chokoria, Pekua, and Ramu have mostly cultivated land. • Each year, the Department of Agricultural Extension (DAE) purchases fertilizer from different projects for free distribution to farmers. • If the quality of the camp-produced compost is good and government-approved, then DAE can purchase compost on a piloting basis from

Sl. No.	Name	Affiliation	Meeting Type	Purpose	Key Findings
					projects in the upazilas adjacent to the camp, through Dhaka DAE, Khamarbari. • Moheshkhali has around 20,000 betel leaf units.
18	Md. Shourov Hossain	UAAO, Moheshkhali, Cox's Bazar	KII	Compost demand information	• One bigha of betel leaf usually has 40,000 seedlings. • Around 1600 hectares of land are dedicated to betel leaf units in Moheshkhali. • For organic fertilizer, 2 kg is recommended for each decimal of land. This will reduce both the use of oilcake and cow dung by 50% each. • Farmers typically apply fertilizer two times in the betel leaf unit. For each bigha of the betel leaf unit, for each application, 2-5 tons of cow dung, costing 10,000 Tk, and 250 kg of oilcake, costing 60 Tk per kg, are usually applied by local farmers.
19	Farmer Group	Local Farmers of Moheshkhali.	FGD	To understand farmers thought	• This area is famous for betel leaf units. • One bigha of betel leaf usually has 40,000 seedlings. • Usually, fertilizer needs to be applied four times in the betel leaf units. • Around 15-18 kg of cow dung in a sack cost 250-280 Tk per sack. • They usually bring cow dung from Satkania. • In betel leaf units, they typically use cow dung, oilcake, and chemical fertilizer. • Each time, 10 sacks of cow dung need to be applied to each decimal of land, and both coco peat and chemical fertilizer need to be applied separately at 80 kg each. • They also use organic fertilizer. • Although cow dung is more expensive than organic fertilizer, they use cow dung because its effects last for 3-3.5 months, while the effects of compost last only 15 days. • Their current buying price for organic fertilizer is 550 Tk for 50 kg. • The average sale from 1 bigha betel leaf unit is 15-30 lakh Tk, with an average of 20 lakh Tk. • They will use camp-produced compost if its quality is good and government-approved. They also request piloting, which will help them decide before using. • As they are closer, transportation costs will decrease, and ultimately the price of compost is expected to decrease.

Sl. No.	Name	Affiliation	Meeting Type	Purpose	Key Findings
20	Mr. Ariful Hassan	BADC Sub Dealer, Moheshkhali	KII	Compost demand and current market situation	• The trade price of organic fertilizer is 390 Tk for 40 kg, and for ACI, it is 450 Tk for 40 kg. • The average yearly sale of organic fertilizer is 40-50 tons. • There are around 15-20 dealers and sub-dealers in this area, each selling around 15-20 tons of organic fertilizer yearly. • Mainly, betel leaf farmers are the primary customers for organic fertilizer. • The sale of organic fertilizer is increasing this year compared to last year. • On average, around 6 kg of organic fertilizer is usually applied in each decimal throughout the year, at least 3 times annually.
21	Mr. Asif Nur Dipto	Technical Manager, NGOF	KII	Information collection of NGOFs' operating plants	• Discuss shared information. • Compost plant costing • Other issues
22	Md. Kabir Hossain	DD, DAE, Cox's Bazar	KII	Compost demand information	• There is sufficient demand for compost in Cox's Bazar district. • Cox's Bazar has about 80,000 hectares of cultivated land, including 10,000 hectares of vegetables and 3500 hectares of betel leaves unit. • There is no specific prescription for the use of organic fertilizer, but we generally prescribe farmers to use organic fertilizer 3 kg per decimal or 100 kg per hectare. • But once a good organic fertilizer is applied to the soil, it stays in the soil for two to three years. • Many locals in Cox's Bazar are now producing compost. • There are different types of farmers, some want to take the free and some want to take the good by spending money, in case of organic fertilizer use. • Co-compost will hurt the religious sentiments and social expectations of the farmers in Cox's Bazar. This will also reduce compost acceptance as well. • Through DAE Teknaf a pilot project was undertaken by UNICEF to give 50 kg compost in 3 months to some user groups. But due to the poor quality of the compost only 15kg can be supplied to the user group.

Sl. No.	Name	Affiliation	Meeting Type	Purpose	Key Findings
					• So, the quality of the compost needs to increase. Maintaining govt. standard is not enough for the in case of business purpose. Trichoderma can be used for rapid decomposition in compost units. • Now the compost production in the entire Rohingya camp will not be able to meet the demand of just betel leaves units in Cox's Bazar • DAE purchases roughly 1-2 tons of compost per Upazila yearly from different projects. If the compost produced in the camps meets all government-mandated parameters and receives approval, DAE can purchase that compost for the Upazilas of Cox's Bazar.
23	Mr. Zolboo Bold-Erdene Md.Tanjibul Alam Arif	ISCG	KII	Request for information to calculate compost demand	• EEN's plantation mapping could assist the study team in obtaining all information related to plantation. • FFS can also provide an estimation of homestead gardening data, while FAO has homestead gardening guidelines, the latest Plantation Assessment Reports, and standards for using compost per plant. • FAO's Agricultural Hazard and Vulnerability Mapping report can be helpful too.
24	Dr. Md. Baktear Hossain	NRM Member, Director, SAARC Agriculture Center	KII	Fertilizer registration Process	• Describe the fertilizer registration process. • Approximately, it takes about 1 year unofficially for the registration process if everything is in order. • According to the Organic Policy, the use of co-compost is not permissible in the food system. However, it can be used in the forest region and for gardening purposes.
25	Dr. Md. Lutfar Rahman	Senior Scientific Officer, SRDI, Dhaka	KII	Fertilizer test	• Pathogen testing needs to be included in the government rules for organic fertilizer testing. • In the co-composting system, the mixing of dry sludge needs to be avoided. Separate composting needs to be done. • SRDI does not conduct testing for co-compost. Dhaka University's Soil, Water & Environment Lab is recommended for the laboratory testing of co-compost.
26	Dr. Md. Jashim Uddin	Professor, Department of Soil, Water & Environment, Dhaka University	KII	Fertilizer test	Co-compost can be tested but it is expensive than SRDI price, around 3 times higher than SRDI price. Dry sludge may contain communicable disease vector, pathogenic

Sl. No.	Name	Affiliation	Meeting Type	Purpose	Key Findings
27	Dr. Md. Nazim Uddin	Senior Scientific Officer, Horticulture Center, BARI	KII	Use of fecal sludge in co-compost	• Currently in Bangladesh, no specific law or policy mandates or prohibits the mixing of fecal sludge with compost to produce co-compost. Nevertheless, international standards advocate for avoiding this practice because of the possibility of presence of heavy metal and pathogen. • While co-compost may initially exhibit lower permeability limits for certain components, repeated use could lead to the accumulation of these components beyond acceptable levels, posing potential health and environmental risks. • As recommended by agricultural scientists, fecal sludge-based co-compost can be effectively utilized for non-food grade plantations, such as forestry initiatives, while strictly avoiding its use in food-grade applications.
28	Mr. Younus	Cox's Bazar Municipality's compost plant operator	KII	Status of compost plant of Cox's Bazar	• He has been operating the compost plant for the past two years. • He collects waste from 15 hotels and restaurants. • The daily collection of waste from the 15 hotels and restaurants is approximately 12 tons. After segregating recyclables, around 9-10 tons of the daily waste is considered organic or input feed for the compost plant. • The average daily compost production from 12 tons of collected waste is 2-2.5 tons. • It takes approximately 45 days to produce one batch of compost. • For each ton of raw material, he mixes in an equal amount of cow dung, 20 kg of oilcake, and 1 kg of Trichoderma powder. His monthly demand for Trichoderma powder is 40-50 kg. • The monthly compost production rate is 18-20 tons.
29	Tanvir Ahmed Chowdory	Business Development Specialist, SNV	KII	Could not make meeting appointment	
30	Mr. Boshir	Business Director, ACI Fertilizer	KII		***Unofficial information***: ***roughly*** dealer price 11-12 Tk including transportation and making whereas purchase price 5 – 6 Tk/kg from manufacturer. No comments received as they do not study the product, process, and plant in person. They have target to increase 20,000 Ton production in next year, 2024
31	Md. Farhatul Islam	MD, Northen Agro Services Ltd.	KII		They do not have market in Cox's bazar, they have target to grow market about 10,000 ton in the year of 2024.

Sl. No.	Name	Affiliation	Meeting Type	Purpose	Key Findings
32		MATI Organics Ltd.	KII	Packaging, Price, Process, Demand	Packaging woven pack recommended. 40 kg price would be 40 Tk, 20 kg 30 Tk and 10 kg bag would cost 20 Tk. There is no specific rules or regulation for packing but before commencing market government approval needed on the pack. Windrow composting would be better than existing composting process. Existing case recommends making partnership with traders after combining all MRF plants. Urban below 5 kg and rural 25 kg and 40 kg bags are suggested. To enhance P and K, Black soldier fly might help to have a quick solution. 15% demand may increase or possible to increase every year.
33	Mr. Riyaz Uddin	BFA Secretary	KII	Demand	ACI and Agro Arina products are available in Cox's Bazar.

Annex 2. Packaging Outlook of Different Compost Producers

Compost Plant at Panchabati, Narayanganj

ACI Fertilizer

Mazim

Payel

Payel

Pran

Annex 3. Contact information key actors based on stakeholders' analysis

Stakeholder Name	Contact Information
SRDI	Dr. Md. Lutfar Rahman Senior Scientific Officer, SRDI, Dhaka Phone: 01915900766
BARI	Director General Email: dg.bari@bari.gov.bd Tel(office): 49270000
Department of Soil, Water & Environment of Dhaka University	Dr. Md. Jashim Uddin Professor Department of Soil, Water & Environment Faculty of Biological Sciences Email: juswe@du.ac.bd Mobile (Dept): 880-2-9661900/7504 Mobile (Personal): 01992230670
BINA	Director General. Bangladesh Atomic Agriculture Research Institute, Mymensingh-2022. Mobile: 01714-492742. Phone: +8809167834.
BRRI	Director General (DG) Bangladesh Rice Research Institute (BRRI) Joydebpur, Gazipur-1701 E-Mail: dg@brri.gov.bd, brrihq@yahoo.com Phone No-880-2-49272005-9; 49272010-38; 49272056
BARC	Phone: +8802-41025252 Email: ec.barc@barc.gov.bd , info@barc.gov.bd Bangladesh Agricultural Research Council Email: ec.barc@barc.gov.bd , info@barc.gov.bd Bangladesh Agricultural Research Council Farmgate, Dhaka - 1215 Bangladesh
DAE	Information Officer: Name: Dr. Mohammad Abdhu Designation: Deputy Director (Monitoring) Office: Field Service Wing, Department of Agricultural Extension (DAE), Khamarbari, Dhaka-1215 Phone: +88-02-8121276; Cell: +88-01552-391229 Fax: +88-02-9111502 e-mail: mohammadabdhu@yahoo.com
DoE	Assistant Director, Cox's Bazar, Department of Environment Mobile : 01794376047 Phone (Office) : 034162232 Email : saifuldoe21@gmail.com
BSCIC	Md. Mizanur Rahman Deputy Manager Marketing Department Mobile 01717236746 E-mail bscic.mizan@gmail.com
DIFE	Mr. Sipan Chowdury, Deputy Inspector General (DIG) Phone: 01722217723 Abedin's, 352 New Circuit House, Ward No.-10, Moddho Baharchora, Cox's Bazar

Stakeholder Name	**Contact Information**
Local Government	Md. Anisur Rahman Executive Engineer Local Government Division, Cox's Bazar Email: xen.coxsbazar@lged.gov.bd Phone: 01708123191, 0341-64276
Bangladesh-Forest-Department	Md. Sarwar Alam Divisional Forest Officer Cox's Bazar South Forest Division Email: sarwoarfd@gmail.com Phone: 01999-004000, 02333346670 Md. Anowar Hossain Sarker Divisional Forest Officer Cox's Bazar North Forest Division Email: dfo-coxn@bforest.gov.bd Phone: 01999003666, 0233346655
ACI	Phone: 01730373912 Email: info@acifertilizer.com
Northern Agro Services Ltd.	Phone: 01713479500 Email: info@northenfertilizer.org
BFA	Bangladesh Fertilizer Association (BFA), Al-Razi Complex (5th Floor), 166-167 Shaheed Syed Nazrul Islam Sarani, Purana Paltan, Dhaka-1000, Bangladesh Phone : +88-02-55111694-96 Mobile: +88-01711335402, +88-01922153500 E-mail : info@bfa-fertilizer.org

Annex 4. Co-compost Test Results

মৃত্তিকা, পানি ও পরিবেশ বিভাগ
ঢাকা বিশ্ববিদ্যালয়, ঢাকা ১০০০, বাংলাদেশ

Department of Soil Water and Environment
University of Dhaka, Dhaka 1000, Bangladesh

December 04, 2023

The Managing Director
Environmental Engineers Limited
(BRAC-HCMP)
Cox's Bazar.

Subject: Analytical reports on co-compost organic fertilizer.

Dear Sir,
As per your request, the supplied compost organic fertilizer sample has been analyzed and the following results have been found.

Name of Product	Properties	Composition
BRAC-HCMP Co-compost Organic Fertilizer	***Physical***	
	Colour	Dark grey
	Physical condition	Granular form
	Odour	Absence of foul odour
	Moisture	8.30 %
	Chemical	
	pH	7.10
	Organic carbon	14.40 %
	Total nitrogen (N)	1.32 %
	C:N	10.90
	Phosphorus (P)	1.21 %
	Potassium (K)	0.82 %
	Sulphur (S)	0.44 %
	Zinc (Zn)	0.16 %
	Copper (Cu)	0.12 %
	Cadmium (Cd)	ND*
	Chromium (Cr)	0.12 ppm
	Lead (Pb)	0.11 ppm
	Nickel (Ni)	0.09 ppm
	Inert material	<1%

*ND= not detected

A.S.M.R

Thanks and regards,

04.12.23

(Professor Dr. Md. Harunor Rashid Khan)
Chairman

Telephone : 9661920-73/7470, Fax: (880-2) 9667222, e-mail: swed@du.ac.bd

Annex 5. Test Result of FSTP Sample

মৃত্তিকা, পানি ও পরিবেশ বিভাগ
ঢাকা বিশ্ববিদ্যালয়, ঢাকা ১০০০, বাংলাদেশ

Department of Soil Water and Environment
University of Dhaka, Dhaka 1000, Bangladesh

December 04, 2023

The Managing Director
Environmental Engineers Limited
(BRAC-HCMP)
Cox's Bazar.

Subject: Analytical reports on FSTP-2 (dry sludge)

Dear Sir,
As per your request, the supplied FSTP-2 sample has been analyzed and the following results have been found.

Sample ID	Test parameters	Unit	Test results
FSTP-2	E. coli	CFU/g	<1.0
Co-compost 1.3.5	E.coli	CFU/g	<1.0

HRK

Thanks and regards,

04/12/'23

(Professor Dr. Md. Harunor Rashid Khan)
Chairman

Telephone : 9661920-73/7470, Fax: (880-2) 9667222, e-mail: swed@du.ac.bd

Annex 6. Compost Sample Test Receipt

গনপ্রজাতন্ত্রী বাংলাদেশ সরকার
মৃত্তিকা সম্পদ উন্নয়ন ইনস্টিটিউট, কৃষি মন্ত্রণালয়
কৃষি খামার সড়ক, ঢাকা-১২১৫

বহি নং 145
রশিদ নং 14448

মৃত্তিকা/সার/উদ্ভিদ/পানি/ নমুনা বিশ্লেষণের রশিদ

তারিখ 12.11.2023

গ্রাহকের নাম Environmental Engineers Limited (BRAC - HCMP) ঠিকানা Mohammadpur, Dhaka-1207.

ক্রমিক নং	নির্ণেয় উপাদান	নমুনার সংখ্যা	হার	মোট টাকা
১.	আদ্রতা	04	5750/=	=23000/=
২.	জৈব কার্বন [OC]	All Element of Organic fertilizer		
৩.	প্রতিক্রিয়া [pH]			
৪.	বিদ্যুৎ পরিবাহিতা [EC]			
৫.	বুনট [Texture]			
৬.	নাইট্রোজেন [N]			
৭.	মোট ফসফরাস [P]			
৮.	পানিতে দ্রবণীয় ফসফরাস [P]			
৯.	পটাশিয়াম [K]			
১০.	সালফার [S]			
১১.	ক্যালসিয়াম [Ca]/ম্যাগনেশিয়াম [Mg]			
১২.	জিংক [Zn]/তামা [Cu]/লৌহ [Fe]/ম্যাংগানিজ [Mn]/বোরন [B]			
১৩.	ক্যাডমিয়াম [Cd]/লেড [Pb]/নিকেল [Ni]/ক্রোমিয়াম [Cr]/আর্সেনিক [As]			
১৪.	অন্যান্য			
			সর্বমোট টাকা	=23000/=

টাকা (কথায়) Twenty Three Thousand Taka Only মাত্র গ্রহণ করিলাম।

12.11.2023
মোঃ আশরাফুল আলম তয়ন
বৈজ্ঞানিক কর্মকর্তা
কেন্দ্রীয় গবেষণাগার
মৃত্তিকা সম্পদ উন্নয়ন ইনস্টিটিউট
খামারবাড়ি সড়ক, ঢাকা-১২১৫

ভারপ্রাপ্ত কর্মকর্তার স্বাক্ষর

Annex 7. Registration/Certification Form

APPLICATION[1] FOR STANDARDIZATION OF NEW FERTILIZER/BIO-FERTILIZER/PLANT GROWTH REGULATOR/STIMULANT/OTHERS.

	Product Name:
1. Name of applicant with address	
a) Local Agent with address	:
b) Contact Number (Telephone/Cell)	:
c) Principal Company/Supplier with address	:
2. Country of Origin of the product	:
a) Name of the manufacturer with address	:
3. Identity of the product (give tick mark)	:
Chemical fertilizer	: [ ]
Organic fertilizer	: [ ]
Bio-fertilizer	: [ ]
Soil physical improver	: [ ]
Soil amendment	: [ ]
Plant growth regulator (stimulant/inhibitor)	: [ ]
Others	: [ ]
4. Physical characteristics	
a) In case of solid:	
Physical condition - Granular/Prill/Powder/Crystalline/Tablet	
Colour	
Moisture %	:
Solubility	
Particle size	:
Toxicity	
Stability	:
Others	

[1]To be addressed:
Member-Director (NRM) and Convener,
Technical Sub-Committee (Fertilizer)
BARC, Farmgate, Dhaka-1215

With cc to: Additional Director (Implementation), Field Service Wing & Member- Secretary,
Technical Sub-Committee (Fertilizer)
Department of Agriculture Extension
Khamarbari, Farmgate, Dhaka-1215

b) In case of liquid:	:
Colour	:
Physical condition - solution/suspension	:
Others	:
Specific gravity	:
Solubility	:
PH	:
Flammability	
5. Total chemical composition[2]	: % ppm or mg/kg
Name of elements	
6. Name of the carrier (if identifiable) with percentage	:
7. Name of conditioner (if identifiable) with percentage	:
8. Target crop/system for the product	:
9. Target soil/agro-ecological zone for application	:
10. Mode of action	:
11. Effect on environment	:
12. Field trial report (if any)- to be attached	:
13. Technical literature[3] - to be attached	:

	Signature of the applicant

[2] ***Reference of Analytical Method followed should be mentioned.***
[3] ***Technical literature shall clearly indicate methods of use of safety measures, if any.***

Note: Following documents should be enclosed with the application

1. **Original copy** of the Lab Analysis Report
2. **Non-toxic Certification**
3. Production process of **Organic Fertilizer** should be mentioned
4. Copy of **Trade License**

Annex 8. Photos of Study

Meeting with BCIC sub-deller at Teknaf

Meeting with BCIC deller at Teknaf

FDG with local farmers of Himchori Pechar Dwip, Ukhiya

Filed inspection and meeting with betel leaf owner

FGD with local Farmers of Inani, Ukhiya

FGD with local farmers of Jaliyapalong, Ukhiya

FGD with local farmers of Waikong, Teknaf


Compost packet sold by Rohingya Refugee to outside


FGD with local farmers of Roikhong, Teknaf


FGD with local farmers of Moheshkhali.


Meeting with BADC sub-deller, Moheshkhali


Compost plant visit inspection 3


Compost & Co-compost plant visit inspection 4


Compost plant inspection camp 4E


FSTP-2 inspection


Dry fecal sample collection from FSTP-2 for labretory test


Compost sapmle collection from camp 4E plant for lab test Compost sapmle collection from camp 3 palnt for lab test


Compost and co-compost sample collection for lab test from plat of camp 4


Moisture and temperature checking during field inspection

BRAC, HCMP
Contract: BPD/MEAR/2023/PO-6872

MARKET-BASED DEMAND ANALYSIS OF COMPOST/CO-COMPOST IN UKHIYA AND TEKNAF UPAZILLA, COX'S BAZAR DISTRICT

FINAL REPORT

STUDY TEAM

Environmental Engineers Limited

December 2023