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EVALUATION OF FECAL SLUDGE MANAGEMENT IN JAMALPUR POURASHAVA

WATER, SANITATION AND HYGIENE (WASH) PROGRAMME

Evaluation of
Fecal Sludge Management in Jamalpur Pourashava

January 2022

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ABOUT BRAC

The journey began in 1972 in the newly sovereign Bangladesh, and over the course of our evolution, we have been playing the role of recognising and tackling the many different realities of poverty. We have, therefore, developed support services in the areas of human rights and social empowerment, education and health, economic empowerment and enterprise development, livelihood training, environmental sustainability, and disaster preparedness across Asia and Africa.

VISION

A world free from all forms of exploitation and discrimination where everyone has the opportunity to realise their potential.

MISSION

Our mission is to empower people and communities in the situation of poverty, illiteracy, disease and social injustice. Our interventions aim to achieve large scale, positive changes through economic and social programmes that enable women and men to realise their potential.

VALUES

Integrity
Innovation
Inclusiveness
Effectiveness

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

The evaluation study on the joint initiative of BRAC WASH Programme and Jamalpur Paurashava titled “Evaluation of Fecal Sludge Management in Jamalpur Pourashava” is conducted by Maharam Dakua, an independent consultant, and his team.

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EXECUTIVE SUMMARY

The practice of indiscriminate Fecal Sludge (FS) dumping in open environment, and illegal connections to storm drainage has created massive concerns in urban areas, which also stands as a barrier to achieving the target of SDG 6.2. To manage the huge amount of FS generated every day in Jamalpur Pourashava, BRAC WASH came forward to collaborate with Jamalpur Pourashava authority in 2017 and started working to establish a value chain model for safe collection, transportation, treatment, and reuse of FS and solid waste. The project was planned to gather learning experiences and subsequently developing an understanding of the feasibility of establishing a value chain model in the Pourashava. At the end of the project, to assess the outcomes/results of and capture project achievements, its relevance, efficiency and effectiveness, quality of implementation, challenges, and best practices, BRAC WASH Programme conducted an evaluation where the study findings will be used to recommending detail outline for future actions to make fecal sludge management (FSM) service sustainable in Jamalpur Pourashava.

The study was carried out based on literature review, secondary data/information from different sources (national and local level), and collection of data/information from Jamalpur Pourashava using a mixed method. Household level questionnaire survey was conducted for quantitative data collection from two separate groups: users of mechanical emptying service and potential users who are yet to avail mechanical emptying service. In addition, six focus group discussion (FGD) with different groups (e.g., pit emptiers, treatment plant operators, solid waste collectors, farmers, etc.) and several key informant interviews (KII) with Pourashava officials and other local stakeholders were conducted to collect qualitative information on the FSM service in Jamalpur Pourashava. In addition, rapid technical assessment of containment, trip time assessment, wastewater and co-compost testing were done. Available data from secondary sources (e.g., record files) on number of trips made, generation of co-compost, income/expenditure were also collected. The analyses focused on finding the coverage of FSM services providing collection and transportation services, performance of fecal sludge treatment plant (FSTP) in treating FS and producing co-compost, and other aspects that help ensuring sustainability of the service. Finally, a validation workshop was organized in Jamalpur Pourashava where the findings from the analyses were shared with staleholders and their feedback was collected.

According to household survey findings, 0.74% households in Jamalpur Pourashava do not have any containments, hence discharging FS directly into open environment. 15.97% of the households reported that they needed desludging of containments, who used the manual emptying system which is unhygienic and often disposes the FS into open environment. Moreover, among the households who never emptied their containments, reporting either their containment was never full, or they abandon it as soon as it gets full, several cases (32.85% septic tanks, all single pits before getting abandoned, and 25.42% twin-pits) were found that discharge wastewater into environment. The findings reveal that FS from a significant percentage of containments

would remain inaptly managed in absence of FSM services. Therefore, to achieve the target of city-wide safely managed sanitation for the Jamalpur Pourashava, the need of introducing FSM service was imperative.

To address this need by establishing the FSM system consisting of all components of the service chain, BRAC's Urban WASH project piloted FSM system in Jamalpur Pourashava to support its waste management capacity. BRAC WASH renovated the Pourashava owned non-functional fecal sludge treatment plant (FSTP) and customized two vacutugs for collection and transportation of FS. The capacity of FSTP was increased where new drying beds followed by anaerobic baffled reactors (ABR) were constructed for effluent treatment before releasing it into the environment through soak wells. There were arrangements for processing of solid waste which is mixed with dried FS to prepare co-compost following scientific methods. BRAC provided training to vacutug operators, FSTP operators on operation and maintenance, and conducted several awareness campaigns (through meetings, sticker/card distribution, and other means of sharing relevant messages) jointly with Pourashava for the citizens of the Pourashava on benefits of using mechanical desludging service. This has helped to create demands for the FSM service among the Pourashava citizens to some extent. However, there is still lack of awareness among people as they are yet to comprehend the benefits of the service, and the risk of manual emptying and indiscriminate disposal of FS in open drains and open environment.

During the mechanical emptying service period from January 2019 to October 2021, 593 households were served through 727 trips. The monthly coverage was highest in 2020 when 23.5 households were served on average. The findings reveal that only 2% of total households took the mechanical emptying service till now, which means that 98% of households in the Pourashava still remain as a potential market for this service. The findings show that although the septic tank users asked for the service more, the pit required more frequent desludging latrine (88.17% of the pits were desludged within 1-12 month) than septic tanks (72.53% of the septic tanks were desludged within 12-24 month) as the containment volume of septic tanks is larger.

The quality of emptying and transportation service has been appreciated by the service users in the Pourashava. The service was quickly available, environment friendly, and available at an affordable cost, as reported by the users. The findings show that 67.93% of the users got the service within 1 day after contacting the service providers and 31.52% of the users got the service within 2-4 days. The study reveals that 70.65% mechanical users were "very satisfied" with this service and 29.35% mechanical users were "satisfied" with this service. None of the households were found "not satisfied" with the service. Among the users of mechanical emptying service, 98.37% availed this service for being "low cost" option, 68.48% availed this service for its "easy availability", 64.13% availed this service for the "low response time", 88.04% availed this service for producing "less odor" than manual service and 85.87% availed this service for being "environment friendly".

It was estimated that the emptying vehicle can make 5-6 trips every day, which equals to approximately 1,500 trips in a year (assuming 5 working days in a week). However, it was found that only 25% of the current capacity of the vehicle was used in 2020, when the highest number of trips were made (371). This indicates that if the demand increases four-fold from the current demand, it can still be covered with one vehicle.

The upgraded FSTP has introduced the co-composting process where FS and organic solid waste are mixed to produce organic fertilizer which has helped to reduce dumping of FS in open environment to some extent. The co-compost has been used by a few local farmers and

in nurseries. From the test results, it was observed that effluent complied with the ECR 1997 standard values for discharging into irrigation land. According to the co-compost test results, the concentrations of tested parameters were found to be okay except for moisture content in one of the samples, which could be improved in the green house.

To some extent, the programme has sensitized the local Pourashava officials and many citizens on the necessity of having FSM service to save the environment as well as to achieve the SDG goal 6.2. In Bangladesh, to implement the entire FSM system in Pourashava towns, the primary responsibility lies with the Pourashava authority. Although Jamalpur Pourashava has provided the land, existing vehicles, and permission to run the FSM system, the system operation was largely dependent on BRAC support. During the KIIs, the Pourashava officials agreed that the Pourashava is not ready to run the FSM service at present and will need some time to institutionalize the system for managing the service through Pourashava staff. The limited staff and capacity might work as barriers to make the service sustainable in the Pourashava.

According to the IRF-FSM the Local Government Division (LGD) though its line agencies (DPHE and LGED) is supposed to provide technical support to the Pourasahvas. However, apart from offering project support, the involvement of LGED and DPHE for capacity building of the Pourashava or in monitoring of the existing FSTP was found inadequate. Private sectors also can play significant roles in FSM implementation starting from supplying the on-site sanitation products to marketing of co-composts in the market. But in Jamalpur Pourashava, FSM service has not been considered as a business opportunity by any entrepreneurs yet, which might be due to lack of knowledge of the potential market size. Regarding raising awareness among the city dwellers on the benefits of using co-composts, a lack of coordination was found among the Pourashava and DAE. It was suggested by DAE that if the Pourashava works together with DAE to disseminate the benefits of using co-compost fertilizer for farming, the demand for co-compost will increase as many people nowadays practice homestead gardening.

Jamalpur Pourashava mainly relied on project funding for any infrastructure or equipment support for FSM. However, the Pourashava provided land for the construction of the treatment plant. The financial analysis indicate that major part of the revenue came from the emptying and transportation service fee. But the system is yet to earn enough revenue from emptying service and sales of co-compost to cover all the costs including emptying and transportation, treatment, and making co-compost. Therefore, it required additional resources to subsidize the system which was provided by BRAC. However, the amount of subsidy required for the co-compost plant is expected to be gradually decreasing and it is also expected that with creation of more demand for emptying service and higher sales of co-compost, the system would make profit.

While mechanical desludging has been introduced (2% coverage) and land procurement for new FSTP is done, Jamalpur Pourashava should take necessary actions to address the gaps to achieve the targets set in the National Action Plan for implementation Institutional and Regulatory Framework for FSM (IRF-FSM). As BRAC WASH programme is willing to handover the FSM system to the Pourashava gradually starting from January 2022, the programme needs to develop a plan for the transition phase until the Pourashava becomes capable of running the FSM service. It is highly recommended that BRAC WASH programme will support Jamalpur Pourashava by sharing their experience, providing technical assistance, organizing exposure visits for Pourashava officials, and connecting them with the FSM network that works in Bangladesh as well as in the South Asia region to implement effective FSM service.

EVALUATION OF FECAL SLUDGE MANAGEMENT IN JAMALPUR POURASHAVA

CHAPTER 1

INTRODUCTION

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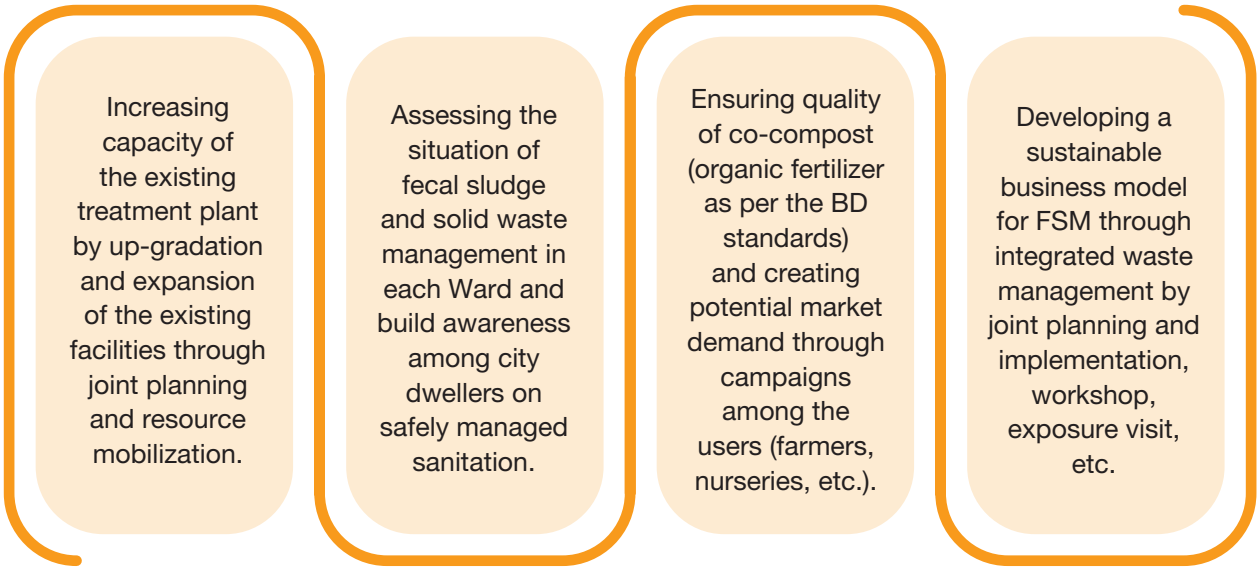
INTRODUCTION

1.1 Background

Successful implementation of Fecal Sludge Management (FSM) has been identified as a major challenge towards the achievement of SDG 6.2 in Bangladesh - "By 2030, achieving access to adequate and equitable sanitation and hygiene for all, and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations". Although Bangladesh has achieved 'open defecation' free status, the overall management of human sludge is still inadequate posing a severe threat to public health and the environment.[1] The huge quantities of fecal sludge (FS) generated in septic tanks and pits are inaptly managed in the absence of effective FSM services. In most of the areas, Local Government Institutes (LGIs) and general people still lack adequate knowledge about the proper management of FS. Under such circumstances, the practice of indiscriminate FS dumping in open environment, and illegal connections to storm drainage has created massive concerns, which also stands as a barrier to achieving the target of SDG 6.2.

BRAC WASH came forward to collaborate with Jamalpur Pourashava authority in 2017 and started working to establish a value chain model for safe collection, transportation, treatment, and reuse of fecal sludge and solid waste to manage the huge amount of fecal sludge generated every day in Jamalpur Pourashava. The project was planned to gather learning experiences and subsequently developing an understanding of the feasibility of establishing a value chain model for safe collection, transportation, treatment, and reuse of fecal sludge in the Pourashava. The main objectives of this project were to:

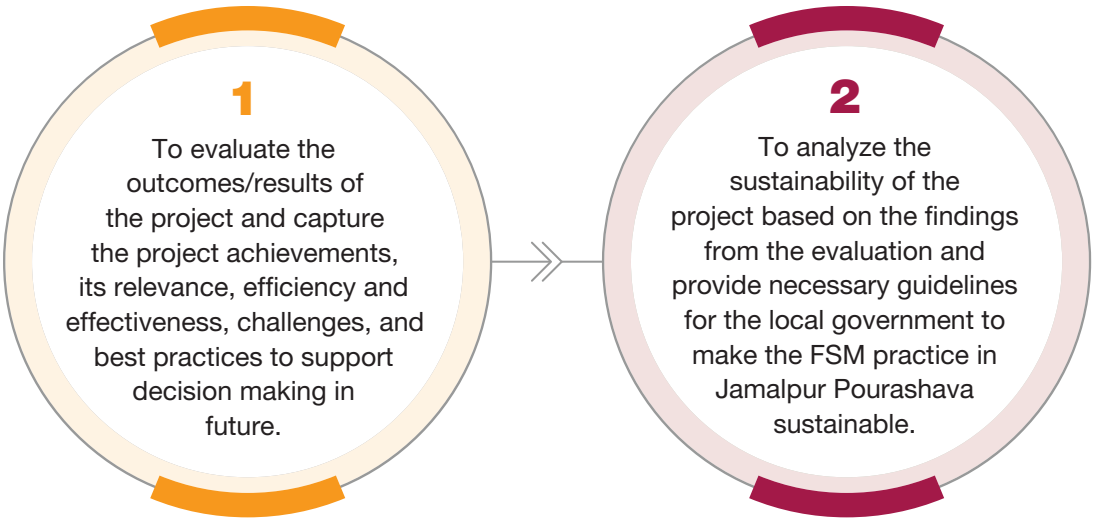
[1] WHO-UNICEF Joint Monitoring Programme Report, 2019.



At the end of the project, BRAC WASH Programme is now willing to assess the outcomes/results of the project and capture project achievements, its relevance, efficiency and effectiveness, quality of implementation, challenges, and best practices. It is also expected that the findings from the study will be used to recommending detail outline for future actions to make FSM service sustainable in Jamalpur Pourashava.

1.2 Objectives

BRAC WASH programme conducted this evaluation with the following objectives which would help both Jamalpur Pourashava and BRAC to jointly develop an action plan for the Pourashava to run the FSM system based on the readiness of the Pourashava.



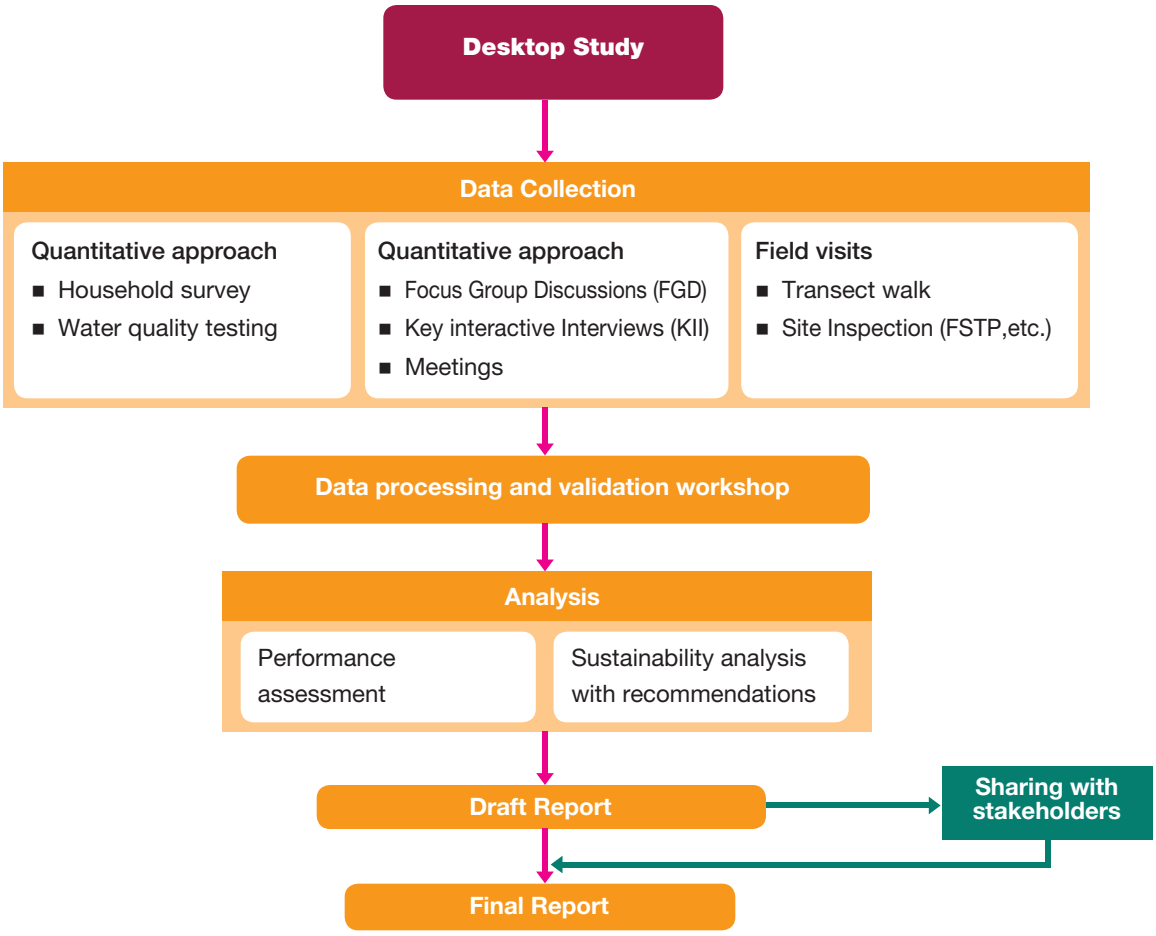
The specific objectives of the evaluation were to:

- Assess the project objectives and outcomes by measuring performance against each objective of the project.
- Assess relevance of the project in relation to the priorities and needs of the communities.
- Evaluate the efficiencies and effectiveness of the project regarding the stated objectives and to compare the findings with national level scenario in Bangladesh.
- Capture success and failure of the project interventions in different aspects (e.g., health, environment, behavioral changes, etc.), directly or indirectly, intended, or unintended.
- Assess sustainability of the project components and identify critical areas/limitations that may affect the sustainability of the FSM service in Jamalpur Pourashava.
- Provide necessary guidelines, based on the findings from the performance assessment and sustainability analysis to the local government to ensure sustainability of the FSM system in Jamalpur Pourashava.
- Assess willingness and readiness of Jamalpur Pourashava to take over the FSM system from BRAC and develop a transition/handover plan.

1.3 Methodology

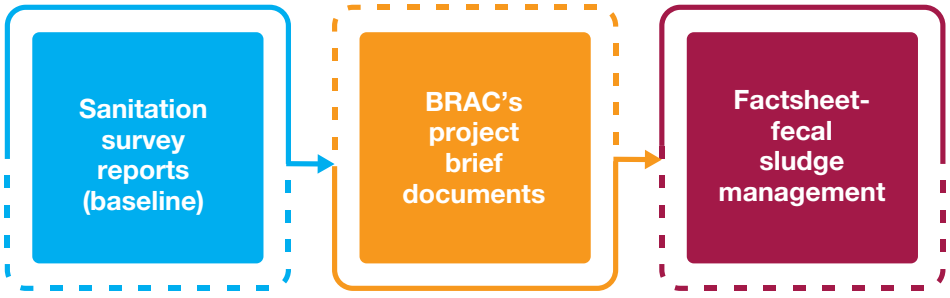
To accomplish the specific objectives, the study was carried out based on the findings from literature review, available secondary data/information from different sources (national and local level), and collection of data/information from the field. The study can be classified into two major sections; (1) collection of information on FSM services in Jamalpur Pourashava, and (2) analysis of collected information to assess the performance of FSM services. The methodology for the study is shown using a simple diagram in Figure 1.

Figure 1 Methodology of the study



1.3.1 Review of Literature and Records

Desktop review of project reports was conducted to get an overview of the project activities, progress, and achievements till date. Reports and documents that were reviewed in the study include -



In addition, available data and other records of sanitation coverage, containment system, emptying and transportation of fecal sludge in the study area, and treatment and re-use related records (data, test results, financial reports, etc.) were collected and reviewed.

1.3.2 Household Questionnaire Survey

Household (HH) level questionnaire survey was conducted to collect information on sanitation coverage in the Pourashava, containment types, emptying practices, and user feedback on FSM services at the household level. A semi-structured questionnaire was used for the collection of data. The households were classified into two groups: "user" group and "potential user" group. HHs that used mechanical emptying service for emptying pits or septic tanks are classified as the "user" group, and HHs that use manual system (e.g., sweepers using bucket and rope to empty the containments) for emptying or are yet to avail any emptying service are classified as "potential user" group. The sample size for the survey was calculated based on the total population of the Pourashava (163,298). The Pourashava has 38,859 households, among which 564 availed FSM service (as of the date of this estimation for the study). Using this data, the total potential user population of the Pourashava was estimated as 160,912 (average HH size 4.2). The sample size estimation for the study was done using the formula[2] shown below. The sample size for the study is shown in Table 1.

$$n = N * \frac{\frac{\{[Z2\ x\ p\ x\ (1-p)]\}}{e2}}{[N-1\ +\ (Z2\ x\ p\ x\ \quad)]}$$

Where,
n = required sample size
Z = confidence level at 90% (standard value of 1.64)
p = estimated prevalence of variable of interest (0.5)
e = margin of error (5%)
N = population size

Table 1 Sample size for user and potential user groups

Category	Sample size	Remarks
Potential user of mechanical emptying service	271	Samples will be randomly selected among all the wards
User of mechanical emptying service	184	Sample selection will depend on presence of HHs in wards that used the service

[2] Thakur, M., & Vaidya, D. (2016- Not sure about the date). Sample Size Formula. Retrieved from https://www.wallstreetmojo.com/sample-size-formula/

The questionnaires used for both user and potential user groups are presented in Annex-I. The survey questionnaires were developed using KOBO Toolbox and survey data were collected using Android phones. Before starting the survey, the surveyors were trained on data collection using KOBO Toolbox and the questionnaires were pre-tested at a few households. To ensure data quality, following methods were used during the survey and any inconsistency found in the process or recorded data was immediately discussed with the survey team for rectification.

Accompany check

In the case of quantitative data collection, Research Associates reviewed the process of the one-to-one interview by accompanying the surveyors. The schedule for the check was randomly designed and executed.

Backcheck

After the completion of each day's quantitative and qualitative data collection, the backcheck process was followed every day by the Research Associates to check for data accuracy/error.

Daily check

The Research Associates checked the data every day to make sure that the data is entered correctly. Research Associates also ran a logical check of the collected data from database.

1.3.3
Focus Group Discussion (FGD)

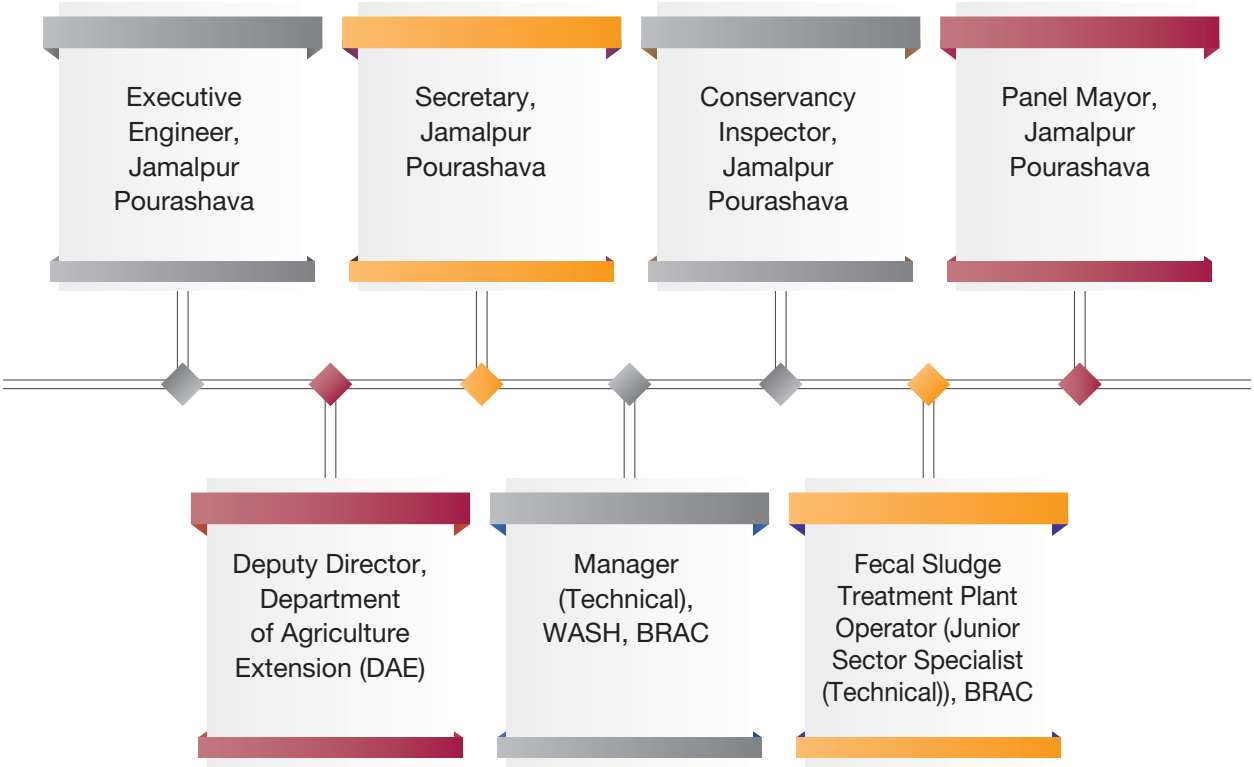
Through six Focus Group Discussions (FGD), information was collected from five different stakeholder groups in the study area. The participants and discussion topics of each FGD are presented in Table 2.

Table 2 List of participants with discussion topics for each FGD

FGD No.	Participants	Topic of discussion
1, 2	■ Pit/septic tank emptiers representing mechanical emptying groups ■ Mechanical desludging vehicle operators and drivers	1. Challenges and barriers for mechanical emptying and its upscaling 2. Operation and maintenance of the mechanical emptying system 3. Occupational health and safety 4. Impact on livelihood options 5. Public perception, etc.
3	■ Pit/septic tank emptiers representing manual emptiers	
4	■ Solid waste collectors	1. Solid waste collection practice (primary, secondary collection, etc.) 2. Challenges and barriers 3. Occupational health and safety 4. Business modality, etc.
5	■ Farmers (users and non-users of co-compost fertilizer)	1. Importance of organic compost 2. Challenges and barriers in using organic compost 3. Initiatives by govt. to increase awareness of organic compost 4. Farmers' knowledge of the benefits of using organic compost
6	■ Treatment plant manager and operators	1. Rate of collected sludge being transported to FSTP 2. The operational procedure of FSTP, performance, end-use product, manpower, associated cost, operational challenges, etc.

1.3.4
Key Informant Interview (KII)

To collect specific information from key informants considering the different aspects of FSM service as well as the components of the service chain, several KIIs were conducted during the study. The list of the key informants who were interviewed during the study includes -



1.3.5
Field Visits

Field visits were conducted several times to visit the FSM treatment plants. The field visits helped to understand how the system works, to verify the data/information collected from different sources, and to address relevant information gaps after data analysis. During the field visits, focus was given on treatment plant technology, its operation, and maintenance, end use product management system, and use of the end use products, etc.

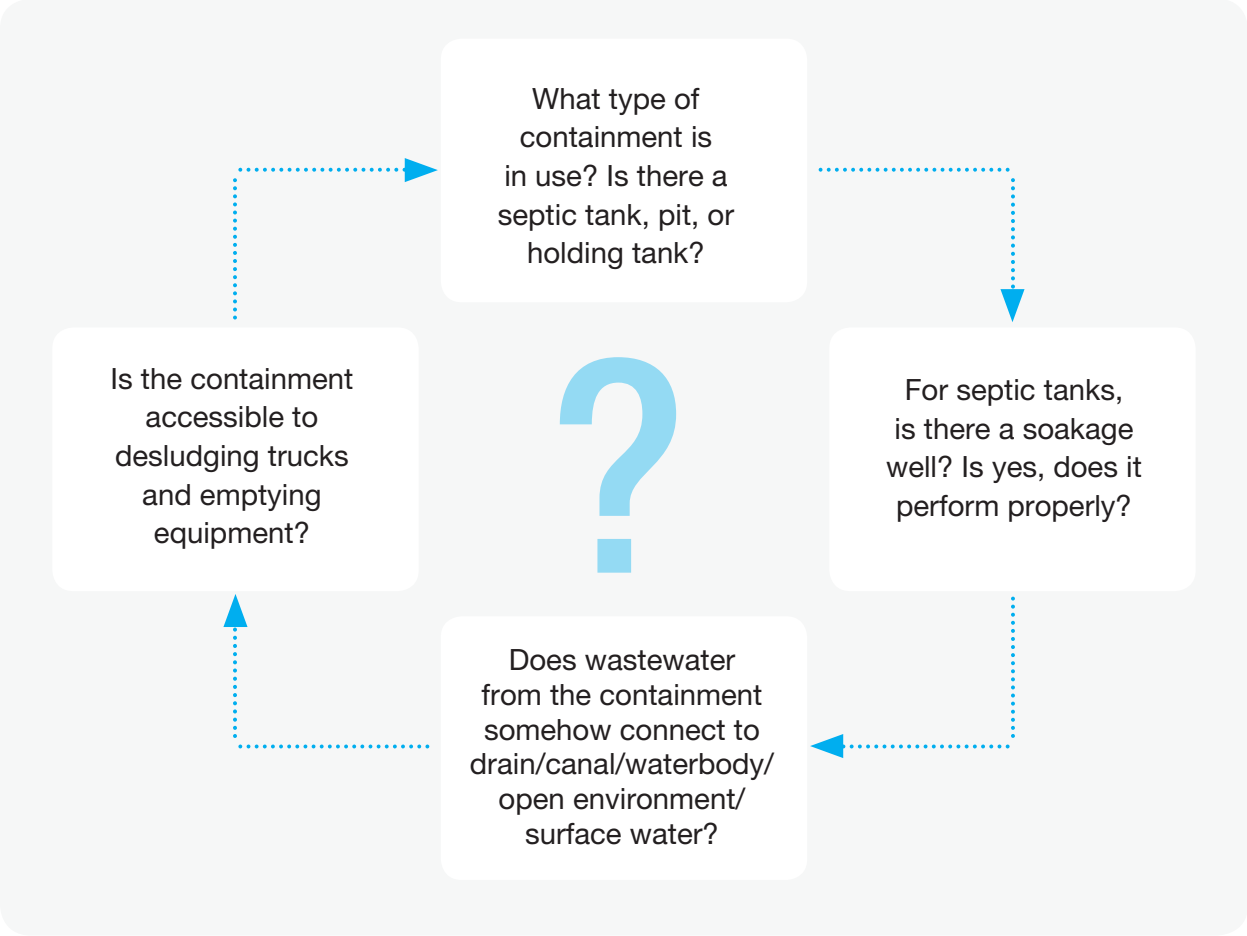
1.3.6
Technical Assessment

To address the study needs, a rapid technical assessment (RTA) was required as the household respondents and system operators are sometimes not well informed of the exact measures or the facts to provide accurate information. For example, some household respondents may not know if their containment is accessible by the vacutugs, how the soakage well should function and/or is functioning, etc. It is also difficult for vacutug operators to know the percentage of containments and/or percentage of households that are inaccessible. Therefore, a technical assessment was conducted at different stages of the service chain.

Figure 2 Field visit at fecal sludge treatment plant in Jamalpur Municipality

1.3.6.1
RTA of Containment

As part of technical assessment, the surveyors who conducted the questionnaire survey at the households also collected information through physical inspection of household toilet facility and the containment. Hence, the sample size for technical assessment is the same as for the household survey. The assessment was done based on the following questions:

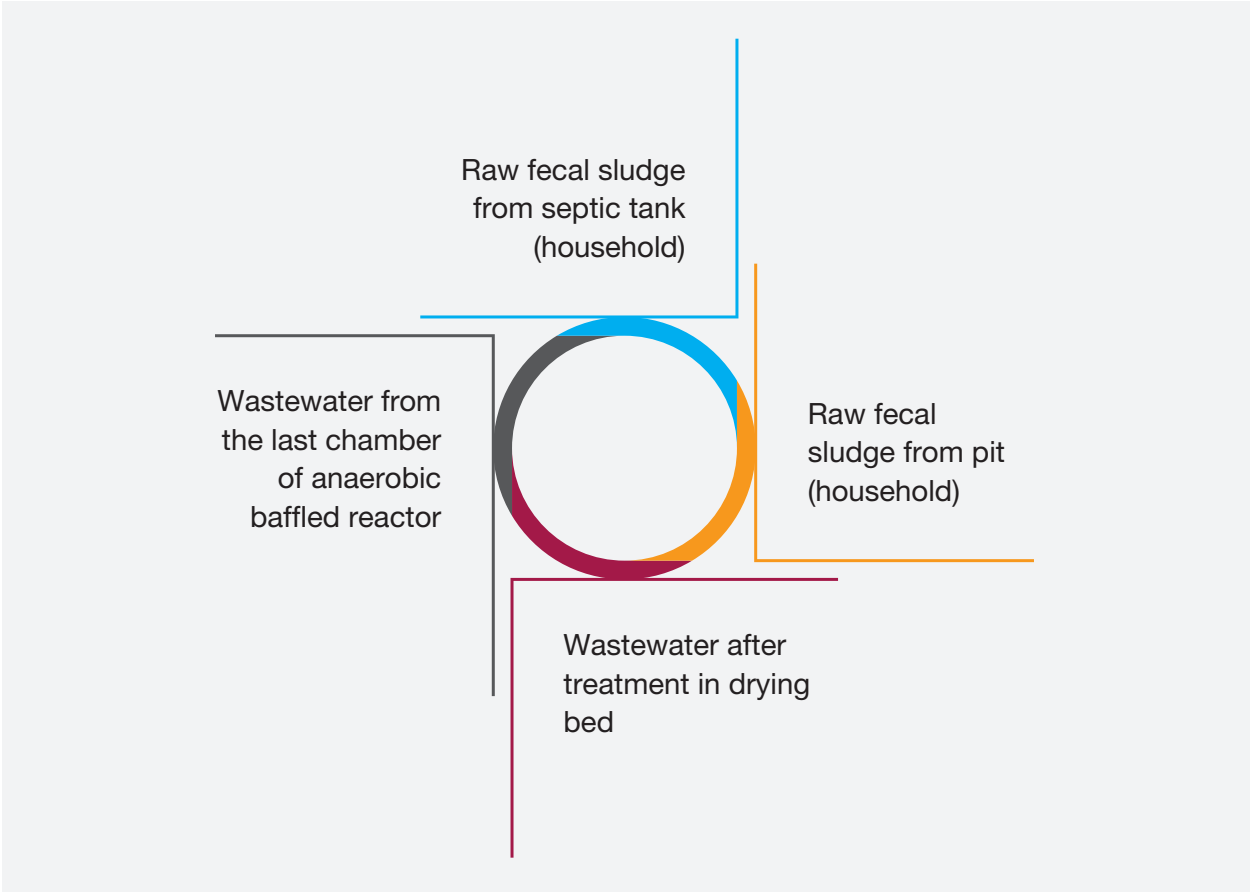


1.3.6.2
Average trip time assessment

The average trip time for collection and transportation of FS from households to the disposal site (FSTP) was measured by using a formula: **Total trip time = (travel time from the treatment plant to the household + parking time + equipment set up time + sludge loading time + travel time back to treatment plant + sludge unloading time).** The findings helped to estimate the average number of trips a vehicle can make per day. The information was collected from the operators of the vacutugs during the FGD.

1.3.7
Sample Testing (wastewater and co-compost)

Both wastewater and co-compost samples were collected and tested at laboratories. The wastewater samples were collected from four locations (one sample from each location):



These samples were tested at the BUET environment laboratory for pH, Total Dissolved Solids (TDS), Total Solids (TS), Biological Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD), Electrical Conductivity, Organic Matter, Total Nitrogen and Ammonia-Nitrogen.

Two co-compost samples were collected from the co-compost plant and were tested at SRDI laboratory, Dhaka. In total, 17 different parameters of the samples including pH, moisture content, Organic carbon, Ammonia-N, Total N, Phosphorus, Sulfur, etc., were tested.

1.3.8 Validation Workshop

A validation workshop was organized in Jamalpur Pourashava on December 28, 2021, where the information collected from different sources on different aspects of FSM services were shared with participants. This helped to further verify the collected data/information. The list of participants and image of the validation workshop is provided in Annex-II. In addition to validation of collected information, the following issues were discussed with the stakeholders:

1.3.9 Analysis of Data/Information

The analyses were conducted using both qualitative and quantitative information collected from FGD and KII, household survey, records, and field visits. Appropriate statistical techniques using MS Excel were used to perform the analyses.

The analyses focused on finding the coverage of FSM services providing collection and transportation services, performance of FSTP in treating FS and producing co-compost. Besides assessing the performance of the FSM services, emphasis was given on assessing other aspects

that help ensuring sustainability of the service. Since it is important to create results that can sustain after the project support stops, a few key areas of sustainability were analyzed which are financial, institutional, environmental, technological and social sustainability.

Willingness and readiness of Jamapaur Pourashava authority to take over the FSM system from BRAC was assessed. While FIETS sustainability analysis focused on five sustainability criteria, the two major criteria that were used to assess the readiness of the authority are financial and institutional readiness. Based on the findings from the performance assessment and sustainability analysis, a few recommendations to make the FSM service sustainable were placed. A handover plan has also been developed in consultation with Jamalpur Pourashava and BRAC, based on the findings of the study.

1.4 Organization of the report

The report contains six chapters to present the findings from the study. The first chapter discusses the background, objectives, and the approach and methodology of the study. Relevance of the programme in the context of sanitation status in Jamalpur Pourashava is presented in chapter two. Chapter three presents the interventions of BRAC WASH programme to the FSM system in Jamalpur Pourashava. The findings from analysis of emptying and transportation service, and treatment of FS at the FSTP to produce co-compost are discussed in chapter four. The institutional arrangements, the institutional capacity of the Pourasahva, and the FSM management systems in the Pourashava with financial analyses are discussed in chapter five. Finally, chapter six presents the summary findings from the study for the FSM system with some recommendations, along with a handover plan to Jamalpur Pourashava authority, to address the challenges identified in the study.

EVALUATION OF
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IN JAMALPUR POURASHAVA

CHAPTER 2

RELEVANCE AND NEED ASSESSMENT OF FSM

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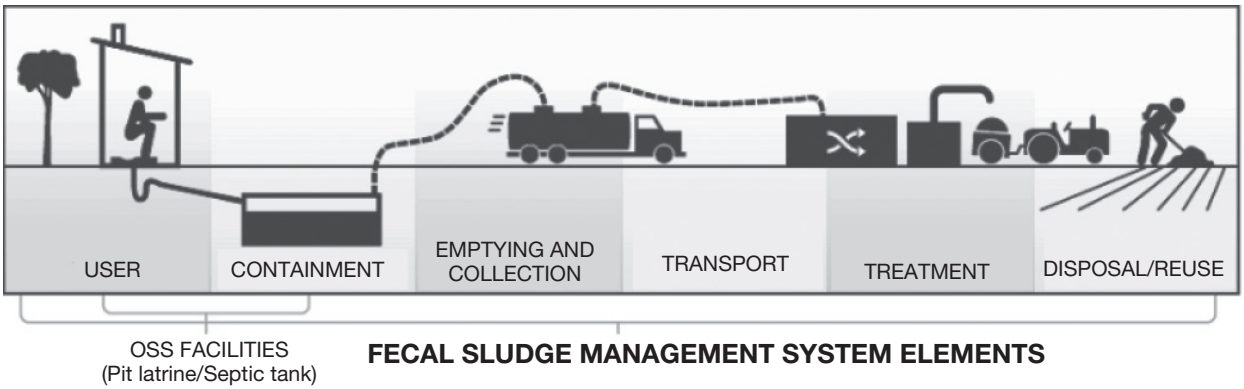
RELEVANCE AND NEED ASSESSMENT OF FSM

FSM is the management of FS contained within non-sewered sanitation systems such as pit latrines and septic tanks. Non-sewered sanitation is also commonly referred to as on-site sanitation because the containment facilities are situated within the plot occupied by a dwelling or its immediate surroundings [1]. A complete FSM system consists of containment system (pit latrines, septic tanks, or other onsite sanitation systems), emptying of FS from the containments, transportation of collected FS, and its proper treatment and disposal or end use. The service chain, termed as "Sanitation Service Chain", defines the stages necessary to properly manage human waste and prevent any health hazard, and consists of a total of five components: containment, emptying, transport, treatment, and reuse or disposal. The elements of the FSM are shown in Figure 3.

Figure 3 Sanitation service chain (Source: Bill & Melinda Gates Foundation)



Jamalpur Pourashava is an A category Pourashava which is one of the largest Pourashavas in Bangladesh that was established in 1869. It has a total area of 53.28 km^2 with a total population approximately 163,298 (Source: BRAC). There are 38,859 households in the Pourashava living in 12 Wards. This chapter focuses on the analyses of current sanitation practice in Jamalpur Pourashava and assessment of the relevance of FSM for this Pourashava. The analyses include an extensive study on the sanitation types and coverage, and FS management practice in the Pourashava.

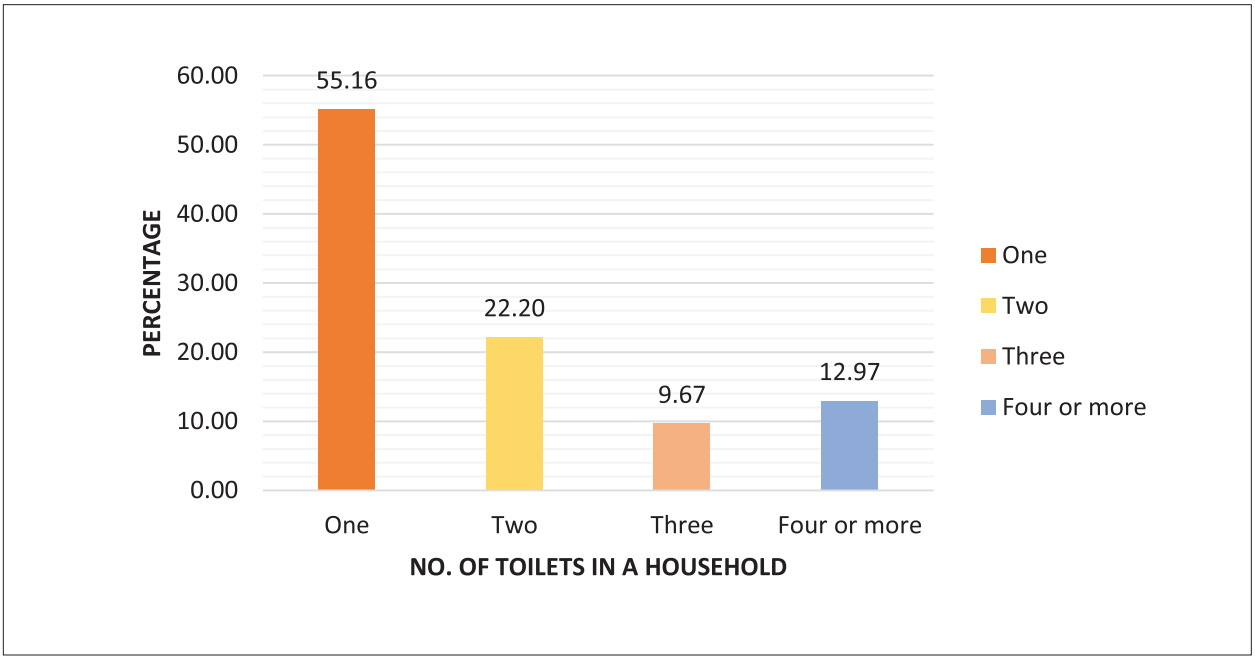
2.1
User Interface and Containment

Sanitation coverage means the type of technologies, such as types of latrines and containments, used by the general population in an area. Sanitation coverage is a very important factor in determining how advanced or improved the sanitation facilities in a community or city is. To assess the functionality of the sanitation system, finding out the coverage of improved technologies throughout the area provides a clear picture of the current scenario [2].

Although no case of open defecation was found from household survey, it was reported during the KIIs that there might be some cases of open defecation in Jamalpur Pourashava, which will be less than 1%. According to KII, it is mainly homeless people or floating population or people living in extreme poverty that still practice open defecation. There are a few public toilets for public use at the locations where people gather regularly (e.g., bus terminals, markets, etc.). There are also a few community toilets, specially built for low-income communities or slums.

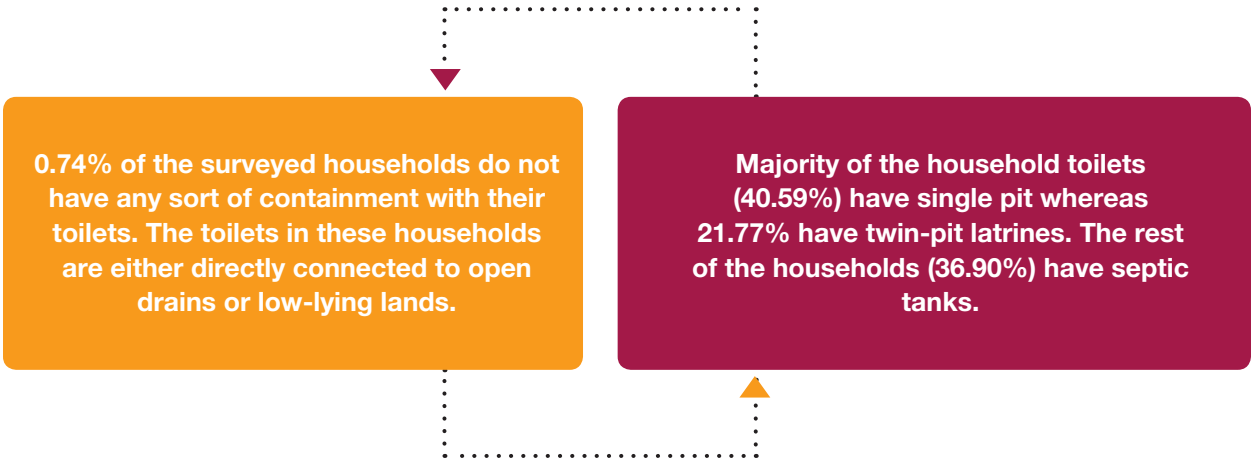
At the household level in Jamalpur Pourashava, it was found that majority of the households[3] (55.16%) have one toilet in their households, while 22.20% have two (22.20%), 9.67% have three, and 4.62% have four toilets in their households. Figure 4 shows the findings from household survey on the number of toilets in households.

Figure 4 Number of toilets in a household



[3] A general household is constituted of persons who make common provision of food and spend night under the same roof. A household includes all the persons who occupy a housing unit as their usual place of residence. The occupants may be a single family, one person living alone, two or more families living together, or any other group of related or unrelated persons who share living arrangements.

The containment system is a major component of the FSM service chain. There are mainly two types of containments in on-site sanitation systems in Bangladesh: septic tank system and pit system. The pit system can further be divided into single pits and twin-pits, based on the number of pits connected to the toilet facility. The key findings on different types of containment systems used in Jamalpur Pourashava are summarized below:



2.2 Management of FS and Wastewater from Containments

Fecal waste contains numerous harmful pollutants, especially a very high concentration of pathogens, and hence, needs to be handled properly. Generally, in an on-site sanitation system, containments are used to properly store and manage these wastes. Once the containment is filled up with FS, either it is emptied (in case of septic tank and single pit) or abandoned (single pit) or alternate containment is used (twin-pit). As soon as the containment becomes full of FS, the users of it feel the urgent need to emptying to avoid overflow from the containment. This condition often results in the spreading of odor and causing an unhealthy environment. Although it is expected that all the containments will be emptied at a regular interval, it has been found from the survey results that a lot of households are yet to empty their containment facility in their lifetime.

In Jamalapur Pourashava, the household survey findings revealed that out of 271 households, 227 households (84.07%) reported to have never emptied their containments (which was 75.09% in the baseline study conducted by BRAC in 2017), mainly because either the containment was never full (74.27%), or they abandon the containment once it is filled up with FS (25.73%), according to their responses. Among the households that have septic tanks, 89.17% have never been desludged in lifetime. Among the single pit users, 56.67% of the pits needed desludging while the rest of the pits (43.33%) have never been desludged in its lifetime.

As 15.97% of the households from potential user group reported that they needed desludging of containments, it is evident that they used the manual emptying system which is unhygienic and often disposes the FS into open environment, unless the owner of the household makes arrangement for burying the FS in a trench or hole in safe manner. Therefore, the management

of FS from this 15.97% households remains as a big concern. However, FS management in the other 84.07% households, who reported that they never needed desludging of containment, need to be investigated if their containments are properly managing the FS.

When the sanitation system is unsafe and/or standards for containment systems are not followed during its design and construction, the FS may end up in open environment. This highly polluted FS often ends up into open environment (e.g., water bodies, open ground, etc.) where humans come directly in contact with the pollutants. Even if the FS does not fall into any water body directly, it might get washed away by rainfall runoff and get mixed with surface water as runoff. This is a very common way of surface water getting polluted by unsafe and inadequately managed sanitation system. On the other hand, if a single/twin pit or soakage pit is constructed in an area having a shallow water table, then there is a possibility that leachate from the pits will reach into the groundwater and thus, can pollute groundwater [2].

To understand the status of management of FS from the containments in Jamalpur Pourashava, information from household level was collected during household survey and RTA. The findings from the analysis of collected information is discussed here briefly.

Septic Tank

The performance of a septic tank greatly depends on its design. A well-designed two-compartment septic tank, the first compartment immediately after the inlet being two-third of the total length, can effectively reduce the discharge of solids with the tank effluent [3]. Therefore, a septic tank is most favored with a length three times its width. From household survey findings, most of the septic tanks in Jamalpur (61.33%) were found to have single compartment, which is a major concern as efficiency of single-compartment septic tanks to reduce pollution from wastewater is very low. Some of the septic tanks have two (26.59%) or three (8.76%) compartments whereas a few septic tanks (3.32%) were found having four or more compartments (Annex-III, Figure A-1). According to the analysis, only 6.04% of the surveyed households with septic tanks in Jamalpur Pourashava have a length-width ratio equal to or above 3 (Annex-III, Figure A-2).

To understand how wastewater from septic tanks is managed in the Pourashava, an analysis on the septic tank effluent discharge options was done where majority of the septic tanks in Jamalpur Pourashava (80.06%) were found to have a soakage pit connected to them. A few of the septic tanks were found discharging wastewater into open drains (11.18%) and a few into open ground (4.23%). A few septic tanks (2.72%) have no outlet with it and some households (6.95%) did not know where the FS ends up (Annex-III, Figure A-3). However, among the soak pits connected to the septic tanks, 13.76% were found discharging wastewater into open drains or water body. Therefore, it can be said that among the septic tanks that have never been desludged, approximately one-third (32.85%) are not safely managing its wastewater.

Single Pit and Twin-Pit

Both single pit and twin-pit latrines are used in Jamalpur Pourashava, where the depth of pits ranges from 3 ft to 20 ft. But many of these pits (62.34%) have a depth between 6 ft to 10 ft, with a significant percentage of pits (31.17%) have a depth below 5 ft as well. Only 6.49% of the pits have depth between 11 ft to 20 ft (Annex-III, Figure A-4).

Among the 110 households having single pit latrines, majority (91.81%) discharge wastewater from the pit into open environment, before abandoning or emptying the pit. It was observed that only 8.19% of the single pits have a soak pit connected to them. However, all these soakage pits were reported to be discharging wastewater into open environment too. Among the 59 twin-pit latrine users, 15 (25.42%) were reported to discharge wastewater into environment, especially during the rainy season.

2.3 Summary Findings

The survey among the potential user groups (n=271) reveals the sanitation status of the Jamalpur Pourashava. According to household survey findings, 0.74% households in Jamalpur Pourashava do not have any containments, hence discharging FS directly into open environment. Among the households that have containments, 36.90% have septic tanks, 40.59% have single pits, and 21.77% have twin-pit latrines.

15.97% of the households reported that they needed desludging of containments, who used the manual emptying system which is unhygienic and often disposes the FS into open environment. Therefore, although the FS is emptied, the management of FS from this 15.97% households remains as a big concern. Moreover, among the households who never emptied their containments, reporting either their containment was never full, or they abandon it as soon as it gets full, several cases were found that discharge wastewater into environment. According to the baseline report (BRAC, 2017), 11.83% containments of Jamalpur Pourashava was directly or indirectly connected to open drain, canal, or open spaces. Among the septic tanks that have never been desludged, approximately one-third (32.85%) are not safely managing its wastewater. The scenario was found worse in the case of single pits as all the single pits, before getting abandoned by the users, were reported to discharge wastewater to the environment. Although the twin-pit latrines were found to be safely managing the FS in most cases, still 25.42% of the twin pits were reported to discharge wastewater from the pits into open environment.

The findings reveal that FS from a significant percentage of containments have been polluting the environment in Jamalpur Pourashava, which is posing a severe threat to public health and the environment. The huge quantity of FS generated in septic tanks and pits would remain inaptly managed in absence of FSM services, largely due to lack of knowledge of Local Government Institutes (LGI) and general people. Therefore, to achieve the target of city-wide safely managed sanitation for Jamalpur Pourashava, the need of introducing FSM service was imperative. Hence, there remains no uncertainty over the necessity of the FSM service that BRAC WASH programme started in 2017 to support Jamalpur Pourashava in achieving one of its SDG goals.

EVALUATION OF
FECAL SLUDGE MANAGEMENT
IN JAMALPUR POURASHAVA

CHAPTER 3

FSM INTERVENTIONS IN JAMALPUR POURASHAVA

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FSM INTERVENTIONS IN JAMALPUR POURASHAVA

This chapter provides a summary of the interventions provided by BRAC WASH programme to establish the FSM system, consisting of all components of the service chain, in Jamalpur Pourashava.

In 2017, BRAC's Urban WASH project piloted the FSM plant in Jamalpur Pourashava to support the Pourashava's waste management capacity. Figure 5 shows the key activities of the project. BRAC WASH renovated the Pourashava owned non-functional fecal sludge treatment plant (FSTP) and customized the vacutug for collection and transportation of FS from the households. The site for this project was an existing but non-functional FSTP. The capacity of the treatment plant was increased where new drying beds followed by anaerobic baffled reactor (ABR) was constructed to treat the effluent leaching out of the sludge drying bed before releasing it into the environment.

Figure 5 FSM by BRAC in Jamalpur Pourashava

Activities in Jamalpur's Sanitation Value Chain

ACCESS TO TOILETS	EMPTYING	TRANSPORT	TREATMENT	REUSE
				
BRAC's Urban WASH project provides sanitation loans so households can install new or upgrade existing latrines. On site twin-pit latrines are promoted as the ideal technology	Pit emptiers are trained on safe emptying of pits or septic tanks using the mechanical vacutug Households receive this service in exchange of a fee	The faecal sludge collected from household pits are safely transported to the FS treatment plant where it is undergoes multiple stages of treatment	The faecal sludge is disposed and stored at the mixing chamber, followed by transfer to the drying chamber to remove moisture, Next, it is co-composted with organic household waste	Faecal sludge and organic waste is co-composted, dried, weighed and packaged into organic fertiliser-The fertilizer is sold to farmers

There are also two soak wells that receive the effluent from ABR and facilitates further treatment through soil infiltration. The major modifications made by BRAC in the treatment plant include:

- Increasing sludge storage capacity up to 60 m3 (initially it was 30 m3)
- Drying bed consisting of six chambers for drying of FS
- Five-chamber anaerobic baffle reactor (ABR) instead of septic tank for treatment of leachate from drying bed
- Green house for further drying of sludge at a certain temperature after removing from dried bed
- Increasing number of chamber (from 6 to 12) for mixing of solid waste (organic) with dried sludge
- Solid waste unloading and processing zone
- Conveyor belt for solid waste processing and solid waste compactor for reduction of volume of solid waste

A non-functional large vacutug owned by the Pourashava was made functional by BRAC during the project where they provided the truck to carry the existing sludge container (2,000 L capacity). A smaller vacutug (800 L capacity) was also customized to access narrow roads of the Pourashava areas which could not be accessed by the larger vacutug. Figure 6 shows the vacutugs that are being used for collection and transportation of FS in Jamalpur Pourashava.

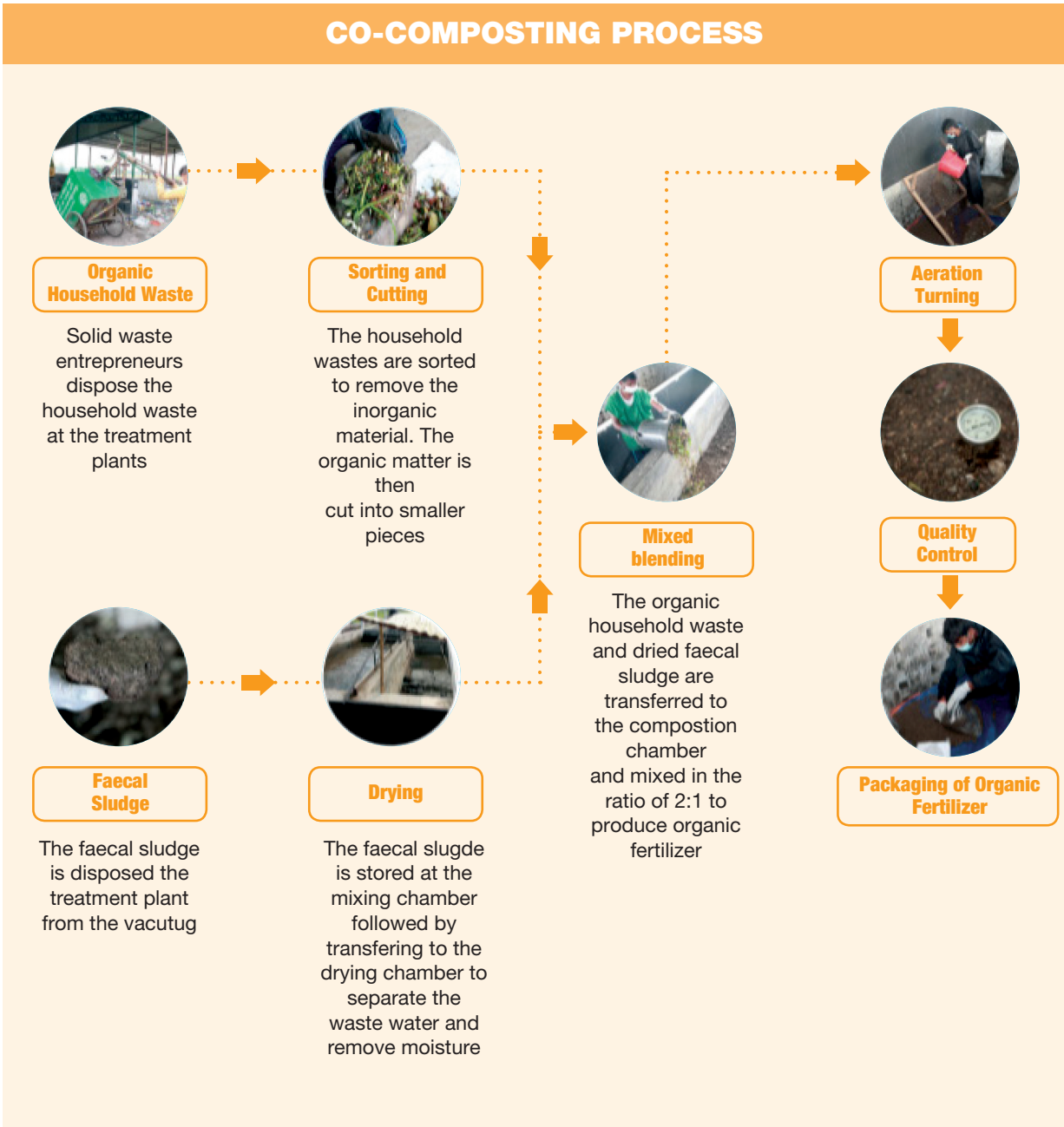
Figure 6 800 L capacity small vacutug (left) and 2,000 L capacity large vacutug (right)

The key features of the upgraded fecal sludge treatment plant (FSTP) are:

- The FSTP is divided into two sections: solid waste dumping zone and FS dumping zone.
- There are two sludge dumping chambers with a capacity of 16,000 L each. In addition, there are two more plastic tanks with 10,000 L as back up for storing sludge if the main dumping chambers are full.
- There are two drying beds (Figure 7), each having three chambers, for drying of FS, which is followed by five ABR chambers that treat the leachate from drying bed. It takes 12-20 days to dry the sludge in dry season whereas in rainy season, it takes more than 20 days to dry the sludge. The capacity of each chamber is 6,500 L. 60-62o C temperature is maintained inside the drying bed chambers. In addition, there is a greenhouse (Figure 7) chamber where dried FS is kept for a period for controlling its moisture content.
- There is no maturation pond and the wastewater from ABR flows into soak wells.
- To prepare co-compost, dried sludge with organic solid waste (ratio 1:2) is mixed to produce organic fertilizer. There are 12 composting chambers where processed solid waste and dried FS is mixed and processed to prepare co-compost. It takes approximately 3 months to prepare co-compost from the dried FS. Figure 8 shows the co-composting process in the FSTP.

Figure 7 Drying bed (left) and greenhouse (right)

Figure 8 Co-composting process in Jamalpur Pourashava FSTP



EVALUATION OF
FECAL SLUDGE MANAGEMENT
IN JAMALPUR POURASHAVA

CHAPTER 4

ASSESSMENT OF FS EMPTYING, TRANSPORTATION AND TREATMENT

CHAPTER 4

ASSESSMENT OF FS EMPTYING, TRANSPORTATION AND TREATMENT

While the management of containment is very important to prevent any pollution at household level, to ensure that the FS is safely managed after emptying, the emptying-transportation and treatment of emptied FS must be done properly. In the FSM service in Jamalpur Pourashava, the emptying, transportation and treatment of FS was managed by BRAC. In this chapter, the findings on emptying and transportation service provided, and efficiency of treatment system will be discussed. The coverage of emptying service and performance analysis of the FSTP will also help to understand how effectively the FSM service has been running during its operation in the last few years.

4.1 Emptying of FS

Emptying is the process of removing the stored FS from the containment by using mechanical or non-mechanical equipment [2]. This section mainly discusses the findings on the mechanical emptying service availed by respondents in the Pourashava, the tendency of emptying among the respondents based on containments, emptying frequency of pits and septic tanks, availability of emptying vehicles, number of trips made by emptying service providers, the reasons for availing mechanical emptying service by users, satisfaction level of users, etc. Household survey findings, available database, and data/information collected through KII and FGD were used for carrying out these analyses.

4.1.1 Emptying of Containment

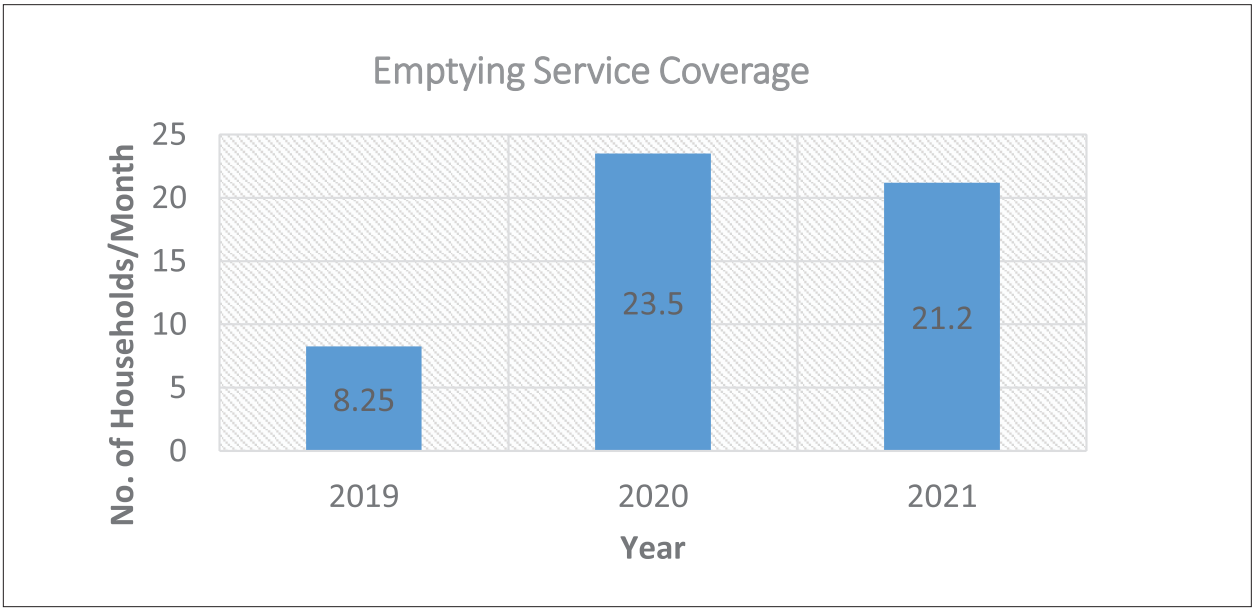
The emptying service in Jamalpur Pourashava is provided by two vehicles: one 800 L capacity vehicle and one 2,000 L capacity vehicle. During the period from January 2019 to October 2021, 593 households were served when 727 trips were made. The monthly coverage was highest in 2020 when 23.5 households were served per month on average (Figure 9). The coverage, which was expected to increase gradually, however, dropped slightly in 2021 (21.2 trips per month) which could be due to the COVID pandemic and less marketing/promotion activities due to

the COVID situation. The findings reveal that only 2% of total households took the mechanical emptying service till now, which means that 98% of households in the Pourashava remain as a potential market for this service. This result also shows resemblance with the findings of SFD of Jamalpur Pourashava which found only 1% of FS was safely managed.

Among the users of mechanical emptying service, 26% were pit users and 74% were septic tank users. Therefore, septic tanks were found to show higher demand for the service. Among the surveyed 91 septic tank users who used mechanical emptying service, 12.09% of the septic tanks were desludged within 1-12 month, 72.53% of the septic tanks were desludged within 12-24 month and 15.39% of the septic tanks are desludged within 24-36 month. Among the surveyed 93 pit users who availed mechanical emptying service, 88.17% of the pits were desludged within 1-12 month, 9.68% of the pits were desludged within 12-24 month and 2.16% of the pits were desludged within 24-36 month. The findings indicate that although the septic tank users asked for the service more, the pit latrine requires more frequent desludging as the containment volume is normally less than the volume of septic tanks, and hence, get filled up quickly.

The number of trips required for desludging of containment is an important factor as it is directly connected to the cost of the service. The cost of the service for a customer is often fixed based on the number of trips required to empty the FS from his/her containment. The study found that most of the households who use pit containments needed only one trip (83.87%) to desludge the pits, 4.30% of the households needed two trips to desludge the pits and rest needed three trips or more. For septic tanks, most of the households needed only one trip (52.75%) to desludge the septic tanks, 27.47% of the septic tanks needed two trips, 10.99% needed three trips and only 2.20% needed four or more trips to desludge the septic tanks. Some of the respondents could not answer the question as they could not remember. The findings also suggest that septic tanks required less frequent desludging compared to pits due to its larger volume.

Figure 9 Average number of households covered in last three years



4.1.2 Response Time

Response time (time taken by service providers to provide the emptying service after getting the application from customers) is another important factor for increasing service quality and satisfaction level among the customers. Response time for mechanical emptying service mainly depends on a number of factors that include the demand for the service, the number of vehicles providing the service, and the service provider's efficiency. If the service demand is too high, but there are not enough vehicles to provide the service, then the response will be delayed. When the efficiency of the service provider is low and the manpower is not skilled, then it will take a lot of time to respond to the service requests as well [2]. During the household survey, the response time that the service providers needed was asked to the users. The findings show that 67.93% of the users got the service within 1 day after contacting the service providers. 31.52% of the users got the service within 2-4 days and only 0.54% of the users got the service after 4 days' time after contacting the service providers.

4.1.3 Satisfaction Level

To understand the main reasons why one desludging method is preferred over another in the study areas, questions were asked to the respondents during the household survey. The study reveals that 70.65% mechanical users are "very satisfied" with this service and 29.35% mechanical users are "satisfied" with this service. None of the households were found "not satisfied" with the service. Among the users of mechanical emptying service, 98.37% availed this service for being "low cost" option, 68.48% availed this service for its "easy availability", 64.13% availed this service for the "low response time", 88.04% availed this service for producing "less odor" than manual service and 85.87% availed this service for being "environment friendly" (Annex-III, Figure A-5).

4.2 Transportation of FS

After emptying, transportation of FS is required to dispose of the collected FS in a treatment plant or a landfill. Transportation of FS is very important as improper or open transportation of highly polluted FS can cause severe problems to public health, environment, and can cause health risks to the people involved in transportation. Transportation of collected FS by the mechanical system is done by two motorized vehicles (vacutugs) in Jamalpur Pourashava, where FS is contained in a closed container mounted on the vehicle.

Average time required for a trip, starting from the FSTP to the household and then coming back to the plant for unloading the collected FS from household, depends mostly on the distance of the household from the plant. Table 3 shows the average time taken, with breakdown of

time taken to perform different tasks during the collection and transportation of FS. It can be said that it takes less time for parking, equipment setup for collection, collection of FS from containment (loading), and unloading of FS at the FSTP. Considering the variabilities in time taken for different trips, it was estimated that the vehicle can make 5-6 trips every day, which equals to approximately 1,500 trips in a year (assuming 5 working days in a week). However, it was found that the highest number of trips was in 2020 when 371 trips were made. Therefore, only 25% of the current capacity of the vehicle was used in 2020. This indicates that if the demand increases four-fold from the current demand, it can still be covered with one vehicle. In addition, more trips can be made by the 800 L capacity vehicle that serves the households having narrow access roads.

Table 3 Average time required for transportation of FS

Average Time (Minutes)						No. of trips in a day	Estimated no. of trips possible by one vehicle in a year	Highest no. of trips made in a year (no. of vehicle, year)	Percentage
Traveling to HH	Parking near containment	Equipment setup and packing	FS loading	Traveling from HH to FSTP	FS unloading at FSTP				
10-30	5-10	25-30	10-15	10-30	5-10	5-6	1,500	371 (2020)	25%

The road and containment accessibility are also important factors which were studied based on two aspects: vehicle accessibility to the households and emptying equipment accessibility to the containments (whether the pipe length can reach the containment from the vehicle parking point). It was found from the survey that 83.72% of the households in Jamalpur Pourashava are accessible, by either of the two vehicles.

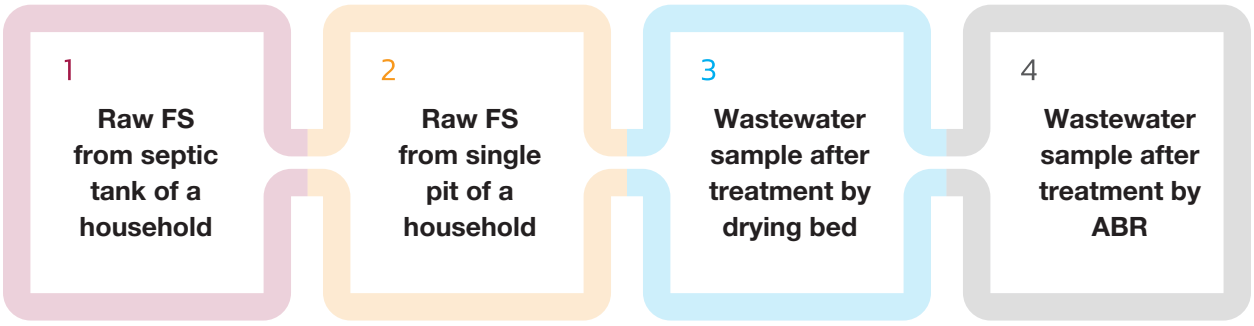
4.3 Treatment of FS

It was found that with the current demand for the service, the treatment capacity of the FSTP is underutilized. The capacity of the treatment plant and supply of FS (highest in 2020) to the plant are shown in Table 4. It is evident from this finding that only 40% of the total capacity of the treatment plant was used in 2020, which was mainly because of the lack of supply of FS to the treatment plant.

Table 4 Treatment of FS is the FSTP and its capacity

Technology used	Unplanted Drying Bed (6 chambers)
Treatment capacity/day (m3)	3.25
Treatment capacity/year (m3)	1,190
FS received/year (m3)	477.1
% of total capacity used	40%

To check the treatment efficiency of the plant and if the wastewater is treated adequately to be discharged into the environment, wastewater samples were tested at the Environmental Engineering Laboratory of Bangladesh University of Engineering and Technology (BUET). Four samples were collected for testing that include:



For each sample, nine parameters were tested that include - pH, TDS, TS, BOD_5, COD, Total Nitrogen, NH_3-N, Organic Matter, and Electrical Conductivity. The test results are provided in Annex-IV. From the test results, it was observed that concentrations of tested parameters in the effluent sample (after ABR treatment) were within the ECR 1997 standard values for inland surface water discharge, except for BOD (concentration 60 mg/l). However, the BOD concentration indicates that the effluent wastewater can be discharged into irrigation land. Moreover, there are soak wells connected to the ABR where the effluent from ABR infiltrates into the soil layer that reduces the risk of any contamination to surface water or land. The distance of nearby groundwater source, a tube well, is more than 10 m from the soak wells which suggest that there would be no chance of groundwater contamination by the soak wells.

The dried sludge from the drying beds is mixed with organic solid waste. In total, 15,113 Kg of co-compost was sold in three years with highest sales in 2020 (4,271 Kg). The co-compost produced at the FSTP using solid waste and fecal waste was tested at Soil Resource Development Institute (SRDI) laboratory in Dhaka. In total, 18 different parameters were tested which include- Color,

Odor, Physical condition, pH, Moisture, Organic Carbon, C: N Ratio, Total Nitrogen (by weight), Total Phosphorus (by weight), Total Potassium (by weight), Total Sulfur (by weight), Total Zinc (by weight), Total Copper (by weight), Total Chromium (by weight), Total Lead (by weight), Total Cadmium (by weight), Total Nickel (by weight) and Inert material. The test results are provided in Annex-V. According to the test results, the moisture content of one sample was found to be not complying with the acceptable range, while the other sample had moisture content within the specified limit.

EVALUATION OF
FECAL SLUDGE MANAGEMENT
IN JAMALPUR POURASHAVA

CHAPTER 5

INSTITUTIONAL CAPACITY AND MANAGEMENT

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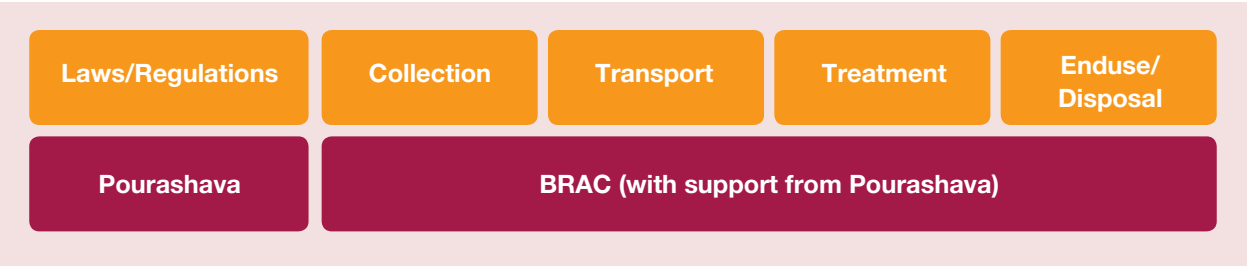
5.1 Readiness and Capacity of Pourashava

To ensure effective and sustainable FSM service delivery, the Pourashavas must have the capacity to manage each of the components of the service chain, either by operating directly by themselves or by monitoring the organizations (or business entrepreneurs) that will run the service [2]. In Bangladesh, to implement the entire FSM system in Pourashava towns, the primary responsibility lies with the Pourashava authority to take steps to include the provisions of the FSM infrastructures (i.e., treatment facility) within their "master plan" (prepared or being prepared in accordance with the provision of Schedule 2 of Paurashava Act 2009) for implementation of City-Wide Inclusive Sanitation (CWIS) or FSM services [4].

While Jamalpur Pourashava provided the land for the construction of FSTP and is offering necessary administrative support, BRAC provided the technical and financial support to run the FSM system. The operation and maintenance of the FSM service was also carried out by BRAC. Although the Pourashava has provided the land, existing vehicles, and permission to run the system, the FSM system operation was largely dependent on BRAC support.

The organization model used for FSM service in Jamalpur Pourashava is shown in Figure 10. Since Jamalpur Pourashava authority owns the FSM service and is going to run the service once BRAC hands over it to them in January 2022, it is important to assess its capacity to provide FSM service delivery. At present, Jamalpur Pourashava is willing to provide administrative support and other assistance, to scale-up the FSM system. The Pourashava provided the land for existing FSTP and already has allocated land (10.5 acre) for construction of a new FSTP, where Department of Public Health Engineering will construct a FSTP along with other waste management services.

Figure 10 Organizational model of FSM services in Jamalpur Pourashava



According to the Pourashava organogram (Annex-VI), the Conservancy Section is responsible for the management FS in Pourashava, along with solid and other waste management. In Jamalpur Pourashava, currently the Conservancy Section has one Conservancy Inspector (CI), who is a permanent staff, and 105 cleaners who are being hired on temporary basis. However, the Pourashava can appoint as many sweepers as they need for this purpose temporarily. It was found that the CI is familiar with the FS emptying service as he used to manage the service when the Pourashava first received the vehicle from LGED in 2013-14. However, if the FSM service is to be run by the Pourashava alone, it would be difficult for the conservancy section to manage the service unless they are strengthened and properly trained on FSM. Currently, there is no Health Officer in the Pourashava who is supposed to lead the Conservancy Section. Therefore, the Executive Engineer or Secretary or other Pourashava officials need to supervise the Conservancy Section, which according to the findings from KIIs with the Pourashava officials is often not sufficient to monitor the activities of conservancy section, since these officials remain occupied in their routine tasks. During the KIIs, the Pourashava officials agreed that the Pourashava is not ready to run the FSM service at present and will need some time to institutionalize the system for managing the service through Pourashava staff. The limited staff and allocation of resources might work as barriers to making the service sustainable in the Pourashava. The Pourashava Mayor and many other officials of the Pourashava have not received any formal training on how to operate and manage FSM, which may also act as a barrier in operation and management of FSM service in Jamalpur.

While the citizens need to have the awareness to not discharge FS into open drains/environment, the Pourashava also needs to take the responsibility to ensure that the containments are not discharging untreated FS into the drains and/or open environment. However, there are no specific government laws or regulations in this regard till now [2]. Therefore, to stop such practices in the Pourashava, the Mayors must take the initiatives. It was found that Jamalpur Pourashava authority is willing to stop such illegal practice of connecting the containments or disposing FS to drains/open environment through raising awareness of the citizens. However, there are still many households that have their containments connected to open drain and/or open environment.

Apart from emptying and transportation service, the Municipalities will also have to focus on treatment and end-use of FS. BRAC was providing technical and financial support for treatment of FS and to make co-compost. There are a couple of trained workers who have learned how to do the routine works at the plant to make co-compost from FS and solid waste. There are two staff who work for collection and transportation of FS from households to the FSTP. These two

staff also dedicate time for processing of dried sludge and organic waste to make co-compost. There is a security guard who works at night to ensure security of the plant. BRAC also assigned Plant Manager (Engineer) who coordinated the whole process.

Considering the need for citywide FSM service delivery in Jamalpur Pourashava, there is lack of technical experts at the local level, who can provide technical input and help decision making in case of any technical issues related to plant maintenance and performance. At present, the Pourashava relies on BRAC and its workers in this regard. At the end of the BRAC project, the Pourashava may have to look for external (project) support to develop a system for managing the whole FSM service and once such support is available, they might develop a plan to slowly build capacity of their staff on operation and management of FSM.

5.2 Stakeholder Management

5.2.1 Customer Management

Managing customers is one of the most important parts of FSM as it deals with awareness-raising among the people that would result in the creation of demand for the service. It also includes making the whole process easier for the customers by making application procedure easier for customers, providing quick service to the customers, and following up with them regarding the service delivery [2].

In Jamalpur Pourashava, most of the customers place the order to BRAC over phone calls for the emptying and transportation service. The phone number was distributed among the citizens of the Pourashavas by BRAC staff. The customers who do not have the contact number of BRAC, contacted the Pourashava to get the service who directed them to the BRAC plant manager. BRAC, in collaboration with Pourashava (e.g., Ward Councilors), has conducted several awareness raising activities for the citizens to encourage them to avail the mechanical emptying and transportation service through meetings, sticker/card distribution, and other means of sharing relevant messages. This has helped to create demands for the FSM service among the Pourashava citizens to some extent. However, there is still lack of awareness among people as they are yet to comprehend the benefits of the service, and the risk of manual emptying and indiscriminate disposal of FS in open drains and open environment.

Most of the mechanical service users contacted the service providers directly over phone call (84.24%) while 11.41% contacted the Pourashava to get the contact address of the service providers. 1.63% of the users physically went to the vacutug operators and only 2.72% of users connected to the service providers through their neighbors for availing the service.

The majority of the respondents (59.56%) in Jamalpur Pourashava have not seen or heard of any awareness campaigning activity in the Pourashava on FSM yet. Among those who said

yes, 40.22% of the respondents got the message through stickers, 22.42% have seen it on cards distributed by BRAC, and the rest heard of it through their neighbors or other community people. The findings indicate that still majority of the citizens in Jamalpur Pourashava are not aware of the service. Therefore, to increase demand for FSM service, attention should be given to effective awareness campaigning in all 12 Wards of the Pourashava.

5.2.2 Pit Emptier Groups

The traditional pit emptier groups (Horizon community) were found providing the emptying service in Jamalpur Pourashava, who are mostly involved in manual service. There is also a new group, known as Muslim pit emptier community, providing this service for a few years. In Jamalpur Pourashava, couple of pit emptiers are providing the mechanical emptying service. However, they do not belong to the traditional pit emptier group and have migrated into this profession from other jobs in the recent past.

Due to a small number of jobs created because of the low demand for the mechanical service, the traditional pit emptiers are not getting the opportunity to work in mechanical service system. Therefore, most of the members of these two groups still provide manual emptying service and/ or depend on other income-generating activities (e.g., solid waste collection or drain cleaners).

Since the mechanical emptying service reduced the work opportunity of the traditional pit emptiers to some extent, they expressed concern about their livelihood getting affected with the increase in coverage in future. As these people depend largely on pit emptying service as their profession, the Pourashava should communicate with them and make arrangements so that the traditional pit emptiers get work opportunity in the FSM service.

5.2.3 Department of Public Health Engineering (DPHE)/Local Government Engineering Department (LGED)

While Local Government Engineering Department (LGED) provided support to Jamalpur Pourashava in 2013-14 to construct the FSTP and provided a vehicle, Department of Public Health Engineering (DPHE) has taken initiatives to provide support to construct a new FSTP along with other waste management facilities shortly. According to the Institutional and Regulatory Framework for FSM (IRF-FSM), the Local Government Division (LGD) through its line agencies (DPHE and LGED) is supposed to provide technical support to the Pourasahvas, However, apart from offering project supports through providing infrastructures, the involvement of LGED and DPHE for capacity building of the Pourashava or in monitoring of the existing FSTP was found inadequate. For example, LGED did not follow up with the Pourashava authority after providing the project support in 2013-14 to establish the FSM system. During the study, the technical expertise of these line agencies at local level was found inadequate to support FSM planning and implementation. It can also be said that Pourashava and BRAC did not show enough interest in involving these line agencies in the current FSM service.

5.2.4
Development Partners and I/NGOs

The FSM services in the Pourashava started with a major contribution from the government and its development partners as Jamalpur Pourashava received financial support for emptying and transportation vehicles in 2013-14. Currently, Islamic Development Bank and Bill and Melinda Gates Foundation (BMGF) are going to support the Pourashava for scaling up of the FSM service. BRAC has been playing major roles in the implementation of FSM services and in supporting the Pourashava to develop a mechanism to ensure sustainable FSM service delivery since 2017. The role of BRAC will also be very important during the scaling up as well as for capacity building of Pourashava officials and other local stakeholders.

5.2.5
Private Sector Engagement

Onsite sanitation is often deemed in sector policy to be a 'private' rather than a 'public' good [5]. In this regard, the providers of services range from the masons, who build latrines and containments, to the entrepreneurs that build and run toilet blocks, from manual pit-emptiers to privately-run vacuum trucks to manage the collected FS. Engaging with the private sector for improving and assisting in developing better on-site sanitation systems and overall management of the service chain may need time but can be very effective. Besides, the FSM system can be a profitable market for private/informal groups as well [2].

Private sector can play significant roles in FSM implementation starting from supplying the on-site sanitation products to marketing of co-composts in the market. However, in Jamalpur Pourashava, FSM service has not been considered as a business opportunity by any entrepreneurs yet, which might be due to lack of knowledge of the potential market size.

5.2.6
Department of Agricultural Extension (DAE) and Farmers

The co-compost produced after the treatment of FS has the potential to become a source of revenue. There is also demand for co-compost fertilizer among the local farmers. Therefore, DAE has the potential to be one of the major stakeholders in sustaining the FSM system by increasing the sales of co-compost through advocacy. However, at present, the government does not have any exclusive project for promoting the co-composts produced from fecal sludge, according to DAE officials.

From the KII, it was found that DAE was not aware of the co-compost production at the FSTP in Jamalpur Pourashava. Regarding raising awareness among the city dwellers on the benefits of using co-composts, a lack of coordination was found among the Pourashava and DAE. It was suggested by DAE that if the Pourashava works together with DAE to disseminate the

benefits of using co-compost fertilizer for farming, the demand for co-compost will increase in the Pourashava as many people nowadays practice homestead gardening. To address this issue, the Pourashava could take initiatives to ensure the involvement of DAE through meetings, agriculture fairs, and other events.

The demand for co-compost is strongly influenced by the availability of other fertilizers and their prices, as well as by the policy in place (e. g., promotion of organic farming by govt. departments) [6]. Farmers' perception of the use of co-compost made from FS, and their willingness to pay for the product are also important factors that can influence the demand for the end products from FSM. The farmers understand that excessive use of chemical fertilizer decreases soil productivity. They also understand the importance of organic co-compost for nourishing the soil health.

Some of the farmers have knowledge about the co-compost produced in the FSTP in Jamalpur Pourashava and they used it. However, they think that there should be more production of this co-compost and more campaign for it. According to them, only 5% of the farmers are interested in the co-compost fertilizer, which could be due to lack of campaigning programs in their area.

5.3 Financial Management

One of the main reasons why FSM has not been sustainable in many Pourashavas is the financial complexity involved with its operational maintenance and management. Financial sustainability of service means that despite all the expenses associated with the service, it still makes profit and ensures the continuity of the service. Although the FSM service has been running for a few years, the service coverage is still very low in Jamalpur Pourashava. Until now, the Pourashava do not have any documented, specific plan for scaling up the system. The FSM service started with project aid and still, it depends on project supports for purchasing new infrastructure and/or to maintain its operational maintenance cost. In absence of a certain scale-up plan, the Pourashava also cannot develop a sustainable financial or business plan outlining long-term strategies, financial goals, and action plans for future.

Although FSM in Jamalpur Municipality started almost seven years ago, the present treatment facility was established in 2017. The sources of capital investment for the current components of the FSM service chain are shown in Table 5. It is evident from the table that the Pourashava mainly relied on project funding for any infrastructure or equipment support. However, the Pourashava provided land for the construction of the treatment plant.

Table 5 Source of support received as capital investment

Item		Source
1.	Vehicle for emptying and transportation	Pourashava received vehicle and other equipment from LGED in 2013-14, and later from BRAC IN 2017.
2.	Land for construction of treatment plant	Municipality provided land (1.5 acre) for FS and SW management.
3.	Construction of co-compost plant	Pourashava received support from LGED in 2013-14, and later from BRAC in 2017

The yearly income and expenditure records from the FSM service is provided in Table 6. Figure 11 shows the sources of income and expenditure. The figure suggest that a major part of the revenue came from the emptying and transportation service. But the system is yet to earn enough revenue from emptying service and sales of co-compost to cover all the costs associated with emptying and transportation, treatment, and making co-compost. Therefore, it required additional resources to subsidize the system which was provided by BRAC. However, the amount of subsidy required for the co-compost plant is expected to be gradually decreasing over the years and it is also expected that with creation of more demand for emptying service in the future and higher sales of co-compost, the system would make profit.

Table 6 Income and expenditure from FSM service in Jamalpur Pourashava

Year	Total Income (BDT)	Total Expenditure (BDT)
2019	105,455	301,196
2020	287,645	509,754
2021	173,300	334,037
Total	**566,400**	**1,144,987**

Figure 11 Source of income and expenditure from FSM service

EVALUATION OF
FECAL SLUDGE MANAGEMENT
IN JAMALPUR POURASHAVA

CHAPTER 6

CONCLUSION AND RECOMMENDATION

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The main objective of this study was to assess the FSM service in Jamalpur Pourashava where FSM service has been functional for a few years. In this chapter, the key findings from the study have been discussed in the conclusion. Based on the findings, a few recommendations have been made for improvement of the FSM service.

6.1 Conclusions

The study primarily focused on the assessment of the technical performance of FSM services in the Pourashava based on available data/information where the specific objectives were broken down into several points that include assessment of FSM coverage, analysis of the containment systems, assessment of emptying and transportation service, analysis of treatment performance and re-use of end products, financial analysis of FSM service, identification of the institutional arrangements and management systems, and stakeholder engagement in FSM service delivery mechanism. There are a few outcomes of the programme that will have long-term positive impact on FSM service in Jamalpur Pourashava.

The BRAC WASH programme has reactivated the FSM service in Jamalpur Pourashava after it remained non-functional for almost 3-4 years. The emptying vehicles and the FSTP provided by LGED in 2013-14 were made functional again by upgrading and extension of the system by BRAC in 2017.

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The quality of emptying and transportation service has been appreciated by the service users in the Pourashava. The service was quickly available, environment friendly, and available at an affordable cost, as reported by the users.

The upgraded FSTP has introduced the co-composting where FS and organic solid waste are mixed to produce organic fertilizer. The FSTP has helped to reduce dumping of FS in open environment, at least to some extent. The co-compost has been used by a few local farmers and in nurseries.

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To some extent, the programme has sensitized the local Pourashava officials and many citizens on the necessity of having FSM service to save the environment as well as to achieve the SDG goal 6.2.

Most importantly, it has created a platform on which the city-wide FSM planning could be built upon in future.

While the programme has had some positive impacts, there are a few areas where the programme faced challenges. It is important to identify these challenges so that necessary actions could be planned and undertaken in future programmes to achieve the desired results. A few challenges that affected the outcome of the programme are:

- The Pourashava authority is yet to take adequate actions against the household who have connections of the containments (e.g., septic tanks, pit latrines) to drains and open environment. Because of this practice, it will be difficult to increase the demand for containment desludging.
- The Pourashava authority has not received any formal training on FSM service, developing a plan for citywide inclusive sanitation, operation and maintenance, business model for sustainable FSM service, etc. Due to COVID-19, the BRAC WASH programme could not organize the training events and/or exposure visits for the Pourashava officials and other stakeholders. This has created some challenges during the programme as sometimes it was difficult to make the Pourashava understand the planning and the implementation steps.
- There is no dedicated center or cell in the Pourashava to monitor the FSM service, which will act as a roadblock in scaling up the FSM service to citywide FSM service.
- The awareness among the citizens of the Pourashava about the importance and benefits of FSM service has been limited. As a result, the demand for the service is low. The awareness campaigns could have been planned in a more effective way in the programme.
- The lack of involvement of DAE in promoting the use of co-compost among local farmers did not help to increase the demand for the co-compost produced at the FSTP.
- There is no established business model for the FSM service, which was required to prepare a long-term plan for sustainable FSM service as well as to draw attention from local entrepreneurs.

6.2 Recommendations

To achieve citywide inclusive sanitation at the Pourashava level, the Local Government Division under MoLGRDC has developed an **Institutional and Regulatory Framework for FSM (IRF-FSM)** for the Pourashavas in 2017. The IRF-FSM has identified the ways and means of implementing FSM services in the Pourashvas with specific roles and responsibilities. To support implementation of IRF-FSM, a separate **National Action Plan (NAP) for Pourashavas** for implementing the IRF-FSM has been published in 2020 by the Local Government Division that includes specific actions for both national and Pourashava level stakeholders. According to the NAP for Pourashavas, there are a few milestones set for the Pourashavas at different stages of implementing FSM. The Jamalpur Pourashava falls in Cluster B in the NAP and the milestones set for these Pourashavas are shown in Table 7 where it says that the Pourashava is supposed to build its capacity, do awareness campaigns, make a plan for citywide FSM implementation, ensure mechanical desludging and complete land procurement for FSTP by the end of 2021.

While mechanical desludging has been introduced (2% coverage) and land procurement for new FSTP is done, Jamalpur Pourashava is yet to make significant progress regarding capacity building, awareness campaigning and planning for citywide FSM implementation. Therefore, Jamalpur Pourashava should take immediate actions to address these gaps and achieve the targets set in the NAP.

Table 7 Milestones for Jamalpur Pourashava (Cluster B) in NAP for Pourashavas

Cluster	Type of Pourashavas	Milestones			
		(2019-2021)	(2022-2024)	(2025-2027)	(2028-2030)
A	Pourashava with operational FSM (10 Paurashavas)	▪ Plan and implement citywide FSM ▪ Capacity building ▪ Ensure mechanical desludging confirming OHS, following proper treatment and disposal methods	▪ Citywide FSM service achieved	▪ FSM service continued and continually updated	▪ FSM service continued and continually updated
B	Pourashava selected for GoB or other development partner funded projects (115 Pourashavas)1	▪ Capacity building ▪ Awareness campaign ▪ Plan for citywide FSM implementation ▪ Ensure machanical desludging confirming OHS ▪ Land procurement for FS treatment facility	▪ Citywide FSM service implementation	▪ City-wide FSM service achieved	▪ FSM service continued and continually updated
C	Pourashava having land for construction of FSTP (26 Pourashavas)	▪ Capacity building ▪ Awareness campaign ▪ Plan for citywide FSM implementation ▪ Introduce mechanical desludging confirmimg OHS ▪ Appropriate and safe burial of emptied sludge until FSTP is constructed ▪ Confirm land procurement/ availability for FS treatment facility	▪ Ensure machanical desludging confirming OHS ▪ Ensure save treatment ▪ Gradual FSM service implementation	▪ Citywide FSM service implementation	▪ Citywide FSM service achieved Ensure safe treatment
D	Pourashava requiring land procurement for construction of FSTP (184 Pourashavas)	▪ Capacity building ▪ Awareness campaign ▪ Plan for citywide FSM implementation ▪ Introduce mechanical desludging and safe burial confirmimg OHS ▪ Land procurement for FS treatment facility	▪ Ensure machanical desludging confirming OHS ▪ Ensure save treatment ▪ Confirm land availability/ procurement for FS treatment ▪ Gradual FSM service implementation	▪ Citywide FSM service implementation	▪ Citywide FSM service achieved Ensure safe treatment

There is a concept among many that ensuring financial support is the only pre-requisite to ensure sustainable operation of FSM services. Such a concept leads to a strategy where projects are designed only to provide emptying and transportation vehicles, and the cost of treatment plant construction. But there are so many examples in Bangladesh where projects that do not look beyond one-time investment for vehicles and treatment plants fail within a very short period. Therefore, it is important to focus on capacity building of the Pourashavas and local stakeholders who will manage, operate, and maintain the FSM system. Based on the study findings, a few other recommendations for Jamalpur Pourashava include:

- Educate the citizens and the local masons on proper design of containments (e.g., septic tank design) and its benefits.
- Prevent discharge of FS and wastewater into open drains/environment by educating citizens and introducing by-laws.
- Citywide awareness campaigning for demand creation among citizens.
- Develop capacity of Pourashava officials and stakeholders on FSM through training and exposure visits.
- Develop a dedicated FSM Service Center (or Cell) in the Pourashava to implement citywide FSM.
- A clear vision derived from a robust strategic planning process, and an effective strategic plan or marketing plan can only come from proper stakeholder engagement. Therefore, engaging with stakeholders is crucial to the success of FSM implementation.

As BRAC WASH programme is willing to handover the FSM system to the Pourashava gradually from January 2022, the programme wants to develop a **handover plan** to support the Pourashava to build its capacity to run the FSM service. It has also been reported by the Pourashava that existing FSTP will be removed to a new location as the current FSTP site will be used for other development purposes by the Pourashava. Considering these issues, BRAC WASH programme need to develop a plan for the transition phase until the new FSTP is constructed and the Pourashava becomes capable of running the FSM service. Therefore, for the transition period, following recommendations are made which were discussed with Pourashava authority during the validation workshop:

- A temporary sludge dumping arrangement (e.g., constructed wetland) will be established by January 31, 2022, near the new FSTP site where BRAC will provide the design and Pourashava will provide other support for establishing the constructed wetland.
- Pourashava will select a place for sludge dumping until the constructed wetland system is constructed and ready to use.
- An FSM Service Center dedicated for providing FSM service will be established by Jamalpur Pourashava at the Pourashava office.

It is highly recommended that the BRAC WASH programme will jointly work with Jamalpur Pourashava to finalize the roles and responsibilities of the FSM Service Center. A few preparatory works for the Center and its scope of works include the following:

- Get written approval from the Mayor of Jamalpur Pourashava about the center and set an organogram for the center which may include one public representative (e.g., Ward Councilor), Executive Engineer of Jamalpur Pourashava as Technical Advisor, Conservancy Inspector, and one staff who will be contacted by the customers regarding application for emptying service.
- Hand over the equipment and machines of the FSM service to the Pourshava and orient the FSM Service Center and its staff on its use.
- Provide training to the members of FSM Service Center on the whole process of service delivery, business model development, operational monitoring, and maintenance.
- Set a tariff system for emptying and transportation service and develop a business model for the service delivery.
- Create the financial management system (e.g., separate bank account).
- Create an official database system for recording of trip number, whether the sludge was properly dumped at the designated site, total income, total expenditure, etc.
- Provide logistics support, if required, to establish the FSM Service Center at the Pourashava office.
- Develop a marketing plan on how FSM Service Center will do marketing in next three to six months. BRAC can provide the necessary materials and resources and share experience.
- Develop a plan for awareness raising programs on stopping containment connections to drains and open environment.
- Launch the FSM Service Center through a formal event to aware people about this dedicated center and its objectives.

During the whole process of launching the FSM Service Center and during the transition phase, it is recommended that BRAC WASH programme will support Jamalpur Pourashava by sharing their experience, providing technical assistance, organizing exposure visits for Pourashava officials, and connecting them with the FSM network that works in Bangladesh as well as in the South Asia region.

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