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ANALYSIS OF ACCESS TO PURE DRINKING WATER FACILITY AND ADEQUATE SANITATION INFRASTRUCTURE AT OMAR ALI MARKET: LARGEST FISHING EQUIPMENT MARKET, FISHERY GHAT, CHATTOGRAM.

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ABSTRACT

In response to the growing global concerns surrounding the essential human right of proper sanitation management and pure drinking water facility, in alignment with the Sustainable Development Goal, this study delves into the evaluation of the conditions regarding access to clean drinking water, sanitation infrastructure, and hygiene facilities in Omar Ali Market, situated in Fishery Ghat, Chattogram, Bangladesh. Despite being recognized as a prominent trading hub for fishing equipment in the area, this market faces a significant challenge – it lacks vital sanitation facilities and access to safe drinking water. This predicament not only poses risks to human health but also has adverse effects on the environment. To comprehensively address these issues, the study adopts a two-pronged approach. Firstly, it conducts an in-depth assessment of the physical infrastructure within the market. Secondly, it administers a comprehensive questionnaire survey among a randomly selected group of market users. Through the analysis of this survey data, the study aims to shed light on the prevalent challenges associated with inadequate sanitation systems and the shortage of clean drinking water within the market area. Furthermore, the study puts forth design recommendations aimed at improving the current situation for the market's patrons.

Keywords: *Drinking Water Facility, Sanitation Infrastructure, Market Area, SDG, Omar Ali market*

1. INTRODUCTION

Public sanitary facilities and potable drinking water are essential infrastructure required for the overall societal welfare and effective functioning of a city. Offering public sanitary facilities and a reliable supply of clean water have significant implications for public and individual health. It also has implications in transportation, crime prevention, urban planning, economic and cultural advancement, as well as social equality. These have been established to improve health, boost socio-cultural development, and promote economic balance. (Olukanni, 2014) (Bendahmane, 1993) (Okun, 1988). Public Conveniences i.e. Toilets, Bathrooms, Urinals and Comfort rooms are provided largely in public places and institutions. These places include Markets, Motor Parks, Religious institutions, Mosques, Churches, Filling stations, Hospitals, Airports, Sporting grounds, Schools etc. It is known to be the basic primary drivers of public health, personal hygiene and human dignity (WHO/UNICEF, 2020)

In Bangladesh, more than 2.1 million individuals are involved in open defecation due to the absence of public toilets, posing a heightened risk of health hazards through the potential transmission of various diseases, as indicated by a report from the Bangladesh Bureau of Statistics (21 lakh people in Bangladesh practise open defecation: BBS, 2022). The lack of sufficient and high-quality public facilities creates a sense of uncertainty among residents and visitors. This has resulted in a real crisis in the quality of life, especially impacting the female, younger and older members of society. According to the ”Joint Monitoring Program (JMP) Report 2021” jointly published by the World Health Organization and UNICEF, Bangladesh is falling behind other South Asian countries in advancing the sanitation sector (21 lakh people in Bangladesh practise open defecation: BBS, 2022). Significant concerns exist regarding the inadequate supply and below-standard quality of public facilities in cities across Bangladesh, giving rise to related difficulties for both inhabitants and visitors.

There is an ongoing global emphasis on achieving sustainable development through ensuring proper sanitation and providing access to clean drinking water. Goal 7 (target 3) of the Millennium Development Goals (MDGs) aimed at halving the proportion of the universal population without sustainable access to clean and safe drinking water and sanitation by 2015 (UN, 2000). Similarly, Goal 6 of the Sustainable Development Goals (SDGs) is to ensure availability and sustainable management of water and sanitation for all (Dodds, 2015). Bangladesh is also participating in this worldwide sustainability initiative. In light of this, the current study aims to evaluate the standards of public toilets in the Omar Ali Market located in Fishery Ghat, Chittagong, Bangladesh. Despite its recognition as a major trading center for fishing equipment in the region, this market struggles with a significant challenge – the absence of essential sanitation facilities and a reliable source of safe drinking water. This situation not only poses health risks to individuals but also has detrimental effects on the surrounding environment.

The objective of the study is to appraise the challenges related to inadequate sanitation facilities and shortage of pure drinking water sources inside and around the Omar Ali market area along with suggesting some design solutions to redeem the situation.

1.1 Literature Review:

Sanitation: The term “sanitation” has received diverse interpretations from different authors and is frequently employed in various aid initiatives. However, According to the Oxford Advanced Learner’s Dictionary, sanitation refers to “systems that safeguard people’s health, particularly those that efficiently dispose of human waste.” Other dictionaries also highlight the prevention of disease transmission and the assurance of both public and private health. In its most basic form, a sanitary facility is a space or room designated for sanitation purposes, encompassing a toilet, washbasin, and associated equipment, which may include a privy, shower, or urinal.

Safe Drinking Water: Safe drinking (potable) water is the water that can be delivered to the user and is safe for drinking, food preparation, personal hygiene and washing (Bos R, 2016). The water should adhere to specified quality standards, encompassing chemical, biological, and physical parameters, at the point where it is supplied to the end-users. (J., 1997) . A universally agreed-upon definition for'safe drinking water" does not exist. Safe drinking water is described as water that poses no substantial health risks during a person's lifetime of consumption. (Fogden J, 2009) .Safe drinking water is anonymously accepted as an international agenda and priority, which is evident from the MDGs and SDGs of the United Nations (UN) initiative and vision (MDGs 7 and SDGs 6). Despite the initiatives under the MDGs, a significant number of individuals still face challenges in obtaining safe drinking water, and many lack access to even basic water services. Worldwide, over 1 billion people do not enjoy access to safe drinking water. As per a report from the Third World Academy of Sciences (TWAS), contaminated or unclean water is causing more fatalities than cancer, AIDS, wars, or accidents. ((TWAS), 2002.).
On a global scale, it is evident that inadequate sanitation poses a significant obstacle to development, education, gender equality, socio-economic progress, and advancements in health across numerous developing nations. (WHO, 2012). Bangladesh is no exception to that. Chittagong is the largest port city of Bangladesh. In Chittagong city the situation of public sanitation and public access to drinking water is dire.According to Estate Department of the CCC, there are 43 public toilets in the city—six reserved for physically challenged people and three for transgender persons, not a single one for ladies. The Chittagong city,with a population of 8.5 million,where major portion of the population, including men, women and children spend 12-16 hours a day away from home, have 43 working toilets for public use. Hence, Women in the city normalise not drinking water to avoid going to toilets, childrens are told it is not safe to go into a public toilet alone. Open defecation and urination among men is very common.

1.2 **Case Study**

Project credits:
Architect: Rohan Chavan
Assistant architect: Tulika Nabar
Structural consultant: Prashant Haval
Contractor: Shailendra Vishvakarma
Architect Rohan Chavan has designed public toilets in the Indian city of Thane, centered around an old tree, featuring a distinctive hot-pink sitting area for women to socialize. Named "The Light Box – Restroom for Women," .This three-by-nine-metre facility in Mumbai includes four female-only toilets arranged around the tree's trunk, with branches extending through a transparent roof. The central area serves as a shaded resting place and a socializing spot for women. Chavan emphasized the significance of public spaces in cities as vital hubs for people to meet and interact, fostering mental engagement and the birth of new ideas. The facility also incorporates amenities such as a vending machine for female hygiene products, mobile phone charging points, a panic alarm system, and provisions for a potential future cash machine. The project was commissioned by Agasti, an organization set up to improve access to public toilets in urban areas of India. "Beyond the obvious toilet blocks, the restrooms aim to provide women an exclusive social space, something that is atypical of urban landscape in India," said Agasti founder Sahej Mantri. (Mairs, 2016)

Figure 1 Case study image : "The Light box - Restroom for Women" *(Mairs, 2016)*

He emphasized the importance of creating a secure environment for women, noting that along with maintaining hygienic standards, the restroom would be under CCTV surveillance and regularly patrolled by a security guard. (Mairs, 2016)
The structure's roof is constructed from polycarbonate sheets, enabling natural light to permeate the interior and inspiring the project's name. The floor is adorned with hot-pink polyurethane. One end of the building houses two stalls adjacent to a washbasin, while the other end features a nursing room and a restroom designed for disabled individuals or seniors. To enhance water conservation, the ceramic toilets are equipped with bio digesters. Internal partitions are crafted from aluminum and stainless steel sheets, and the outer walls are constructed from perforated steel, facilitating ventilation and serving as a support structure for climbing plants. (Mairs, 2016)

2. METHODOLOGY

2.1 Selection of Study Area:

For scrutinizing the existing condition and problems of the pedestrian sanitation system, hygiene condition and drinking water facilities affecting the market users' comfort and health, we have taken Omar Ali Market, largest fishing equipment market alley of Chittagong city, as our main study area. This alley is situated in between four major roads: Mariners Drive Road), Iqbal Road, Ashraf Ali Road and Asadganj connecting road. The market is very near (less than half a kilometer) fishery ghat, situated on the bank of Karnafuli riverbank. The expansive Chattogram Fishery Ghat stands as a prominent hub, hosting the largest fish market for both marine and native fish in the port area. This colossal ghat serves as a pivotal point where various districts across the country source fish of diverse categories through wholesale transactions. Subsequently, these districts engage in local trade, fostering the distribution of fish within the locals. (Rahman, 2022) The selected area is the largest fishing gear market alley of the consists of various types of shops for all kind of fishing gears and net mending equipment, warehouse, vehicle repairing shops, diesel shop, local bhatghar, local pharmacy and utensil shop. The locational map of selected area is shown in Figure 2.

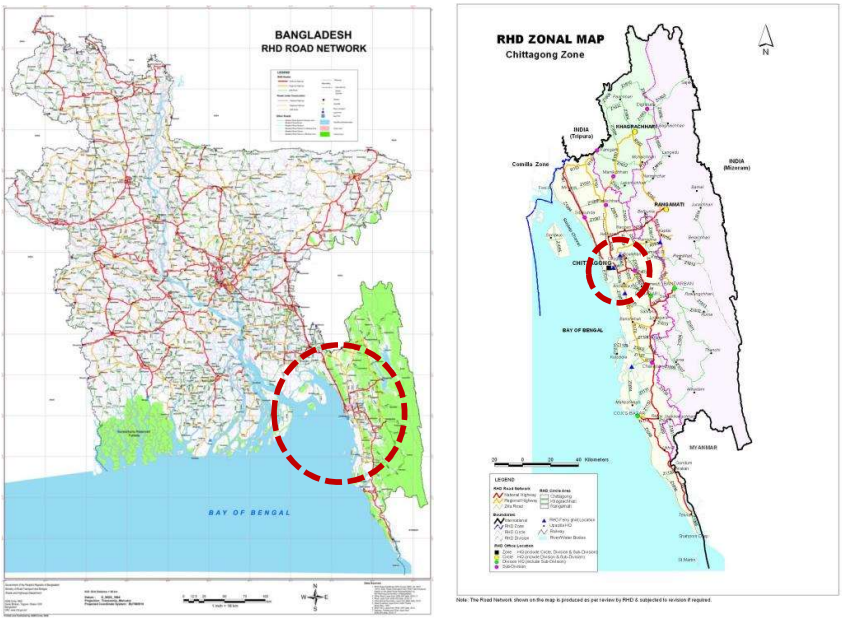

Figure 2 Location of Study Area *(Department, n.d.)*

Omar Ali Market, recognized as the largest fishing gear market in Chittagong, serves not only as a prominent trading hub but also as a crucial transit point for various businesses. It plays an important role in the distribution network, receiving products, food, and goods from across the country through the Karnaphuli River and subsequently dispatching them to different destinations. Consequently, numerous warehouses are strategically positioned within the market. This distinctive character of the market introduces an additional user category beyond buyers and sellers—the delivery personnel. These individuals receive shipments from ships and ensure their timely delivery to designated locations within the city. The delivery person usually wait for the shipment to come in the warehouses of the market as there are no provision for resting space in the market area.

The gender distribution in the market is characterized by an 80% to 20% ratio, with male users being significantly more prevalent than their female counterparts.

Particularly during shipment periods, the market can accommodate up to 2000 users simultaneously, witnessing a substantial daily footfall of nearly 10,000 people in this bustling area.

Figure 3 Land Use Map of Adjacent Market Area (Source: Authors' field survey)

2.2 Field Survey:

This study utilizes field survey methods, employing both Questionnaire Surveys and Video Observation, to evaluate the present status of the existing sanitation system and the availability of safe drinking water sources. Data for this research were gathered from primary and secondary sources. Secondary sources encompassed information derived from books, journals, conference proceedings, newspapers, and reports detailing the global and local sanitation conditions in Chittagong, Bangladesh. Primary data, conversely, were directly obtained from the field through a meticulously designed questionnaire and firsthand observations.
The data collection method of this research can be strategically divided into 3 types:

2.2.1 Reconnaissance Survey:

This survey refers to investigate the site conditions and the presence of infrastructure. A reconnaissance survey is described as "a thorough examination of an entire or partial area, conducted in enough detail to draw conclusions about the types and distributions of historical properties that might exist" within the designated project area. Reconnaissance surveys serve as a form of field survey commonly employed to collect preliminary data on the existence or non-existence of relevant physical infrastructure within the project area.

2.2.2 Questionnaire Survey:

A Questionnaire survey is a method for obtaining statistical data about the characteristics, attitudes, or behaviors of a population through a structured set of questions.

A questionnaire serves as a research tool comprising a series of questions or various prompts designed to gather information from a participant. Information regarding the source, availability, accessibility, and the presence of toilet facilities, was obtained through interviews utilizing a pretested and semi-structured questionnaire.

2.2.2.1 Sampling Technique:

Convenience sampling was adopted to sample 70 participants for the study. The choice of convenience sampling was based on the fact that people who are pressed exhibit similar characteristics. Convenience sampling was necessary since there is no available register of the population of the users of the public toilets in the study area.

2.2.2.2 Method of Data Analysis:

The data gathered from the questionnaire survey were subjected to descriptive statistical analysis techniques. The research findings are depicted through the presentation of frequency tables, charts, graphs, and visual plates.

2.2.3 Literature Survey:

The literature survey includes reviewing of published professional reports, newspaper reports, WHO, WASH guidelines regarding standard criteria for sanitation system and pure drinking water.

3. RESULTS

3.1 Findings from Spot Observation and User Survey

To evaluate the present scenario, the authors conducted spot observations and a questionnaire survey in the surrounding area of **OMAR ALI MARKET, FISHERY GHAT IN 2021.**The outcomes from the questionnaire survey are outlined below.

3.1.1 Gender of the Respondents

Table 01 indicates the percentage of the respondents of the questionnaire survey based on gender. Majority of the respondents are male, totalling 82%.And the rest 18% are female.

Table 1: Gender Participation

Occupants	Percentage
Male	82%
Female	18%

3.1.2 Age Distribution of the Respondents

Table 02 indicates the percentage of the respondents based on age group. 40% of the respondents (representing the majority) fall within the age bracket of 26-35 years old. Those between the age brackets of 16-25 years and 36-45 years account for 20% and 25% of the respondents respectively. Furthermore, those above 46years old and less than 15 years old account for 07% and 08% of the respondents respectively. This shows that majority of the users of the market fall within the age bracket of 26-35.

Table 2: Age distribution of the respondents

Age Group	Percentage
1-15	08%
16-25	20%
26-35	40%
36-45	25%
46-above	07%

3.1.3 Occupation of the Respondents

Table 03 indicates the percentage of the respondents based on occupation. The market caters to a diverse range of users, including wholesalers and retailers, buyers, delivery personnel, and net menders.45% of the respondents are sellers, both whole seller and retailer combined. The buyer and the delivery person make 25% and 20% of the total. And lastly 10% of the population are the net mender and repairer.

Table 3: Occupation of the respondents

Occupation	Percentage
Whole Seller Retailer	45%
Delivery Person	20%
Buyer	25%
Net Mender and Repairer	10%

3.1.4 Challenges Faced by the Respondents for the Lack of Sanitation System

Table 04 present the information on the challenges faced by the respondents for the lack of sanitation system in the study area. The majority of respondents identified the rise in open defecation as a consequence of the absence of adequate public sanitation infrastructure. 45% of them agree with it and only 10% disagreed. Additionally, respondents acknowledged that the lack of sanitation facilities in the study area contributes to a dirty environment and unpleasant odors. 60% of them strongly agreed to bad odor. 45% of the respondents strongly agree and 35% of them agree with dirty environment is caused by lack of public toilets. They explained it was mainly due to male users of the market resort to urinating and defecating in random places due to the absence of public toilets in the study area. 30% of the respondents acknowledge that the absence of sanitary facilities causes an invasion of privacy, while 25% express a neutral stance on the matter.

Table 4: Challenges faced by the respondents for the lack of sanitation system

Challenges	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Rising Open Defecation	25	45	20	10	0
Bad Odor	60	20	15	03	02
Dirty Environment	45	35	10	05	05
Facing Health Hazards and Infectious Diseases	20	25	20	15	20
Invasion of Privacy	15	30	25	20	10

3.1.5 User Preferences for Effective Sanitation Infrastructure

Table 05 present the information on the preferences of the respondents for effective sanitation infrastructure. 45% of the respondent agree and 25% of them strongly agree that proximity of the public toilet is their preference. According to them if the public facility is not near, it does not serve the purpose. While majority of the respondents' preferred free access to public toilets, 20% of the disagreed. They elaborated that providing free access would lead to a lack of maintenance, ultimately rendering the toilet unusable over time. 25% of the respondents prioritize privacy as an essential feature for effective sanitation infrastructure, with 20% expressing a neutral stance, and 15% in disagreement. The majority of respondents show a preference for universal access, as 30% agree, and an additional 15% strongly support it. However, 25% remain neutral, and 20% express disagreement regarding the preference for universal access in public toilets.Similarly, the majority of respondents express a preference for features such as adequate light, ventilation, and maintenance, with most responses being affirmative

Table 5: User preference for effective sanitation infrastructure

Demand of Repondents	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Proximity	25	45	20	10	00
Free Access	40	20	13	20	02
Cleanliness	45	35	10	15	00
Privacy	20	25	20	15	20
Universal Access	15	30	25	20	10

Light and Ventilation	60	37	03	00	00
Maintenance	30	70	00	00	00

3.1.6 User Expectations Concerning Access to Safe Drinking Water

Table 06 present the information on the preferences of the respondent's expectations concerning access to safe drinking water. 60% of the respondent strongly agree and 20% of them agree that proximity potable water source is their preference. While majority of the respondents' preferred safe drinking water to be free of cost, 03% strongly disagreed and 07% disagreed on the topic. 75 % of the respondents strongly agree that drinking water should be filtered and free of chemical substances .water for effective sanitation infrastructure, with 20% expressing a neutral stance, and 15% in disagreement. Almost all of them replied in the affermative regarding this preference. Aditionaly, majority of respondents expect the source of potable water to be well maintained. 25% astongly agree to it, 35% agree to it and 30% were neutral about it.

Table 6: User expectations concerning access to safe drinking water

Demand of Repondents	**Strongly Agree** (%)	**Agree** (%)	**Neutral** (%)	**Disagree** (%)	**Strongly Disagree** (%)
Proximity	60	20	10	10	00
Free of Cost	30	35	15	07	03
Filtered	75	20	05	00	00
Well Maintained	25	35	30	06	04

4. RECCOMENDATIONS

WaterAid, an international organization has released a guideline on the construction of public toilets. (Nikki Shaw, 2019). By following the guidelines, some strategies can be adopted to meet the challenges related to inadequate sanitation facilities and shortage of pure drinking water in Omar Ali Market, Chattogram.

1. Stakeholder Engagement and User-Centric Design: Engaging stakeholders in the design phase is vital. Encouraging open dialogue among them will nurture connections, increase awareness of existing challenges and obstacles, and instill a sense of responsibility. Building facilities that meet the unique requirements and preferences of the community is crucial. It's important to comprehend the potential users' preferences regarding the design and functionality of the facilities. This method has the potential to boost ownership, stimulate active involvement in upkeep and management, and may even encourage a willingness to contribute financially for using or maintaining public toilets.

2. Pre-Design Assessment for Facility Quantification:
   During the initial planning phase, it's essential to determine the required quantity of toilet cubicles and related amenities. This evaluation serves two primary goals: firstly, to confirm feasibility concerning expenses, land needs, and the logistical capability for construction; and secondly, to guarantee easy access to the facilities. It's vital to provide enough facilities to avoid prolonged queues, as these could compel people to seek unsafe alternatives.these facilities should not just include toilets. Urinals for male toilet, handwashing arrangements, menstrual hygiene management area, and drainage for wash water should also be included.
3. Sustainable Management Approach - Foreseeing Long-Term Facility Operation and Maintenance: In the initial design phase of toilet facilities, it's pivotal to anticipate the long-term aspects of operation and maintenance. Although larger entities such as local governments or donors typically cover the primary expenses for institutional and public toilets, it's essential to acknowledge that every type of toilet involves continuous and substantial costs for maintenance and potential replacements. Thus, proactive planning and internal management of these ongoing expenses within the institution are strongly encouraged. This proactive strategy ensures the sustainable functionality and efficient maintenance of the constructed facilities in the long run.
4. Drinking Water Stations: There ought to be periodic stations for drinking water facilities that are located in a secure region apart from any contagious or dumping zones. All of these infrastructure need to be kept up properly, and some influential individuals—like market owner associations—should shoulder the burden.
5. Green Initiatives: Integrate eco-friendly practices by providing options for reusable water bottles and incorporating sustainable materials in the construction of water stations.
6. Other social amenities, such as a spot for delivery personnel to rest and a location for weavers to fix nets, can be added to the programs to assist prevent the area from becoming abandoned

5. CONCLUSIONS

Proper sanitation and access to pure drinking water are significant components of the Goal 7 (target of the Millennium Development Goals (MDGs) and Goal 6 of the Sustainable Development Goals (SDGs) (UN, 2000) (Dodds, 2015). Despite the widespread acknowledgment of the importance of providing adequate, secure, and easily accessible public toilets and safe drinking water on a global scale, the translation of this awareness into substantial improvements in urban sanitation remains limited.. A significant contributing factor to this limited progress is the historically low priority accorded to sanitation, coupled with a widespread lack of awareness regarding its direct impact on public health.
This study, focusing on Omar Ali Market in Fishery Ghat, Chittagong, reveals a stark absence of adequate, effective public toilet facilities and a reliable source of safe drinking water for users. The respondents express profound dissatisfaction with this situation, emphasizing the negative repercussions on both human health and the environment. According to their feedback, an effective sanitation system should be in close proximity, well-maintained, and easily accessible to address these critical concerns.

REFERENCES:

(TWAS), T. W. (2002.). Safe Drinking Water: The Need, the Problem, Solutions and an Action Plan. (p. p. 23). Trieste, Italy: TWAS.

21 lakh people in Bangladesh practise open defecation: BBS. (2022, November 19). *The Daily Star*.

Bendahmane, D. B. (1993). *Lessons Learned in Water, Sanitation and Health: Thirteen Years of Experience in Developing Countries.* Arlington, Virginia: Water and Sanitation for Health (WASH).

Bos R, A. D. (2016). *Human Rights to Safe Drinking Water and Sanitation for Practitioners.* London, UK: IWA Publishing.

Department, R. a. (n.d.). *RHD Maps*. Retrieved from Roads and Highway Department Bangladesh: https://www.rhd.gov.bd/RHDMaps_new/Index.asp

Dodds, f. (2015). *Negotiating the Sustainable Development Goal: A transformational agenda for an insecure world.* Routledge, London.

Fogden J, W. G. (2009). *Access to Safe Drinking Water and Its Impact on Global Economic Growth.* WA, USA: A Study for HaloSource, Inc .

J., d. Z. (1997). *Handbook of Drinking Water Quality.* NY, USA: John Wiley & Sons.

Mairs, J. (2016, August 19th). *Rohan Chavan's public toilets aim to provide a safe socialising space for women*. Retrieved from Dezeen: https://www.dezeen.com/2016/08/19/rohan-chavan-public-toilets-india-safe-space-women/

Nikki Shaw, E. F. (2019, June). *Technical guidelines for construction.* Retrieved from washmatters.wateraid.org: https://washmatters.wateraid.org/sites/g/files/jkxoof256/files/technical-guidelines-for-construction-of-institutional-and-public-toilets.pdf

Okun, D. A. (1988). *The Value of Water Supply and Sanitation in Development.* Vol. 78 (11), Pp. 1463-1467: An Assessment: American Journal of Public Health, .

Olukanni, D. O. (2014). *The South-West Experience of Water, .* Valencia, Spain: Proceeding of the International Conference on Technology, Education and Development (INTED 2014).

Rahman, N. (2022). Fishery Ghat: A market unlike any other. *The Daily Star*.

UN. (2000). United Nations Millennium Declaration. *http://www.un.org/millennium/declaration/ares552e.pdf.*

WHO, U. (2012). *UN-Water Global Annual Assessment of Sanitation and Drinking Water Report: The Changes of Extending Sustaining Services.* Switzerland : WHO.

WHO/UNICEF. (2020). *Global water supply and sanitation* .