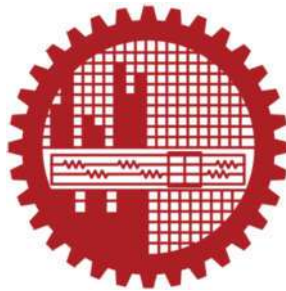


**A STUDY ON INTERVENTION IN WATER AND SANITATION
FACILITIES IN SELECTED SLUMS OF DHAKA NORTH CITY
CORPORATION**

by

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May, 2022

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Paromita Shome

Dedicated to my family

ACKNOWLEDGEMENT

At the very beginning all praises goes to the Almighty who is the most precious and merciful to all human beings. The infinite mercy of the Almighty has given me the opportunity to complete my research successfully.

I would like to express my sincere and heartiest gratitude to my honorable supervisor Dr.Mohammad Shakil Akther, Professor, Department of Urban and Regional Planning, BUET for his constant guidance, wholehearted encouragement, supervision and suggestions at all stages. From the first stage of conceptualization of the topic to the last stage of thesis writing, his inspirations and motivations provided me with the spirit to perform the activities relating to the research. I am indebted to him for giving me the opportunity to conduct this unique research which has not ever been done in BURP and MURP Thesis in BUET.

I appreciate all of my colleagues in my department, especially Ms. Nawshin Tabassum, Ms. Sadia Afroj, and Mr. Niaz Mahmud Zafri for their valuable support, motivation and encouragement.

I am thankful to the officials of DNCC, WASA, and all the key informants of different organizations for providing me with the required information. I am also grateful to the respondents of the HH questionnaire survey and the FGDs for their valuable time and opinions. Without their wholehearted support, conducting the research would not have been possible.

I want to express cordial thanks to my classmates and friends who have encouraged and motivated me at different phases of the study and stayed beside me with such a cooperative attitude.

Finally, I want to express humble gratitude and acknowledgement to my family members, especially my husband whose heartiest encouragement and cooperation worked as a source of pleasure for me. Without the moral support and inspiration of my family, this research would not have been completed.

ABSTRACT

Dhaka, the capital and the largest city of Bangladesh is straining under the pressure of its rapidly increasing slum residents. The dwellers are facing difficulties in water and sanitation facilities in terms of sharing status, safety, accessibility, reliability, quality, and so on. To improve this critical situation, researchers have been trying to assess the water and sanitation services in the slums of Dhaka. Different national policies and global commitments like Sustainable Development Goals, National Water Policy, National Policy for Safe Water Supply and Sanitation, Eights 5-Year Plan, National Strategy for Water Supply and Sanitation demand for necessary water and sanitation interventions and monitoring in the slums for ensuring water and sanitation facilities for all. In line with this, the study identifies the types of interventions by different organizations involving FGDs, assesses the level of service through HH questionnaire surveys applying relevant criteria, indicators and forming indices, and addresses sustainability of the interventions derived from the results of level of service and conducting KIIs. The slum dwellers, leaders, managers and the relevant working organizations were involved in the data collection process.

According to DNCC record, and FGDs; different NGOs (national and international) work at the field level regarding water and sanitation facilities. Construction activities involved establishment of new tube wells, water platforms, establishment of new latrine superstructures, toilet platforms etc. Maintenance works included enhancement of water quality, cleaning of toilets etc.

Regarding level of service, the situation of sanitation is poorer than the water facilities. Considering availability, accessibility, safety, affordability and acceptability of the facilities, water acceptability index is the worst for water facility; whereas for sanitation facility, availability index is lower in the study area. The difference between the composite water index and sanitation index is significant in the slums based on whether subsequent support from the organizations after the accomplishment of the interventions is available. This indicates the unsustainability of most of the interventions. The targets of SDG 6 call for achieving safe and affordable drinking water for all and special attention towards the sanitation needs of women and girls. But the slum dwellers are not so satisfied with the water safety or quality depicted by the lowest water acceptability index. There is also no menstrual hygiene management in any slum and the privacy index is so low according to the females participated in the HH questionnaire survey reflecting the women and girls are not being given specific considerations complying the targets of SDG 6.

According to 8th 5-years plan, the capacity of local government needs to be strengthened to provide universal water and sanitation to all. This study would be helpful for the local level authority to comprehend and manage the water and sanitation services in the slums and integrate the local level plans with the goals and targets of the national policies and the global commitments.

ABBREVIATIONS

ADB	Asian Development Bank
AHP	Analytic Hierarchy Process
BRAC	Bangladesh Rural Advancement Committee
CBO	Community Based Organization
DSK	Dushtha Shasthya Kendra
FGD	Focus Group Discussion
GO	Governmental Organization
HRWS	Human Rights to Water and Sanitation
KII	Key Informant Interview
MDG	Millennium Development Goals
NGO	Non-Governmental Organization
OSHA	Occupational Safety and Health Administration
PCA	Principal Component Analysis
SDG	Sustainable Development Goal
SI	Sanitation Index
UNICEF	United Nations Children's Fund
WASA	Water Supply and Sewerage Authority
WASH	Water, Sanitation, and Hygiene
WHO	World Health Organization
WI	Water Index

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CHAPTER ONE: INTRODUCTION

1.1. Background

There has been an incredible growth of the urban population over the last century but the growth has taken place in an uneven form (United Nations, 2018). Although as a percentage of the urban population, the slum population has been decreasing over the years; the absolute number of slum-dwellers is increasing (United Nations, 2019). It is argued that slums in and around the city are the first living place for most of the poor rural migrants and urban slums are the fastest-growing human habitat in the world (Walsham, 2010; Bruschi, 2013).

In developing countries, urban population is growing at a faster rate than in the developed countries. The developing countries often struggle to provide adequate infrastructure and basic services such as housing, water, sanitation for the swelling influx of the urban population. As a result, the rapid urbanization has become a great concern for these countries (Henderson, 2002; Mahabir, 2016; United Nations, 2018). Difficulties to meet the needs for the urban population lead to the emergence of slums in the developing countries (Mahabir, 2016). In fact, one of the unintended consequences of rapid and unplanned urbanization in the developing world is the proliferation of slums (United Nations Human Settlements Programme, 2003).

Bangladesh, as a developing country, is not an exception and is suffering from the pervasiveness of slums. This country is the home of approximately 160 million people of which 53 million people live in urban area. In around 5,000 slums of the capital city of Bangladesh, approximately four million people live (Bangladesh Bureau of Statistics, 2015; UNICEF, 2018). In Dhaka, the slum residents have to face difficulties in many ways including water and sanitation (WATSAN) facilities in terms of sharing status, safety, accessibility, reliability, quality and so on (Rahman *et al.*, 2014; Islam *et al.*, 2015; International Centre for Diarrhoeal Disease Research, Bangladesh, 2016; Haque *et al.*, 2020; Chowdhury, 2021; Rahaman *et al.*, 2021).

Water and sanitation are at the core of sustainable development integral to the persistence of the people and the planet (Fan & Azad, 2017). Target 10 of Millennium Development Goals (MDGs) 2000-2015 included sustainable access to safe drinking water and improved sanitation. But at the end of 2015, quality or safety of water and accessibility to improved sanitation still lagged behind (Satterthwaite, 2016). Building upon the experiences and lessons learnt from the critical analysis

of the achievements of MDG targets, the Sustainable Development Goals (SDGs) 2016-2030 emerged. Goal 6 of SDGs, targeting the clean water and sanitation for all is a major concern. Specially, targets 6.1 and 6.2 of SDG 6 called for achieving access to safe, adequate, affordable and equitable water, sanitation and hygiene by 2030. For sanitation, special attentions have been recommended to be taken towards the women, girls and other vulnerable people (UN Water, 2016). National Strategy for Water Supply and Sanitation, 2014 urged for water and sanitation-related interventions and enhancement of monitoring to ensure the sustainability of interventions (GoB, 2014). This approach is also supported by academicians (Turkstra & Raithelhuber, 2021; Field & Kremer, 2021). Therefore, it is necessary to study the category, nature and sustainability of WATSAN interventions for the slums of Dhaka.

Several studies have already been conducted focusing on the current status of water supply and sanitation system in the small, medium or large slums of Dhaka North City Corporation (DNCC) and Dhaka South City Corporation (DSCC) in terms of source, modality, quality, pricing, related diseases and other difficulties faced (Biplob *et al.*, 2011; Rahman *et al.*, 2014; Razzak *et al.*, 2014; Islam *et al.*, 2015; Haque *et al.*, 2020), the role of different actors on slum dwellers in gaining access to water and sanitation services (Jinnah, 2007; Hackenbroch, 2012), designing and managing of community managed water points and sanitation blocks (Hanchett, 2003). Moreover, existing literatures are more focused on evaluating the accessibility of water and sanitation than the sustainability of intervention projects (Hanchett, 2003; Degert *et al.*, 2016; Bangladesh Rural Advancement Committee, n.d.). Though there is literature on the level of service of WATSAN facilities considering issues of sustainability in the African context (Baquero *et al.*, 2017), the case is sorely missing in Dhaka or Bangladesh context.

Bearing these in mind, the present study explored the types and sustainability of interventions by different organizations to improve the services of WATSAN facilities and compared the variations in different aspects of WATSAN services between slums getting subsequent support and slums not getting subsequent support from the involved organizations after the project completion.

1.2. Research Objectives

The main purpose of the study is to investigate the variations in WATSAN interventions of slums by several organizations, as well as monitor the sustainability after the withdrawal of the support from the organizations. The study has been carried out with the following objectives-

- (i) To identify types and characteristics of interventions by different organizations to improve the services of water and sanitation facilities in selected slums of Dhaka North City Corporation (DNCC).
- (ii) To assess the level of service in the selected intervened slums of Dhaka North City Corporation (DNCC) in terms of water and sanitation facilities.
- (iii) To compare the sustainability of the interventions in slums in the post-project period with and without the support of the involved organizations.

1.3. Scopes and Limitations

The research is a local level study conducted in slums. It provides a community perception on WATSAN interventions. The study determines to which extent the government, the city corporations, other relevant governmental and non-governmental organizations, as well as public health policies support in availability, reliability, quality, safety, affordability of WATSAN facilities in slums. The study is expected to increase the accountability of the organizations and enable users to consider probable impacts in a comprehensive manner at the outset of project intervention. It would work as a baseline for intervention at water supply and sanitation sectors in slums and urge for designing sustainable infrastructure and conducting routine maintenance after the completion of the interventions. It would assist policymakers in designing appropriate policy interventions to achieve the targets of SDG 6 in slums. In summation, this research provides outstanding scope for analyzing the people's and organizational perspectives simultaneously regarding the infrastructural interventions of slums in Bangladesh.

However, this study covers only the selected slums of Dhaka North City Corporation. Slums of Dhaka South City Corporation could not be included due to data unavailability. Small and medium sized- slums were not surveyed as the interventions and organizational support related information of these types of slums are not documented in the city corporation office. For limited manpower, all the intervened slums could not be surveyed; rather some selected ones were chosen. The sample size of the study was chosen based on Slum Survey, 2014. Therefore, the changes in the number of HHs of the selected slums in the successive years have not been considered. Moreover; in the DNCC office, there is no record of organizational interventions that have taken place before 2013 and the slum dwellers cannot reliably remember the information of the interventions taken place a long ago in their slums. Also, the WATSAN interventions undertaken by the slum communities

without any involvement of the organizations have not been considered. So, some interventions related information may become excluded in this study. Since, the respondents of the questionnaire surveys included only women, the views of the male slum dwellers regarding level of service of water and sanitation could not be reflected in this study. Moreover, bathing places of the slums were not included in this study. Some key-informants were difficult to be reached out due to the spread of COVID-19. Again, reluctance of the household members to respond to the questions led to the inaccessibility to some households.

1.4. Organization of the Thesis

This report has been organized in a sequential pattern in which different issues have been discussed in different chapters.

In Chapter One, background of the study has been described which expresses the context of the study and the present situation of slums in Dhaka. The importance of conducting the study has also been pointed out. Objectives of the study have been mentioned accompanied by the scopes and limitations of the study.

In Chapter Two, definitions of some key words relating to the study and relevant literature reviews are contained both from Bangladesh and abroad. Information regarding different journals, articles, newspapers have been mentioned to understand the situation of slums more practically.

Chapter Three contains the whole methodology for conducting the study more elaborately along with expressing different tools and techniques for achieving the objectives.

In Chapter Four, study area profile has been discussed to understand the study area more thoroughly.

Chapter Five encompasses general socio-economic profile of the respondents as well as the outline of perception of local people regarding level of service of WATSAN facilities.

Chapter Six comprises the analysis based on the first objective which mainly identifies intervening organizations and describes the WATSAN intervention types and categories.

Chapter Seven incorporates second objective of the research in which level of service of WATSAN facilities in slums has been analyzed from the perception of the local people.

Chapter Eight contains third objective of the research where sustainability of WATSAN interventions has been compared depending on whether the slum dwellers still get support from the intervening organizations if required or not.

The major findings of the research have been included in Chapter Nine. Relevant recommendations have also been provided based on the analysis, findings and overall understanding of the situation which may improve the existing scenario of WATSAN facilities in slums or related interventions. It may also provide with opportunities to mitigate the problem at large. At last, the overall conclusion and future scope of the research have been described in brief.

CHAPTER TWO: THEORETICAL FRAMEWORK AND LITERATURE REVIEW

This chapter discusses relevant literatures that have been used to develop the conceptual framework of this study. It describes the definitions of the terms used in this research. It also provides an overview of literatures on water and sanitation and the related interventions in slums of Dhaka and worldwide.

This chapter is divided into two sections. The operational definitions are discussed in the first section of the literature review. The other section focuses on the current situation of water supply and sanitation in the slums of Dhaka, water and sanitation facilities related interventions that are widely practiced in Bangladesh as well as in other countries and the concept of measuring level of service of these facilities. Besides these, previously conducted studies on the monitoring of sustainability of the related interventions have been discussed briefly.

2.1. Theoretical Framework

In this section, some operational definitions used in this study have been provided to explain the study's significance and validity. The gaps of knowledge and practice have also been figured out.

2.1.1. Slum

Slums come in different sizes, shapes and possess various names, yet all of those depict the same thing: an overcrowded residential urban area characterized by below-standard housing, insufficient basic services and filth (Habitat for Humanity, n.d.). Slums in urban areas are emerging as the place for the underprivileged to live, specifically in developing world which fail to provide slum-dwellers with food, clothing, shelter, and proper hygiene facilities. (Roy et al., 2014; Mahabir, 2016). Rural to urban migration indicates that the rural poor discern slums as a progression from their current status. The poor people typically enter cities through existing or new slums. In spite of being a type of illegal settlements, slum is widely admitted by the politicians as a legitimate form of entry (Walsham, 2010; Bruschi, 2013; Roy et al., 2014).

In this research slums have been defined following the definition provided by Bangladesh Bureau of Statistics. Bangladesh Bureau of Statistics has defined a slum household as-

“A Slum is a cluster of compact settlements of 5 or more households which generally grow very unsystematically and haphazardly in an unhealthy condition and atmosphere on government and

private vacant land. Slums also exist on the owner-based household premises.” (Bangladesh Bureau of Statistics, 2015).

Slums are heterogeneous and each slum suffers from erratic degrees of depravity. The degree of deprivation within a slum household depends on the pervasiveness of the number of the conditions that define slums (Roy et al., 2014).

2.1.2. Level of Service (LOS)

Level of Service (LOS) has been emerged as an effective tool to measure the quality of a given service. Although, the term was derived in transportation science (Pattnaik & Kumar, 2007; Kang & Lee, 2012; Das & Pandit, 2013), it is now widely used to evaluate the quality of the facilities like water supply, sanitation, hygiene, educational infrastructure and services in terms of eminence, quantity, reliability, accessibility etc. (Potter & Klutse, 2010; Hoon & Satiman, 2016; Serag et al., 2020). It is defined as customer's expectations or satisfactions for the facilities as well as performance level of asset. Therefore, types of measuring the levels of service can be perceived as technical or strategic. Technical LOS represents the service provider's perspective, while strategic LOS reflects the user's perspective. For instance, service providers usually are more concerned about the technical aspects of a service infrastructure, whereas the user's main concern is the availability and reliability of the service or facility. Analysis of LOS typically includes-

- i) Understanding the expectation of the receivers,
- ii) Developing LOS,
- iii) Consultation, communication and approval,
- iv) Continuous review, updates and enhancement

(Source: Municipal Finance Officers' Association, 2018)

This study is mainly focused on strategic LOS, where dweller's perspective regarding the water and sanitation facilities in their residing slums was taken into consideration. For example, indicators used in the study like perception regarding water quality, satisfaction with the location of sanitation facilities encompass the strategic LOS.

2.1.3. Intervention

Rahman et al. (2014) worked on both intervened and non-intervened slums. In that study, 'Intervened Slums' were defined as the slums where WASH interventions have taken place in the

past and also where interventions are continuing currently by different organizations. In contrast, “Non-intervened Slums’ were referred as the slums where no intervention is going on at this moment.

This study has been conducted in the intervened slums, where WATSAN intervention was accomplished about more than two years ago. In three of the five selected slums, WATSAN interventions are currently going on too.

2.1.4. Sustainability

According to the United Nations Brundtland Commission’s report in 1987, sustainability refers to- *“Meeting the needs of the present without compromising the ability of future generations to meet their own needs”* (Brundtland Commission Report, 1987).

Sustainable development requires a cohesive effort that takes into consideration the environmental concerns along with economic advancement. Sustainability in facilities management is extremely important because decisions that facilities managers make can have incredible consequences as long as they choose to encompass sustainability. The infrastructure building today will need to meet tomorrow’s cities and communities. Therefore, sustainability in designing, building, and operating of the infrastructure is important and the services provided through the infrastructure should also be sustainable in order to ensure long-lasting development of a community (Tafazzoli, 2019).

In this study, sustainability of water and sanitation related infrastructure and their services from the people’s and organizational perspectives were ascertained for the slums where the associated interventions took place.

2.1.5. Importance of WATSAN Assessments, Interventions, and their Sustainability in light of National and Global Commitments

The water related indicator of target 10 of MDG included sustainable access to water source (Selendy, 2018). In continuation of this, the SDG-6 has established striving WASH-related targets of universal access to safe water (target 6.1); adequate sanitation and hygiene, and the elimination of open defecation (target 6.2); as well as reduced untreated wastewater (target 6.3). In the ultimate goal of ensuring access to all, the SDG-6 emphasizes progressive reduction of inequalities,

injustice and leaving no one behind, as well as providing inclusive, standard, and sustainable services—thereby ensuring access for poor and vulnerable populations (Fan & Azad, 2017; Hutton & Chase, 2017). Following the key concepts (mentioned in Table 2.1 and Table 2.2), the situation of the WATSAN criteria has been compared with relevant SDG 6 targets and indicators in several studies (GoB, 2019; GoB, 2020). Fan & Azad (2017) mentioned that attaining SDG 6 is critical for achieving the rest of the SDGs. For sustainable management of water resources, two fundamental initiatives are enhancement of water quality and protection of water ecosystem (GoB, 2020). National Strategy for Water Supply and Sanitation also included that the drinking water quality must meet the national standards (GoB, 2014). But it has been observed that in terms of water quality, Bangladesh is still lagged behind. Specifically, the slums of Dhaka are in extremely adverse situation in this case (GoB, 2020). For sanitation, slums of Dhaka are far behind in terms of using improved sanitation facilities (GoB, 2019).

Through the gradual introduction of interventions such as source protection, mechanical abstraction, storage, treatment and distribution; the water security can be improved and the level of service can be amplified. In developing countries, the benefits to women and young girls gained from time saved in collecting water and increased personal safety are noteworthy (Pedley et al., 2011). Also, for sanitation facilities, 8th 5-year plan has called for the deployment of women by the municipalities in the operation and maintenance phase due to the sensitivity of women in sanitation (GoB, 2021). Water, Sanitation, and Hygiene (WASH) interventions also bring social and economic benefits, with inferences for environmental cleanliness, health, poverty reduction and equity (Waddington et al., 2009; Joshi & Amadi, 2013; Taylor *et al.*, 2015; Freeman et al., 2016; Hutton & Chase, 2017; Watson et al., 2019).

Pedley et al. (2011) identified that in the absence of development of improved water supply and emphasis on providing improved services for disadvantaged people, progresses in other areas may produce negligible benefit. According to WHO and UNICEF, billions of people will have no or limited access to safe water, sanitation and hygiene in 2030 unless the progress quadruples. The COVID-19 pandemic has revealed the distressful situation. It is claimed that 3 in 10 people worldwide could not wash their hands with soap and water at home amidst the pandemic (UNICEF, 2021). But according to the indicator 6.2.1b of SDG, handwashing facility is to be provided with soap and water on each of the premises. According to Dr. Tedros Adhanom Ghebreyesus, WHO

Director-General- *“Investment in water, sanitation and hygiene must be a global priority if we are to end this pandemic and build more resilient health systems.”* (UNICEF, 2021). Rahman et al. (2014) explored that the sanitation intervention projects in slums of Dhaka could not be successful due to inadequate or unsystematic technological options, mismanagement or lack of regulations and absence of social cohesion. Therefore, proper policies should be made at the national and the local level to incite the program managers to select the most suitable option for each community.

2.1.6. Criteria and Key Concepts of Level of Service of Water and Sanitation Facilities

Human Rights to Water and Sanitation (HRWS) has come up as applicable framework to measure the levels of services (Flores-Baquero et al., 2017). However, some critical issues come forward while applying this; such as absence of participatory technique to discuss the relative importance of the regularizing criteria to reflect water and sanitation services, defining a short list of key indicators to measure the different dimensions of HRWS, assessing the impact of different weighting systems in the construction of an aggregated index. In order to tackle these shortcomings, Flores-Baquero et al. (2017) used and developed relevant criteria (Table 2.1 and Table 2.2) and indicators for two African countries and mentioned that the criteria and indicators have considerable scopes for accommodating in a wide range of regional, national or local contexts taking into account the HRWS normative content. Flores-Baquero et al. (2017) used different indicators to measure the performance of the criteria like time spent to use the facilities, water treatment, disposal of children stools etc. IRCWash, 2012; Serag et al., 2020 also used water quality, continuity of supply as the factors of LOS of water supply system. Billig et al, 1999; Ali, 2009; Senna et al., 2019 considered capacity, accessibility, HH investment to measure the performance of water supply and sanitation. Billig et al. (1999) suggested some criteria for operating and maintaining the intervened water or sanitation related facilities by the community itself like the existence of a functioning operations and maintenance committee, designated people who would be responsible for operations and maintenance of the facilities etc. Billig et al. (1999) also mentioned that the criteria should be developed by the intervening organization itself. Flores-Baquero et al. (2017); Serag et al. (2020) used Analytic Hierarchy Process (AHP) to analyze expert opinions on the relative importance of the HRWS criteria keeping contextual perspective in mind.

Table 2.1: Criteria and Key Concepts of Level of Service of Water

Criteria	Key Concepts
Availability	Acceptable quantity for domestic uses; continuity
Physical Accessibility	Distance from the dwelling to the water point; time spent on hauling water; source-to-person ratio; safe and convenient path for all; easy-to-use and adapted technology
Quality / Safety	Safe drinking quality; guidelines for drinking water quality
Affordability	Reasonable price (water connections and water services) for all; capacity of people to pay for water in addition to acquiring other basic goods
Acceptability	Color; odor; taste; cultural issues related to the service

Source: Flores-Baquero et al. (2017)

Table 2.2: Criteria and Key Concepts of Level of Service of Sanitation

Criteria	Key Concepts
Availability	Sufficient number of facilities; individual and/or shared facilities according to the context
Physical accessibility	Reliable accessibility; accessible at all times of day and night; reasonable waiting times; safe and convenient path for all; easy-to-use and adapted technology
Quality / Safety	Technical safety; hygienic safety; access to safe water for hand washing and other hygiene practices; menstrual hygiene management; hygienic cleaning and emptying of pits; safe management and disposal of human urine and faeces
Affordability	Reasonable price of sanitation services for all
Acceptability	Cultural issues related to the service; privacy; gender issues

Source: Flores-Baquero et al. (2017)

Ali (2009) and Senna et al. (2019) used principal component analysis (PCA) to determine the weights of the relevant factors for developing Water Poverty Index and Water Sustainability Index. Potter & Klutse, 2010 suggested to measure the level of service of sanitation following the sanitation service level ladders.

2.1.7. Types and Characteristics of WATSAN Interventions

In this study, the interventions conducted by different organizations have been categorized into two types- ‘Construction’ and ‘Maintenance’. According to Occupational Safety and Health Administration (OSHA), construction means establishment/ alteration, and/or repair, including painting or decorating. Construction work is not limited to new establishments, but may include the repair of existing facilities or the replacement of structures and their elements (Facilities Management Advisor, 2019).

On the other hand, there is no regulatory definition for maintenance. According to OSHA’s directive, upkeeping facilities or infrastructure working in its existing state, preventing its failure or decline is termed as maintenance (Facilities Management Advisor, 2019).

Therefore, the replacement of one utility equipment with a new, identical equipment would be referred as maintenance; however, if it were replaced with an improved equipment, it would be considered as construction (Facilities Management Advisor, 2019).

This study also follows the same definitions of ‘Construction’ and ‘Maintenance’ as suggested by OSHA’s directive.

2.2. Literature Review

The previous studies that were helpful and relevant to conduct this study are discussed in this section.

2.2.1. Current Situation of Water and Sanitation in the Slums of Dhaka

Water Facilities in Slums of Dhaka

Studies found that water connections are mostly metered (at community point, or at HHs level) in maximum slums of Dhaka and most platforms of water sources are made of concrete. Water quality is not being monitored regularly by any organization. In some cases, water is to be bought spending

a high amount from community water points managed by a group of influential community people (Rahman et al., 2014; Islam et al., 2015). Usually the NGOs, the slum owners, the community, caretakers appointed by the community or the influential people are responsible for the operation, management and cleanliness of the water points (International Centre for Diarrhoeal Disease Research, Bangladesh, 2016; Haque et al., 2020; Chowdhury, 2021; Rahaman et al., 2021). Rahman et al. (2014) discovered that in intervened slums, water collection points are located within 20 feet distance from the residence in most cases and the residents spend less than 60 minutes per day to collect water. On the other hand, in the non-intervened slums, the distance between the residence and the water points is 50 feet or more, and more than 60 minutes is required to collect water daily. However, respondents in both intervened and non-intervened slums suggested making available new connections, building storage facilities at household level, construction of platforms at water points, improvement in water quality and drainage system of wastewater, reducing associated costs etc. (Rahman et al., 2014). It was found that illegal water connections are prevalent in some slums of Dhaka and mostly the female members collect water for their HHs (UNICEF. n.d.).

Sanitation Facilities in Slums of Dhaka

Sanitation facility in slums of Dhaka has been found to be worse than the water facility (Rahman et al., 2014). In most cases, latrines are unhygienic and open defecation is highly practiced. Financial difficulty has been reported as reason for not having usable toilets. Rahman et al. (2014) have explored that access to latrine is common but presence of hygiene latrine is hard to find in the slums of Dhaka. Also, the women lack the equal opportunity for using the toilet as men. 10 to 20 minutes is required in the queue to use the toilet once. Sometimes financial contribution from the HHs is needed to clean the toilets. For the location, operation and management of the sanitation system; the slum owners, the community, the caretakers appointed by the community or the influential people are responsible (Rahman et al., 2014; Islam et al., 2015; International Centre for Diarrhoeal Disease Research, Bangladesh, 2016; Haque et al., 2020; Chowdhury, 2021; Rahaman et al., 2021).

2.2.2. Types of WATSAN Interventions in Bangladesh and in other Countries

Water related interventions usually take place in case of water sources or in the areas of water supply or distribution (Pedley et al., 2011).

2.2.2.1. Intervention in Water Sources

Cairncross & Feachem, 1993; Schouten & Moriarty, 2003; Skinner, 2003 provided guidelines on the planning and construction of improved water supply sources. Water related interventions primarily intend to bring the water source nearer to the user, at least until it meets the criterion for access. Amenability with the Water Framework Directive necessitates interventions at the land-use protection sector such as soil and nutrients management, or the introduction of buffer strips, since the land-use protection measures may alter the surface water quality (European Commission, 2002). Catchment assessment and management can also be adopted to reduce the amount of treatment that is required to supply safe and clean water (Environmental Protection Agency, 2002). Two or more communities sometimes develop a water source jointly to attain significant savings, and make it economically viable to develop the quality and quantity (Pedley et al., 2011). Erection of tube wells or other water sources in slums of Dhaka is also highly extant (Rahman et al., 2014). Legal water connections for urban slum dwellers are being increasingly practiced in Bangladesh (UNICEF, n.d.).

Intervention in Water Sources specifically for the Slums of Dhaka

For the slums of Dhaka, problems of dirty water carried by faulty water pipes have been fixed by different NGOs. It had been ensured that the slum dwellers can collect water from improved water sources (Abbas, 2017). Community based water points have also been established by the NGOs (Das et al., 2010).

2.2.2.2. Water Supply or Distribution related Interventions

Mechanical pumps have been installed, water treatment processes have been introduced in response to the transmission of pathogenic microorganisms in Bangladesh and in other countries (Pedley et al., 2011; Rahman et al., 2014; World Vision, n.d.). Rainwater harvesting system was installed for a household in Eastern Africa (Smet, 2005).

In Bangladesh, National Implementation Plan on Arsenic Mitigation in Water Supply is being adopted (UNICEF, n.d.).

Water Supply or Distribution related Interventions specifically for the Slums of Dhaka

Different organizations supply water treatment equipment to the slum HHs. For example, in slums like Vashantek, Peyarabagh; water treatment projects have been carried out by the NGOs in Dhaka (Rahman et al., 2014).

2.2.2.3. Sanitation Related Interventions

Sanitation related interventions usually take place in terms of latrine construction, latrine subsidy/provision interventions, sewerage interventions, sanitation education interventions etc. (Boisson et al., 2014; Garn et al., 2017; Capone et al., 2020). Rehabilitation and expansion of sewage collection and treatment, latrine programs and hygiene education in a variety of projects have been undertaken for Bangladesh (Asian Development Bank, 2009). Provision of handwashing facilities in latrines have also been provided in many countries including Bangladesh (Darvesh et al., 2017).

Sanitation Related Interventions specifically for the Slums of Dhaka

For different slums of Dhaka, construction of sanitation infrastructure is being widely practiced as a part of sanitation related interventions (Rahman et al., 2014). Provision of handwashing facilities have also been provided in some slums of Dhaka by several working NGOs (Rahman et al., 2014).

2.2.3. Sustainability Assessment of WATSAN Interventions supported by Previous Studies

Impacts of water and sanitation related interventions are evaluated by many researchers as well as the intervening or other organizations worldwide (Garn et al., 2017; Capone et al., 2020). But most of these evaluations are accessibility based (Garn et al., 2017; Hanchett, 2003; Bangladesh Rural Advancement Committee, n.d.; Degert et al., 2016). WHO/UNICEF Joint Monitoring Programme (2021) addressed the progress in WASH facilities over five years towards the targets set by SDG. In the report, it has been mentioned that if current trends persist, billions of families would be left without critical, life-saving WASH infrastructure and services by 2030. Sustainability of water and sanitation related interventions has been assessed for some countries of Africa to some extent but the organizational perspective is absent (Flores-Baquero et al., 2017). In case of Bangladesh, some organizations measure the progress after their interventions (Asian Development Bank, 2009; Bangladesh Institute of Development Studies, 2014; Luby et al., 2017). WHO has measured

sustainability of a WASH education project in rural Bangladesh after five years of the project completion (Hoque et al., 1996). Rahman et al. (2014) assessed the accessibility of WASH facilities in some slums of Bangladesh and compared the accessibility between intervened and non-intervened slums. Rahman et al. (2014) identified level of satisfaction, convenience of the slum dwellers as vital issues influencing the outcomes of urban WATSAN projects in Bangladesh.

Sustainability Assessment of WATSAN Facilities specifically for the Slums of Dhaka

Although National Strategy for Water Supply and Sanitation, SDGs emphasized on the sustainability of WATSAN facilities, limited studies have been conducted based on the slums of Dhaka. Nahar (2009) assessed the sustainability of the CBO interventions in WASH facilities for selected slums of Dhaka. It has been found in the study that the sustainability of the water system is reliant upon easy and continuous flow of water supply and the roles of women are important regarding the sustainability of the sanitation and hygiene practices. Rahaman et al. (2021) measured the sustainability of accessing to WATSAN facilities in slums of Dhaka comparing to the relevant targets of SDG 6. Habib (2009) recommended some strategies that can be undertaken by the Government and the NGOs for ensuring the sustainability of WATSAN facilities in the context of Dhaka.

2.2.4. Examples of Good Practices in Bangladesh regarding WATSAN Facilities

Besides overall poor situation regarding water and sanitation, Bangladesh has also made remarkable progresses in some cases due to a number of good practices by the households and the organizations; like for water, 98% of the population now gets drinking water from a technologically improved source, whereas in 1990, the rate was 79% (Fan & Azad, 2017). 89.6% people of Bangladesh have clean water closed to their homes (WaterAid, 2019). For sanitation, seven out of 10 HHs use latrines and other improved sanitation facilities, and one in eight HHs use septic tanks. Since 2000, the number of persons with a decent toilet of their own have increased by 131% (WaterAid, 2019).

Both in urban and rural areas of Bangladesh, drinking water treatments like boiling, using disinfectants are increasingly being practiced within the HHs. Over 80% of households are aware to start using improved hygienic latrines, and over 88% people on the positive practice of washing hands with soap after defecation (Abbas, 2017).

Different organizations are undertaking numerous impactful projects. Bangladesh Rural Water Supply and Sanitation Project has funded the construction of a piped water supply scheme, 11,900 water options and 36,000 hygienic latrines that benefit 948,000 inhabitants of the rural areas. The construction of a water treatment plant, transmission and distribution system under the Chittagong Water Supply Improvement Project is going to serve a total of 150,000 people with access to improved water sources. A technical assistance for developing sanitation and drainage master plans in Chittagong has also begun (The World Bank, 2016). Organizational focus has also been provided on influencing four key areas of handwashing with soap, safe water handling, menstrual hygiene management and safe disposal of faeces and urine (UNICEF, n.d.). DWASA has introduced a small-bore sewerage system in Mirpur with financial aids from ADB. Other initiative includes the construction of latrines in the slum areas (Haq, 2006).

CHAPTER THREE: METHODOLOGY

This chapter provides an overview of the methodology that the study employed to attain the objectives. Though the methodology was described in a sequential order, it is obvious that the process was more cyclic than an ordered progression.

3.1. Literature Review

At the initial stage of this research; certain number of reports, journal articles, conference papers, newspapers, official websites of relevant organizations of both inside and outside the country were reviewed to understand and visualize the context of the study.

The reviewed literatures were helpful to acquire an overall idea about the measurable situation of water and sanitation in the slums of Dhaka; recognize the adverse impacts of this situation on the residents, identify the interventions that the working organizations take to mitigate this hostile situation; ascertain if these interventions are actually benefitting the community in the long run.

Some literatures were also useful to identify the tools and techniques in order to assess the level of service of WATSAN facilities in the slums from the perceptions of the slum dwellers.

Chapter 2 provides an overview of the literatures that have been reviewed for the research. It should be mentioned here that beside the cited ones there are other literatures which were reviewed but were not mentioned in this document as it did not match with the content and scope of this research.

Based on gap in research that was identified in the initial literature review, three objectives were set for conducting the study. The associated variables, criteria and indicators were also selected and appropriate methods and techniques were followed with the help of literature review to fulfill the objectives of the study.

3.2. Selection of Slums

The slums containing 5 to 10 households can be considered as small slums, slums having 11 to 200 households can be considered as medium and slums with more than 200 households can be considered as large slums in the context of Dhaka (Haque et al., 2020). This study also follows the same consideration. The study area included only the slums of DNCC due to data availability and the highest number of slum households within its jurisdiction comparing to the other areas of

Bangladesh (Bangladesh Bureau of Statistics, 2015). There are 424 small slums, 1308 medium slums, and 120 large slums in DNCC (Bangladesh Bureau of Statistics, 2015). According to the officials of Slum Development Department, DNCC; water and sanitation related interventions usually take place in the large slums. Although some small-scale interventions might be conducted in the small or medium slums, but they are not recorded in the documents of DNCC office. As this study is focused on WATSAN interventions and organizational support in the slums, only the large slums were surveyed from DNCC and the slums where water and sanitation projects ended at least two years ago were chosen. This study considers both the cases where on-demand support from organizations is still available and where no support is available.

According to the DNCC record; in 72 large slums, water or sanitation related interventions have taken place since 2013 and among these, both water and sanitation related interventions have taken place in 60 slums. Interventions are ongoing in eight slums at this moment among these 60 slums. In case of the 49 slums, both of the water and sanitation related interventions have been completed about more than two years ago and 19 slums are still under support and 30 slums are not under support from the working organizations at this moment (Appendix A). Five slums were selected for the study (Figure 3.1), which were selected using simple random sampling. Among these five, two slums (Ceramic Basti and Korom Ali Basti) are still supported by the intervening organizations and three slums (Milk Vita Khalpar Basti, Kala Pani Basti and Jasim Molla Basti) do not have any organizational support available at this moment (Table 3.1).

Table 3.1: Selected Slums and Availability of Support

Serial No.	Name of the Slum	Location	Area (acres)	Number of HHs	Time(s) of WATSAN Interventions	Availability of Support
Slum 1	Ceramic Basti	Ward No 2, Pallabi Thana	1.85	423	2005, 2015, 2017, 2018	Yes
Slum 2	Kala Pani Basti	Ward No 6, Pallabi Thana	6	1485	2014, 2016, 2020	No

Serial No.	Name of the Slum	Location	Area (acres)	Number of HHs	Time(s) of WATSAN Interventions	Availability of Support
Slum 3	Milk Vita Khalpar Basti	Ward No 6, Pallabi Thana	2.03	477	2013, 2014, 2015, 2018	No
Slum 4	Jasim Molla Basti	Ward No 7, Pallabi Thana	2.05	529	2016, 2017, 2018	No
Slum 5	Korom Ali Basti	Ward No. 27, Sher-E-Bangla Nagar Thana	1.8	416	2014, 2020	Yes

Source: Bangladesh Bureau of Statistics, 2015; DNCC, 2022

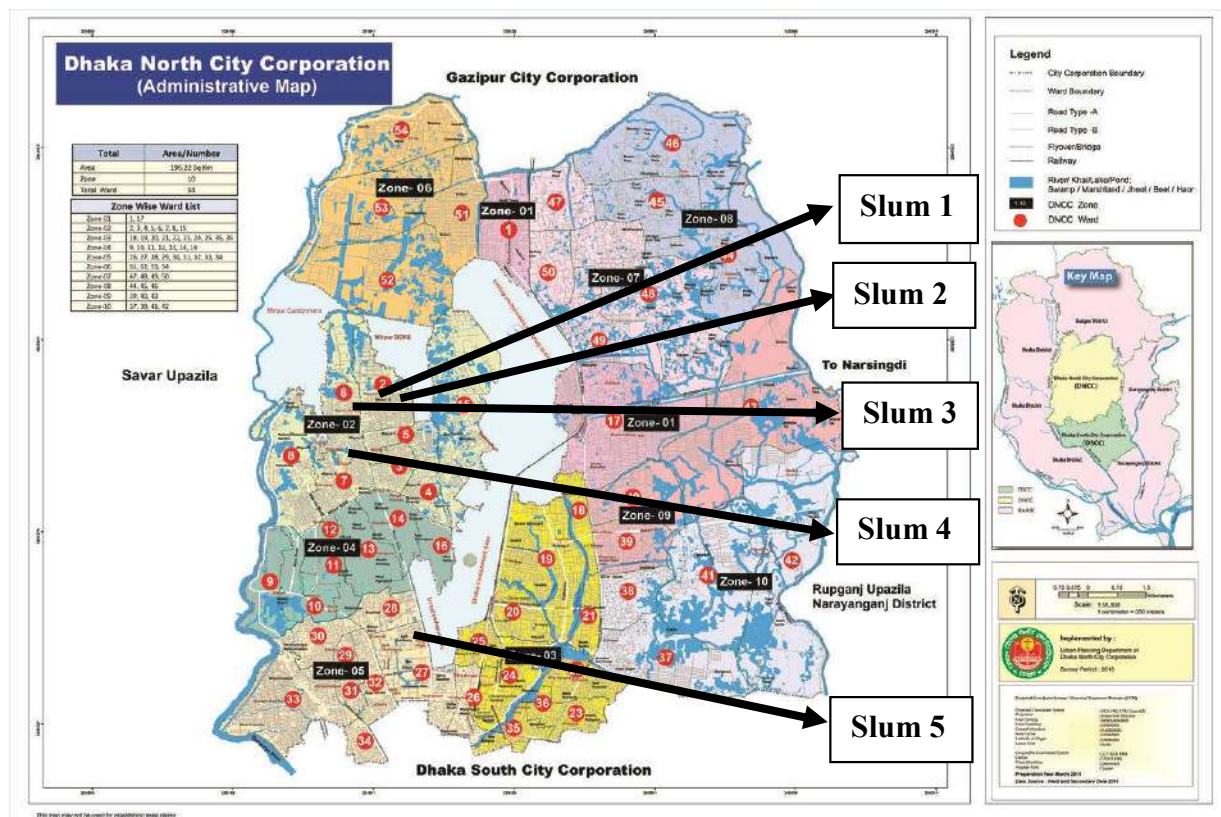


Figure 3.1: Selected Slums of DNCC (Source: Dhaka North City Corporation)

3.3. Data Collection

The research used both primary and secondary data. Primary data were collected through questionnaire, key informants' interview and focus group discussion while reports of different government agencies, service providers were used for secondary data.

3.3.1. Secondary Data Collection

Secondary data were collected from BBS (Bangladesh Bureau of Statistics, 2015) regarding the number of slums and residing households for survey design and analysis. Also, WATSAN interventions and organizational support related data were collected from DNCC office.

3.3.2. Primary Data Collection

3.3.2.1. Household Questionnaire Survey

For understanding the socio-economic profile of the slum dwellers and also for fulfilling the second objective of the study, a household questionnaire survey was conducted through face-to-face interview with the residents of the selected study area. Specifically, for measuring the level of service of WATSAN facilities, data of indicators under certain criteria (availability, accessibility, affordability, acceptability, etc.) of WATSAN facilities were collected through the questionnaire survey.

Initially, a pilot survey was conducted in all the selected slums on December, 2021. Data were collected from 10 households during the pilot survey. Some adjustments were made in the questionnaire based on the findings of pilot survey and then final questionnaire was prepared. The final questionnaire is attached in Appendix B.

Determination of Sample Size and Sampling Method

Slum Census, 2014 was used as the baseline for determining the target population, survey frame and sample distribution.

It was found that the total number of households in the selected slum was 3,330. At 95% Confidence Level and at ± 5 Confidence Interval, total sample size was determined to be 345. As mentioned in Section 2.2.1, the females are usually engaged in the water collection related activities for the HHs in the context of Bangladesh. Also, UN Water, 2016 has mentioned that

regarding sanitation, the women need to provide special consideration as they do not have the equal provision of sanitation as the males. That is why, all the respondents of the HH questionnaire surveys were female. The number of households in each slum was determined according to the ratio of total number of households in the slum with respect to total number of households in the target group. The distribution of samples in the selected slums is shown in Table 3.2. Simple random sampling was used to determine the target household.

Table 3.2: Sample Size in the Selected Slums

Name of the Slum	Number of Households	Sample Size
Korom Ali Basti	416	43
Ceramic Basti	423	44
Milk Vita Khalpar Basti	477	49
Kala Pani Basti	1485	154
Jasim Molla Basti	529	55
Total	3,330	345

The survey was conducted throughout January and February, 2022.

3.3.2.2. Focus Group Discussion (FGD)



Figure 3.2: FGD with Male

Source: Field Survey, 2022



Figure 3.3: FGD with Female

Source: Field Survey, 2022

Two FGDs (One for male and one for female) in each slum were conducted separately to get the views and opinions of both the male and female slum dwellers. It also helped to figure out if there is any difference between the opinions of the male and the female. As a result, 10 FGDs were conducted in total for the selected five slums. These FGDs were used to collect information on the activities of organizations, problems regarding water and sanitation facilities, and the reasons behind them. Figure 3.2 and Figure 3.3 shows the FGDs conducted in the Jasim Molla Basti.

3.3.2.3. Key informant Interview (KII)

The KIIs included representatives from non-governmental organizations (NGOs) because the NGOs usually work in the field level for the water and sanitation related interventions in slums. It was found that ten organizations have provided WATSAN facilities to the dwellers of the studied slum in the last few years. Dushtha Shasthya Kendra (DSK), Bangladesh Rural Advancement Committee (BRAC), WaterAid, Shobar Jonno Pani (SJP), and World Vision had the larger number of water and sanitation related interventions than the other organizations in the selected slums. For this reason, the representatives from these five organizations were interviewed. Representatives from governmental organizations like DNCC, WASA were also reached out for understanding their views and ideas. These KIIs were basically conducted to gain perceptions on the sustainability of interventions and considerations for designing new projects by DNCC and intervening organizations. Also, opinions on the existing or any missing criteria and indicators as well as the weights of the selected criteria for measuring the LOS of the WATSAN facilities were obtained from practitioners and researchers on water supply and sanitation. Table 3.3 includes the list of the key informants from different organizations.

Table 3.3: List of the Key Informants

Name of the Key Informant	Designation	Organization
Mr. Ripon	Chief Social Welfare and Slum Development Officer	Dhaka North City Corporation (DNCC)
Mr. Hasan	Slum Development Officer	
Mr. Karim	Assistant Engineer	DWASA
Ms. Momena	Deputy Director	DSK

Name of the Key Informant	Designation	Organization
Mr. Mofiz	Chief Engineer, Construction & Maintenance Department	BRAC
Mr. Abdul	Programme Officer, WASH	WaterAID
Mr. Bashir	Program Manager	Shobar Jonno Pani (SJP)
Abu Naim	Monitoring and Evaluation Officer	World Vision

**** The names are pseudonyms**

3.4. Data Analysis

3.4.1. Types and Characteristics of Interventions

Data collected from the focus group discussions regarding areas of intervention were identified and categorized using statistical analysis.

3.4.2. Level of Service of Water and Sanitation Facilities

The Level of Service of Water and Sanitation Facilities in the selected slums was assessed using the following procedure.

Analytical Framework

United Nations (Baquero et al., 2017; United Nations, n.d.) developed the criteria and indicators for measuring the level of service of WATSAN facilities. This study contextually followed the relevant criteria and indicators, also incorporating the suggestions received from KII. To measure water and sanitation service level, data on the indicators were collected under certain criteria like availability, accessibility, affordability, acceptability, etc. from household questionnaire survey (Table 3.4 and 3.5).

The perceptions of the residents were scored between 0 and 1 for further operations.

Sub-indices for Water and Sanitation

$$Av, PA, Q, Aff, Acc = \frac{\sum_{i=1,2,3\dots} X_i}{n_T}$$

Here; Av (Availability), PA (Physical Accessibility), Q (Quality and Safety), Aff (Affordability), and Acc (Acceptability)= values of each criterion (for water and sanitation) for a particular household.

And,

X_i =indicator i of the criterion and

n_T = Total number of indicators considered under each criterion.

The average value of the calculated Av, PA, Q, Aff, and Acc of the households were considered as the Av, PA, Q, Aff, and Acc for that particular slum.

The criteria (Av, PA, Q, Aff, Acc) were weighted according to the expert opinion determined by AHP.

Table 3.4: Criteria and Indicators of Level of Service of Water

Criteria	Indicators
Availability	Sufficient quantity (Perception)
	Continuity
	Reliability
Physical Accessibility	Time spent to Collect Water
	Security in paths
Quality and Safety	Water treatment facility within the household
Affordability	Perception of affordability
	Disconnection because of failures to pay
Acceptability	Satisfaction regarding water quality

Table 3.5: Criteria and Indicators of Level of Service of Sanitation

Criteria	Indicators
Availability	Sharing Status
	Adequacy of Gender Separated Toilets
Physical accessibility	Security on paths
	Continuity
	Security while using the sanitation facility
Quality and safety	Presence of insects
	Unpleasant smell
	Adequate conditions of cleanliness
	Condition of latrine and superstructure
	Hand washing facility and soap in the vicinity of the latrine
	Disposal of children stools
Affordability	Household investment/contribution to construction of the facility (perception)
	Reasons for not having a latrine
Acceptability	Conditions of privacy in the latrine
	Conditions of comfort in the latrine
	Satisfaction with the location of the facility

Weights of the Water and Sanitation Criteria

The key informants as the practitioners and researchers of WASH field were contacted regarding the weights of different criteria for both water and sanitation. The informants in this case were the same as mentioned in Table 3.3. As per the opinions from the experts, Analytic Hierarchy Process (AHP) has been applied to determine the final weightage of the Water and Sanitation Criteria (availability, physical accessibility, quality/safety, affordability, acceptability).

At first, criteria were fixed following the ones used by Flores-Baquero et al., 2017 and incorporating KIIs. Then eight key informant interviews (KII) were conducted in total for pair-wise comparison of criteria. Based on the result of KII, the final weightages for all the criteria were calculated using AHP.

These final weights of the criteria were used further to determine the WI and SI for each of the selected slums. The final weights of the WATSAN criteria are shown in Table 3.6.

In case of water, quality or safety has been regarded as the most important criteria for determining the service level by the experts. Hence, the weight is the highest (0.25) for this particular criterion. As per the final weights from the higher to the lower order, the criteria of LOS of water are availability (0.23), physical accessibility (0.22), affordability (0.19), and acceptability (0.11) respectively. It depicts that quality or safety of water facilities is of the highest importance, availability is of second importance, and acceptability has the least importance among the criteria. This order is consistent with the order of the weights of the criteria provided by the international experts for measuring LOS of water facilities, which was derived from Baquero et al. (2017).

Also, for sanitation, quality or safety has the highest weight (0.27) provided by the experts. Physical accessibility and availability have the second (0.25) and the third (0.20) highest weight respectively. Affordability has not been considered as important for sanitation. Therefore, the weight is the lowest (0.12). The weightage of acceptability has been derived as 0.16 for sanitation. This order (quality/ safety > physical accessibility > availability > acceptability > affordability) also conforms to the order of the weights for the sanitation criteria by the international experts (Baquero et al., 2017). It reflects that according to the key informants, quality or safety of sanitation has the highest importance in the slums, physical accessibility has the second highest importance, and affordability is the lowest important aspect considering sanitation.

Table 3.6: Final Weights of the Water and Sanitation Criteria

Criteria	Final Weights (Water)	Final Weights (Sanitation)
Availability	0.23	0.20
Physical Accessibility	0.22	0.25
Quality/Safety	0.25	0.27
Affordability	0.19	0.12
Acceptability	0.11	0.16

The sub-indices were then aggregated to a single value for water and sanitation respectively.

Water Index (WI) and Sanitation Index (SI) were calculated for a particular slum using the following formula.

$$WI = \prod_{i=Av,PA,Q,Aff,Acc} X_i^{w_i} \quad SI = \prod_{i=Av,PA,Q,Aff,Acc} X_i^{w_i}$$

Where, WI and SI=Water and Sanitation Index for a particular slum

X_i = Dimension i of the index

W_i =Weight of that dimension

3.4.3. Sustainability of the Interventions

The indices, criteria and indicators of the level of service of water and sanitation facilities were compared between the slums under support and without support using descriptive statistics and tests for statistical significance. The discussions from the key informant interviews were also incorporated in this case.

3.5. Formulation of Recommendations

On the basis of the analyses and major findings of the study, some relevant recommendations have been formulated for the betterment of the existing adverse scenario of WATSAN facilities in slums.

3.6. Preparation of Final Report

After all the assessments; a report was prepared showing maps, data interpretations and other analyses. After receiving feedback from honorable juries, necessary corrections had been made and by incorporating all those comments, the final report was prepared and submitted.

CHAPTER FOUR: STUDY AREA PROFILE

This chapter discusses about the general overview of the study area. To conduct the research, five slums were selected from DNCC based on their completed interventions and availability of on-demand support. Detail information of these slums are briefly discussed as follows.

DNCC is divided into 10 zones. In case of the 49 slums where both the water and sanitation related interventions have been completed about more than two years ago, are distributed into five zones (Zone 1,2,3,4 and 5) of DNCC. These slums are mostly located at Zone 2 of DNCC. Specifically, 33 out of these 49 slums are situated in Zone 2; whereas Zone 1,3,4 and 5 contain only one, seven, two, and six slums respectively. The selected slums in this research which were identified using simple random sampling are also located in Zone 2 of DNCC mostly.

4.1. Location and Households

Five slums were selected as the study area. The location of the selected slums- 1) Ceramic Basti, 2) Kala Pani Basti, 3) Milk Vita Khalpar Basti, 4) Jasim Molla Basti, and 5) Korom Ali Basti are shown in Figure 4.1.

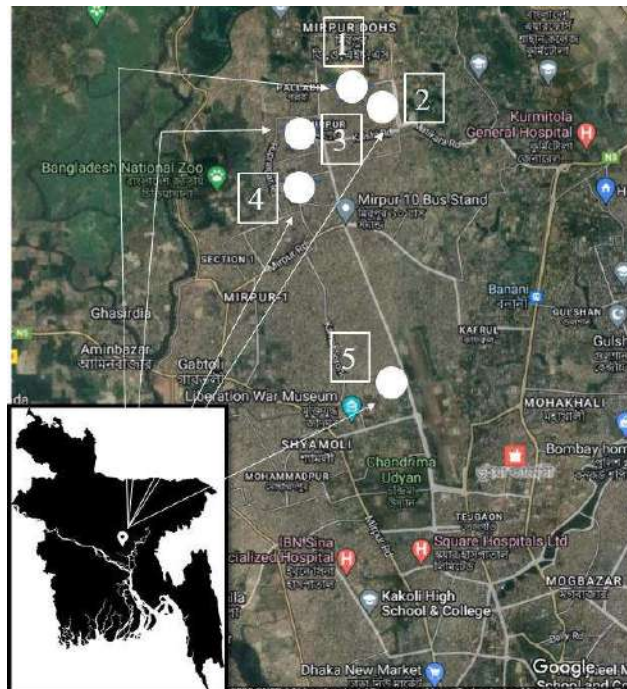


Figure 4.1: Location of the Study Area

Source: Google Map, 2022

Ceramic Basti

This slum is located at Ward No.2 under the Pallabi Thana. The total number of households living in the slum is approximately 423 and the total population is 1665. 52% of the slum dwellers are female and the rests include the male (Bangladesh Bureau of Statistics, 2015). The surroundings mostly include residential and commercial land uses (Field Survey, 2022).

Kala Pani Basti

This slum is a part of Ward No. 6, DNCC under the Pallabi Thana. This slum has 1485 households. Out of the total population, male is 51% and female is 49% (Bangladesh Bureau of Statistics, 2015). The surrounding land use is mostly commercial for this slum (Field Survey, 2022).



Figure 4.2: Ceramic Basti



Figure 4.3: Kala Pani Basti



Figure 4.4: Milk Vita Khalpar
Basti



Figure 4.5: Jasim Molla Basti



Figure 4.6: Korom Ali Basti

Source: Field Survey, 2022

Milk Vita Khalpar Basti

Milk Vita Khalpar Basti has 477 households. The population is approximately 1730, of which 885 residents are male and 844 residents are female (Bangladesh Bureau of Statistics, 2015). It is located at Ward No. 6, DNCC under Pallabi Thana surrounded by commercial land uses mostly (Field Survey, 2022).

Jasim Molla Basti

This slum is in Ward No. 7 under the Pallabi Thana, DNCC. The total number of households living in the slum is about 529. The residential land uses are dominant in the surroundings of the slum (Field Survey, 2022).

Korom Ali Basti

Korom Ali Basti has 416 households. The population is approximately 1520, of which 51% residents are male and 49% residents are female (Bangladesh Bureau of Statistics, 2015). It is located at Ward No. 27 under Sher-E-Bangla Nagar Thana surrounded typically by residential and commercial land uses (Field Survey, 2022).

4.2. Situation of Water and Sanitation Facilities in the Selected Slums

Ceramic Basti

There are currently thirty-five water taps and nine tube wells in this slum. Although some concrete water platforms have been constructed within the past ten years, there are still some water platforms that are broken or unsupportive or inundated even after a little rainfall and therefore, water collection becomes difficult. Through the last few years, water quality enhancement activities are being performed in this slum. Therefore, in general, the residents are using the water treatment facilities in their households.

In total, there are twenty-nine toilets in the slum. There was no female toilet before. In the recent years, male-female separate toilets have been constructed. But the females still face eve-teasing within the slum while using the toilets.

Kala Pani Basti

There are approximately 90 water taps, 50 tube wells and 110 latrines in Kala Pani Basti. Four female toilets and two tube wells have been recently constructed. But the scenario of WATSAN facilities in this slum is not so satisfactory. Specially, for sanitation facility, there is little or no privacy in most of the toilets except the individual toilet used only by the HH of the owner.



Figure 4.7: Unsupportive Water Platform in Ceramic Basti



Figure 4.8: Lack of Privacy in the Toilets of Kala Pani Basti



Figure 4.9: Poor Situation of the Female Separate Toilets in Milk Vita Khalpar Basti



Figure 4.10: Storing of Water in Jasim Molla Basti due to Irregular Water Supply



Figure 4.11: Darkness at the Entrance of the toilet in Korom Ali Basti

Source: Field Survey, 2022

Milk Vita Khalpar Basti

Although there are almost thirty water taps and twelve tube wells in this slum, the residents demand for more tube wells. Long queue for collecting water is a common scenario in this slum, as approximately 15 HHs share a single water source here on an average.

In case of sanitation, there are thirty-eight toilets including five female toilets. One female toilet is used only by the female members of the manager's HH. The other four female toilets were established a long ago and as a result, the situation of these toilets has been deteriorated. In recent years, two toilets have been constructed but these toilets are being used by both male and female. Therefore, the women want the repairing of the existing female toilets or constructing new female toilets.

Jasim Molla Basti

In Jasim Molla Basti, there are forty water taps and ten tube wells. But the water supply is irregular. Therefore, the residents always have to store water for their domestic uses. One tube well was erected a long ago by community initiative. The other tube wells were established as the results of organizational intervention.

There are forty toilets in this slum. Though cleaning activities have been performed in the toilets within a few years, it is not being continued by the slum community. Therefore, the situation of the toilets is so dirty and unhygienic as a whole.

Korom Ali Basti

There are thirty-two water taps and nine tube wells in the slum. In case of sanitation, most of the toilet infrastructure are not so supportive. In some cases, the latrine platforms are situated at a height that the women find it difficult to use. The way of entrance to the toilets are also dark in most of the cases even in sunlight. There are thirty toilets in the slum. Four latrine superstructures have been quite newly constructed. One of them has been recently established through community initiative. But also in this toilet, the air circulation and lighting are poor.

CHAPTER FIVE: SOCIO-ECONOMIC CHARACTERISTICS AND WATSAN STATUS OF THE SLUM DWELLERS

To gather information about socio-economic context of households and their perception, 345 households were surveyed from the five selected slums. As literatures suggested water fetching for households are generally done by female members of the households, the women were targeted as the respondents for the questionnaire. In this chapter, the socio-economic context of the respondents including their age, occupation, educational qualification, household income, expenditure etc. are summarized. Again, situation of water supply and sanitation of the slum dwellers in terms of sources, sharing status etc. have been focused on this chapter.

5.1. Socio-Economic Profile of the Households

Household size, age, occupation, educational qualification etc. are included in the social profile of the respondents. For economic profile, household income and expenditure are discussed.

5.1.1. Household Size and Earning Members

According to the respondents, the range of HH size in the slums is from 1 to 12. On an average, approximately five persons live in a household of the slums (Figure 5.1).

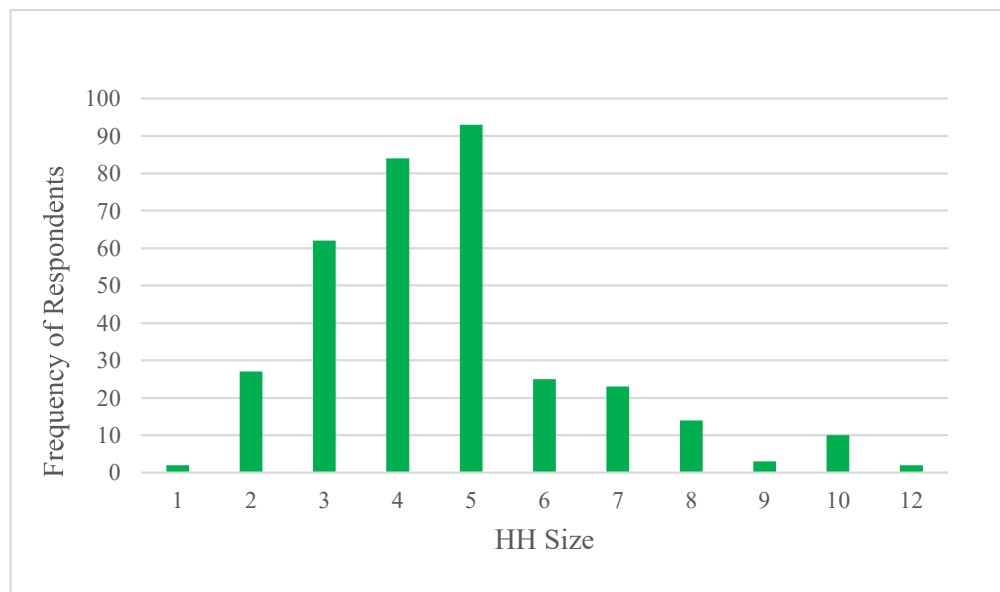


Figure 5.1: HH Size of the Respondents

Source: Field Survey, 2022

223 out of 345 respondents have stated that there is only one earning member in their households. 109 households have two earning members and only 13 respondents have 3 earning members in their households. A crosstabulation of HH size and number of earning members is shown in Table 5.1.

Table 5.1: HH Size* Number of Earning Members in the HH Crosstabulation

Number of Earning Members in the HH	HH Size											Total
	1	2	3	4	5	6	7	8	9	10	12	
1	2	23	52	60	69	6	5	4	2	0	0	223
2	0	4	10	18	24	19	18	7	1	6	2	109
3	0	0	0	6	0	0	0	3	0	4	0	13
Total	2	27	62	84	93	25	23	14	3	10	2	345

Structure Type and Ownership Status

78% households reside in semi-pucca houses and the rest of the households live in katcha houses. The respondents are mainly tenants (317 out of 345 surveyed households). The rest of the respondents possess the ownership of the residences.

Duration of Living in the Slums

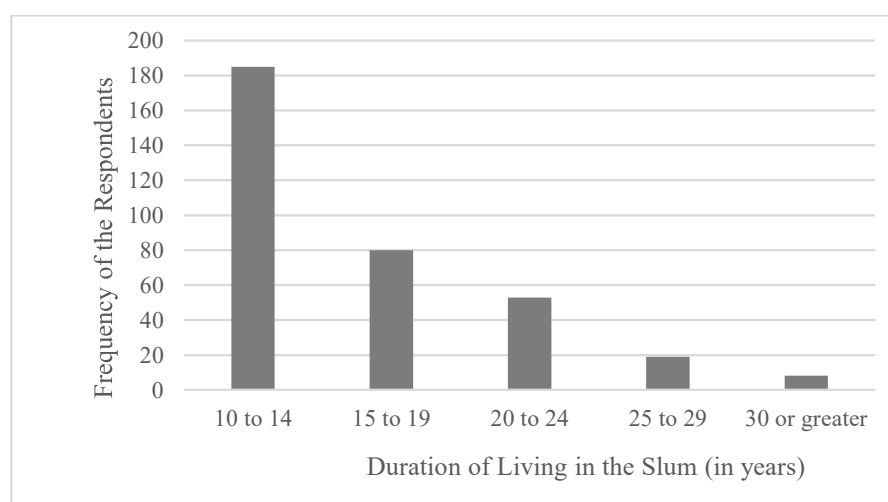


Figure 5.2: Duration of Living in the Slum by the Respondents

Source: Field Survey, 2022

The range of duration of living in the slums lies in between 10 to 35 years. On an average, the slum dwellers reside in the respective slums for almost 15 years. The frequency of number of years living in the slums by the respondents are highlighted in Figure 5.2.

Age and Occupation

Most of the respondents belong to the age group between 41 to 60 years (approximately 69%). Age ranging from 61 to 70 years lie the most prior after the previous range (around 20%). 7% residents are more than 70 years. The rest of the respondents are younger than people of all these age groups (30 to 40 years). Figure 5.3 depicts the scenario.

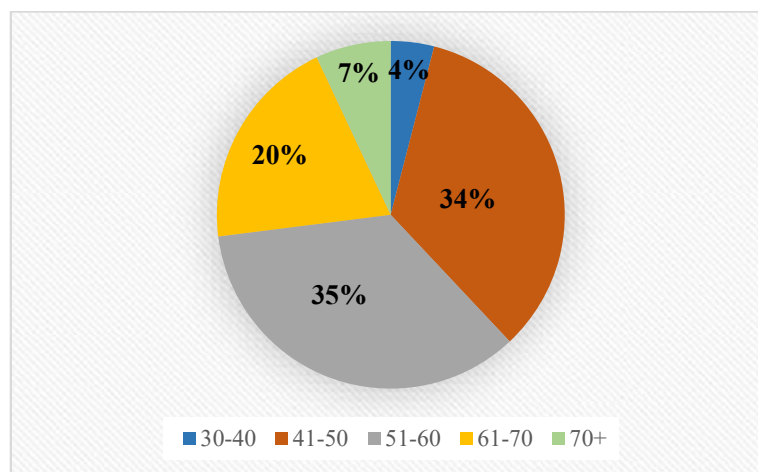


Figure 5.3: Age (in years) of the Respondents

Source: Field Survey, 2022

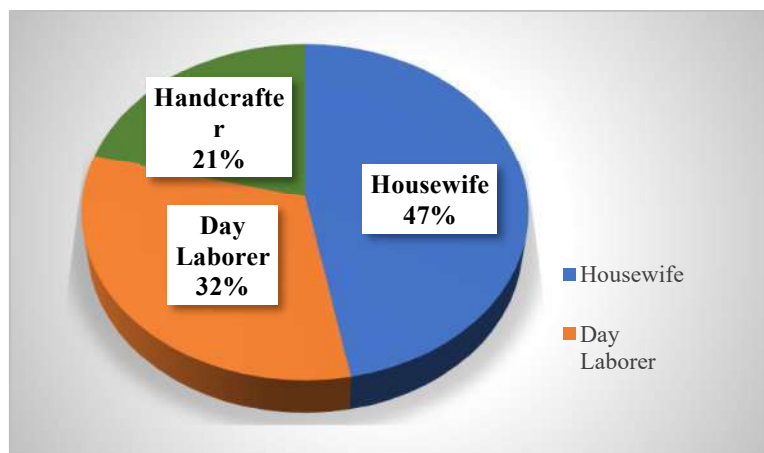


Figure 5.4: Occupation of the Respondents

Source: Field Survey, 2022

Three types of occupations have been found in which the respondents are engaged in. About 47% of the respondents are housewives, 32% respondents work as day laborers and 21% are involved in handcrafting (Figure 5.4).

Educational Qualification

Majority of slum dwellers in the study area are illiterate or studied up to the primary level (42% and 41% respectively). 12% slum dwellers have completed secondary education and 5% people have the educational qualification up to HSC (Figure 5.5).

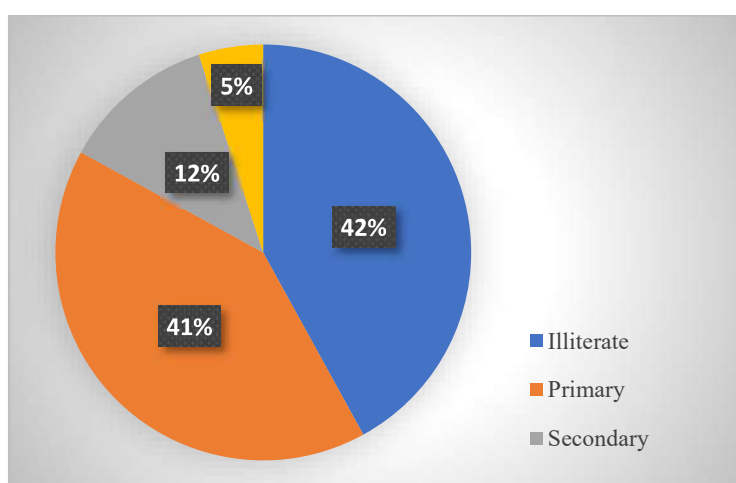


Figure 5.5: Educational Qualification of the Respondents
Source: Field Survey, 2022

Monthly Income and Expenditure

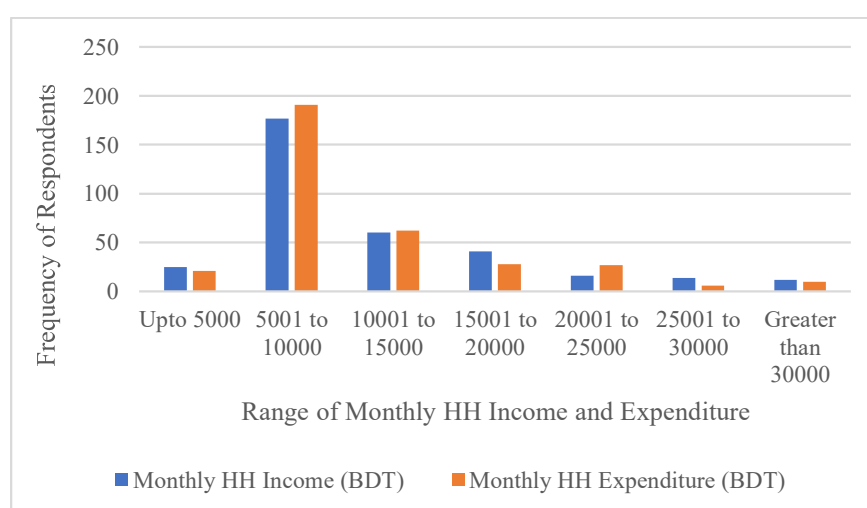


Figure 5.6: Monthly Household Income and Expenditure (BDT) of the Respondents
Source: Field Survey, 2022

The monthly income level of the respondents ranges from 3,000 to 35,000 BDT and the average monthly income is approximately 10,000 BDT. The average monthly expenditure of the slum dwellers is also closed to 10,000 BDT depicting that there is almost no savings of the slum dwellers. The overall situation is shown in Figure 5.6.

5.2. Water Supply and Sanitation Status in the Households

The existing situation of water supply and sanitation facilities in the slums are briefly discussed in this section.

5.2.1. Water Supply

5.2.1.1. Water Source

Most of the surveyed households (302 out of 345 households) use one source of water supply for both drinking and other domestic uses. The rest of the households use two water supply sources, one for drinking water and another one for other domestic uses. The residents of these HHs think the water quality of their sources for domestic uses is not satisfactory. So, they opt for a drinking water source which is better in quality.

Almost 80% households use piped water supply. Tube wells are used by 16% households. The rest of the households buy bottled water for drinking purpose, as they are not satisfied with the water quality of their slums.

5.2.1.2. Nature of Water Supply and Sharing Status

Almost 49% households have intermittent water supply. 28% households have stated that their water supply is continuous (24 hours water supply in a day), and 23% have mentioned that they have irregular water supply in their households.

337 out of 345 households share the water supply sources with other households. Only eight people have mentioned that they have individual water supply source in their households. All of these HHs hold the ownership of houses in the slums. In case of sharing, approximately 10 families share a single water source on an average in their day-to-day life.

5.2.2. Sanitation

5.2.2.1. Sharing Status

The slum dwellers mainly use shared toilet. 341 out of 345 households have stated that they share toilet with other families. Only four households, who are the owners of the houses have individual toilets in their households. On an average, 15 families share one toilet in the slums.

5.2.2.2. Usability of Toilets

According to 86% of the surveyed households, they can use their designated toilets of their slums. Among the remaining 14% respondents, 11% use another toilet within their slums or outside their slums. The rest of the 3% households practice open defecation. The reasons behind the unusability of the designated toilets are presence of insects, inadequate cleanliness etc.

CHAPTER SIX: TYPES AND CHARACTERISTICS OF INTERVENTIONS AND ASSOCIATED ORGANIZATIONS FOR WATSAN FACILITIES

The objective of this chapter is to provide detail description of the WATSAN interventions undertaken by different organizations in the study area.

6.1. Intervening Organizations

According to the records available in DNCC office, the NGOs generally work at the field level for providing and managing WATSAN facilities in slums. The FGDs supported this. 10 NGOs have conducted intervention projects or programs in the last few years for the selected slums. The names and types of the intervened organizations are listed in Table 6.1.

Table 6.1: Names and Types of the Intervened Organizations

Name of the Organizations	Type of the Organizations
Dushtha Shasthya Kendra (DSK)	National voluntary development organization
Bangladesh Rural Advancement Committee (BRAC)	International development organization
WaterAid	International charity organization
Shobar Jonno Pani (SJP)	National Social Enterprise
World Vision	International humanitarian organization
Water and Life	International non-governmental organization
United Nations Development Programme (UNDP)	International development agency
United States Agency for International Development (USAID)	International development agency
Water and Sanitation for the Urban Poor (WSUP)	International non-profit organization
Unnayan Shahojogy Team (UST)	National non-governmental organization

Source: Organizational Websites and KII, 2022

6.2. Types and Characteristics of WATSAN Interventions in the Selected Slums

This study follows the same definitions of ‘Construction’ and ‘Maintenance’ as suggested by OSHA’s directive which are mentioned in the sub-section 2.1.6. The above-mentioned 10

organizations undertook several interventions in the selected slums. Some slums are still being supported by the organizations and in some slums, support has been withdrawn. In spite of living in the slums for a long time period, almost 30% respondents surveyed through questionnaires are not aware of the fact that WATSAN interventions have taken place in their residing slums. It should be also worth mentioning that usually the slum dwellers have been able to remember the construction related interventions but often forgot the maintenance activities in general.

Although these interventions are conducted by NGOs, 62% of respondents stated that they think water related interventions are carried out by governmental organizations. Also, according to 40% respondents, sanitation related interventions are carried out by governmental organizations in the slums. But their perspective is not correct, which was proved clearly while conducting FGDs, as well as from government records and some residents of the slums. In all the FGDs of the selected slums, the members of the discussions agreed that the WATSAN interventions are undertaken by several NGOs in practice. A brief description of the interventions by the organizations in the selected slums are discussed as follows.

Dushtha Shastha Kendra (DSK)

Out of the five selected slums, Dustha Shastha Kendra intervened in three slums (Ceramic Basti, Jasim Molla Basti, Korom Ali Basti). In these slums, the organization undertook sanitation related interventions. DSK basically performed construction related activities in these slums. In Jasim Molla Basti and Korom Ali Basti; new latrine superstructures were conducted in 2017 and 2020 serving 70 and 60 HHs respectively, where the latrines were covered previously using sacks, torn clothes etc. In Ceramic Basti, construction of some toilet platforms was accomplished by DSK. The dwellers of Ceramic Basti were facing problems in utilizing the toilets during the rainy season. Then DSK came forward in 2017 to construct elevated toilet platforms in order to ensure the usability of the toilets throughout the year.



Figure 6.1: Elevated toilet platform in
Ceramic Basti by DSK
Source: Field Survey, 2022

Bangladesh Rural Advancement Committee (BRAC)

BRAC intervened in Ceramic Basti, Milk Vita Khalpar Basti and Korom Ali Basti. In Milk Vita Khalpar Basti and Korom Ali Basti, it worked only on sanitation sector, and in Ceramic Basti, both water and sanitation sectors were under consideration. It performed both construction and maintenance activities. As part of construction related activities, concrete platforms at water collection points were constructed in Ceramic Basti facilitating 30 families and male-female separate toilets were constructed in both Ceramic Basti and Korom Ali Basti. As a part of maintenance, raised toilet platforms were provided replacing the broken platforms of the toilets for 45 families in Milk Vita Khalpar Basti. The sanitation related interventions took place in the years of 2005 and 2014, and the water related interventions were conducted in 2018.



Figure 6.2: Concrete platform at water collection points in Ceramic Basti by BRAC

Source: Field Survey, 2022

WaterAid

In Kala Pani Basti, Jasim Molla Basti and Milk Vita Khalpar Basti; WaterAid undertook interventions in 2014, 2016 and 2018 respectively. In Jasim Molla Basti, platforms were constructed at water collection points and equipment were provided to enhance the water quality. In Kala Pani Basti, four male-female separate toilets, and platforms at two water collection points were constructed. Broken toilet platforms were replaced in two toilets of Milk Vita Khalpar Slum facilitating 20 families.



Figure 6.3: Male-female separate toilet in Kala Pani Basti by WaterAid

Source: Field Survey, 2022

Shobar Jonno Pani (SJP)

SJP intervened in Milk Vita Khalpar Basti (2013, 2014), Ceramic Basti (2017), Jasim Molla Basti (2018), and Kala Pani Basti (2020). It mainly undertook water related interventions in the slums. In Kala Pani Basti (2020), two tubewells were erected, and in Ceramic Basti, Milk Vita Khalpar Basti, and Jasim Molla Basti; SJP monitored the water quality, applied disinfectants, and provided water disinfectants and purification tablets to the slum dwellers in order to ensure better water quality in the slum.



Figure 6.4: New Tubewell in Kala Pani Basti by SJP

Source: Field Survey, 2022

United Nations Development Programme (UNDP)

UNDP did not work directly within the slums. But it financed projects involving the community. Five new toilets in Ceramic Basti and Milk Vita Khalpar Basti were constructed with the financial contribution from UNDP. This intervention project was also supported by DNCC. Both interventions were conducted in 2015.



Figure 6.5: New Toilet in Milk Vita Khalpar Basti by UNDP

Source: Field Survey, 2022

World Vision

World Vision mainly undertook maintenance activities in Kala Pani Basti (2014), Karam Ali Basti (2014), and Milk Vita Khalpar Basti (2015). In Milk Vita Khalpar Basti, disinfectants were applied to get better water quality. In Kala Pani Basti (2014) and Karam Ali Basti (2014), water quality was enhanced applying disinfectants and toilets were cleaned employing the members of the slum committee.

Water and Life

This organization worked in Kala Pani slum. Maintenance was performed regarding water quality in this slum. Disinfectants were applied and the dwellers were distributed water filter. The intervention took place in 2016 serving 50 HHs.

United States Agency for International Development (USAID)

USAID provided financial support to the slum community. In Milk Vita Khalpar Basti, both water and sanitation related interventions took place. In 2013, for 25 families, two new tube wells were erected and one latrine was replaced which got cracked previously.



Figure 6.6: New Tubewell in Milk Vita
Khalpar Basti by USAID

Source: Field Survey, 2022

Unnayan Shahojogy Team (UST)

In Jasim Molla Basti, the platforms at three water collection points were katcha. Therefore, the place always remained muddy and slippery. UST came forward in 2016 and constructed three elevated water collection platforms in this slum serving 15 HHs.



Figure 6.7: Elevated water platform in
Jasim Molla Basti by UST

Source: Field Survey, 2022

Water and Sanitation for the Urban Poor (WSUP)

WSUP checked the cleanliness of the toilets in Jasim Molla Basti in 2016 and found the toilets were lacked in adequate cleanliness. Therefore, almost all the toilets of the slums were cleaned by WSUP in 2017 involving the slum community.

These interventions of the organizations are summarized and highlighted in Table 6.2 and Table 6.3.

Table 6.2: Sectors of Interventions by the Organizations in the Selected Slums

Name of the Slum	Intervened Organizations	Intervened Sector (Year of Completion)
Ceramic Basti	United Nations Development Programme (UNDP)	Sanitation (2015)
	Shobar Jonno Pani (SJP)	Water (2017)
	Dushtha Shasthya Kendra (DSK)	Sanitation (2017)
	Bangladesh Rural Advancement Committee (BRAC)	Water and Sanitation (2005 and 2018)
Kala Pani Basti	WaterAid	Water and Sanitation (2014)
	World Vision	Water and Sanitation (2014)
	Water and Life	Water (2016)
	Shobar Jonno Pani (SJP)	Water (2020)
	United States Agency for International Development (USAID)	Water and Sanitation (2013)

Name of the Slum	Intervened Organizations	Intervened Sector (Year of Completion)
Milk Vita Khalpar Basti	Shobar Jonno Pani (SJP)	Water (2013 and 2014)
	Bangladesh Rural Advancement Committee (BRAC)	Sanitation (2014)
	World Vision	Water (2015)
	WaterAid	Sanitation (2018)
	United Nations Development Programme (UNDP)	Sanitation (2015)
Jasim Molla Basti	Unnayan Shahojogy Team (UST)	Water (2016)
	WaterAid	Water (2016)
	Water and Sanitation for the Urban Poor (WSUP)	Sanitation (2017)
	Dushtha Shasthya Kendra (DSK)	Sanitation (2017)
	Shobar Jonno Pani (SJP)	Water (2018)
Korom Ali Basti	World Vision	Water and Sanitation (2014)
	Bangladesh Rural Advancement Committee (BRAC)	Sanitation (2014)
	Dushtha Shasthya Kendra (DSK)	Sanitation (2020)

Table 6.3: Types and Categories of Interventions by Different Organizations

Name of the Organizations	Types of Interventions
Dushtha Shasthya Kendra (DSK)	Construction (new latrine superstructure, new toilet platform)
Bangladesh Rural Advancement Committee (BRAC)	Construction (platform at water collection points, male-female separate toilets) Maintenance (replacing broken toilet platform)
WaterAid	Construction (platform at water collection points, male-female separate toilets) Maintenance (enhancing water quality, replacing broken toilet platform)
Shobar Jonno Pani (SJP)	Construction (tubewell) Maintenance (enhancing water quality)
World Vision	Maintenance (enhancing water quality) Maintenance (cleaning toilets)
Water and Life	Maintenance (enhancing water quality)
United Nations Development Programme (UNDP)	Construction (new toilets)
United States Agency for International Development (USAID)	Construction (tubewell) Maintenance (replacing the latrine)
Water and Sanitation for the Urban Poor (WSUP)	Maintenance (cleaning toilets)
Unnayan Shahojogy Team (UST)	Construction (platform at water collection points)

6.3. Timeline and Sustainability of the WATSAN Interventions

No specific connection has been found between the timeline of interventions and its sustainability (availability of organizational support). For Kala Pani Basti, Jasim Molla Basti, and Milk Vita Khalpar Basti, no support is available from any of the working organizations. World Vision and DSK provide support in Korom Ali Basti, whereas Ceramic Basti is supported by BRAC and SJP. Initially, BRAC undertook sanitation related intervention on 2005 in Ceramic Basti. Later, it worked in water sector for this slum in 2018. BRAC is still supporting the residents of this slum if required. SJP worked in 2017 and is still supporting the slum dwellers of this particular slum. On the other hand, DSK intervened at the same year (2017) in Ceramic Basti, but has stopped supporting. The slum community of DSK is performing routine monitoring by themselves. DSK is supporting Korom Ali Basti, where intervention was undertaken in 2020. BRAC worked there in 2014, but has stopped supporting.

In the KII, the representative of BRAC has mentioned that the working team thinks the dwellers of Ceramic Basti is in need of support due to their extremely poor WATSAN situation. Also, around 2018, some slum leaders approached to them demanding physical support for improving the WATSAN sectors in their slums, and BRAC is still providing so. But in the other slums where it worked (Korom Ali Basti and Milk Vita Khalpar Basti), support is not needed as nobody has ever come to them for getting any kind of support on behalf of the slum residents. The representatives from the other organizations also agreed that the dwellers need to come to them for seeking support. Otherwise, it is difficult for them to identify which slum needs support as they intervene in so many organizations. Although they have agreed to form a team considering sustainability issues in their further projects, they expect cooperation from the slum dwellers.

Therefore, it can be stated that the organizations have no specific plan regarding sustainability or providing support after WATSAN intervention, and it is also not connected with the time of the intervention. Rather, they have plans to provide continuous support for a long time only if they realize or get informed about the necessity of support in the specific slum.

Table 6.4: Timeline of Interventions, No. of serving HHs, and Routine Monitoring in the Slums

Slum	Intervening Organization	Types of Interventions	Number of HHs Served	Year of Interventions	Continuation of Routine Monitoring
Ceramic Basti	UNDP	Construction of three new toilets	30	2015	Discontinued
	SJP	Enhancement of water quality	100	2017	By organization
	DSK	Construction of five new toilet platforms	25	2017	By community
	BRAC	Construction of four male and female separate toilets	70	2005	By organization
		Construction of six water collection platforms	30	2018	By organization
Kala Pani Basti	WaterAid	Construction of four male-female separate toilets, and platforms at two water collection points	90	2014	Discontinued
	World Vision	Enhancement of water quality, and cleaning toilets	100	2014	Discontinued
	Water and Life	Enhancement of water quality	50	2016	Discontinued
	SJP	Erection of two new tube wells	20	2020	Discontinued
Milk Vita Khalpar Basti	USAID	Erection of two new tube wells and replacement of one latrine	25	2013	Discontinued
	SJP	Enhancement of water quality	200	2013, 2014	Discontinued
	BRAC	Replacement of three broken toilet platforms with raised platforms	45	2014	Discontinued
	World Vision	Enhancement of water quality	40	2015	Discontinued
	WaterAid	Replacement of broken platforms in two toilets	20	2018	Discontinued
	UNDP	Construction of two new toilets	20	2015	Discontinued
Jasim Molla Basti	UST	Construction of three elevated water collection platforms	15	2016	Discontinued
	WaterAid	Construction of eight water collection platforms and enhancement of water quality	250	2016	Discontinued
	WSUP	Cleaning toilets	300	2017	Discontinued
	DSK	Construction of five new latrine superstructure	70	2017	Discontinued
	SJP	Enhancement of water quality	50	2018	Discontinued
Korom Ali Basti	World Vision	Enhancement of water quality, and cleaning toilets	100	2014	By organization
	BRAC	Construction of five male-female separate toilets	80	2014	Discontinued
	DSK	Construction of four new latrine superstructure	60	2020	By organization

6.4. Identification of the Stakeholders of the Organizational WATSAN Interventions in the Slums

Four types of stakeholders are generally involved in the WATSAN interventions of the slums (Figure 6.8). The NGOs generally undertake WATSAN interventions in the field level getting financial or logistic support from the city corporation. The NGOs contact the relevant slum committee or leaders or managers and express their interests in intervening the slums, if they realize WATSAN interventions are required to be taken in the respective slums. Sometimes the representatives of the respective slums approach the city corporation or NGOs regarding their WATSAN related problems and requirements of interventions. The general slum dwellers also come forward to describe their individual problems regarding WATSAN facilities. Then, the organizations intervene in the slum following their own plans or incorporating the opinions of the slum dwellers. The NGOs usually provide physical or financial support in the interventions depending on the context of the slums or the requirements of the slum dwellers.

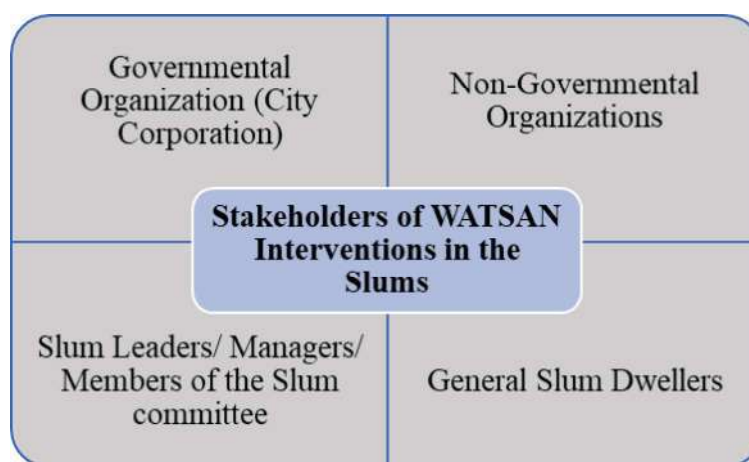


Figure 6.8: Stakeholders of WATSAN Interventions in the Slums

Source: Field Survey, 2022

6.5. The Views of the Stakeholders regarding WATSAN Interventions

The views of general slum dwellers were derived from HH questionnaire surveys, the slum leaders provided their opinions in the FGDs. The male and female dwellers face separate types of problems in WATSAN facilities, which were reflected in the male and the female FGDs. The organizational views were revealed in the KIIs. From Table 6.5, it is clear that different types of stakeholders

have diverse views regarding WATSAN interventions. The males have been found to be generally concerned about the nature and the quality of the supplied water, whereas in the female FGDs, the females have stated that they face more trouble regarding the security in the water collection paths. As the women have been found to be responsible for water collection in most of the HHs, they are more concerned about the problem while collecting water. On the contrary, the males are more worried about the supplied water. Regarding sanitation, the males do not face any privacy related issues. But almost all the females face this while using the toilets, which was derived from both questionnaire survey and the female FGDs.

In the KIIs, the organizations have mentioned that their financial contribution is sufficient for undertaking interventions, in the male FGDs, the statement was denied and the females stated in the FGDs that they are not usually allowed to participate in this matter, therefore they have no idea about this. The respondents have mentioned in the HH questionnaire survey that the availability of physical support or arrangement of WATSAN training from the organizations is rare. Both the male and the female FGDs agreed that the organizations are not willing in providing this. But in the KIIs, the organizations have mentioned that the residents themselves are not willing to receive this kind of support or training. According to the males, the involvement of CBOs is not necessary. But the organizations have acknowledged the necessity of the CBOs in WATSAN sector. The females have no opinion in this case.

Table 6.5: The Views of the Stakeholders regarding WATSAN Interventions

Issues	HH Questionnaire Surveys	Male FGDs	Female FGDs	KIIs
Main problems regarding LOS of water	Water supply is not continuous, poor water quality, and less security in water collection paths	Water supply is not continuous and poor water quality	Less security in water collection paths	-
Main problems regarding LOS of sanitation	Lack of privacy in the toilets	Dark entrance of the toilets	Lack of privacy in the toilets	-
Initiatives of Interventions	-	Mostly the organizations come forward, but sometimes	The organizations come forward to intervene	City corporation provides financial or logistic support

Issues	HH Questionnaire Surveys	Male FGDs	Female FGDs	KIIs
		the leaders or general residents approach the city corporation		and NGOs undertake the interventions
Sufficiency of financial support from the organizations	-	Not sufficient	Unknown whether sufficient or not	Sufficient
Nature of financial support from the organizations	Distributed to the slum leaders only	Distributed to the slum leaders only	Nature of Financial Support is unknown	Distributed to the slum leaders only as they want monetary support from the organizations
Physical support or arrangement of training from the organizations	Rarely happens	The organizations are not willing	The organizations are not willing	The organizations are willing if required, but the residents are not willing
Communication between the residents and the organizations	Problems are ignored after hearing	Problems are ignored after hearing	No willingness to contact and problems are ignored after hearing	Lack of willingness from the residents to approach the organizations
Sustainability issues in the interventions	-	No consideration	Do not have any idea	At present, no concrete plan
Involvement of CBOs	-	Not required	Do not have any idea	Required

CHAPTER SEVEN: ASSESSMENT OF LEVEL OF SERVICE IN TERMS OF WATSAN FACILITIES

This chapter reflects the level of service of WATSAN facilities in the selected slums considering the criteria: availability, accessibility, quality or safety, affordability and acceptability. 345 households were surveyed through a questionnaire to understand the water and sanitation related services in their residing slums. Different indicators derived from Flores-Baquero et al. (2017) and suggestions from KII were used for each of the criteria to get a clear idea about the level of service of water and sanitation facilities in all the selected slums. This chapter describes the variations of the criteria in each of the slums for both water and sanitation facilities, the weights of the criteria, and elaborates the findings in greater detail.

7.1. Water

For each of the criteria (Availability, physical accessibility, quality/safety, affordability, acceptability), different indicators were used to compute the composite indices for each of the slums. The methodology followed to calculate the water availability, physical accessibility, quality/safety, affordability, acceptability indices has been clearly described in Chapter 3. The indices of the slums for different criteria of water facilities are discussed in the following sub-sections.

7.1.1. Availability

Three indicators were used to measure the ‘water availability’ criterion. These indicators were sufficiency of water supply, continuity, and reliability. Combining the perceptions of the slum dwellers regarding these indicators and following the methods described in chapter 3, the availability index for each of the slums were found.

The water availability indices do not vary significantly among the selected slums. For Jasim Molla Basti, the index is the lowest (0.48) depicting that the situation of the indicators of water availability like sufficiency, continuity and reliability are poorer in this slum than in the other ones. On the other hand, Milk Vita Khalpar Basti has the most satisfactory water availability index (0.59). Kala Pani Basti and Ceramic Basti have the same water availability index (0.5). For Korom Ali Basti, the index is comparatively higher (0.56). Table 7.1 reflects the overall scenario.

In case of water availability, the sufficiency of water supply according to the perception of the residents has been found poorer than the other two indicators (continuity and reliability) in all the selected slums. The average water sufficiency index is 0.36, whereas on an average, the continuity index and reliability index are 0.53 and 0.66 respectively for the slums. It is clear that although there is variation on water availability within the slum, the variation is not high and the index values which hovers around 0.5 indicate that overall, the perception of the dwellers on water availability is neither good nor bad.

Table 7.1: Water Availability Indices of the Slums

Slum	Water Availability Index
Korom Ali Basti	0.56
Ceramic Basti	0.50
Milk Vita Khalpar Basti	0.59
Kala Pani Basti	0.50
Jasim Molla Basti	0.48

Case Study

Mrs. Shaila, aged 35, has been living in Jasim Molla Basti for almost 20 years. She is the only responsible person in her HH for collecting water. The water supply in her HH is inadequate and irregular. The situation of the other water sources of the slum is more or less similar. Sometimes, she has to wait for the whole day to collect necessary amount of water for her HH. She needs to continuously check the availability of water in the source. In most of the days, she cannot take her little son (aged five years) to the school, because she suspects that if she goes to school with her son, she may fail to collect water for that day.

7.1.2. Physical Accessibility

Two indicators (security in water collection paths, and waiting time to collect water) were combined to get the ‘water physical accessibility’ indices for the slums.

The variation in physical accessibility indices of water supply ranges from 0.34 to 0.52. The situation is almost similar for Korom Ali Basti, Ceramic Basti and Milk Vita Khalpar Basti (water accessibility indices are 0.50, 0.52 and 0.51 respectively). For Kala Pani Basti and Jasim Molla Basti, the indices fall to 0.46 and 0.34 respectively (Table 7.2).

In the case of physical accessibility, the security in water collection paths is in worse condition than the other indicator (residents' perception regarding waiting time for water collection). The average index for residents' perception regarding waiting time for water collection is 0.56, while the index of security in water collection paths is 0.35. Only for Milk Vita Khalpar Basti, the index of both these two indicators is same (0.51).

For Jasim Molla Basti, the index of security in water collection paths is significantly poor (0.1), which has contributed to the poorest water accessibility index of the slum. The respondents of all the slums more or less stated that they face eve-teasing by the people within the slum while collecting water. As stated in section 4.2, in Ceramic Basti, there are some broken or unsupportive water platforms and they are sometimes inundated even after a little rainfall. For that reason, almost all the respondents of this slum have mentioned about the recurrence of accidents in the water collection paths.

Table 7.2: Water Accessibility Indices of the Slums

Slum	Water Accessibility Index
Korom Ali Basti	0.50
Ceramic Basti	0.52
Milk Vita Khalpar Basti	0.51
Kala Pani Basti	0.46
Jasim Molla Basti	0.34

7.1.3. Quality/Safety

Availability of water treatment facilities within the HHs was used to measure the 'water quality/safety' index.

The water quality/safety of the selected slums is better than the other criteria of determining LOS of the water facilities. In Ceramic Basti, the water quality index is 0.95 depicting that most of the residents of this slum have water treatment facility available in their households. It was also mentioned in section 4.2. Milk Vita Khalpar Basti has the lowest water quality index, which is 0.67. Kala Pani Basti and Korom Ali Basti have the same index (0.79). The situation is reflected in Table 7.3. It is clear that there is wide variation among the slums. While the residents of Ceramic Basti have almost agreed that they have water treatment facilities available in their HHs, the

residents of Milk Vita Khalpar Basti have some reservation on the water treatment facilities that they have or use in their HHs.

Table 7.3: Water Quality/Safety Indices of the Slums

Slum	Water Quality Index
Korom Ali Basti	0.79
Ceramic Basti	0.95
Milk Vita Khalpar Basti	0.67
Kala Pani Basti	0.79
Jasim Molla Basti	0.87

7.1.4. Affordability

The water affordability criterion has two indicators: residents' perception regarding affordability of water facilities and disconnection due to unaffordability. Combining these indicators, the 'water affordability' index was calculated for each of the slums.

In Jasim Molla Basti, the water affordability index is the highest (0.85). For Korom Ali Basti, Ceramic Basti, and Milk Vita Khalpar Basti, the indices are almost similar (0.60, 0.63 and 0.62 respectively). In Kala Pani Basti, the index is comparatively higher (Table 7.4).

Although the residents' perception is not so satisfactory regarding water affordability (index is 0.39 on an average), no household has mentioned that they face disconnection when they fail to pay for the water facility (index is 1 for all households). That is why, the overall water quality index is not so poor. On an average, the residents of the slums have to pay approximately 360 BDT in a month.

Table 7.4: Water Affordability Indices of the Slums

Slum	Water Affordability Index
Korom Ali Basti	0.60
Ceramic Basti	0.63
Milk Vita Khalpar Basti	0.62
Kala Pani Basti	0.71
Jasim Molla Basti	0.85

7.1.5. Acceptability

Satisfaction regarding the water quality was used to calculate the ‘water acceptability’ index. Satisfaction regarding water quality in the selected slums is not up to the mark. In Korom Ali Basti and Ceramic Basti, the water quality is comparatively better (indices are 0.51 and 0.52 respectively) than the other three slums according to the perception of the slum dwellers. In Jasim Molla Basti, the residents are quite unsatisfied regarding the water quality. Therefore, the water acceptability index has come out to be so poor (0.33) for this slum (Table 7.5).

Case Study

Mrs. Lutfa, aged 32, residing in Kala Pani Basti has a daughter, who is currently suffering from typhoid and diarrhea. She suffers from several water-borne diseases most often due to poor water quality of the slum. Mrs. Lutfa was pregnant a few months ago. Then suddenly, she started suffering from typhoid severely and she had to get hospitalized. But after staying in the hospital for two days, her baby died before birth.

Table 7.5: Water Acceptability Indices of the Slums

Slum	Water Acceptability Index
Korom Ali Basti	0.51
Ceramic Basti	0.52
Milk Vita Khalpar Basti	0.45
Kala Pani Basti	0.43
Jasim Molla Basti	0.33

7.1.6. Water Index (WI)

WI has been derived considering the indicators of the relevant criteria (availability, physical accessibility, quality/safety, affordability, acceptability) altogether. Therefore, the overall situation of water facilities in the slums is reflected in these water indices of the respective slums. From Table 7.6, it is revealed that Korom Ali Basti and Ceramic Basti have comparatively higher water indices (0.60 and 0.62 respectively) than the other slums. Milk Vita Khalpar Basti and Kala Pani Basti have the same WI (0.58). Jasim Molla Basti has the lowest WI (0.55) showing that the situation of water facilities is poorer comparing to the other selected slums.

Table 7.6: Water Indices (WIs) of the Slums

Slum	Water Index (WI)
Korom Ali Basti	0.60
Ceramic Basti	0.62
Milk Vita Khalpar Basti	0.58
Kala Pani Basti	0.58
Jasim Molla Basti	0.55

7.1.7. Relationship between HH Size and WI

Table 7.7 shows that there is a significant relationship between HH Size and WI. A negative correlation has been found between HH Size and WI. This negative correlation implies that WI is greater for households having less members. On the other hand, WI has been found to be smaller for large family size.

Table 7.7: Relation between HH Size and WI

		Number of HH Member	Water Index
Number of HH Member	Pearson Correlation	1	-.79**
	Sig. (2-tailed)		.000
	N	345	345
Water Index	Pearson Correlation	-.79**	1
	Sig. (2-tailed)	.000	
	N	345	345

** Correlation is significant at the 0.05 level (2-tailed)

7.1.8. Relationship between Number of HH Earning Members and WI

From Table 7.8, it is found that WI is less for comparatively larger size of earning members in the households and the relationship is significant. The reasons have been derived that the earning members usually have a hurry to start their workings in the morning, sometimes from home and sometimes going outside. Therefore, those households having larger HH earning members face the water and sanitation related problems more acutely than the other ones.

Table 7.8: Relation between Number of HH Earning Members and WI

		Number of earning member	Water Index
Number of earning member	Pearson Correlation	1	-.77**
	Sig. (2-tailed)		.000
	N	345	345
Water Index	Pearson Correlation	-.77**	1
	Sig. (2-tailed)	.000	
	N	345	346

** Correlation is significant at the 0.05 level (2-tailed)

7.1.9. Relationship between Monthly HH Income and WI

There is a positive relationship between Monthly HH Income and WI and it is a significant relationship (Table 7.9). This relationship depicts that the households having higher family income have higher water indices.

Table 7.9: Relation between Monthly HH Income and WI

		Monthly income of HHs	Water Index
Monthly income of HHs	Pearson Correlation	1	0.985**
	Sig. (2-tailed)		.002
	N	345	345
Water Index	Pearson Correlation	0.985**	1
	Sig. (2-tailed)	.002	
	N	345	346

** Correlation is significant at the 0.05 level (2-tailed)

7.2. Sanitation

Like the case of water facilities, for each of the criteria (Availability, physical accessibility, quality/safety, affordability, acceptability), different indicators were used to calculate the composite indices for each of the slums in case of sanitation facilities. The methodology followed to measure the sanitation availability, physical accessibility, quality/safety, affordability, acceptability indices has been clearly described in Chapter 3. The indices of the slums for different criteria regarding sanitation facilities are discussed in the following sub-sections.

7.2.1. Availability

Sharing status and presence of adequate gender separated toilets in the slums were used as indicators and considered for measuring the ‘sanitation availability’ index following the methodology mentioned in Chapter 3.

The residents are not so satisfied with the quantity of gender separated toilets. Therefore, the average index of this particular indicator is 0.43 in the selected slums. Moreover, the slum dwellers do not have individual toilets. Except for four households that were surveyed, the dwellers typically use shared toilets. From the survey, it has been found that a single toilet is shared by 35 families in Jasim molla Basti. Therefore, the sanitation availability index is also the lowest in this slum (0.18). Comparatively, in Korom Ali Basti, and in Ceramic Basti, the situation is better than in the other slums (indices are 0.26 for both). But overall, the sanitation availability indices are so poor for all the selected slums (Table 7.10).

Table 7.10: Sanitation Availability Indices of the Slums

Slum	Sanitation Availability Index
Korom Ali Basti	0.26
Ceramic Basti	0.26
Milk Vita Khalpar Basti	0.23
Kala Pani Basti	0.21
Jasim Molla Basti	0.18

7.2.2. Physical Accessibility

In order to measure the ‘sanitation accessibility’, there are three indicators. These are security in paths, perception regarding waiting time, and security while using the toilets. For Korom Ali Basti and Jasim Molla Basti, the sanitation accessibility indices are comparatively better than the other

slums (indices are 0.50 and 0.52 respectively). For Kala Pani Basti, the situation is the poorest. The index has been found to be 0.38, which is the lowest among the selected slums (Table 7.11).

The average index of the security on paths is 0.5. In terms of continuity, the scenario is better depicting that the dwellers think there is a reasonable waiting time to use the latrine once. But in case of security while using the toilet, the index is not so satisfactory (index is 0.1) portraying that the women do not feel secured while availing the facility. Most of the respondents have put incidents of eve-teasing as a reason behind the poor perception regarding this indicator. For Korom Ali Basti, and Jasim Molla Basti, the situation is different. For Korom Ali slum, the index of security on paths is poorer than the other two indicators. As there is no sufficient lighting at the entrance of most of the toilets, they do not feel secured in the paths. For Jasim Molla Basti, the index of perception regarding waiting time is the poorest as sometimes they have to wait too long due to comparatively higher sharing quantity of the toilets (mentioned in section 7.2.1).

Table 7.11: Sanitation Accessibility Indices of the Slums

Slum	Sanitation Accessibility Index
Korom Ali Basti	0.50
Ceramic Basti	0.42
Milk Vita Khalpar Basti	0.41
Kala Pani Basti	0.38
Jasim Molla Basti	0.52

Case Studies

Mina, a twenty-five years old young woman of Milk Vita Khalpar Basti has mentioned that she is always scared of using toilets. Some boys of the slum have created some holes in the toilet used by her and they always want to look into the toilet through the holes when she uses it. Even if she covers the hole using sacks or plastics, the boys always uncover the hole again.

Moriom, a resident of Ceramic Basti has claimed that her physically challenged son cannot go to the toilet alone because of the unsupportive infrastructure within the toilet. The toilet platform is situated so high that he cannot use it. Therefore, Moriom has to go with her son each and every time her son needs to use the toilet.

7.2.3. Quality/Safety

The unpleasant smell within the toilets, cleanliness, condition of superstructure, hand washing facilities in the toilets, disposal of children stools and menstrual hygiene management were considered and combined to get the composite water quality/safety indices for each of the slums.

The ‘sanitation quality/ safety’ indices are quite similar in all the selected slums and the indices are not so sufficient. The indices vary from 0.32 to 0.37 (Table 7.12).

Except for four households, the other households have reported that they experience unpleasant smell in their toilets. Only 28 households have handwashing facilities in their toilets. 127 households use separate bins for the disposal of children’s stools. There is also no menstrual hygiene management in any of the selected slums. Regarding cleanliness in the toilet and the condition of superstructure, the situation is also poor. The indices are 0.26 and 0.38 respectively in the slums on an average. Although a number of interventions have been taken regarding the latrine superstructures and cleaning the toilets that have been mentioned in Chapter 6, the situation is still not up to the mark according to the perception of the residents.

Table 7.12: Sanitation Quality/ Safety Indices of the Slums

Slum	Sanitation Quality/ Safety Index
Korom Ali Basti	0.36
Ceramic Basti	0.37
Milk Vita Khalpar Basti	0.32
Kala Pani Basti	0.35
Jasim Molla Basti	0.34

7.2.4. Affordability

Two indicators: whether the reason for not having latrine in slums is the unaffordability of the dwellers, and the perception (cheap or moderate or costly) regarding HH investment for toilets were combined to get the sanitation affordability index.

In terms of affordability, the indices are satisfactory. There are toilets in all the selected slums. No household has mentioned that they have to practice open defecation or use toilet outside their residing slums only because of unaffordability. So, only the perception regarding HH investment

for toilets played the role mainly. In Korom Ali Basti, and Ceramic Basti, sanitation affordability index has been derived to be 1 reflecting that the surveyed households of these two slums do not face any affordability issue regarding sanitation facilities. The other three slums also have quite impressive indices (0.98, 0.94, and 0.89 respectively for Milk Vita Khalpar Basti, Kala Pani Basti, and Jasim Molla Basti). The situation is depicted in Table 7.13.

Table 7.13: Sanitation Affordability Indices of the Slums

Slum	Sanitation Affordability Index
Korom Ali Basti	1
Ceramic Basti	1
Milk Vita Khalpar Basti	0.98
Kala Pani Basti	0.94
Jasim Molla Basti	0.89

7.2.5. Acceptability

Privacy, comfort, and satisfaction regarding location of the toilets were considered as indicators to determine the ‘sanitation acceptability’ indices for the selected slums.

The acceptability indices regarding sanitation do not differ much (ranging between 0.33 to 0.37). Table 7.14 reflects the scenario regarding sanitation acceptability indices.

In terms of privacy, the index is poorer than the other two indicators (comfort and satisfaction for toilet location). But, the situation of comfort and satisfaction for toilet location is also not up to the mark. On an average, the indices of privacy, comfort and satisfaction for toilet location are 0.28, 0.3, and 0.43 respectively for the selected slums.

Table 7.14: Sanitation Acceptability Indices of the Slums

Slum	Sanitation Acceptability Index
Korom Ali Basti	0.35
Ceramic Basti	0.37
Milk Vita Khalpar Basti	0.34
Kala Pani Basti	0.34
Jasim Molla Basti	0.33

7.2.6. Sanitation Index (SI)

SI has been derived for each of the slums considering all the indicators of the LOS criteria like availability, physical accessibility, quality/safety, affordability, acceptability simultaneously following the method described in Chapter 3.

Korom Ali Basti has the highest SI (0.41). The SI of Ceramic Basti (0.40) is also close to that of Korom Ali Basti. Kala Pani Basti has the lowest SI (0.36). The sanitation indices of the other two slums (Milk Vita Khalpar Basti, Jasim Molla Basti) are same (0.37) and this is almost close to the lowest SI found in the case of Kala Pani Basti. Table 7.15 shows the Sanitation Indices (SIs) of all the selected slums.

Table 7.15: Sanitation Indices (SIs) of the Slums

Slum	Sanitation Index (SI)
Korom Ali Basti	0.41
Ceramic Basti	0.40
Milk Vita Khalpar Basti	0.37
Kala Pani Basti	0.36
Jasim Molla Basti	0.37

7.2.7. Relationship between HH Size and SI

The negative correlation between HH Size and SI means that smaller households have better SI than the larger households (Table 7.16). It reflects that the residents having small HH size are in a better state in terms of sanitation facilities of the slums than the residents of larger family size.

Table 7.16: Relation between HH Size and SI

		Number of HH Member	Sanitation Index
Number of HH Member	Pearson Correlation	1	-.64**
	Sig. (2-tailed)		.000
	N	345	345
Sanitation Index	Pearson Correlation	-.64**	1
	Sig. (2-tailed)	.000	
	N	345	345

** Correlation is significant at the 0.05 level (2-tailed)

7.2.8. Relationship between Number of Earning Members of HH and SI

There is a significant relationship between number of earning members in HHs and SI. The relationship is negative. Therefore, SI is greater, when number of earning member in HHs is less (Table 7.17).

Table 7.17: Relation between Number of Earning Members of HH and SI

		Number of earning member	Sanitation Index
Number of earning member	Pearson Correlation	1	-.66**
	Sig. (2-tailed)		.000
	N	345	345
Sanitation Index	Pearson Correlation	-.66**	1
	Sig. (2-tailed)	.000	
	N	345	345

** Correlation is significant at the 0.05 level (2-tailed)

7.2.9. Relationship between Monthly HH Income and SI

SI positively increases with the increase of the monthly HH income (Table 7.18). This relationship reveals that the comparatively richer household face less difficulties in availing sanitation facilities. It depicts that because of their affluency, they are able to manage better sanitation facilities.

Table 7.18: Relation between Monthly HH Income and SI

		Monthly income of HHs	Sanitation Index
Monthly income of HHs	Pearson Correlation	1	.51
	Sig. (2-tailed)		.001
	N	345	345
Sanitation Index	Pearson Correlation	.51	1
	Sig. (2-tailed)	.001	
	N	345	345

** Correlation is significant at the 0.05 level (2-tailed)

7.3. Comparison between Water Indices and Sanitation Indices

The average WI of the selected five slums is 0.59, whereas the SI of the slums is 0.38 on an average. For no slum, SI is better than the WI depicting that for all the selected slums, LOS is better for water facilities than the sanitation facilities (Table 7.19). Rahman et al (2014) have brought out in their study that the situation of sanitation facilities is poorer than the situation of water facilities in Vashantek, Badda, Vawalbagh, and Peyarabagh slums of Dhaka. Razzak et al. (2014) have also reported that the sanitation facilities serve the slum residents of Dhaka in a more measurable way than the water facilities, which conforms to the finding of this study.

Table 7.19: Comparison between Water Indices (WIs) and Sanitation Indices (SIs) of the Slums

Slum	Water Index (WI)	Sanitation Index (SI)
Korom Ali Basti	0.60	0.41
Ceramic Basti	0.62	0.40
Milk Vita Khalpar Basti	0.58	0.37
Kala Pani Basti	0.58	0.36
Jasim Molla Basti	0.55	0.37
Average	0.59	0.38

7.4. Overall Situation of WATSAN Facilities in Slums and the Needs of the Residents

Ceramic Basti

In Ceramic Basti, among nine tube wells, no tube well was erected in the last few years. According to the respondents of the questionnaire and the members of the FGDs, the tube wells are running quite well. Two new tube wells are also under construction at this moment. Some elevated water collection platforms were constructed back in 2018 by BRAC, but the residents still demand to have elevated water collection platforms at all the water collection points of the slums.

Among twenty-nine toilets, three toilets are the results of the intervention in 2015 within the slum. Four female toilets have also been constructed within the last few years. The residents don't demand for more male-female same toilets in general, but the women want at least two more dedicated female toilets in the slum.

Kala Pani Basti

In total, four tube wells have been erected from 2013 in this slum. Also, four female toilets have been constructed. But the residents have some issues regarding water quality. Although water quality enhancement program was undertaken in this slum within few years, they now still think this type of program is needed again in this slum. In the FGD involving only the female participants, they demanded to increase the privacy of the existing female toilets.

Milk Vita Khalpar Basti

Five tube wells and six toilets have been constructed in the slum from the last ten years. Two latrines have also been replaced. But from FGDs, the leaders and the other dwellers have mentioned that they are not satisfied with the quantity of the total water sources and the situation of the toilets in general.

Jasim Molla Basti

No water source has been added in Jasim Molla Basti for the last ten years, but the population of the slum has been significantly increased in this time period. So, they are not able to get sufficient water. The water supply is also irregular. Therefore, in FGDs the dwellers have mentioned that they want at least five new tube wells with continuous water supply.

In case of toilets, continuing cleaning activities is demanded by the slum community and they are planning to conduct it on a regular basis by themselves.

Korom Ali Basti

The water taps and the nine existing tube wells were established long ago, but the residents are quite satisfied with both the quality and the quantity of supplied water from the water taps and the tube wells comparing to the other slums.

But in case of sanitation, they have demanded for adequate lighting and air circulation within their toilets. Although new latrine superstructures are being constructed within the slum at this moment, the air and lighting condition is always getting neglected as mentioned in Sections 4.2 and 7.2.2. As a result, the toilets have bad odor and sometimes minor injuries happen to the users due to darkness at the entrance of the toilets. Therefore, in the FGDs, the slum dwellers have mentioned that besides constructing new latrine superstructures, these issues should also be considered.

7.5. Comparison between Existing Scenario of WATSAN Facilities in Slums and Relevant Policies and Standards

In several global commitments and national documents, there have been different standards set for various aspects of WATSAN facilities to ensure adequate level of service. In the study area, the standards have not been met yet in many of the cases. The comparison of standards mentioned in several policies with the local context of WATSAN facilities in the selected slums are shown in Table 7.20.

Table 7.20: Global or National Guidelines and Local Context

Sector	Aspects	Standards mentioned in Different Policies	Existing Scenario in the Study Area
Water	Location	The safe drinking water source should be within 50 meters of HH premise (GoB, 2014).	Only eight HHs have individual water supply source in their premises. On an average, the water points are 10 to 12 minutes' walk away from their houses.
	Quality	Drinking water must meet the national quality standards (GoB, 2014) and be free of faecal contamination (GoB, 2019)	The slum dwellers are not so satisfied with the water quality. The average index for the HHs is 0.45 out of 1 regarding satisfaction with water quality.
	Quantity	The basic minimum LOS is 20 litres/capita/day for several purposes (GoB, 2014) Water must be available when needed (GoB, 2020)	The average water sufficiency index is 0.36 out of 1 depicting that most of the HHs are not satisfied with the quantity of water supply. Moreover, only 28% HHs receive continuous water supply
	Role of CBOs	DWASA would provide water connection in slums based on	The existing CBOs do not work on the WATSAN sector

Sector	Aspects	Standards mentioned in Different Policies	Existing Scenario in the Study Area
		the application from CBOs under Community Programme and Consumer Relation Division (Khan, n.d.)	
Sanitation	Sharing Quantity of Latrine	One hygienic latrine for each HH or maximum two HHs or 10 persons (GoB, 2014)	On an average, 15 families share one toilet in the selected slums
	Flushing Facility in Latrines	Improved sanitation facilities include flush/pour flush to piped water system (GoB, 2019)	There is no flushing facility in the toilets
	Handwashing Facility	Handwashing facility with soap and water will be available on premises (GoB, 2020)	Only 28 households have handwashing facilities in their toilets
	Role of the Local Government	The local government will emphasis on involvement of women in operation of the sanitation facilities and in skill development training (GoB, 2021)	Women do not play any significant role in the operation of the sanitation facilities and they do not usually take part in the training due to opposition of their male family members

CHAPTER EIGHT: COMPARISON OF THE SUSTAINABILITY OF INTERVENTIONS BETWEEN THE SLUMS WITH AND WITHOUT THE SUPPORT OF THE ORGANIZATIONS

Among the five selected slums, two slums (Korom Ali Basti, and Ceramic Basti) are supported by the intervening organizations and three slums (Milk Vita Khalpar Basti, Kala Pani Basti, and Jasim Molla Basti) are not under support. This chapter demonstrates the comparison between the slums on the basis of whether on-demand support is available or not from the intervened organizations. The slums have been compared in terms of availability, physical accessibility, quality, affordability of WATSAN facilities and so on.

8.1. Water

8.1.1 Availability

For the slums under support, the mean water availability index is 0.53, and for the unsupported slums, the corresponding index is 0.51. The difference of water availability between the supported slums and unsupported slums is not significant (Table 8.1).

In case of continuity of water supply, approximately 25% of the surveyed households residing in the unsupported slums have stated that their water supply is irregular, whereas for the supported slums, the rate is 18%. In terms of reliability, almost 59% households who are supported by the organizations have stated that their main source is always reliable. In case of the households currently not under support, the percentage is lower (approximately 43%). For sufficiency regarding water quantity, there is no such mentionable difference between the two types of slums with respect to availability of support by the organizations.

Although in Milk Vita Khalpar Basti, two tubewells were constructed by USAID, almost 80% of the dwellers have mentioned that the speed of waterfall from the tubewell is too low. Therefore, sometimes they have to use the other water sources like water tap or other older tubewells. In these other water sources, water quality is worse than the newer tubewells. Still, they are compelled to do that due to unreliability towards these newer tubewells. When USAID undertook the intervention (2013), the situation was better, but day by day the situation got worse. The situation could not be improved due to lack of support from the organization.

Table 8.1: Significance of Difference in Water Availability Index in the Slums based on Availability of Support

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Av of Water	Equal variances assumed	1.2	.28	.85	.395	0.02	0.023
	Equal variances not assumed			.88	.382	0.02	0.023

8.1.2. Physical accessibility

There is a significant difference between the water accessibility index of the supported and unsupported slums (p value <0.05). The difference between the mean water accessibility index is 0.06 (Table 8.2).

For the supported two slums, only 5% slum households have reported that they are extremely unsatisfied with the waiting time of collecting water, for the unsupported three slums, the percentage is quite higher (almost 31%). The differences in these percentages reflect that the residents of the slums without any support from the organizations typically have to wait significantly more time than the other ones to collect water. Specially, for Jasim Molla Basti, 31 out of 55 residents have reported that they have to wait more than 30 minutes on an average for collecting the water once. There is no considerable difference in the other indicator (safety in paths) of water accessibility for the supported and the unsupported slums.

Table 8.2: Significance of Difference in Water Accessibility Index in the Slums based on Availability of Support

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
PA of Water	Equal variances assumed	.06	.81	1.976	.04	.06	.03
	Equal variances not assumed			1.988	.04	.06	.03

8.1.3. Quality/Safety

Although the mean difference of water quality or safety for the slums under support and the slums without support is 0.09, the difference is not significant (Table 8.3).

In all the slums, distribution programs of water treatment facilities have taken place by different organizations like SJP, WaterAid, World Vision. In Ceramic Basti, SJP is still performing water quality monitoring activities and trying to enhance the quality or safety through applying disinfectants. Although SJP, World Vision intervened in Milk Vita Khalpar Basti regarding water treatment facilities, the index is comparatively poor. They are not getting any support from the intervening organizations. The situation is same for Jasim Molla Basti.

Table 8.3: Significance of Difference in Water Quality/Safety Index in the Slums based on Availability of Support

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Q of Water	Equal variances assumed	14	.000	1.78	.076	.09	.049
	Equal variances not assumed			1.97	.051	.09	.044

8.1.4. Affordability

The differences of affordability index between the supported and the unsupported slums is significant (Table 8.4). But the unusual fact is that, the mean of the index is higher for the unsupported slums.

Most of the residents of both the supported slums have mentioned that they have to pay a considerable amount to the slum managers or leaders on a monthly basis for water facilities. In fact, in Korom Ali Basti, the residents pay up to 1000 BDT. On the other hand, the residents of the unsupported slums have reported the cost they have to pay for water facilities to be comparatively lower in general.

Table 8.4: Significance of Difference in Water Affordability Index in the Slums based on Availability of Support

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Aff of Water	Equal variances assumed	27.7	.000	-4.2	.000	-.1	.02
	Equal variances not assumed			-4.7	.000	-.1	.02

8.1.5. Acceptability

The acceptability index is better for the slums under support. Also, the difference is significant (p value <0.05). Table 8.5 reflects the scenario.

The residents of the supported slums are more satisfied with the water quality than the dwellers of the unsupported slums. As many organizations have undertaken interventions for improving the water quality and these organizations are still supporting the slums through monitoring and implementing ways to enhance the water quality, the index has come out to be higher for the supported slums. On the contrary, despite of different interventions accomplished by several organizations in the slums which are not supported, the residents have claimed that the water quality of the slum has been deteriorated in the past two or three years, but no step is being taken to improve the situation except some personal attempts by the dwellers themselves.

Table 8.5: Significance of Difference in Water Acceptability Index in the Slums based on Availability of Support

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Acc of Water	Equal variances assumed	51.3	.000	4.5	.000	.1	.02
	Equal variances not assumed			5.8	.000	.1	.02

8.1.6. Water Index (WI)

The difference in the composite index of water (WI) is 0.16 and the difference is significant (p value <0.05) depicting that the water index of the unsupported slums is significantly lower than the water index of the supported slums (Table 8.6).

Table 8.6: Significance of Difference in Water Index (WI) in the Slums based on Availability of Support

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Water Index	Equal variances assumed	65.8	.000	4.3	.000	.16	.03
	Equal variances not assumed			4.9	.000	.16	.03

8.2. Sanitation

8.2.1. Availability

There is significant difference regarding the availability of sanitation in the slums with support and without support. The mean difference between the supported slums and unsupported slums is 0.05 (Table 8.7).

In case of sharing status, only four households reported that they use individual toilets. And these four households reside in the Korom Ali Slum. In terms of availability of gender separated toilets, the residents of the supported slums are more satisfied. In the supported two slums, almost 5% surveyed HHs have stated that they are extremely satisfied with the location of the toilets. For the unsupported slums, no resident is extremely satisfied with the location. Rather, approximately 18% residents of the unsupported slums are extremely unsatisfied with the toilet location. For the supported slums, the rate is 2%.

In Korom Ali Basti and Ceramic Basti, latrines or latrine superstructures were constructed by DSK or UNDP and these slums get full support if required. Therefore, the residents of these slums complained less. Although in Milk Vita Khalpar Basti, latrines were constructed or replaced by UNDP or USAID, they do not provide required support to the slum dwellers. Therefore, the residents are less content than the residents of the supported slums. Two of their latrines are on the verge of complete uselessness, but they do not have any support from the organizations to improve the condition of the latrines.

Table 8.7: Significance of Difference in Sanitation Availability Index in the Slums based on Availability of Support

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Av of Sanitation	Equal variances assumed	21.3	.000	3.7	.000	.05	.01
	Equal variances not assumed			4.2	.000	.05	.01

8.2.2. Physical Accessibility

There is no significant difference in the accessibility index of sanitation, though the index is higher by 0.04 for the slums under support than the slums without any support (Table 8.8).

In the case of security in paths and security while using the toilets, there is no mentionable difference between the two types of slums. But in terms of continuity, for the supported two slums, most of the dwellers have reported that the waiting time of using the toilet is reasonable. On the other hand, the percentage is lower (52%) for the unsupported slums. 3% residents of these slums have mentioned the waiting time to be totally unreasonable.

Table 8.8: Significance of Difference in Sanitation Accessibility Index in the Slums based on Availability of Support

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
PA of Sanitation	Equal variances assumed	5.9	.015	1.3	.185	.04	.03
	Equal variances not assumed			1.5	.135	.04	.03

8.2.3. Quality/Safety

Although the average sanitation quality or safety index is slightly higher for the supported slums, the difference is not significant between the supported and unsupported ones (Table 8.9).

The overall situation regarding quality or safety of sanitation is not up to the mark. In case of cleanliness and condition of latrine superstructure, no household is extremely satisfied regardless of availability of support. 46% dwellers of the two supported slums dispose the children's stools

in separate bins. For the unsupported three slums, the rate is 33%. Regarding hand washing facility in toilets, the facility is available in the toilets of only 3 HHs of the unsupported slums. Though, toilet cleaning activities were performed by World Vision or WSUP in Kala Pani Basti, Korom Ali Basti and Jasim Molla Basti, only the Korom Ali Basti is getting support from the intervening organization (World Vision). Therefore, the cleanliness index is to some extent higher for Korom Ali Basti.

Table 8.9: Significance of Difference in Sanitation Quality/Safety Index in the Slums based on Availability of Support

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Q of Sanitation	Equal variances assumed	1.11	0.293	1.89	0.06	0.02	0.01
	Equal variances not assumed			1.9	0.058	0.02	0.01

8.2.4. Affordability

Regarding affordability, the difference of mean index based on the availability of support is 0.06. The supported slums have a better affordability index in this case and the difference is significant (Table 8.10).

For all the residents of the slums under support, the HH investment for toilets is negligible. But for the other slums, 56% residents think that they have to pay extremely high amount for sanitation facility. And 42% of the residents think their investment is quite higher. Despite better sanitation affordability indices for all the slums, the reason behind the significant difference is that the supported slums face no affordability issue at all resulting in the indices to be perfect.

Table 8.10: Significance of Difference in Sanitation Affordability Index in the Slums based on Availability of Support

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Aff of Sanitation	Equal variances assumed	247.4	.000	7.2	.000	0.06	0.008
	Equal variances not assumed			12.4	.000	0.06	0.004

8.2.5. Acceptability

There is no significant difference between the two types of slums considering acceptability (privacy, comfort and satisfaction regarding toilet location). Table 8.11 depicts the scenario.

No HH has very high privacy in the toilets. 35% residents of the unsupported slums think the toilet has no privacy at all. For the other slums, the rate is 30%. 7% HHs think the toilet is not comfortable at all in the slums without support. For the other slums, 3% dwellers think the same. Almost 18% dwellers are extremely unsatisfied with the toilet location and no one is extremely satisfied in the unsupported slums. But for the supported slums, the rate is 2% and 3% respectively.

Table 8.11: Significance of Difference in Sanitation Acceptability Index in the Slums based on Availability of Support

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Acc of Sanitation	Equal variances assumed	8.1	.005	.9	.34	0.019	0.02
	Equal variances not assumed			1.1	.27	0.019	0.02

8.2.6. Sanitation Index (SI)

On an average, the difference of SI between the two categories of slums is quite higher (0.13). The index is significantly higher for the supported slums (Table 8.12).

Table 8.12: Significance of Difference in Sanitation Index (SI) in the Slums based on Availability of Support

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Sanitation Index	Equal variances assumed	124	.000	5.5	.000	.13	.02
	Equal variances not assumed			6.6	.000	.13	.02

8.3. Nature of Organizational Support according to the Perceptions of Residents, Slum Managers, and Organizational Representatives

Regarding WATSAN facilities, the organizations mainly provide physical or financial support. In case of providing support, usually they involve their own manpower to work in the slums. Some organizations like World Vision and WSUP worked in the slums involving either the slum committee or the general slum households. The members of the slum committee or the general dwellers usually contribute to the physical labor required. In most of the times they are paid by the organizations for their contribution.

Also, in some cases the organizations pay a fixed amount to the slum managers or leaders for maintenance purpose of WATSAN facilities. Then the leaders coordinate the things required. But the residents have complained during the questionnaire survey that in these cases the whole process

get mismanaged. The financial support from the organizations is grasped by the slum leaders. Therefore, there comes no improvement in the WATSAN services for which the financial support was actually made. On the other hand, the slum leaders denied the complains during FGDs and stated that they do not get enough financial support from the organization to conduct the activities (Box 8.1).

Box 8.1: The respondents of all the surveyed slums mentioned that the financial contribution is distributed to the slum leaders only and they are deprived of the monetary assistance and the outputs made from the monetary assistance in the WATSAN sector. According to the representatives from DSK, SJP, and World Vision in the KIIs; the managers always want help in monetary terms. They are not willing to get any physical support or training. In case of monetary contribution, enough assistance is made. The slum leaders and managers of Jasim Molla Basti, Milk Vita Khalpar Basti, and Kala Pani Basti in the FGDs stated that they hardly get the enough amount required for the construction or maintenance of the WATSAN facilities from the working organizations. Therefore, they cannot properly conduct the required interventions. They denied the claims of the respondents that they are irresponsible, insincere, and lay hold of the money allocated for the intervention purpose by the organizations. On the other hand, in the FGDs conducted in Ceramic Basti, Korom Ali Basti, the leaders have mentioned that they would like to have skill development workshops or trainings for the management of the WATSAN services in the slums. But the organizations are not willing to do that.

8.4. Reasons behind the communication gap between the residents and the organizations derived from HH Questionnaire Surveys, FGDs and KIIs

Organizational Perspective

In the KIIs, the representatives from several organizations have mentioned that the slum dwellers never come to them willingly for any support regarding the WATSAN facilities. And they are always interested in supporting the intervened slums if needed. Even if the organizations express their interests to provide support to the slum managers, the managers want monetary contribution to be distributed to them. They themselves are not willing to improve their situation and do not

want that their residing slums to be under continuous monitoring service by the intervened organizations (Box 8.2). So, the communication gap between the slum dwellers and the organizations is created.

Residents' Perspective

From questionnaire survey, it has been found that 30% HHs are reluctant to contact the organizations regarding the support for WATSAN facilities. 6% HHs do not know how to contact the relevant organizations. But maximum HHs (64%) have asserted that previously no improvement was resulted even after informing the organizations. Therefore, they have lost the interest to approach the organizations (Figure 8.1). Also, in the FGDs, the reasons have come out to be the same (Box 8.2).

Box 8.2: In the HH questionnaire surveys many of the residents except the residents of Ceramic Basti have stated that they have lost their hope of improvement in the WATSAN activities of slums as the past interventions had never come out to be fruitful. So, they are not willing to contact the organizations during or after the interventions. The members of the FGDs conducted in the slums also supported the statement. In the KIIs, all the personnel stated that due to the unwillingness of the slum community to seek assistance, the communication gap is created. And it is difficult for them to identify the slums that need assistance unless the slum dwellers themselves come forward.

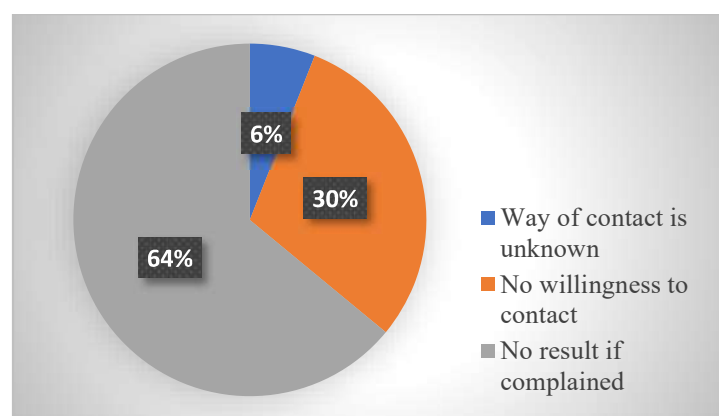


Figure 8.1: Reasons behind the communication gap between the residents and the organizations from the residents' perspective

Source: Field Survey, 2022

8.5. Loss of Trust on Authorities

In case of supported slums, 67% HHs have reported that they have lost their trust on authorities associated with WATSAN facilities. For the dwellers of the slums without any support at this moment, the rate is much higher (92%). The residents have lost their trust on government organizations like city corporation (36%), WASA (41%). Some of the households have also blamed the working NGOs (23%). Figure 8.2 reflects on which authorities the trust has been lost.

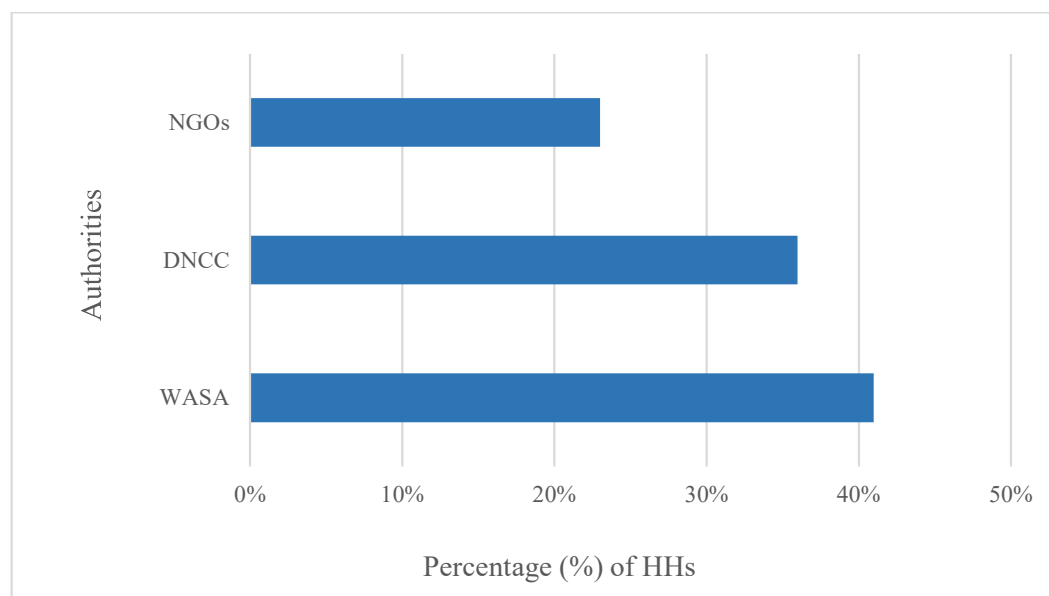


Figure 8.2: Loss of Trust on Authorities

Source: Field Survey, 2022

8.6. Considerations of Sustainability in Interventions by the Organizations

In KIIs, the representatives from different organizations were asked about their plans regarding sustainability while intervening in WATSAN facilities. It has been found from KIIs that regarding sustainability issues, the working organizations do not have any concrete plan. The representative from World Vision has informed that they perform monitoring on WATSAN facilities in low-income settlements forming a team after six months of completing the interventions. According to the representative from BRAC, they contact the slum representatives (managers or leaders) on a regular interval to check whether they need any improvement in their WATSAN facilities. The personnel from other three organizations (SJP, WaterAid, DSK) that were interviewed have not

mentioned such things. After the completion of the interventions, they try to support the residents of the intervened slums if they come forward to seek help.

8.7. Planning for New Projects by the Organizations

Although the organizations are still not aware of the sustainability issues of the interventions, the representatives from the organizations are concerned that while designing new projects regarding WATSAN facilities in slums, they need to consider the sustainability issues of the interventions. The representatives have agreed to some points regarding that. The representatives have agreed that a committee will be formed by the organizations themselves consisting of the general HHs of the intervened slums. Then with the help of this committee, the organizational team responsible for the specific task would carry on the intervention. After the completion of the project, the team would provide their contact addresses or contact numbers to the involved committee so that they can contact with the organizations later if needed.

The organizational team would also maintain connection with the committee of general slum HHs to check whether any support from them is required. Thus, forming an improved inter-communicational network between the slum residents and the organizations would pave a way to incorporate the sustainability issues while designing new intervention projects.

CHAPTER NINE: MAJOR FINDINGS AND CONCLUSION

This chapter discusses major findings of the research. Recommendations have also been provided based on the findings in the end of this chapter.

9.1. Major Findings and Recommendations

Several types of national NGOs like DSK, SJP, UST and international NGOs like BRAC, UNDP, USAID etc. worked on the selected slums regarding WATSAN facilities. In case of water facility, construction activities involved establishment of new tube wells, water platforms. Maintenance works included enhancement of water quality. In terms of sanitation facility, construction works included the establishment of new latrine superstructures, toilet platforms. Maintenance activities involved cleaning of toilets, replacement of toilet platforms.

In case of level of service regarding water facilities in the selected slums, the overall quality or safety index is higher than the other indices. For sanitation facilities, the affordability index is comparatively better. But on the whole, the services of water facilities is comparatively better than the services of sanitation facilities.

Both the Water Index (WI) and the Sanitation Index (SI) are comparatively better for the two slums under support by the intervened organizations (Korom Ali Basti and Ceramic Basti). Regarding water facilities, there is significant difference between the supported and the unsupported slums in terms of accessibility, affordability and acceptability. In case of sanitation facilities, the significance exists for availability and affordability. Therefore, the organizations should keep continuing their support regarding WATSAN facilities considering sustainability issues of the interventions.

Sustainability issues should not be ignored in the WATSAN projects in order to achieve the targets of SDG 6 and National Strategy for Water Supply and Sanitation. Separate CBOs can be formed or the existing CBOs can of the WATSAN facilities of the slums complying the master plan of DWASA. During the interventions and also after the interventions, they can work as a medium between the general slum dwellers and the intervening organizations. Moreover, gender issues such as menstrual hygiene management, special needs of the pregnant women, and the access of persons with disability in WATSAN facilities are often not addressed at all. These matters need to be mainstreamed in future interventions in order to comply with the targets of SDG 6.

9.2. Conclusion

This research only covered the selected slums of DNCC due to data availability. But the sustainability issues of the WATSAN interventions can also be monitored for the slums of other areas. A contextual framework for monitoring the sustainability of the interventions in WATSAN facilities should be developed, which may assist the relevant personnel to monitor and evaluate the sustainability of the projects on a regular basis. The city corporations may play a major role in this case. Specifically, the targets of SDGs should be more strongly integrated with the local level planning.

This study explored the aspects of WATSAN facilities that are not in a satisfactory condition for the unavailability of support from the organizations. This can be taken into consideration in undertaking WATSAN and other facilities management at the community level. Also, other areas of development that were not within the scope of this study, like internal road network and connectivity, drainage, supply of utilities etc. are also important issues to be addressed through integrated development approach to ensure overall sustainability.

References

- Abbas, F. (2017). *PEHUP project helps 170 urban slums of the country gain access to safe water, improved sanitation and better hygiene practices*. Retrieved on April 24, 2022 from <https://www.wateraid.org/bd/media/pehup-project-helps-170-urban-slums-of-the-country-gain-access-to-safe-water-improved>
- Ali, H.M.M. (2009). Development of Arab Water Sustainability Index using Principal Component Analysis. Retrieved on June 02, 2022 from <https://citeseerx.ist.psu.edu/viewdoc/doi=10.1.1.302.7915&rep=rep1&type=pdf>
- Asian Development Bank. (2009). Sector Assistance Program Evaluation for the Urban Sector and Water Supply and Sanitation in Bangladesh: An Exploratory Evaluation of the Programs of ADB And Other Aid Agencies. Retrieved on February 20, 2021 from <https://www.oecd.org/countries/bangladesh/47148619.pdf>
- Bangladesh Bureau of Statistics. (2015). *Census of Slum Areas and Floating Population 2014*. Retrieved on June 18, 2021 from <http://203.112.218.65:8008/WebTestApplication/userfiles/Image/Slum/FloatingPopulation2014.pdf>
- Bangladesh Institute of Development Studies. (2014). Impact Evaluation Study of Hygiene, Sanitation and Water Supply (HYSAWA). Retrieved on July 23, 2021 from https://imed.portal.gov.bd/sites/default/files/files/imed.portal.gov.bd/page/e773d5bf_184fc5_a856_dfd3c8d05ced/HYSAWA%20final%20report_16.07.214.pdf
- Bangladesh Rural Advancement Committee. (n.d.). *Water, Sanitation and Hygiene: Urban Development Programme, Bangladesh*. Retrieved on August 20, 2021 from <http://www.brac.net/program/wp-content/uploads/2020/02/WASH-FACTSHEET.pdf>
- Billig, P., Bendahmane, D., & Swindale, A. (1999). *Water and Sanitation Indicators Measurement Guide*. Washington D.C: USAID.
- Biplob, P., Sarker, D.C., & Sarker, R.C. (2011). Assessment of Water Supply and Sanitation Facilities for Korail Slum in Dhaka City. *International Journal of Civil & Environmental Engineering*, 11, (115-128).

- Boisson, S., Sosai, P., Ray, S. Routray, P., Torondel, B., Schmidt, W., Bhanja, B., & Clasen, T. (2014). Promoting latrine construction and use in rural villages practicing open defecation: process evaluation in connection with a randomised controlled trial in Orissa, India. *BMC Research Notes*, 7 (486).
- Brundtland Commission Report, 1987. Report of the World Commission on Environment and Development: Our Common Future. Oxford: Oxford University Press.
- Bruschi, A. (2013). *5 largest slums in the world*. Retrieved on February 23, 2022 from <https://borgenproject.org/tag/urban-slums/>
- Capone, D., Buxton, H., Cumming, O., Dreibelbis, R., Knee, J., Nala, R., Ross, I., & Brown, J. (2020). Impact of an intervention to improve pit latrine emptying practices in low-income urban neighborhoods of Maputo, Mozambique. *International Journal of Hygiene and Environmental Health*, <https://dx.doi.org/10.1016%2Fj.ijheh.2020.113480>.
- Chowdhury, S. (2021). Drinking Water Quality in Some Selected Slums of Dhaka City, Bangladesh. *International Journal of Engineering Applied Sciences and Technology*, 5, (66-70).
- Darvesh, N., Das, J.K., Vaivada, T., Gaffey, M.F., Rasanathan, K., & Bhutta, Z.A. (2017). Water, sanitation and hygiene interventions for acute childhood diarrhea: a systematic review to provide estimates for the Lives Saved Tool. *BMC Public Health*, 17 (776).
- Das, R., Ghosh, G., & Singha, D. (2010). *Participatory Community Hygiene Education in Dhaka Slums: DSK Experience*. Retrieved on April 24, 2022 from <https://www.ircwash.org/sites/default/files/Das-2010-Participatory.pdf>
- Das, S., & Pandit, D. (2013). Importance of user perception in evaluating level of service for bus transit for a developing country like India: A review. *Transport Reviews*, 33(4), (402-420).
- Degert, I., Parikh, P., & Kabir, R. (2016). Sustainability assessment of a slum upgrading intervention in Bangladesh. *Cities*, 56, (63-73).
- Environmental Protection Agency. (2002). *Delineation of source-water protection areas in karst aquifers of the Ridge and Valley and Appalachian Plateaus physiographic provinces: rules*

of thumb for estimating the capture zones of springs and wells. Washington, D.C.: Environmental Protection Agency, Office of Water.

European Commission. 2002. Introduction to the EU Water Framework Directive. Retrieved on March 08, 2022 from https://ec.europa.eu/environment/water/water-framework/info/intro_en.htm

Facilities Management advisor. (2019). *Infographic: Why the Difference Between Construction and Maintenance Matters.* Retrieved on April 1, 2022 from <https://facilitiesmanagementadvisor.blr.com/infographic/infographic-why-the-difference-between-construction-and-maintenance-matters/>

Fan, Q., & Azad, M.A.K. (2017). *Towards a cleaner Bangladesh: Safe water, sanitation, and hygiene for all.* Retrieved on March 12, 2022 from <https://blogs.worldbank.org/endpovertyinsouthasia/towards-cleaner-bangladesh-safe-water-sanitation-and-hygiene-all>

Field, E., & Kremer, M. (n.d.). *Impact Evaluation for Slum Upgrading Interventions.* Retrieved on August 20, 2021 from https://scholar.harvard.edu/files/field/files/kremer_field.pdf

Flores-Baquero, O., Gallego-Ayala, J., Giné-Garriga, R., Palencia, Jiménez-Fernández de A., & Pérez-Foguet, A. (2017). The Influence of the Human Rights to Water and Sanitation Normative Content in Measuring the Level of Service. *Social Indicators Research*, 133, (763-786).

Freeman, M.C., Strunz, E., Utzinger, J., & Addiss, D.G. (2016). Interventions to improve water, sanitation, and hygiene for preventing soil-transmitted helminth infection. *The Cochrane database of systematic reviews*, (5), 1-12.

Garn, J.V., Sclar, G.D., Freeman, M.C., Penakalapati, G., Alexander, K.T., Brooks, P., Rehfuess, P., Boisson, S., Medicott, K.O., & Clasen, T.F. (2017). The impact of sanitation interventions on latrine coverage and latrine use: A systematic review and meta-analysis. *International Journal of Hygiene and Environmental Health*, 220 (2), 329-340.

Government of the People's Republic of Bangladesh. (2014). *National Strategy for Water Supply and Sanitation, 2014.* Ministry of Local Government, Rural Development and

- Cooperatives. Local Government Division. Retrieved on May 28, 2022 from <https://www.psb.gov.bd/policies/nswsse.pdf>
- Government of Bangladesh. (2019). *Sustainable Development Goals: Bangladesh Progress Report*. Dhaka: Government of Bangladesh
- Government of the People's Republic of Bangladesh. (2020). *Sustainable Development Goals: Bangladesh Progress Report 2020*. General Economics Division, Bangladesh Planning Commission, Ministry of Planning
- Government of the People's Republic of Bangladesh. (2021). *8th Five-Year Plan (July 2020-June 2025)*. General Economics Division, Bangladesh Planning Commission, Ministry of Planning
- Habib, E. (2009). The role of government and NGOs in slum development: the case of Dhaka City. *Development in Practice*, 19(2), 259-265.
- Habitat for Humanity, (n.d.). *Urbanisation and the Rise of Slum Housing: The birth and growth of informal settlements*. Retrieved on January 01, 2022 from <https://www.habitatforhumanity.org.uk/blog/2018/09/urbanisation-slum-housing/>
- Hackenbroch, K., & Hossain, S. (2012). The organised encroachment of the powerful Everyday practices of public space and water supply in Dhaka, Bangladesh. *Planning Theory and Practice*, 13, 397-420.
- Hanchett, S., Akhter, S., & Khan, M.H. (2003). Water, sanitation and hygiene in Bangladeshi slums: an evaluation of the WaterAid–Bangladesh urban programme. *Environment and Urbanization*, 15, (43-55).
- Haq, A.K., (2006). Water management in Dhaka. *Water Resources Development*, 22(2), 291-311.
- Haque, S.S., Yeanez-Pagans, M., Arias-Granada, Y., & Joseph, G. (2020). Water and sanitation in Dhaka slums: access, quality, and informality in service provision. *Water International*, 45, (791-811).
- Henderson, V. (2002). Urbanization in Developing Countries. *The World Bank Research Observer*, 17, (89-112).

- Hoque, B., Juncker, T., Sack, R.B., Ali, M., & Aziz, K.M.A. (1996). Sustainability of a water, sanitation and hygiene education project in rural Bangladesh: A 5-year follow-up. *Bulletin of the World Health Organization*, 74(4).
- Hoon, T.S., & Satiman, F. (2016). An Investigation on The Dimensions of Service Quality in Private Schools. *Asian Journal of University Education*, 12(1), 39-51.
- Hutton, G., & Chase, C. (2017). Water Supply, Sanitation, and Hygiene. In C. N. Mock, R. Nugent, O. Kobusingye, & K.R. Smith (Eds). *Injury Prevention and Environmental Health*, (9).
- International Centre for Diarrhoeal Disease Research. (2016). *Bangladesh. Baseline Population and Socioeconomic Census: Slums of Dhaka (North and South) and Gazipur City Corporations, 2015-16*. Retrieved on September 12, 2021 from <http://uphpc.gov.bd/cmsfiles/files/BaselinePopulation%20and%20Socioeconomic%20Census.pdf>
- IRCWash. (2012). Analysing water service levels. Retrieved on August 20, 2021 from https://www.ircwash.org/sites/default/files/module_3b_0.pdf
- Islam, M.S., Anannya, A.M., Rahman, M.S., & Rahman, M.M. (2015). Present Situation of Water Supply and Sanitation at Karail Slum Dhaka. *Journal of Environmental Science and Natural Resources*, 8, (161-163).
- Jinnah, S.I.A. (2007). Rights of Water Connections for Urban Slum Dwellers in Bangladesh: A study on DSK's experience in three slums of Mirpur, Dhaka. Retrieved from <https://washmatters.wateraid.org/publications/rights-of-water-connections-for-urban-slum-dwellers-in-bangladesh>
- Joshi, A., & Amadi, C. (2013). Impact of Water, Sanitation, and Hygiene Interventions on Improving Health Outcomes among School Children. *Journal of Environmental and Public Health*. <https://doi.org/10.1155/2013/984626>.
- Kang, K., & Lee, K. (2012). Development of a bicycle level of service model from the user's perspective. *KSCE Journal of Civil Engineering*, 16, (1032-1039).

- Khan, T. A. (n.d.). Dhaka Water Supply and Sewerage Authority: Performance and Challenges. Retrieved on April 16, 2022 from <http://app.dwasa.org.bd/admin/news/Dhaka%20WASA%20Article-for%20BOOK.pdf>
- Luby, S., Pickering, A., Winch, P., Kremer, M., Unicomb, L., & Sultana, F. (2017). *Impact of Low-Cost In-Line Chlorination Systems in Urban Dhaka on Water Quality and Child Health*. Retrieved on March 09, 2022 from <https://www.worldbank.org/en/programs/sief-trust-fund/brief/impact-of-low-cost-in-line-chlorination-systems-in-urban-dhaka-on-water-quality-and-child-health>
- Mahabir, R., Crooks, A., Croitoru, A., & Agouris, P. (2016). The study of slums as social and physical constructs: challenges and emerging research opportunities. *Regional Studies, Regional Science*, 3, (399-419).
- Municipal Finance Officers' Association., 2018. Asset Management Framework. Retrieved on February 13, 2022 from https://web.archive.org/web/20200216080646/http://mfoa.amp.ca/AMF/AMF_04.html
- Nahar, F. (2009). *A study on the sustainability of CBO-managed water and sanitation service in slums of Dhaka city*. Retrieved on June 01, 2022 from <http://lib.buet.ac.bd:8080/xmlui/bitstream/handle/123456789/3918/Full%20Thesis.pdf?sequence=1&isAllowed=y>
- Pattnaik, S.B., Kumar, K.R. (2007). Level Of Service of Urban Roads Based on Users' Perception. *Civil Engineering and Environmental Systems*, 14(2), (87-110).
- Pedley, S., Pond, K., & Joyce, E. (2011). Interventions for water provision. World Health Organization. Retrieved on March 11, 2022 from https://www.who.int/water_sanitation_health/economic/chapter6.pdf
- Potter, A. & Klutse, A. (2010). Assessing Sanitation Service Levels. Retrieved on March 13, 2022 from <https://www.ircwash.org/sites/default/files/Potter-2011-Assessing.pdf>
- Rahaman, M, M., Galib, A.I., & Azmi, F. (2021). Achieving drinking water and sanitation related targets of SDG 6 at Shahidbug slum, Dhaka. *Water International*, 46, 462-476.

- Rahman, M., Atkins, P.J., & Mcfarlane, C. (2014). Factors affecting slum sanitation projects in Dhaka City: learning from the dynamics of social-technological-governance systems. *Journal of Water, Sanitation and Hygiene for Development*, 4(3), 346-358.
- Rahman, M. M., Ali, M.A., Choudhury, M.R., Rahman, M.A., Ahmed, A., Soneji, S.V., Akhter, M.B., Syafitri, S., & Das, S. (2014). *WASH Challenges in Slum Areas of Dhaka City*. Retrieved on March 18, 2021 from https://itn.buet.ac.bd/publications/sector documents/documents/Study_report_on_WASH_Challenges_in_Slum_Areas_of_Dhak City.pdf
- Razzak, N.R.B., Chowdhury, S., & Ohi, S.J. (2014). Assessment of Essential Public Services in Slums of Dhaka City. *Current Advances in Civil Engineering*, 2, (126-132).
- Roy, D., Lees, M.H., Palavalli, B., Pfeffer, K., & Slood, M.A.P. (2014). The emergence of slums: A contemporary view on simulation models. *Environmental Modelling & Software*, 59, (76-90).
- Satterthwaite, D. (2016). Missing the Millennium Development Goal targets for water and sanitation in urban areas. *Environment and Urbanization*, 28(1), 99-118.
- Selendy, J.M.H. (Ed.). (2018). *Water and Sanitation-Related Diseases and the Changing Environment: Challenges, Interventions, and Preventive Measures*. United States: John Wiley & Sons.
- Senna, L.D.D., Maia, A., & Medeiros, J.D.F.D. (2019). The use of principal component analysis for the construction of the Water Poverty Index. *Brazilian Journal of Water Resources*, <http://dx.doi.org/10.1590/2318-0331.241920180084>
- Serag, A., Samra, S.A., & Zayed, T. (2020). Level of Service-Based Asset Management Framework for Water Supply Systems. *Journal of pipeline systems and engineering*, 11(3).
- Smet, J. (2005). WELL fact sheet: domestic rainwater harvesting. *Waterlines*, 24, 13–20.
- Tafazzoli, M. (2019). Maintaining the Sustainability of Critical Infrastructure. In S.M.E. Sepasgozar, F. Tahmasebinia, & S. Shirowzhan (Eds). *Infrastructure Management and Construction*. DOI: 10.5772/intechopen.85915

- Turkstra, J., & Raithelhuber, M. (n.d.). *Urban Slum Monitoring*. Retrieved on August 20, 2021 from <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.465.3193&rep>
- Taylor, D.L., Kahawita, T.M., Cairncross, S., & Ensink, J.H.J. (2015). The Impact of Water, Sanitation and Hygiene Interventions to Control Cholera: A Systematic Review. *Plos One*. <https://doi.org/10.1371/journal.pone.0135676>.
- The World Bank. (2016). *Bangladesh: Improving Water Supply and Sanitation*. Retrieved on June 05, 2022 from <https://www.worldbank.org/en/results/2016/10/07/bangladesh-improving-water-supply-and-sanitation>
- Un-Habitat, (2014). Slums: Some Definitions. Retrieved on February 28, 2022 from https://mirror.unhabitat.org/documents/media_centre/sowcr2006/SOWCR%205.pdf
- UNICEF. (2018). *Children in Cities*. Retrieved on June 20, 2021 from <https://www.unicef.org/bangladesh/en/children-cities%C2%A0>
- UNICEF. (2021). *Billions of people will lack access to safe water, sanitation and hygiene in 2030 unless progress quadruples – warn WHO, UNICEF*. Retrieved on March 10, 2022 from <https://www.unicef.org/bangladesh/en/press-releases/billions-people-will-lack-access-safe-water-sanitation-and-hygiene-2030-unless>
- UNICEF. (n.d.). *Better access to safe drinking water: Quality, equitable access and sustainability*. Retrieved on March 11, 2022 from <https://www.unicef.org/bangladesh/en/better-access-safe-drinking-water>
- UNICEF. (n.d.). *Safer sanitation and hygiene: Quality, equitable access and sustainability*. Retrieved on June 02, 2022 from <https://www.unicef.org/bangladesh/en/better-access-safe-drinking-water/safer-sanitation-and-hygiene>
- United Nations. (2019). *Population Facts 2018*. Retrieved on May 19, 2021 from https://population.un.org/wup/Publications/Files/WUP2018-PopFacts_2018-1.pdf.
- United Nations. (2019). *SDG indicator Goal 11*. Retrieved on May 20, 2021 from <https://unstats.un.org/sdgs/report/2019/goal-11/>

- United Nations Human Settlements Programme. (2003). *The Challenge of Slums: Global Report on Human Settlements*. London: Earthscan Publications Limited.
- UN Water. (2016). *Integrated Monitoring Guide for SDG 6 Targets and global indicators*. Retrieved on February 23, 2022 from http://www.unwater.org/app/uploads/2017/03/SDG-6-targets-and-global-indicators_2016-07-19.pdf
- Waddington, H., Snilstveit, B., White, H., & Fewtrell, L. (2009). *Water, Sanitation And Hygiene Interventions To Combat Childhood Diarrhoea In Developing Countries*. Retrieved on March 29, 2021 from <https://developmentevidence.3ieimpact.org/search-result-details/systematic-review-repository/water-sanitation-and-hygiene-interventions-to-combat-childhood-diarrhoea-in-developing-countries/9406>
- Walsham, M. (2010). *Assessing the Evidence: Environment, Climate Change*. Dhaka: International Organization of Migration.
- WaterAid. (2019). *Bangladesh - Facts and Statistics*. Retrieved on June 02, 2022 from <https://www.wateraid.org/bd/bangladesh-facts-and-statistics>
- Watsan, J., Guyett, L.D-M., Flynn, E., Falconer, J., Mills, J.E., Prual, A., Hunter, P., Allegranzi, B., Montgomery, M., & Cumming, O. (2019). Interventions to improve water supply and quality, sanitation and handwashing facilities in healthcare facilities, and their effect on healthcare-associated infections in low-income and middle-income countries: a systematic review and supplementary scoping review. *BMJ Global Health*, 4(4).
- WHO/UNICEF Joint Monitoring Programme. (2021). Progress on household drinking water, sanitation and hygiene (2000-2020). Retrieved on March 02, 2022 from <https://www.unwater.org/app/uploads/2021/07/jmp-2021-wash-households-LAUNCH-VERSION.pdf>
- World Vision. (n.d.). Approaches and Interventions. Retrieved on March 10, 2022 from <https://www.wvi.org/clean-water-sanitation-and-hygiene-wash/approaches-and-interventions>

Appendix

Appendix A

Table A1: List of Supported Slums

Thana	Slum	Availability of Support
Banani	Karail Basti	Yes
Pallabi	Kala Bagan	Yes
Banani	Godwan Basti	Yes
Mohammadpur	7 No. Road Chandrima	Yes
Mohammadpur	Sadek Khan	Yes
Pallabi	Shahparan & Gafur	Yes
Pallabi	D-Block Beri Badh	Yes
Pallabi	Ceramic Basti	Yes
Sher-E-Bangla Nagar	Purba Agargaon	Yes
Pallabi	Paris Road More Basti	Yes
Pallabi	Bagun Bari Tek	Yes
Rupnagar	Jheelpar Basti	Yes
Sher-E-Bangla Nagar	Korom Ali Basti	Yes
Darus Salam	City. Corp. Colony Basti	Yes
Pallabi	Milk Vita & Wapda Camp	Yes
Banani	Sat Tala Dakshin Staff Basti	Yes
Banani	Sat Tala Chow.Para Basti	Yes
Banani	Sat Tala Purba Paser Basti	Yes
Bhasantek	Bhasantek Basti	Yes

Table A2: List of Unsupported Slums

Thana	Slum	Availability of Support
Pallabi	Kala Pani	No
Pallabi	Kormitola Natun Camp	No
Pallabi	Milk Vita Khalpar Basti	No
Pallabi	Madrasha Camp	No
Pallabi	M.C.C. Camp Basti	No
Kafrul	Bagan Bari	No
Mohammadpur	Market Camp Basti	No
Pallabi	Nazrul Mollah	No
Pallabi	Nagra Molla	No
Shah Ali	Zilpar Hazi Road	No
Rupnagar	Jheel Par Matbar	No
Mirpur	Khalil Sab	No
Pallabi	Kormitola Purba Camp & Gudhara	No
Shah Ali	Bari Band East & West	No
Banani	Arshad Nagar Basti	No
Shah Ali	Lalmath Basti	No
Pallabi	Balur Math//Kalshi Signal	No
Uttara Paschim	Baribad	No
Pallabi	Elksh Mollah	No

Pallabi	Millat Camp	No
Shah Ali	Uttar Bishil Balur Math	No
Adabor	Balur Math Basti	No
Rupnagar	Bareker Basti	No
Bhasantek	B.N.P. Road	No
Pallabi	Sattar Mollah	No
Rupnagar	Arambagh Basti	No
Pallabi	Jasim Molla	No
Banani	Sat Tala Paschim B.Wall Basti	No
Mirpur	Pura Basti	No
Pallabi	C-Block Pukur Par	No

Appendix B



BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF URBAN AND REGIONAL PLANNING

Assalamualaikum/Adab. I am a Master's student of Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology (BUET). I am conducting a research on 'A Study on Intervention in Water and Sanitation Facilities in Selected Slums of Dhaka North City Corporation'. To fulfill objectives of my research I need to know about the water and sanitation related interventions in your area. This research is designed solely for academic purpose and all your responses will remain confidential. I shall be extremely grateful if you agree to co-operate with us and give some of your time to answer few questions. I thank you in advance for your kind co-operation.

For further query, please feel free to contact, Professor Dr. Mohammad Shakil Akther, Department of Urban and Regional Planning (URP), Bangladesh University of Engineering and Technology (BUET), Dhaka-1000.

Questionnaire ID

Date:

1. General Information

a. Name of the Respondent:		Contact No.:	
b. Address of the Slum:	c. Household Size 1. <3, 2. 3 to 5, 3. 6 to 10, 4. 10+	d. Number of Earning Member in Household 1. 1, 2. 2-3, 3. 3+	e. Monthly Household Income 1. >5000, 2. 5000-10000, 3. 10000-20000, 4. 20000+
f. Monthly Household Expenditure (BDT) 1. >5000, 2. 5000-10000, 3. 10000-20000, 4. 20000+	g. Ownership Status of the Residence 1. Owner 2. Tenant 3. Free lease	h. Structure Type: 1. Katcha , 2. Semi-pucca , 3. Pucca	i. Duration of Residing in this Slum: 1. <6 months, 2. 6 months to <1year, 3. 1-3 Years, 4. >3 years

2. Water Related Information

a. Number of water source in the household 1. 1, 2. 2, 3. More than 2	b. Source(s) of Water 1. Piped, 2. Tubewell, 3. Nearby Waterbody, 4. Other (Please specify).....	c. Sharing Status 1. Individual, 2. Sharing If shared, how many households share? 1.	d. Nature of Water Supply 1. Continuous, 2. Intermittent, 3. Irregular
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		Less than 5, 2. 5 to 15, 3. 16 to 25, 4. 25+	
e. Perception of Water Quantity 1. Not enough for drinking, 2. Enough for drinking but not for all domestic purposes, 3. Enough for all domestic purposes	f. Reliability 1. Most of the time have to rely on other sources-0, 2. Sometimes other sources have to be used, 3. All year round	g. Distance of the Nearest Water Source from house 1. In house, 2. <500m, 3. 500m to <1 km, 4. 1-2 km, 5. 2+ km	h. Time Spent to Collect Water 1. >30 mins 2. 21-30 mins 3. 11-20 mins 4. <10 mins 5. Piped into house/compound Please, mention your perception regarding the waiting time: 1. Too long, 2. Long, 3. Moderate, 4. Not so long, 5. Not long at all
i. Do you feel secured in paths 1. Yes, 2. No If no, what problems do you face? 1. Eve-teasing, 2. Accident-prone area, 3. Crime-prone zone, 4. Others (Please specify)	j. Water treatment within the household 1. Yes, 2. No	k. Monthly Cost for Collecting Water 1. No Cost, 2. <100BDT, 3. 100-300BDT, 4. 301-500 BDT, 5. 500+BDT	l. Perception of Cost for Collecting Water 1. Too expensive, 2. Expensive, 3. Fair, 4. Cheap, 5. Very Cheap/No Cost If money is spent, is there disconnection because of failures to pay 1. Yes, 2. No
m. Satisfaction regarding water quality 1. Extremely unsatisfied, 2. Unsatisfied, 3. Moderately satisfied, 4. Satisfied, 5. Extremely satisfied	n. Did any water related intervention complete before two years or more in your slum? 1. Yes, 2. No If yes, how many interventions took place according to your knowledge? And which type of interventions took place in your slum? 1. Construction, 2. Maintenance, 3. Improvement, 4. Others (please specify)	o. Type of the organization(s) which undertook water related interventions 1. Government organizations, 2. NGOs, 3. Community-based organizations, 4. The community altogether, 5. Others (please specify)....	
p. Do you get any support from the intervened organization(s) if necessary? 1. Yes, 2. No	q. Loss of Trust on Authority 1. Yes, 2. No		

If yes, what kind of support do you get? 1. Financial support, 2. Physical support, 3. Others (please specify) If no, what problems do you face while reaching them? 1. Way of contact is unknown, 2. Problems are ignored after hearing, 3. Unwillingness to contact, 4. Others (please specify)	If yes, on which authority trust has been lost? 1. City corporation, 2. WASA, 3. Other government organizations, 4. Non-government organizations, 5. Community-based organizations, 4. Others (please specify) And reasons behind loss of trust on authority 1. Insincerity during intervention phase, 2. Unavailability of support after intervention, 3. Others (Please specify)
r. If you have any opinion/suggestion regarding water facility in your slum, please share	

3. Sanitation Related Information

a. Sharing Status 1. Open Defecation, 2. Shared, 3. Individual Facility If open defecation, reason behind this 1. No toilet provision in slum, 2. Unusable toilet If no toilet, reason for not having: insufficient money? 1. Yes, 2. No	b. Location 1. 1. In house, 2. <500m, 3. 500m to <1 km, 4. 1-2 km, 5. 2+ km c. Average daily waiting time for using toilet 1. No waiting time, 2. <15 mins 3. 16-30mins, 4. 31 mins-1hr, 5. 1hr+ d. Distance of the nearest toilet from house 1. In house, 2. <500m, 3. 500m to <1 km, 4. 1-2 km, 5. 2+ km State your satisfaction with the location of the facility 1. Extremely unsatisfied, 2. Unsatisfied, 3. Moderately satisfied, 4. Satisfied, 5. Extremely satisfied	e. Type of toilet 1. Katcha, 2. Semi-pucca, 3. Pucca f. Nature of used toilet 1. Male-female combined 2. Male-female separated and sharing quantity: Satisfaction regarding quantity of gender-separated toilets: 1. Extremely unsatisfied, 2. Unsatisfied, 3. Moderately satisfied, 4. Satisfied, 5. Extremely satisfied	g. Security in Paths 1. Yes, 2. No If no, what problems do you face? 1. Harassment, 2. Accident-prone area, 3. Crime-prone zone, 4. Others (Please specify)
h. Continuity 1. Seasonal discontinuity, 2. All year round 1. Privacy 1. No privacy at all, 2. Low privacy, 3. Moderate privacy, 4. High privacy, 5. Very high privacy	i. Problems faced while using toilet 1. Presence of insects, 2. Irregular water supply, 3. Unsupportive infrastructure within toilet, 4. Others (please specify)	j. Unpleasant smell 1. Yes, 2. No m. Cleanliness 1. Not adequate at all, 2. Mostly inadequate, 3. Moderately adequate, 4. Mostly adequate, 5. Very adequate	k. Condition of latrine and superstructure 1. Very poor, 2. Poor, 3. Fair, 4. Good, 5. Excellent n. Hand washing facility and soap in the vicinity of the toilet 1. Yes, 2. No

o. Disposal of children stools 1. Open defecation, 2. Separate Bin p. Comfort 1. Not comfortable at all, 2. Mostly uncomfortable, 3. Moderately comfortable, 4. Comfortable, 5. Very comfortable	q. Household investment/contribution to construction/maintenance of the facility 1. Very low, 2. Low, 3. Fair, 4. High, 5. Very high If invested, annual household expenditure for toilet construction/maintenance 1. No cost 2. <200BDT, 3. 201-500BDT, 4. 501-1000 BDT, 5.1000BDT+	r. Is there any provision for menstrual wastes disposal in your slum? 1. Yes, 2. No If yes, do you face any problem while disposing of menstrual wastes? 1. Yes, 2. No If yes, what kinds of problems do you face? 1. Harassment, 2. Social and cultural taboos 3. Poor provision/maintenance of the disposal system, 4. Others (Please specify)
s. Did any sanitation related intervention complete before two years or more in your slum? 1. Yes, 2. No If yes, how many interventions took place according to your knowledge? And which type of interventions took place in your slum? 1. Construction, 2. Maintenance, 3. Improvement, 4. Others (please specify)	t. Type of the organization(s) which undertook sanitation related interventions 1. Government organizations, 2. NGOs, 3. Community-based organizations, 4. The community altogether, 5. Others (please specify)....	u. Do you get any support from the intervened organization(s) if necessary? 1. Yes, 2. No If yes, what kind of support do you get? 1. Financial support, 2. Physical support, 3. Others (please specify) If no, what problems do you face while reaching them? 1. Way of contact is unknown, 2. Problems are ignored after hearing, 3. Unwillingness to contact, 4. Others (please specify) v. Loss of Trust on Authority 1. Yes, 2. No If yes, on which authority trust has been lost? 1. City corporation, 2. Other government organizations, 3. Non-government organizations, 4. Community-based organizations, 4. Others (please specify) And reasons behind loss of trust on authority 1. Insincerity during intervention phase, 2. Unavailability of support after intervention, 3. Money is delivered only to the leaders through a mutual understanding
v. If you have any opinion/suggestion regarding sanitation facility in your slum, please share		