M. Alamgir, S.M.T. Islam and J. A. Saju (Eds.)
ISBN: 978-984-35-4034-8

Proceedings of the Waste Safe 2023 – 8th International Conference on
Integrated Solid Waste and Faecal Sludge Management
25-26 February 2023, Khulna, Bangladesh

SANITATION SERVICE DELIVERY LOOPHOLES IN SELECTED URBAN SLUMS OF KHULNA

Tahdia Tahmid[*] and Khondoker Mahbub Hassan[**]

*Department of Urban and Regional Planning, KUET, Khulna-9203, Bangladesh.
**Department of Civil Engineering, KUET, Khulna-9203, Bangladesh.

ABSTRACT

Sanitation is one of the key factors for global health safety conditions and in this context Bangladesh faces various challenges specially for low income community residing in urban slum areas. The present study was undertaken to identify the loopholes in sanitation service delivery chain for selected urban slums at Khulna. In this research work, the sanitation service data have been extracted from a comprehensive questionnaire survey at three major slums: Green Land Slum, Rupsha slum and Kulibagan Rail Colony Slum located at ward No. 21, 22 and 03 respectively, in Khulna city area. A random selection of 170 slum dwellers were interviewed for the identification of loopholes in sanitation service delivery chain at the field level. NGO sanitation service provision among all service is 16%, 10% and 22% in Green Land slum, Rupsha Slum and Kulibagan Rail Coloney respectively. The Greenland slum and Rupsha slum showed a positive correlation between income level and toilet accessibility which found to be increasing with the income level. For, income level >10000 taka/month, the toilet accessibility was found to be 100% in Rupsha slum and 64% in Green Land slum whereas for income level <5000 taka/month, the accessibility was found to be dropped down to 78% and 54%, respectively. Though, the Kulibagan slum did not show any relation between accessibility and income. This study identified the major problem in slum sanition services in sharing of 1 toilet with more than 20 family without any scheduled maintenance, lack of desludging/faecal sludge emptying services, unplanned and unhygienic transport of septage, and finally indiscriminate disposal of faecal sludge to the environment.

INTRODUCTION

Excreta are a normal part of life; an adult produces 130 g of faecal matter and 1.4 L liquid urine everyday (Rose *et al.*, 2015) . The drawback of all this excrement is that, if it is not adequately managed, it can result in water pollution, waterborne infections, and threats to human dignity due to a lack of access to safe sanitary facilities. The aim of Goal 7 of the Millennium Development Goals was established by the United Nations in response to the lack of access to basic sanitation (WHO, 2017). Tactlessly, it was not reached. Nevertheless, now the Sustainable Development Goals (SDGs) have established a new objective to stop open defecation by 2030 and provide all individuals having access to sufficient and equitable sanitation and hygiene. The worldwide consensus of its importance led to 'access to adequate and equitable sanitation' becoming part of the Sustainable Development Goals. The collection, storage, or treatment of excreta and blackwater (i.e., toilet wastewater) from onsite sanitation methods leads in faecal sludge which need to be safely emptied, transported, treated and disposed to environment (Strande, 2014). However, in most of the cases, faecal sludge is not properly treated due to lack of sanitary emptying management, no treatment plants, and illegal dumping directly into the environment. There are loopholes in the entire sanitation service chain which require satisfactory management to ensure safety of public and environmental health. Still, in the majority of low-income countries, adequate faecal sludge management (FSM) is not in place. Some recent studies reflect the serious situation and current faecal sludge crisis. The World Bank Water and Sanitation Program reported on FSM in 12 cities in Africa, Latin America, South Asia and East Asia along the entire service chain (World Bank, 2020). Yet, with an estimated 1.3 billion people lacking basic sanitation, the scale of the problem is huge (Mara

& Evans, 2018). Recent trends in global slum population suggest that after an encouraging decline between 2001 and 2014, there is a reversal with increased slum population by 2018 (UN-Habitat, 2022). Today, there are more than 1 billion people live in slums, with most of them living in the Global South. It is estimated that 3 billion people will need adequate and affordable housing by the year 2030. Compared to other urban inhabitants and even their rural counterparts, residents of urban slums frequently experience lower health results. This shows that the "urban advantage" of having better access to health-promoting services does not always benefit slum dwellers. Lack of access to water and sanitary facilities in slums may be a factor in people' bad health. In Bangladesh, these services are typically not provided by formal utilities instead by intermediaries and local service providers operating efficient informal markets. In poor nations like Bangladesh, where just 57.7% of people in the metropolitan area have access to sanitary services, represents extremely bad sanitation system (Worldn Bank, 2016). Khulna is the third-largest city of Bangladesh with 1.5 million residents. The Khulna City Corporation (KCC) region has roughly 1134 slums, which is 8.14% of the total KCC area (BBS, 2015) and the sanitation status in these slums is not good at all. The present study was undertaken to assess the sanitation status in selected slums of Khulna city in relation to the socio-economic condition and identification of loopholes in the existing sanitation service delivery chain.

METHODOLOGY

In this study, survey data was extracted from a comprehensive questionnaire survey at three major slums which are Green Land Slum, Rupsha slum and Kulibagan Rail Colony Slum located at ward No. 21, 22 and 03 respectively, in Khulna city area (Fig 1 & 2). These slums provide local informal sanitation services and re-emerge the importance of safe sanitation by the entanglement of loopholes in sanitation services in the context of urban area. This study consists of a random selection of 170 slum dwellers.

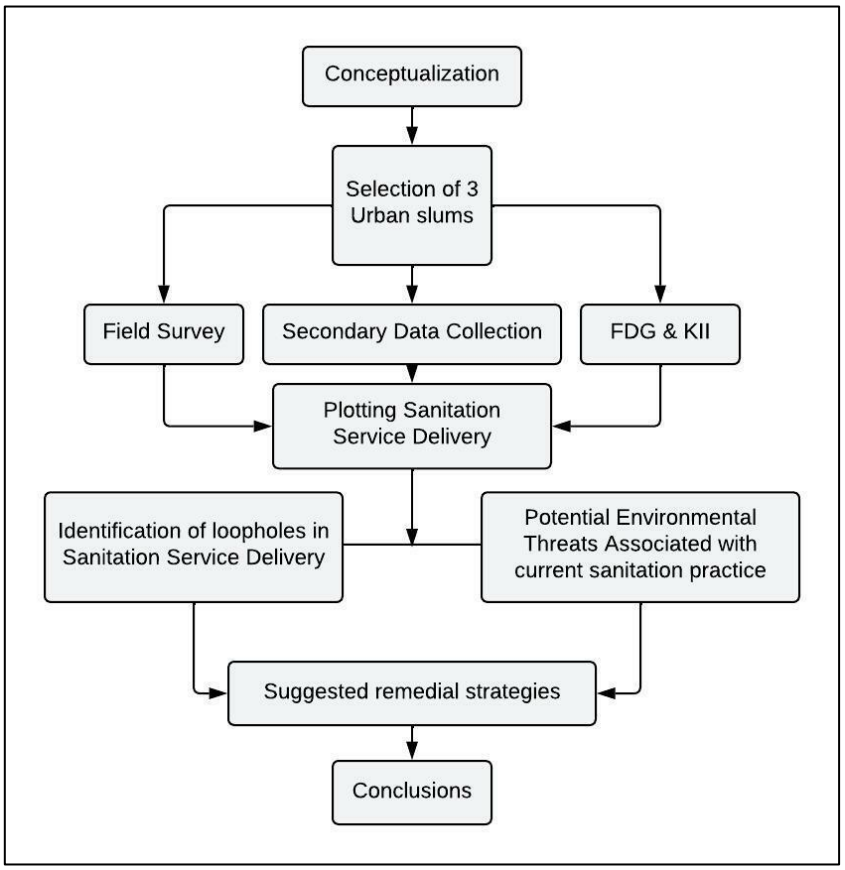


Figure 1. Research Strategical Flow Chart

- **Conceptualization:** Loopholes in Sanitation Service Chain of Urban Slums
- **Selection of Tree Urban Slums:**

ISBN: 978-984-35-4034-8

Green Land Slum, Rupsha slum, Kulibagan Rail Colony Slums are choosen for the study as these slums are some of the major slums in Khulna City Corporation (KCC) area. Greenland slum, located infront of 5 no. ghat Rupsha River in ward No. 21 and Rupsha slum located along the Rupsha River bank in ward No. 22. Whereas, Kulibagan Railway colony, located near Daulotpur Railway Station in ward No. 03**.**

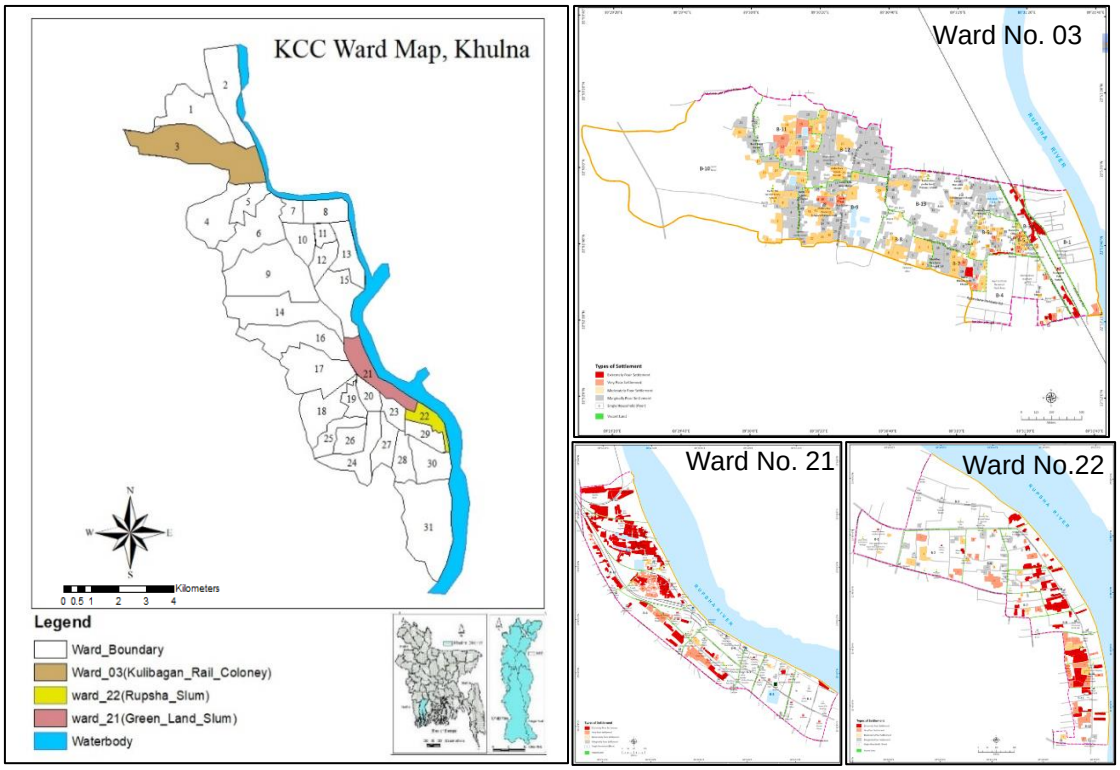


Figure 2. Study Area Map (KCC Wards: 03, 21, 22)

- **Data:**
  - Field survey: Field Survey was conducted by a comprehensive questionnaire survey with the random selection of 170 slum dwellers.
  - Secondary Data Collection: Online data, map, location of the slums collected from secondary source.
  - FDG and KII: Overall condition and recommendation collected from Experts and General people,
- **Plotting of Sanitation Service Delivery (SSD):** Inclusive sanitation service chain observed and plotted on the diagram for each slum. Then the overall analysis was conducted considering the sanitation service chain loopholes in these three study area.
- **Identification of Loopholes SSD:** Loophole in the sanitation service chain was identified for each step of the chain and the lackings in the management system.
- **Potential Environmental Threats:** Loopholes in sanitation service chain refer to the shortcomings in the chain for improper fecal sludge management with a lack of adequate and safe emptying, improper treatment and illegal dumping in the environment.
- **Suggested Remedial Strategies:** Some proposals are given to restore the sanition service delivery loopholes in the studied urban slums of Khulna.

RESULTS AND DISCUSSION

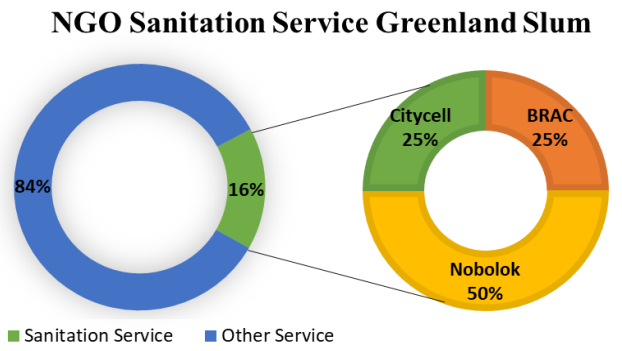
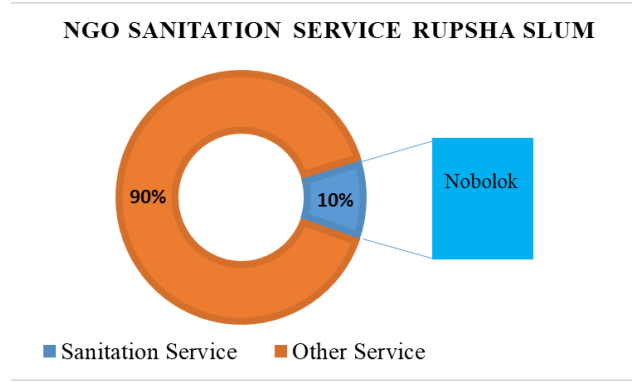
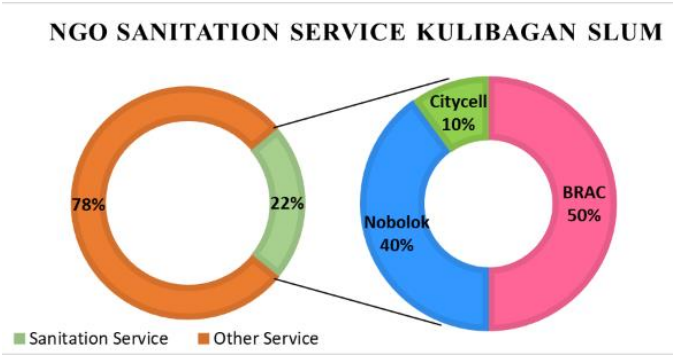
Sanitation Service Provider NGOs

Because of poverty, lack of education, and lack of knowledge about sanitation, a large portion of slum dwellers have ongoing issues with water, sanitation, and hygiene. This leads to cholera and other water-borne illnesses in slum societies. Some slums have had getting sanitation facilities due to the effective policies and initiatives of the NGOs. BRAC, Nobolok and Citycell are some of the renowned NGOs of this region that have been working for providing healthy sanitation and hygiene infrastructure

ISBN: 978-984-35-4034-8

development. In Kulibagan Rail Colony slum and Rupsha slum, only 22% and 16% sanitation services respectively, is provided by NGOs mainly: BRAC, Nobolok and Citycell. In case of Green Land slum, only Nobolok NGO is working for sanitation. Nabolok made a two chambered sanitary latrine with the facility of bathing.

Table 1. NGO Services for Sanitation in Slum Dwellers

Slum	Sanitation Service	Sanitation Service Type
Green Land Slum		• Toilet • Tubewell
Rupsha Slum		• Education • Early Marriage Prevention • Road Construction • Toilet • Repairing Loan
Kulibagan Slum		• Toilet • Allowance • Help • roads • Loan • Water • Sanitation • Toilet

The Greenland slum and Rupsha slum showed a positive correlation between income level and toilet accessibility (Figure 3). The accessibility rate was found to be increasing with the gradual increase of income level. For, income level >10000 taka/month, the toilet accessibility was found to be 100% in Rupsha slum and 64% in Green Land slum whereas for income level <5000 taka/month, the accessibility was found to be dropped down to 78% and 54%, respectively. However, the Kulibagan slum did not show any relation between accessibility and income and here most of the slum dwellers had access to toilet facilities regardless of income level due to provision of sanitation services by NGOs. Nevertheless, the sanitation service delivery chain should be properly designed in local context with regards to environmental safety. Otherwise, there would have loopholes in spite of existing sanitation services and eventually led to environmental threats.

ISBN: 978-984-35-4034-8

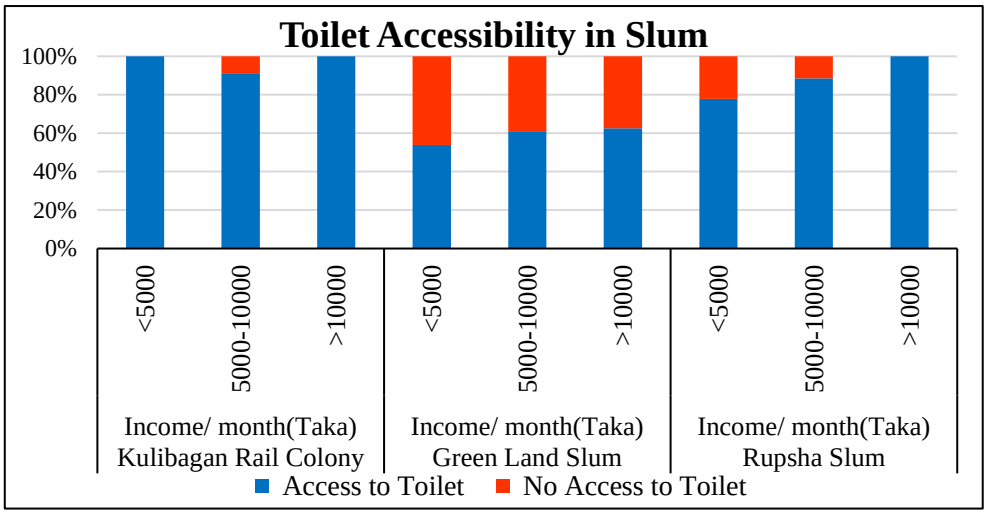


Figure 3. Toilet accessibility in relation to income level at urban slums in Khulna.

Sanitation Service Chain of Green Land Slum

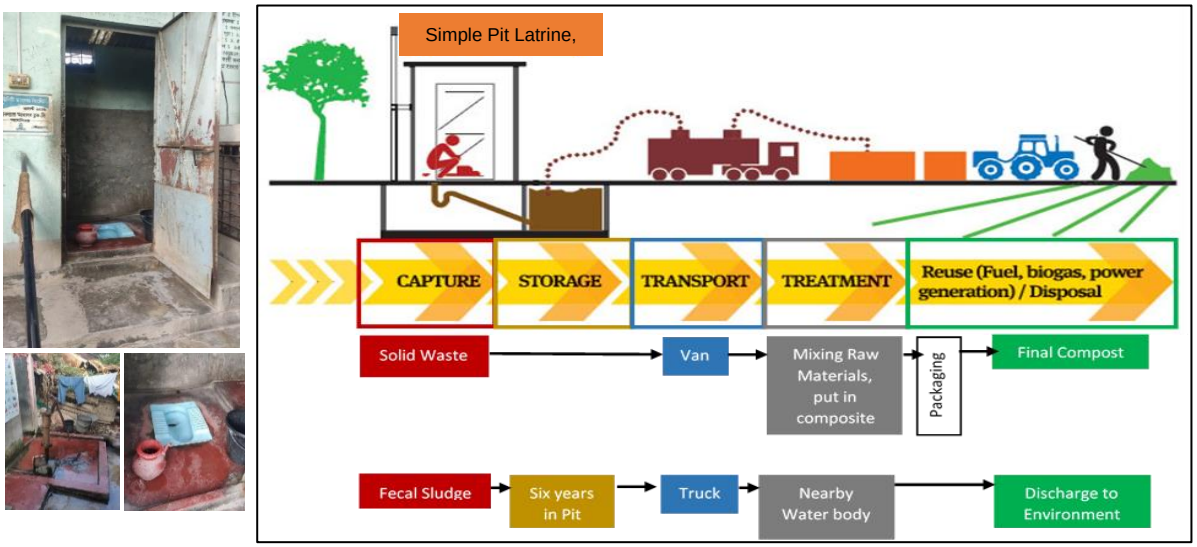


Figure 4. Sanitation Service Chain of Green Land Slum

Twin pit puccha latrines are used in this slum and for eighteen families, there are only two toilets, one for male and other for female. In case of tube well and bathroom, there is only one for eighteen families. These toilets are provided by NGO (Nobolok). The slum drainage system is very poor and there exists water logging problems. Irregular maintenance is also a major problem in this slum. Pit were emptied after six years according to the questionnaire survey findings from slum dweller. Infiltration of the liquid portion into groundwater and overflows during the rainy season or flood time from the pit. It have made pit latrines causes of groundwater pollution in the area. At the time of emptying the sludge from the pit, desludging done without any protective gear resulting odor and air pollution by manual emptying system informally. From the slum, the FS are transported to the Rajbandh FSTP though it is observed that sometimes it is just disposed to the nearby waterbody without treating it. As a result FSTP is not receiving enough FS for inadequate emptying and loopholes in the service. Finally the FS is disposed to the environment as landfill or to the nearby drain of FSTP.

Sanitation Service Chain of Rupsha Slam

ISBN: 978-984-35-4034-8

Table 2. Condition of Different Types of Toilets in Rupsha Slum

	Toilet Exterior	**Toilet Interior**	**Bathroom Interior**
Toilet provided by NGO (BRAC) (Septic Tank)			
Old Toilet (More than 40 years) (Simple Pit)			

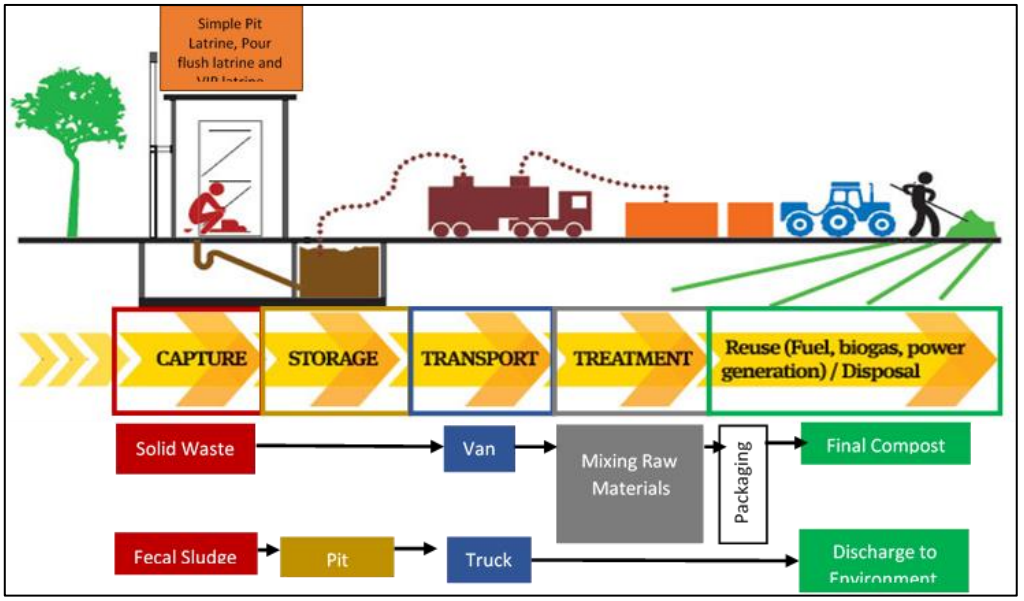


Figure 5. Sanitation Service Chain of Rupsha Slam

Here, 3 types of latrines are mostly used, simple pit latrine, pour flush latrine and VIP latrine. Only 1 (one) toilet is allocated for 20 families. Most of the people (around 75%) use simple pit latrine. Latrines are mostly provided by non-government organizations (NGO) and a few (around 20%) are given by government organization like City Corporation. As the maintenance is beared by the slum dwellers, they are not able to do it properly for their poor socio- economic conditions. For septic tank system, most of the septic tanks are emptied when there is bad smell and it is done in more than three years. Manual emptying services are available for the pit latrine by call for service system and they use simple

equipments for it and this is harmful for environment. FS are transported to the Rajbandh FSTP though there is inadequate emptying and loopholes in the service by the illegal outflow system. Dried sludge is disposed to the low landfill site and treated sewage is discharged to drain.

Sanitation Service Chain of Kulibagan Rail Colony Slum

Kulibagan Rail colony has got mainly the simple pit latrine.Their main problem is that one latrine used by almost 25 people and the preservation condition is poor as the cost beared by the slum dwellers. Their FFM condition is very wicked as they dispose it nearby waterbody. Most of the sludge are not properly treated at all.Toilets are mosly provided by BRAC, Citycell and Nobolok. But the maintenance system is too poor to manage prpper environmental balance. s

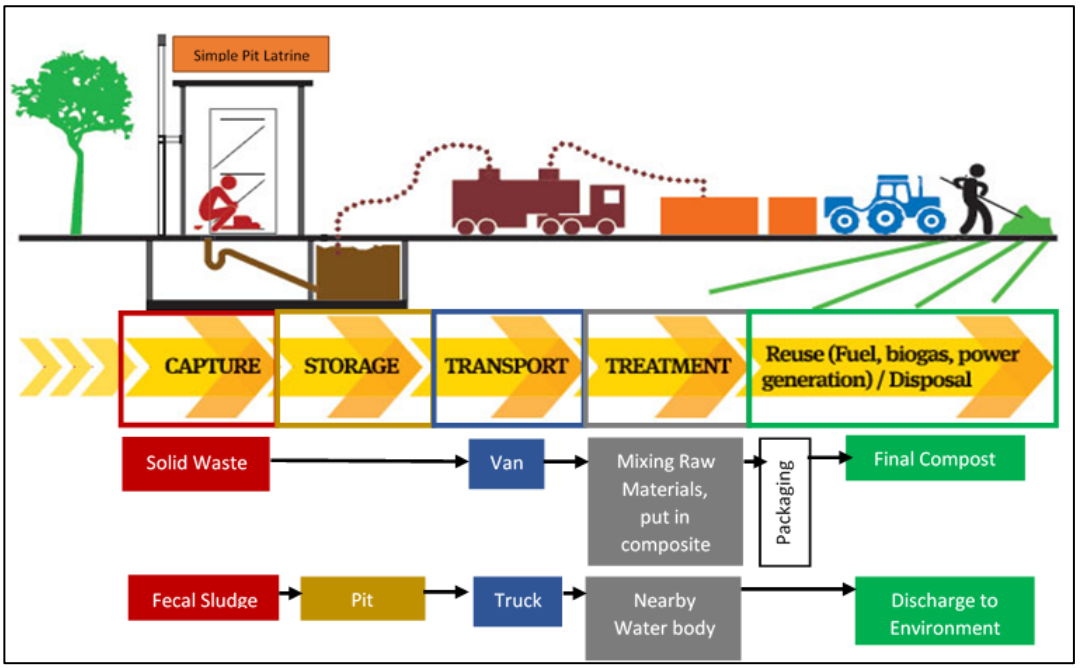


Figure 6. Sanitation Service Chain of Kulibagan Rail Colony Slam

Sanitation Service Chain Loopholes

Loopholes in sanitation service chain refer to the shortcomings in the chain for improper fecal sludge management with a lack of adequate and safe emptying, improper treatment and illegal dumping in the environment.

Environmental Pollution While Emptying

Table 3. Safe Emptying Checklist

Safe Emptying Factors	Green Land Slum	Rupsha Slum	Kulibagan Slum
FS disposal to designated place	✓	✓	x
Emptying within Three years	x	x	x
Mechanical Emptying	x	x	x
No spillage during emptying	x	x	x
Personal protective equipment use	x	x	x

Ground water Pollution from Liquid

The increasing uses of both pit latrines and groundwater resources in low-income countries may cause human and environmental health impacts related with microbiological and chemical contamination of

groundwater (Graham & Polizzotto, 2013). All three slums have tube well just beside the pit toilet wich is harmul to use as drinking water. There many type of liquid effluent into the ground water such as faecal coliform, Nitrate, Chloride etc contaminate the groundwater which later used as drinking water in the slum area. Along with this, there is a possibility that the liquid from the pit toilet will mix with the deep tube well water and contaminate the drinking water.

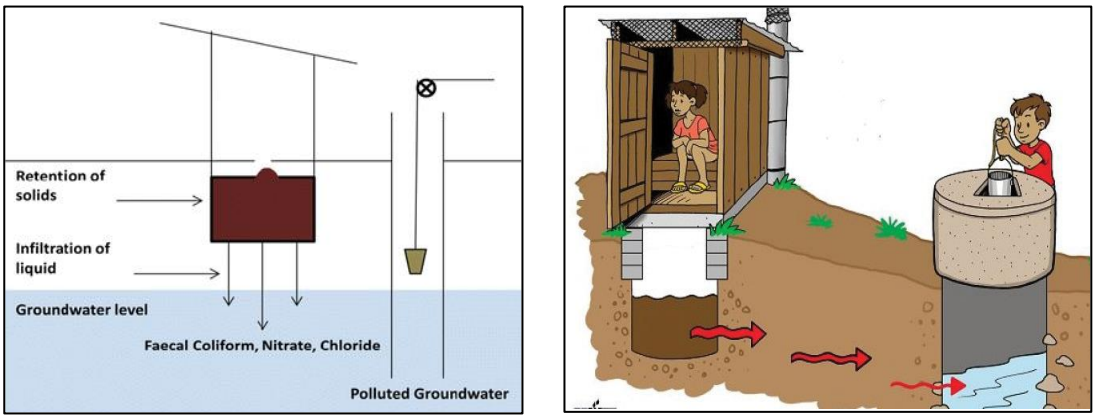


Figure 7. Sanitation Service Chain Loophole in Pit Toilets

Pollution from Solid

The quality of FS depends on the design and construction of the sanitation system and it causes different type of contamination. When the pit is overloaded and not cleaned for a long time, there is a high possibility of environmental degradation. Irreguler and illegal emptying of faecal sludge cause high risk for the ecological system by creating imbalance. It produce pathogens to the soil and cause rapid degradation. (Saxena & Den, 2021).

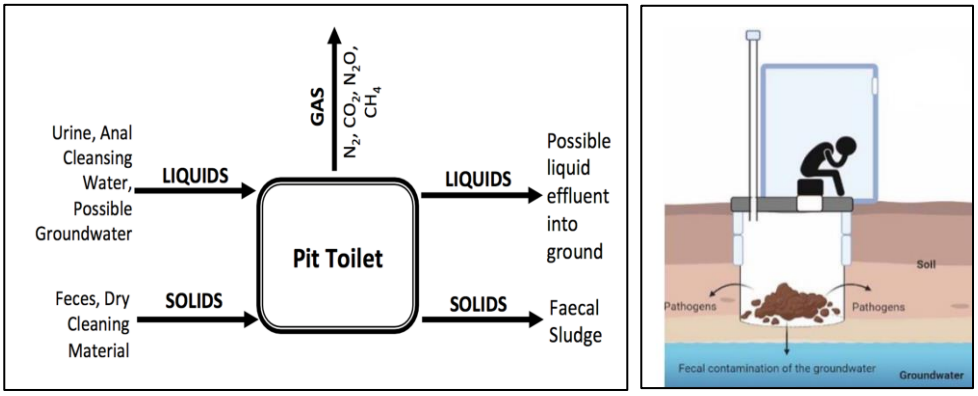


Figure 8. Sanitation Service Chain Loophole in Emptyinh System

Unplanned disposal of sewage will later go into the environment and pollute the environment severely. Excreta and wastewater discharge into a septic tank or pit or into the environment as with non-networked sanitation. The fecal sludge is frequently buried or thrown in the open when pits and tanks full up. These manual procedures are informal, filthy, and degrading. Cholera and other intestinal infections frequently break out as a result, affecting the entire city.

This study identified that the major problem in slum sanition services were sharing of 1 toilet with more than 20 people without any scheduled maintenance, lack of desludging/faecal sludge emptying services, unplanned and unhygienic transport of septage, and finally indiscriminate disposal of faecal

sludge to the environment. Thus, there is a high risk of environmental pollution leading to degradation of human health as well as ecosystem (Figure 9).

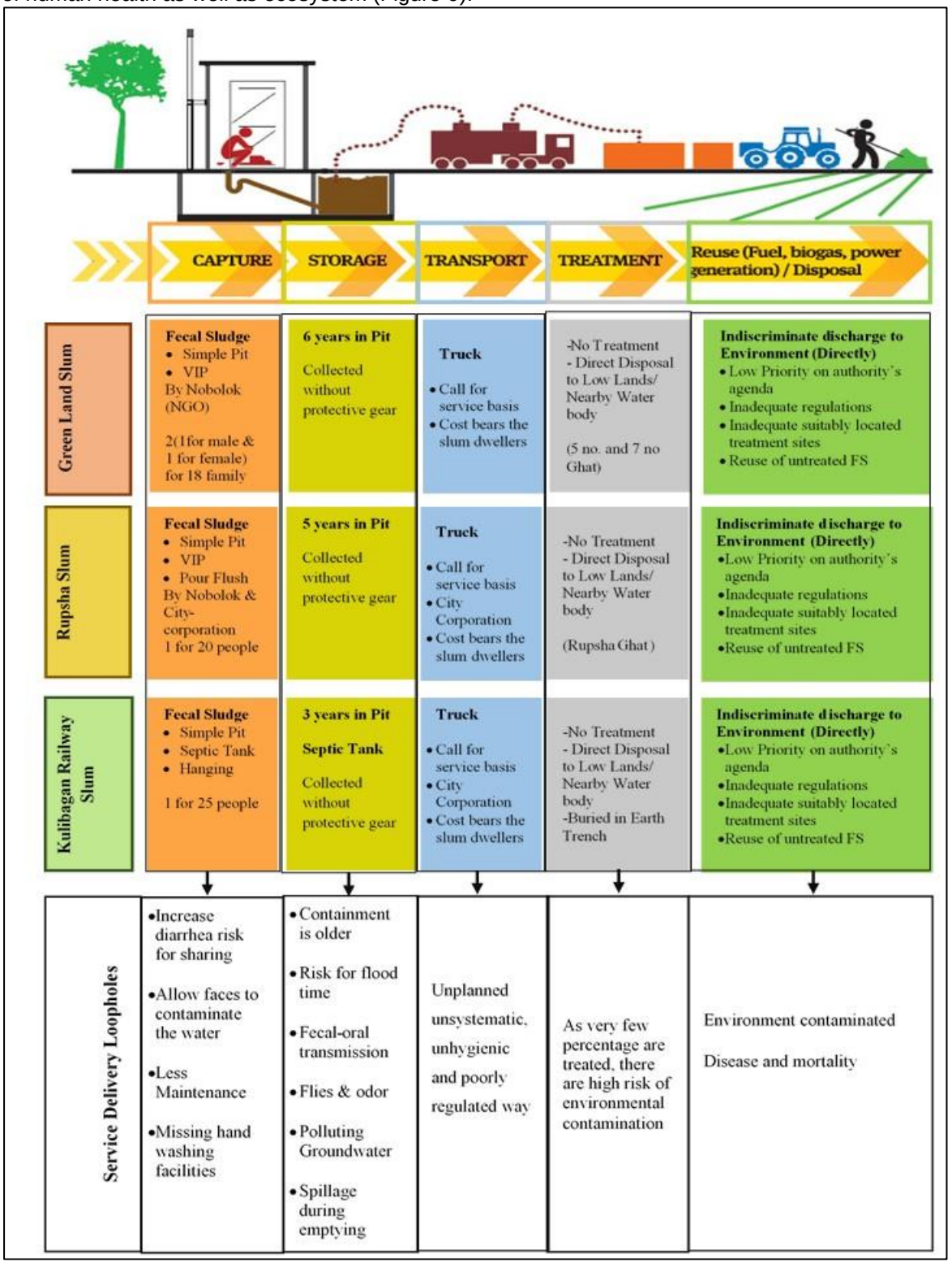


Figure 9. Loopholes in Sanitation Service Chain for Urban Slums at Khulna

REFERRENCES

Bangladesh Bureau of Statistics. (2015*). Census of slum areas and floating population*. Final Report.

Statistics and Information Division. Ministry of Planning. Dhaka.

C. Rose, A. Parker, B. Jefferson & E. Cartmell (2015). *The Characterization of Feces and Urine: A Review of the Literature to Inform Advanced Treatment Technology*, Critical Reviews in Environmental Science and Technology DOI: 10.1080/10643389.2014.1000761

Graham, J. P., & Polizzotto, M. L. (2013). Pit latrines and their impacts on groundwater quality: a systematic review. Environmental health perspectives, 121(5), 521–530. https://doi.org/10.1289/ehp.1206028

Mara, D., & Evans, B. (2018). *The sanitation and hygiene targets of the sustainable development goals: Scope and challenges*. Journal of Water, Sanitation and Hygiene for Development, 8(1), 1-16.

Saxena, S., & Den, W. (2021). In situ treatment technologies for pit latrines to mitigate groundwater contamination by fecal pathogens: a review of recent technical advances. *Journal of Water, Sanitation and Hygiene for Development*.

Strande, L., Ronteltap, M., & Brdjanovic, D. (2014). *Faecal Sludge Management (FSM) book - Systems Approach for Implementation and Operation.* UK: International Water Association (IWA) Publishing.

Uited Nations. (2022). *Make Cities and Human Settlements Inclusive, Safe, Resilient and Sustainable*. Retrieved from Department of Economic and Social Affairs: https://unstats.un.org/sdgs/report/2019/goal-11

WHO. (2017, August 1). *Progress on sanitation and drinking water: 2015 update and MDG assessment*. Retrieved from World Health Organization: https://www.who.int/publications/i/item/9789241509145

World Bank. (2017, September 15). *Towards a cleaner Bangladesh: Safe water, sanitation, and hygiene for all*. Retrieved from World Bank Blogs: https://blogs.worldbank.org/endpovertyinsouthasia/towards-cleaner-bangladesh-safe-water-sanitation-and-hygiene-all

World Bank. (2020). *The Sanitation Service Chain: How to Manage Sanitation Safely and Sustainably*. Retrieved from The World Bank: https://www.worldbank.org/en/news/infographic/2020/07/02/sanitation-service-chain