# Investigation on Inequality and Development of WASH Facilities between Rural and Urban areas in Bangladesh using Ratio, Theil and Concentration Index Approach

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***Abstract:*** *This study aims to find out if Bangladesh has managed to reduce inequality between urban and rural populations in WASH (Water, Sanitation & Hygiene) services throughout the last decade. This study analyzed publicly available WASH data from Joint Monitoring Programme (JMP) website. Using Ratio, Theil Index, and Concentration Index methods, this study finds that the inequality between rural and urban areas in water and hygiene facilities has reduced throughout the last decade, but, has increased in sanitation facilities. Findings summarized that in both urban and rural areas, WASH services are more concentrated on advantaged than disadvantaged subgroups in society. This study found that there is still a high level of inequality between urban and rural areas in basic hygiene and sanitation services, and collaborative effort is needed to reduce that gap. This study also suggests more coordinated policy adaptation and implementation to ensure the availability of WASH services, especially for people living in informal settlements, remote areas, and socially vulnerable groups, to achieve SDG 6 and to create equal opportunity for all.*

**Keywords:** WASH inequality, Development, Theil Index, Concentration Index, Inequality

## 1. Introduction

Since the announcement of the Millennium Development Goals (MDGs) in 2000 and the Sustainable Development Goals (SDGs) in 2015 by the UN, there have been a lot of discussions and studies going on around the world. The main objective of these MDGs and SDGs is to end all forms of poverty; however, the key difference between SDGs and MDGs is their integration of environmental, economic, and social aspects. Through SDGs, the UN wants to ensure equal and sustainable development for the poor and vulnerable population by focusing on including everyone in the development process so that no one is left behind. One of the goals of SDGs is Goal 6 (7c in MDGs): 'Ensure availability and sustainable management of water and sanitation for all', which is the subject of discussion in this paper. Discussion on this goal is important because not only

UN has recognized getting access to water and sanitation services is a human right for everyone (Luh et al., 2013) but also wider and equal access to these services can generate long-term economic benefits which can help reducing poverty (Slaymaker et al., 2007). Even though some researchers have found relative inequality has reduced in many developing nations such as Bangladesh and India (Atkinson & Brandolini, 2010; Hoy & Samman, 2015) however, in some cases, absolute inequality between and inside countries has increased (Hoy, 2015) which made the achievement of this goal even more challenging, especially the growing inequality between rural and urban areas (Wolf et al., 2013).

Bain et al. (2018) have pointed out that achieving SDG 6 not only will ensure everyone has equal access to WASH (water, sanitation, and hygiene) services but also will help achieve other targets such as universal access to basic services under the poverty reduction goal (SDG 1), a safe, inclusive, and effective learning environment (SDG 4), access to quality essential health-care services (SDG 3.8), reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination (SDG 3.9), and of course reducing inequalities (SDG 10). However, despite all the progress made since the announced the Millennium Development Goals (MDGs) in 2000, they've estimated that, in 2018, only 34.4%, 47.7%, and 29.7% of the world population have access to safely managed drinking water, safely managed sanitation and basic hygiene services respectively. Accessibility of these services is even worst in rural areas, which indicates the growing inequality in this sector and how unequal the development is. Furthermore, in South Asian nations (India, Bangladesh, Pakistan, and Nepal), only 56% of the population can access safe drinking water with only 44% of rural households in India, 32% in Pakistan, and 19% in Nepal having this facility (WaterAid, 2019). On the contrary, Bangladesh is doing good in terms of the availability of basic drinking water. According to United Nations Children's Fund (UNICEF) and World Health Organization (WHO), in 2019, 97% of the population in rural and urban areas had basic drinking water facilities. However, when it comes to the availability of safely managed drinking water, 55% of the national population, with 61% of rural and 45% of the urban population, have this facility. Regarding sanitation, 48% of the national, with 47% rural and 51% urban population, have at least a basic facility. The most worrying data we get from this report is related to basic hygiene facilities. Only 35% of the nation, including 26% rural and 51% urban population, came under the basic hygiene facility coverage. From these data, one thing is clear, the government of Bangladesh needs to do a lot of work not only to reach the SDG targets by 2030 but also to reduce the inequality between urban and rural areas.

The aim of this study is to find out if Bangladesh is managed to reduce inequality between urban and rural populations in WASH services throughout the last decade. There are four parts in this paper. Part one will present some findings from previous research about WASH services by reviewing some past literature, specifically keeping

inequality in mind. The second part attempted to create a bridge between equality and economic growth. Data analyses and result, which includes some descriptive data analysis, will be presented in part three. Lastly, in part four, this paper will suggest some recommendations for policymakers to help formulate and implement WASH-related policies.

## 2. Literature Review

According to the Organization's (2019) report, the coverage of using safely managed drinking water globally increased from 61 to 71 percentage points, and the difference between urban and rural areas' coverage declined from 47% to 32% between 2000 to 2017. During the pandemic (COVID 19), around one in four people could not access safely managed drinking water, almost half of the world population was not able to access safely managed sanitation, and three in 10 people did not have handwashing facilities with soap and water in their homes (Fund, 2021). There were large disparities between urban and rural areas in almost all countries; the coverage of WASH service is higher in urban than rural areas (Fund, 2021). In 2020, globally, 54% of the population had access to safely managed sanitation services and even though the basic sanitation service level is higher in urban areas, the increase in coverage is faster in rural areas (Fund, 2021). Moreover, Progress on household drinking water, sanitation, and hygiene 2000-2020 report that 71% of the population have basic handwashing facilities with soap and water, rest of them have limited or no facilities in their home. It illustrates that the basic hygiene service level is higher in urban than in rural areas. Many studies revealed that generally, there exists inequality in access to WASH services at a different level in the region and especially between urban and rural (Ohwo, 2019).

So, what are the causes of these existing inequalities? Wilbur & Dobias (2015) mentioned 4 types of inequality: spatial, economic, individual, and group-related inequalities. Like Wilbur & Dobias (2015), World Bank in 2017 also found four (4) patterns of inequality: poverty, location, social identity, and time. These patterns were identified by Bank (2017) after conducting studies on the bottom 40% (B40) and top 60% (T60) of the wealth distribution in 18 countries. Spatial/location inequality is one of the reasons inequalities still exist because people living in remote rural areas and slums in urban areas are often forgotten by policymakers and hidden behind national statistics (Pullan et al., 2014). For example, among all the households living in the slums of the five metropolises in Bangladesh, only 13% of them have their own sanitation facilities. Hawkins et al. (2013) found that the current monitoring system in the WASH sector only collects data on overall urban and rural areas; however, to make sure that everyone has the same facilities, people living in slums or informal communities require

more attention. Secondly, economic disparity/poverty inequalities also contribute to these widening inequalities because there is a consensus that the wealthier would get better access to water, sanitation, and hygiene facilities than the poor. Bank (2006) also identifies that wealth is the most important contributing factor in having access to these basic facilities. The third and fourth types of inequality Wilbur & Dobias (2015) have mentioned are individual and group-related inequalities or social identity, according to Bank (2006). Studies found that individuals and groups that are discriminated against based on their gender, age, religion, disabilities, chronic illness, etc., are more likely to be disadvantaged in society (Lande, 2016). Andres et al. (2017) also found that there was little improvement in reducing inequality among the most vulnerable group, such as women and physically challenged people.

Climate change is another concerning matter which is significantly affecting access to water for drinking, sanitation, and hygiene, especially for people living in coaster areas in South Asian countries such as India and Bangladesh. River salinity due to increasing sea level, frequent floor, cyclone, and drought reducing the sources of freshwater, which put extreme pressure on people living in the coastal zone (Mimura, 2013; Chang et al., 2011). Additionally, climate change also forces people to migrate from rural coaster areas to urban are due to loss of livelihood, which causes the cities to become overpopulated and congested. This leads to unplanned urbanization resulting in increasing inequality due to a lack of planned water, sanitation, and hygiene facilities.

## 3. Equality and Economic Growth

In economics, equality and fairness are concepts incorporated with Welfare Economics; however, this was first started as a concept of Ethics and Law. Economists such as Ok & Kranich (1998); Savaglio & Vannucci (2007); and Weymark (2003) ranked a set of opportunities in their models according to equality, known as a 'direct' approach. Others, such as Fleurbaey (1994) and Bossert (1995), considered exogenous circumstances, endeavors, prospects, and consequences when developing models known as an 'indirect' approach. It is important for a country to reduce inequality for sustainable economic growth because if social inequality increases, so does economic inequality (Brunori et al., 2013). Furthermore, a higher degree of inequality in society can have a long-term negative effect on a country's future economic growth (Bank, 2006). Not only that, higher inequality can cause unrest in society resulting in more violence and higher social cost, which in turn can deter all the efforts for reduction in poverty and achieving higher economic growth. That's why among all the global risks, Forum (2012) identified inequality as one of the tops.

Moreover, if there is inequality in accessing the basic health facilities such as water, sanitation, and hygiene means the allocation of resources is not efficient in society, and potential future economic growth will be lower. And if this continues in the long term, a part of the population may go down into inequality traps and may not be able to participate in economic activities, which can then be damaging to economic growth. Additionally, future human capital accumulation will greatly affect if children do not have proper access to basic opportunities such as education, safe drinking water, and sanitation because these are needed for a child to realize their full potential (Barros et al., 2009).

## 4. Data and Methodology

### 4.1 Database

The data on WASH services used in this study is collected from the WHO/UNICEF Joint Monitoring Programme (JMP) website (washdata.org), including national data and wealth quintile survey data. The national data set were collected from 2010 to 2020, which includes the national and rural and urban coverage of WASH services. The wealth quintile survey from 2011, 2014, 2018, and 2019 were collected which presents the raw data from the household survey conducted by JMP based on their wealth group and region of residence (urban/rural). Raw data on the availability of basic sanitation and hygiene services to households was available only for these years between 2010 and 2020 and for safely managed water services, only 2018 and 2019 raw data were available. Data on the population of Bangladesh is collected from the World Bank website.

### 4.2 Indicator of WASH

JMP tracks the progress of the water and sanitation services against 5 service ladders (Safely managed, Basic, Limited, Unimproved, and No service) and hygiene service against 3 service ladders (Basic, Limited, and No service). The service ladders selected for this paper and their descriptions according to JMP are given below.

**Table 1: Description of the Selected Service Ladder of WASH Program**

| WASH service | Service Ladder | Description |
|---|---|---|
| Drinking Water | Safely managed | Drinking water from an improved water source that is located on premises, available when needed and free from faecal and priority chemical contamination |
| Sanitation | Safely managed | Use of improved facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated offsite |
| | Basic | Use of improved facilities that are not shared with another household |
| Hygiene | Basic | Availability of a handwashing facility on premises with soap and water |

***Source:*** Joint Monitoring Programme (JMP)

### 4.3 Analytical Strategies

In this paper, the level of inequality is estimated using three measurement techniques. These techniques are independent of each other and provide their own estimation of inequality. Two of the techniques, i.e., Ratio and Theil Index are adopted from the 'Health Inequality Monitoring' handbook published by WHO. The concentration Index is the third measurement used in this paper, which is adapted from the statistical workbook published by Fuller & Lury (1977).

#### 4.3.1 Ratio (R)

Ratio (R) is categorized by WHO as a simple measure (also called pairwise comparisons) to estimate unweighted inequality between two groups in a society such as most advantageous and least advantageous, in this paper between urban and rural. The formula is:

$$R = y_{max} / y_{min}. \quad (1)$$

Here, y-max is the favorable coverage of the WASH indicator between urban and rural and y-min is the adverse coverage of the WASH indicator between urban and rural. R takes only positive values. If there is no inequality, R will be equal to 1. The further value of R from 1, the higher the level of inequality.

However, simple measure like Ratio has a couple of weaknesses. The first one is if there are more than 2 groups, it ignores all other subgroup lies between 2 extremes, and the second one is it doesn't consider the size of the group. Since R in this paper is estimated between urban and rural and there is no subgroup between them, there is no need to worry about the first weakness. To overcome the second weakness, a more complex measure i.e., Theil Index is used to estimate inequalities.

### 4.3.2 Theil Index (TI)

Theil Index (TI) is used to measure relative inequality between subgroups where there is no natural ordering among the groups, in this case, urban and rural. It generates a single number that expresses the extent of inequality present across all the subgroups. The TI is calculated using the following formula:

$$T = \sum_{i=1}^{N} p_i r_i ln(r_i) \quad (2)$$

Here, pi is the proportion of the population in subgroup i, ri is the ratio of the WASH indicator in sub-group i. For easier interpretation, TI is multiplied by 1000. TI will always be a positive value and will take the value of zero if there is no inequality. The higher the value of TI, the higher the level of inequality.

### 4.3.3 Concentration Index (CI)

Ratio and Theil Index are good measures of inequality. However, these don't take the wealth factor into consideration, and we know the wealth of households is the most important determinant for the kind of WASH facilities they would have. The Concentration Index (CI) measures relative inequality across multiple subgroups with natural ordering such as wealth. It reveals whether the WASH facility is concentrated towards the advantaged or the disadvantaged group. The value of a CI will lie between -1 and +1, and if there is no inequality, CI would be 0. It will take a negative value if the WASH indicator is concentrated towards the disadvantaged subgroup and will be positive if towards the advantaged subgroup. The CI has been estimated using the following formula (Fuller & Lury, 1977):

$CI = (p_1L_2 - p_2L_1) + (p_2L_3 - p_3L_2) + ... + (pT\text{-}_1LT - pT\ LT\text{-}\neg_1)$ (3)

Here, t =1,...,T indicated socio economic groups, p is the cumulative percentage of the sample ranked by economic status in group t, and L is the corresponding Concentration Curve ordinate in group t.

But first Concentration Curve (CC) needs to be drawn which is a visual illustration of CI. CC identifies if there is any socioeconomic inequality exists in the WASH indicators and then quantifies the magnitude of inequality by estimating CI. CI is defined as twice the area between the CC and the line of equality (the 45-degree line). First, rank the weighted sample of the population from the most disadvantaged subgroup (Quantile 1) to the most

advantaged subgroup (Quantile 5) according to wealth (x-axis). Second, estimate the cumulative fraction of the WASH service available to each corresponding subgroup (y-axis). If the CC lies on the 45-degree line means no inequality. However, if it lies above the line, the WASH indicator is concentrated among the disadvantaged, and if below the line means concentrated among the advantaged subgroups. According to the WHO, if the value of the CI exceeds 0.2, it indicates a reasonably high level of inequality.

Many researchers such as Wagstaff (2000), Gwatkin et al. (2007) and O'Donnell et al. (2007) used CI to measure and compare socioeconomic related inequality in different health-related indicators such as child mortality, child immunization, health subsidies and child malnutrition. However, to the best of my knowledge, there has never been an attempt to measure and compare the degree of socioeconomic inequality in WASH services among the urban and rural populations in Bangladesh using CI. So, this is a small attempt to reduce that knowledge gap.

## 5. Results and Discussion

First, we may explore the results of the investigation. Table 2 presents the percentage of the population in rural and urban areas in Bangladesh that have access to the selected WASH facilities. All the indicators show gradual development with more people having better WASH facilities. Also, the gap between rural and urban areas in water and hygiene facilities has reduced from 18.21 and 29.79 in 2010 to 9.27 and 11.95 in 2020 respectively. On the other hand, the gap in sanitation facility has increased from 3.1 in 2010 to 8.35 in 2020.

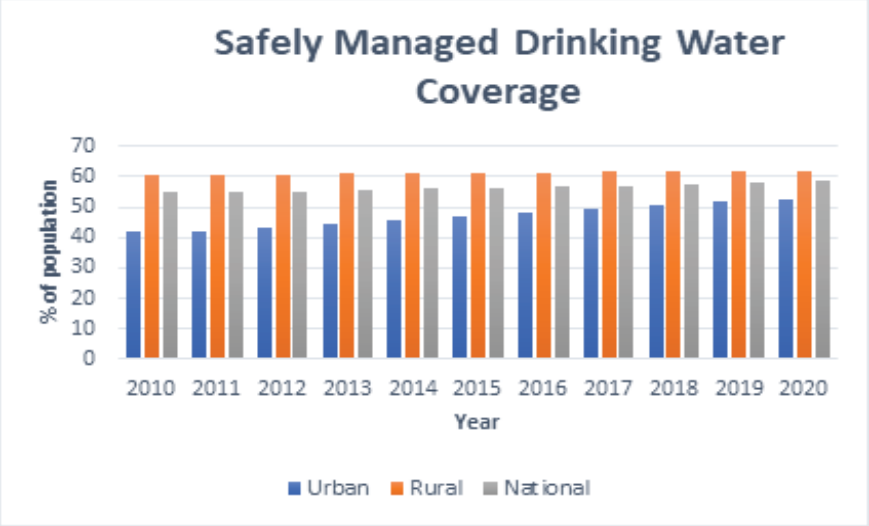
**Table 2: Area based Coverage of the WASH Facilities, Percentage of Population**

| | Safely Managed Water | | Safely Managed Sanitation | | Basic Hygiene | |
|---|---|---|---|---|---|---|
| Year | Rural | Urban | Rural | Urban | Rural | Urban |
| 2010 | 60.47 | 42.26 | 27.48 | 30.58 | 15.35 | 45.14 |
| 2011 | 60.58 | 42.28 | 28.84 | 30.90 | 19.20 | 47.20 |
| 2012 | 60.75 | 43.44 | 30.22 | 31.21 | 23.04 | 49.27 |
| 2013 | 60.91 | 44.60 | 31.61 | 31.52 | 26.89 | 51.33 |
| 2014 | 61.07 | 45.77 | 33.02 | 31.82 | 30.74 | 53.40 |
| 2015 | 61.23 | 46.94 | 34.45 | 32.11 | 34.59 | 55.46 |
| 2016 | 61.40 | 48.10 | 35.90 | 32.40 | 38.44 | 57.53 |
| 2017 | 61.56 | 49.27 | 37.36 | 32.69 | 42.29 | 59.60 |
| 2018 | 61.72 | 50.44 | 38.84 | 32.97 | 46.14 | 61.66 |
| 2019 | 61.89 | 51.61 | 40.34 | 33.24 | 49.99 | 63.73 |
| 2020 | 62.05 | 52.78 | 41.86 | 33.51 | 53.84 | 65.79 |

*Source:* Joint Monitoring Program (JMP)

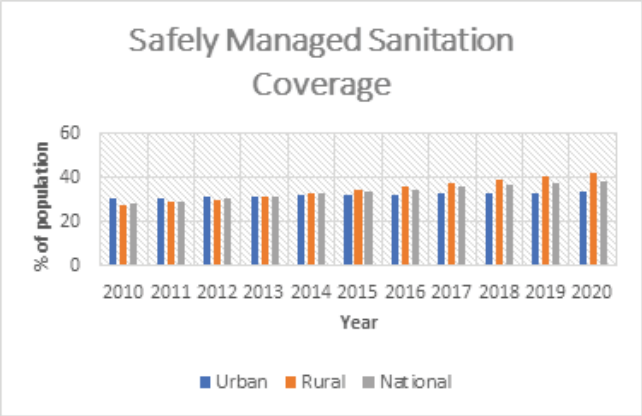
Figures 1, 2, and 3 are the visual presentation of the data from Table 2. These figures clearly show rural areas are doing much better than their urban counterpart in terms of accessibility of safely managed drinking water and safely managed sanitation services; however, they are lacking in basic hygiene coverage but the gap with urban areas has reduced a lot in the last few years.

**Figure 1: Safely Managed Drinking Water Coverage in Bangladesh and Percentage of Population:**




*Source:* Author's own calculation.

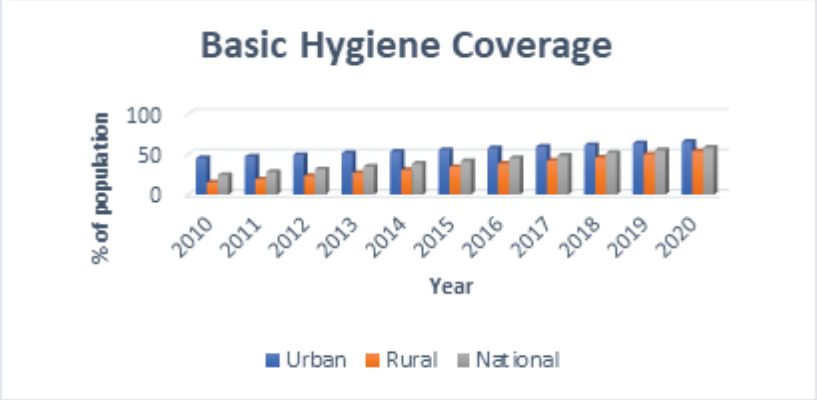
**Figure 2: Safely Managed Sanitation Coverage in Bangladesh, percentage of population:**




*Source:* Author's own calculation

ISSN 2664-3413 (Print) 2664-3421 (Online)
Daffodil International University Journal of Business and Entrepreneurship, Vol. 15, No. 2, PP 64-91 December-2022

**Figure 3: Basic Hygiene Coverage in Bangladesh and Percentage of Population:**




*Source:* Author's own calculation

### 5.1 Ratio (R)

Tables 3, 4, and 5 each illustrate R calculations of WASH coverage in Bangladesh. Inequality in the availability of safely managed drinking water has been reduced from 1.43 in 2010 to 1.18 in 2020. This also can be said for the basic hygiene service which also reduced from 2.94 in 2010 to 1.22 in 2020. However, in the case of safely managed sanitation services, inequality between rural and urban has increased. Since 2013 when there was no inequality between rural and urban (R=1), it has increased to 1.25 in 2020**.**

**Table 3: Area based inequality in Safely Managed Drinking Water in Bangladesh**

| Year | Coverage in rural area (%) | Coverage in urban area (%) | Ratio $(ymax/ymin)$ |
|---|---|---|---|
| 2010 | 27.48 | 30.58 | 1.11 |
| 2011 | 28.84 | 30.90 | 1.07 |
| 2012 | 30.22 | 31.21 | 1.03 |
| 2013 | 31.61 | 31.52 | 1.00 |
| 2014 | 33.02 | 31.82 | 1.04 |
| 2015 | 34.45 | 32.11 | 1.07 |
| 2016 | 35.90 | 32.40 | 1.11 |
| 2017 | 37.36 | 32.69 | 1.14 |
| 2018 | 38.84 | 32.97 | 1.18 |
| 2019 | 40.34 | 33.24 | 1.21 |
| 2020 | 41.86 | 33.51 | 1.25 |

*Source:* Author's own calculation

**Table 4: Area based Inequality in Safely Managed Sanitation in Bangladesh**

| Year | Coverage in rural area (%) | Coverage in urban area (%) | Ratio ($ymax/ymin$) |
|---|---|---|---|
| 2010 | 60.47 | 42.26 | 1.43 |
| 2011 | 60.58 | 42.28 | 1.43 |
| 2012 | 60.75 | 43.44 | 1.40 |
| 2013 | 60.91 | 44.60 | 1.37 |
| 2014 | 61.07 | 45.77 | 1.33 |
| 2015 | 61.23 | 46.94 | 1.30 |
| 2016 | 61.40 | 48.10 | 1.28 |
| 2017 | 61.56 | 49.27 | 1.25 |
| 2018 | 61.72 | 50.44 | 1.22 |
| 2019 | 61.89 | 51.61 | 1.20 |
| 2020 | 62.05 | 52.78 | 1.18 |

*Source:* Author's own calculation

**Table 5: Area based Inequality in Basic Hygiene in Bangladesh**

| Year | Coverage in rural area (%) | Coverage in urban area (%) | Ratio ($ymax/ymin$) |
|---|---|---|---|
| 2010 | 15.35 | 45.14 | 2.94 |
| 2011 | 19.20 | 47.20 | 2.46 |
| 2012 | 23.04 | 49.27 | 2.14 |
| 2013 | 26.89 | 51.33 | 1.91 |
| 2014 | 30.74 | 53.40 | 1.74 |
| 2015 | 34.59 | 55.46 | 1.60 |
| 2016 | 38.44 | 57.53 | 1.50 |
| 2017 | 42.29 | 59.60 | 1.41 |
| 2018 | 46.14 | 61.66 | 1.34 |
| 2019 | 49.99 | 63.73 | 1.27 |
| 2020 | 53.84 | 65.79 | 1.22 |

*Source:* Author's own calculation

### 5.2 Theil Index (TI)

TI indices for the WASH indicators illustrated in Tables 6, 7 and 8 appear to be consistent with the estimation got in R. Both water and hygiene show a gradual reduction in the level of inequality but have increased in sanitation. All these indices are presented in Figure 4 for easy comparison.

**Table 6: Theil Indices for Safely Managed Drinking Water in Bangladesh**

| Year | Region | Proportion of the population (p) | Ration of coverage in region i to national coverage (ri) | Theil Index*1000 |
|---|---|---|---|---|
| 2010 | rural | 0.42 | 1.10 | 18.58 |
| | urban | 0.13 | 0.77 | |
| 2011 | rural | 0.42 | 1.10 | 19.08 |
| | urban | 0.13 | 0.77 | |
| 2012 | rural | 0.41 | 1.10 | 17.22 |
| | urban | 0.14 | 0.79 | |
| 2013 | rural | 0.41 | 1.10 | 15.42 |
| | urban | 0.15 | 0.80 | |
| 2014 | rural | 0.41 | 1.09 | 13.69 |
| | urban | 0.15 | 0.82 | |
| 2015 | rural | 0.40 | 1.09 | 12.03 |
| | urban | 0.16 | 0.83 | |
| 2016 | rural | 0.40 | 1.08 | 10.46 |
| | urban | 0.17 | 0.85 | |
| 2017 | rural | 0.39 | 1.08 | 8.98 |
| | urban | 0.18 | 0.86 | |
| 2018 | rural | 0.39 | 1.07 | 7.60 |
| | urban | 0.18 | 0.88 | |
| 2019 | rural | 0.39 | 1.07 | 6.32 |
| | urban | 0.19 | 0.89 | |
| 2020 | rural | 0.38 | 1.06 | 5.15 |
| | urban | 0.20 | 0.90 | |

*Source:* Author's own calculation

**Table 7: Theil Indices for Safely Managed Sanitation in Bangladesh**

| Year | Region | Proportion of the population (p) | Ration of coverage in region i to national coverage (ri) | Theil Index*1000 |
|---|---|---|---|---|
| 2010 | rural | 0.19 | 0.97 | 1.09 |
| | urban | 0.09 | 1.08 | |
| 2011 | rural | 0.2 | 0.98 | 0.47 |
| | urban | 0.1 | 1.05 | |
| 2012 | rural | 0.21 | 0.99 | 0.11 |
| | urban | 0.1 | 1.02 | |
| 2013 | rural | 0.21 | 1 | 0 |
| | urban | 0.1 | 1 | |
| 2014 | rural | 0.22 | 1.01 | 0.15 |
| | urban | 0.11 | 0.98 | |
| 2015 | rural | 0.23 | 1.02 | 0.55 |
| | urban | 0.11 | 0.95 | |
| 2016 | rural | 0.23 | 1.04 | 1.2 |
| | urban | 0.11 | 0.93 | |
| 2017 | rural | 0.24 | 1.05 | 2.1 |
| | urban | 0.12 | 0.92 | |
| 2018 | rural | 0.25 | 1.06 | 3.25 |
| | urban | 0.12 | 0.9 | |
| 2019 | rural | 0.25 | 1.07 | 4.65 |
| | urban | 0.12 | 0.88 | |
| 2020 | rural | 0.26 | 1.08 | 6.3 |
| | urban | 0.13 | 0.87 | |
| | urban | 0.13 | 0.87 | |

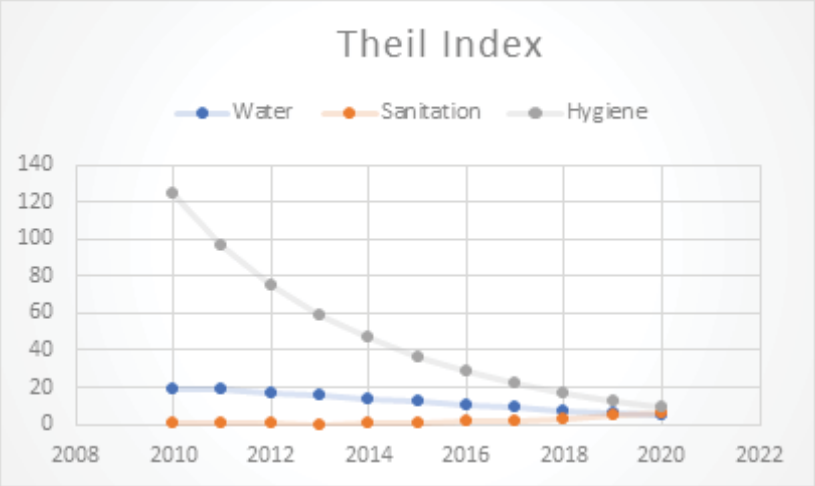
***Source:*** Author's own calculation

**Table 8: Theil Indices for Basic Hygiene in Bangladesh**

| Year | Region | Proportion of the population (p) | Ration of coverage in region i to national coverage (ri) | Theil Index*1000 |
|---|---|---|---|---|
| 2010 | rural | 0.11 | 0.63 | 124.94 |
| | urban | 0.14 | 1.85 | |
| 2011 | rural | 0.13 | 0.69 | 96.51 |
| | urban | 0.15 | 1.69 | |
| 2012 | rural | 0.16 | 0.73 | 75.34 |
| | urban | 0.16 | 1.57 | |
| 2013 | rural | 0.18 | 0.77 | 59.12 |
| | urban | 0.17 | 1.47 | |
| 2014 | rural | 0.2 | 0.8 | 46.44 |
| | urban | 0.18 | 1.39 | |
| 2015 | rural | 0.23 | 0.83 | 36.36 |
| | urban | 0.19 | 1.33 | |
| 2016 | rural | 0.25 | 0.85 | 28.27 |
| | urban | 0.2 | 1.27 | |
| 2017 | rural | 0.27 | 0.87 | 21.74 |
| | urban | 0.21 | 1.23 | |
| 2018 | rural | 0.29 | 0.89 | 16.45 |
| | urban | 0.23 | 1.19 | |
| 2019 | rural | 0.31 | 0.91 | 12.18 |
| | urban | 0.24 | 1.16 | |
| 2020 | rural | 0.33 | 0.92 | 8.75 |
| | urban | 0.25 | 1.13 | |

*Source:* Author's own calculation

**Figure 4: Theil Indices for WASH Indicators in Bangladesh**




*Source:* Author's own calculation

### 5.3 Concentration Curve (CC) and Concentration Index (CI)

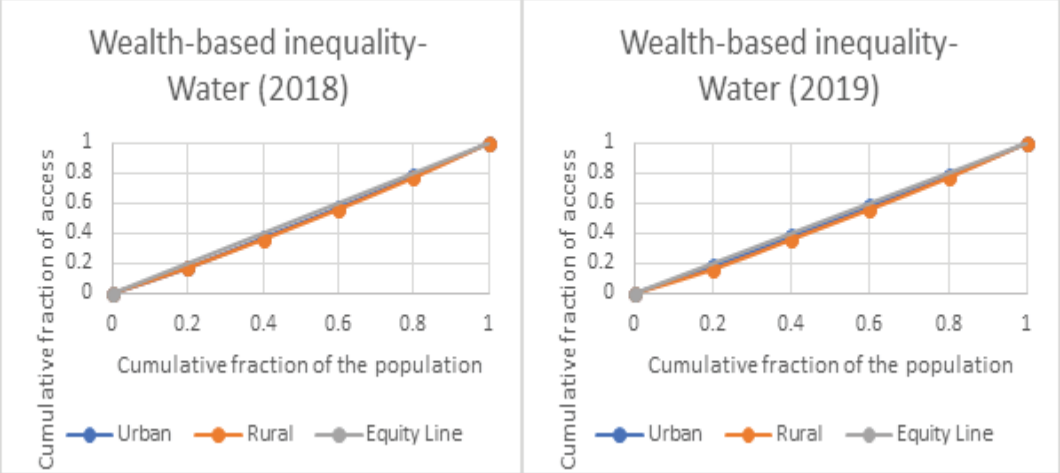
CC and CI are estimated for safely managed drinking water, basic sanitation, and basic hygiene services in rural and urban areas based on the raw data available on the JMP website. CC and CI for safely managed water facilities are estimated for 2018 and 2019 and for basic sanitation and hygiene facilities are for 2011, 2014, 2018, and 2019. (See appendix)

#### 5.3.1 Safely Managed Drinking Water

CC of the wealth based relative inequality in safely managed drinking water service from 2018 and 2019 are presented in figure 5 and the final estimation of the CI in table 9.

ISSN 2664-3413 (Print) 2664-3421 (Online)
Daffodil International University Journal of Business and Entrepreneurship, Vol. 15, No. 2, PP 64-91 December-2022

**Figure 5: Wealth based Relative Inequality in Safely Managed Water Service in Rural and Urban Areas in Bangladesh, Represented using Concentration Curves, 2018 & 2019**




*Source:* Author's own calculation

**Table 9: Wealth based Relative Inequality in Safely Managed Water Service in Rural and Urban Areas in Bangladesh, 2018 - 2019**

| | 2018 | | 2019 | |
|---|---|---|---|---|
| | Urban | Rural | Urban | Rural |
| Household wealth | CI | CI | CI | CI |
| Quintile 1 (poorest) | 0.00527 | 0.00435 | 0.00325 | 0.00691 |
| Quintile 2 | 0.00836 | 0.00685 | 0.00604 | 0.00925 |
| Quintile 3 | 0.01399 | 0.01449 | 0.00799 | 0.01701 |
| Quintile 4 | 0.01755 | 0.02687 | 0.01506 | 0.02795 |
| Quintile 5 (richest) | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| | **0.04516** | **0.05256** | **0.03233** | **0.06111** |

*Source:* Author's own calculation

Wealth-based relative inequality inaccessibility of safely managed drinking water between urban and rural seems to be relatively less in Bangladesh; however, positive CI and CC lie below the equity line, indicating that the advantaged subgroup still has more of the facility than the disadvantaged group. Furthermore, it appears that inequality between wealthy groups in urban areas has reduced by 0.01283 from 2018 to 2019 but has slightly increased in rural areas by 0.00855. This is by no means a big rise but the government needs to be cautious with their policies so that this doesn't keep increasing.

### 5.3.2 Basic Sanitation

CC of the wealth based relative inequality in basic sanitation facilities from 2011, 2014, 2018, and 2019 are presented in figure 6 and the final estimation of the CI in Table 10.

**Figure 6: Wealth based Relative Inequality in basic Sanitation Service in Rural and Urban Areas in Bangladesh, Represented Using Concentration Curves, 2011, 2014 and 2018 - 2019**


*Source:* Author's own calculation

**Table 10: Wealth based Relative Inequality in basic Sanitation Service in Rural and Urban Areas in Bangladesh, 2011, 2014 and 2018 - 2019**

| | 2011 | | 2014 | | 2018 | | 2019 | |
|---|---|---|---|---|---|---|---|---|
| | Urban | Rural | Urban | Rural | Urban | Rural | Urban | Rural |
| Household wealth | CI | CI | CI | CI | CI | CI | CI | CI |
| Quintile 1 (poorest) | 0.00699 | 0.00866 | 0.0034 | 0.00954 | 0.00445 | 0.0057 | 0.00003 | 0.00405 |
| Quintile 2 | 0.00937 | 0.03113 | 0.00299 | 0.02843 | 0.01081 | 0.02859 | 0.00166 | 0.01600 |
| Quintile 3 | 0.06564 | 0.06347 | 0.05700 | 0.06804 | 0.06389 | 0.06625 | 0.05585 | 0.03113 |
| Quintile 4 | 0.14748 | 0.18687 | 0.13222 | 0.12411 | 0.13629 | 0.13833 | 0.09871 | 0.05578 |
| Quintile 5 (richest) | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| | **0.22948** | **0.29013** | **0.19561** | **0.23012** | **0.21546** | **0.23887** | **0.15626** | **0.10695** |

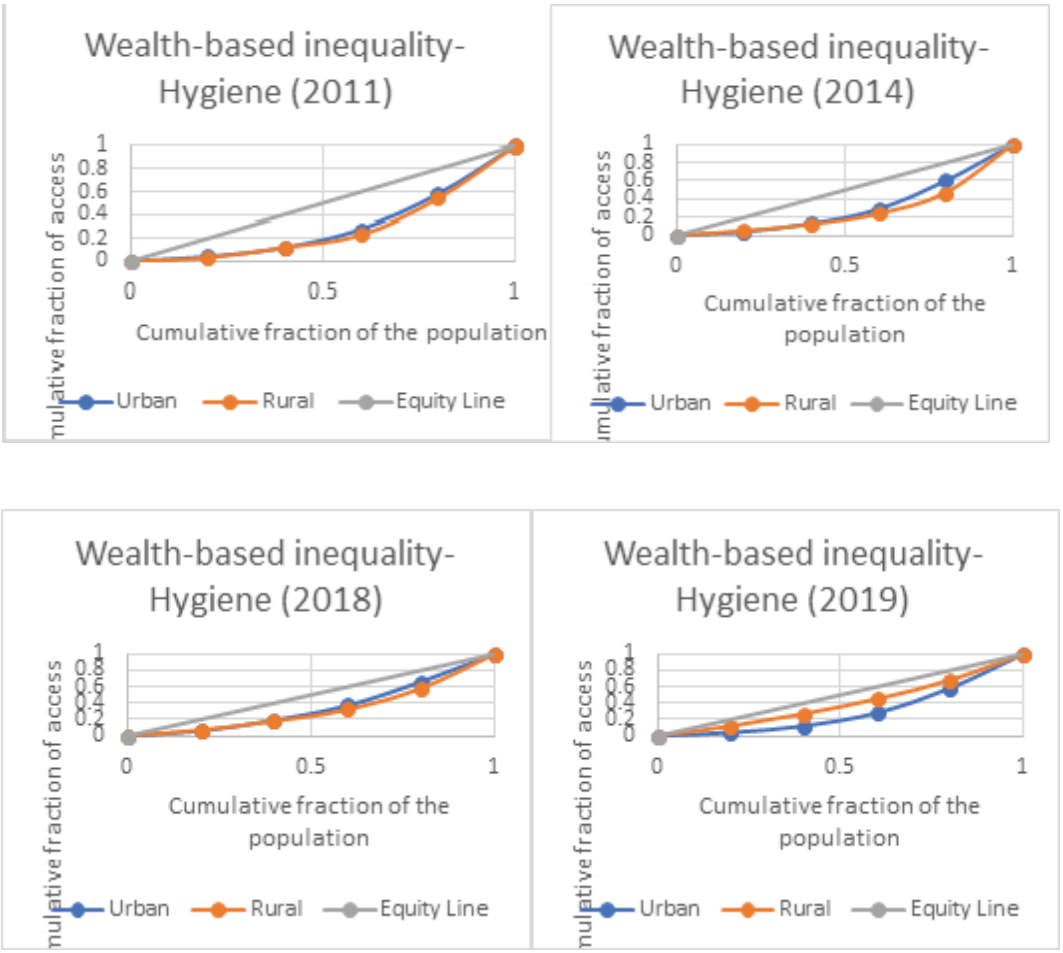
*Source:* Author's own calculation

Even though the situation has improved a lot since 2011, inequality between urban and rural areas in having basic sanitation facilities is still relatively high. CI has reduced by 0.07322 from 2011 to 2019 in urban and 0.18318 in rural, but this was because the higher income subgroups such as quintile 3 and 4 in both urban and rural areas were getting more of this service than the lower-income subgroups. Also, lying the CC below the equity line and positive CI suggest the facility is still more concentrated among the advantaged subgroups.

### 5.3.3 Basic Hygiene

CC of the wealth based relative inequality in basic hygiene facilities from 2011, 2014, 2018, and 2019 are presented in figure 7 and the final estimation of the CI is in Table 11.

**Figure 7: Wealth based Relative Inequality in basic Hygiene Service in Rural and Urban Areas in Bangladesh, Represented Using Concentration Curves, 2011, 2014 and 2018 - 2019**




*Source:* Author's own calculation

**Table 11: Wealth based Relative Inequality in basic Hygiene Service in Rural and Urban Areas in Bangladesh, 2011, 2014 and 2018 - 2019**

| | 2011 | | 2014 | | 2018 | | 2019 | |
|---|---|---|---|---|---|---|---|---|
| | Urban | Rural | Urban | Rural | Urban | Rural | Urban | Rural |
| Household wealth | CI | CI | CI | CI | CI | CI | CI | CI |
| Quintile 1 (poorest) | 0.00712 | 0.01275 | 0.01059 | 0.00415 | 0.01344 | 0.00807 | 0.00633 | 0.00625 |
| Quintile 2 | 0.03933 | 0.02004 | 0.03901 | 0.02314 | 0.03750 | 0.02169 | 0.01889 | 0.01682 |
| Quintile 3 | 0.13035 | 0.07160 | 0.12302 | 0.08884 | 0.09557 | 0.08562 | 0.06119 | 0.04971 |
| Quintile 4 | 0.22430 | 0.36431 | 0.19935 | 0.32992 | 0.13899 | 0.22434 | 0.09128 | 0.12110 |
| Quintile 5 (richest) | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| | **0.40110** | **0.46871** | **0.37197** | **0.44605** | **0.28549** | **0.33971** | **0.17770** | **0.19388** |

*Source:* Author's own calculation

The biggest concern among the WASH indicators in Bangladesh is the inequality in basic hygiene services. Like the other WASH indicators, wealth base inequality between urban and rural has substantially improved since 2011; however, there is still a higher level of inequality exist at 0.17770 in urban and 0.19388 in rural. It appears that there is little improvement among the quintile 1 subgroup in urban and 2 in rural. CC below equity line and positive CI means advantaged subgroups such as quintiles 3, 4, and 5 have greater access to the facility than the most disadvantaged group (quintiles 1 and 2).

## 6. Policy Recommendations

The result from the analysis has shown that there is a significant reduction in inequality of WASH services in both urban and rural areas. However, this analysis also revealed that there is still a higher level of inequality exists. In a recent study, Ahmed et al. (2021) found that 99.5%, 60.7%, and 56.3% of the households in Bangladesh have access to basic water, sanitation, and hygiene facilities, respectively, with only 40.2% having all three of them. They have also found that households with high income, higher education, and 5+ family members have a higher possibility to have basic WASH facilities. So, what Bangladesh government can do to make sure all households in the country can have equal access to the WASH facilities? A few suggestions are made below to increase access to WASH.

- More government initiative needs to be taken to include the population living in geographically detached such as people living in islands and remote areas. Informal settlers such as people living in slums should be compensated with targeted projects to bring them within national WASH facilities.

- It is well documented that in many countries poorest two quintiles are the subgroups that miss out when it comes to improving WASH facilities. Policies need to be taken and implemented specifically targeting these two subgroups not only to provide them with better facilities but also to carve out the inequalities between the most disadvantaged and advantaged.
- Bangladesh Government is trying to decentralize the government system. However, local government still lacks proper control in policy formulation. They still rely on the central government in various decision-making, such as recruitment and distribution of responsibilities. This creates a lack of understanding about the tasks among the staff members and poor accountability. So, it is important for the central government to include local authorities when formulating policies.
- The local community needs to be involved more when taking on a project as they will be the targeted beneficiary. Consulting with local people will not only help to point out the area that needs improvement but also, they'll feel ownership of the project, which will support implementing projects efficiently. Moreover, a program like WASH which affects everyone in the community, needs to be implemented with the collaboration of different sectors such as local government, private sectors, and non-government organizations (NGOs) (Uddin and Jeong, 2021). If this can be done, it will not only improve public health but also will increase positive awareness of the importance of WASH services among the citizens.

## 7. Conclusion

This study found a considerable amount of inequality still exist between the urban and rural population in Bangladesh as far as WASH services are a concern, especially in sanitation and hygiene services even though this has reduced substantially throughout the last decades. The government also needs to make significant progress not only to bring everyone within the coverage of WASH facilities as more than half of the households still lack all three components but also to ensure everyone has equal access. This paper identified that increase in equal access to WASH facilities can be beneficial to the country's economy in the long run. There are many constraints for many households to access these services, such as affordability, living in informal settlements and hard-to-reach areas, and disjoint policies and projects from different sectors (government, NGOs, and private sectors). The findings of this study wish to contribute to the policymakers and professionals in developing an efficient and comprehensive program for WASH development as it sheds light on the areas that need more attention to ensure SDG 6 can be achieved. However, this study only analyzed 2 out of the 5 ladders from WASH indicators so there is a scope for a more comprehensive study by including all the ladders. Lastly, making equal WASH facilities available to everyone will not only help the country's economic growth by building a healthier labor force but also promote social justice and sustainability.

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## Appendix

**Table 12: Estimation of Concentration Index - Sanitation**

**2011**

| Household wealth | Access rate | population | relative frequency | cumulative frequency | f_access | cum_f_access | q | CI |
|---|---|---|---|---|---|---|---|---|
| Urban | | | | | | | | |
| Quintile 1 (poorest) | 26.40 | 4039 | 0.2 | 0.2 | 5.28 | 0.11 | 0.11 | 0.00699 |
| Quintile 2 | 34.00 | 4035 | 0.2 | 0.4 | 6.80 | 0.14 | 0.25 | 0.00937 |
| Quintile 3 | 35.40 | 4040 | 0.2 | 0.6 | 7.08 | 0.15 | 0.41 | 0.06564 |
| Quintile 4 | 57.40 | 4041 | 0.2 | 0.8 | 11.48 | 0.24 | 0.65 | 0.14748 |
| Quintile 5 (richest) | 81.40 | 4035 | 0.2 | 1 | 16.28 | 0.35 | 1.00 | 0.00000 |
| | | 20190 | | | 46.92 | | | 0.22948 |
| Rural | | | | | | | | |
| Quintile 1 | 13.30 | 12590 | 0.2 | 0.2 | 2.66 | 0.08 | 0.08 | 0.00866 |
| Quintile 2 | 21.50 | 12591 | 0.2 | 0.4 | 4.30 | 0.12 | 0.20 | 0.03113 |
| Quintile 3 | 31.30 | 12587 | 0.2 | 0.6 | 6.26 | 0.18 | 0.38 | 0.06347 |
| Quintile 4 | 40.70 | 12595 | 0.2 | 0.8 | 8.14 | 0.23 | 0.62 | 0.18687 |
| Quintile 5 | 67.60 | 12586 | 0.2 | 1 | 13.52 | 0.39 | 1.00 | 0.00000 |
| | | 62949 | | | 34.88 | | | 0.29013 |

**2014**

| Household wealth | Access rate | population | relative frequency | cumulative frequency | f_access | cum_f_access | q | CI |
|---|---|---|---|---|---|---|---|---|
| Urban | | | | | | | | |
| Quintile 1 | 39.00 | 4412 | 0.20 | 0.2 | 7.77 | 0.14 | 0.13 | 0.00340 |
| Quintile 2 | 39.10 | 4444 | 0.20 | 0.4 | 7.85 | 0.15 | 0.28 | 0.00299 |
| Quintile 3 | 39.00 | 4424 | 0.20 | 0.6 | 7.80 | 0.15 | 0.42 | 0.05700 |
| Quintile 4 | 63.20 | 4424 | 0.20 | 0.8 | 12.63 | 0.24 | 0.66 | 0.13222 |
| Quintile 5 | 88.40 | 4428 | 0.20 | 1 | 17.69 | 0.33 | 0.98 | 0.00000 |
| | | 22132 | | | 53.74 | | | 0.19561 |

| Rural | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Household wealth | Access rate | population | relative frequency | cumulative frequency | f_access | cum_f_access | q | CI |
| Household wealth | Access rate | population | relative frequency | cumulative frequency | f_access | cum_f_access | q | CI |
| Quintile 1 | 24.70 | 11802 | 0.20 | 0.2 | 4.93 | 0.11 | 0.09 | 0.00954 |
| Quintile 2 | 32.20 | 11829 | 0.20 | 0.4 | 6.45 | 0.14 | 0.23 | 0.02843 |
| Quintile 3 | 43.30 | 11813 | 0.20 | 0.6 | 8.66 | 0.18 | 0.41 | 0.06804 |
| Quintile 4 | 58.80 | 11805 | 0.20 | 0.8 | 11.75 | 0.25 | 0.66 | 0.12411 |
| Quintile 5 | 75.10 | 11824 | 0.20 | 1 | 15.03 | 0.32 | 0.98 | 0.00000 |
| | | 59073 | | | 46.82 | | | 0.23012 |

**2018**

| Urban | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Household wealth | Access rate | population | relative frequency | cumulative frequency | f_access | cum_f_access | q | CI |
| Quintile 1 | 28.40 | 4893 | 0.2 | 0.2 | 5.68 | 0.12 | 0.12 | 0.00445 |
| Quintile 2 | 34.90 | 4896 | 0.2 | 0.4 | 6.98 | 0.14 | 0.26 | 0.01081 |
| Quintile 3 | 38.80 | 4896 | 0.2 | 0.6 | 7.76 | 0.16 | 0.42 | 0.06389 |
| Quintile 4 | 60.50 | 4901 | 0.2 | 0.8 | 12.10 | 0.25 | 0.67 | 0.13629 |
| Quintile 5 | 82.70 | 4897 | 0.2 | 1 | 16.54 | 0.34 | 1.00 | 0.00000 |
| | | 24483 | | | 49.06 | | | 0.21546 |
| Rural | | | | | | | | |
| Household wealth | Access rate | population | relative frequency | cumulative frequency | f_access | cum_f_access | q | CI |
| Quintile 1 | 23.10 | 12910 | 0.2 | 0.2 | 4.62 | 0.10 | 0.10 | 0.00570 |
| Quintile 2 | 30.10 | 12914 | 0.2 | 0.4 | 6.02 | 0.13 | 0.23 | 0.02859 |
| Quintile 3 | 43.50 | 12912 | 0.2 | 0.6 | 8.70 | 0.19 | 0.41 | 0.06625 |
| Quintile 4 | 58.20 | 12911 | 0.2 | 0.8 | 11.64 | 0.25 | 0.66 | 0.13833 |
| Quintile 5 | 79.30 | 12912 | 0.2 | 1 | 15.86 | 0.34 | 1.00 | 0.00000 |
| | | 64559 | | | 46.84 | | | 0.23887 |

**2019**

| Urban | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Household wealth | Access rate | population | relative frequency | cumulative frequency | f_access | cum_f_access | q | CI |
| Quintile 1 | 49.50 | 11339 | 0.20 | 0.2 | 9.90 | 0.15 | 0.15 | 0.00003 |
| Quintile 2 | 48.60 | 11342 | 0.20 | 0.4 | 9.72 | 0.15 | 0.30 | 0.00166 |
| Quintile 3 | 49.90 | 11345 | 0.20 | 0.6 | 9.98 | 0.15 | 0.45 | 0.05585 |
| Quintile 4 | 79.20 | 11334 | 0.20 | 0.8 | 15.83 | 0.24 | 0.70 | 0.09871 |
| Quintile 5 | 96.50 | 11340 | 0.20 | 1 | 19.30 | 0.30 | 1.00 | 0.00000 |
| | | 56700 | | | 64.74 | | | 0.15626 |
| Rural | | | | | | | | |
| Household wealth | Access rate | population | relative frequency | cumulative frequency | f_access | cum_f_access | q | CI |
| Quintile 1 | 47.60 | 40851 | 0.2 | 0.2 | 9.52 | 0.15 | 0.15 | 0.00405 |
| Quintile 2 | 54.70 | 40853 | 0.2 | 0.4 | 10.94 | 0.17 | 0.32 | 0.01600 |
| Quintile 3 | 64.30 | 40854 | 0.2 | 0.6 | 12.86 | 0.20 | 0.52 | 0.03113 |
| Quintile 4 | 72.40 | 40850 | 0.2 | 0.8 | 14.48 | 0.23 | 0.75 | 0.05578 |
| Quintile 5 | 82.30 | 40852 | 0.2 | 1 | 16.46 | 0.26 | 1.00 | 0.00000 |
| | | 204260 | | | 64.26 | | | 0.10695 |

***Source:*** Concentration Index

ISSN 2664-3413 (Print) 2664-3421 (Online)
Daffodil International University Journal of Business and Entrepreneurship, Vol. 15, No. 2, PP 64-91 December-2022

**Table 13: Estimation of Concentration Index - Water**

**2018**

| Household wealth | Access rate | population | relative frequency | Urban cumulative frequency | f_access | cum_f_access | q | CI |
|---|---|---|---|---|---|---|---|---|
| Quintile 1 | 71.80 | 4755 | 0.2 | 0.2 | 14.36 | 0.17 | 0.17 | 0.00527 |
| Quintile 2 | 83.80 | 4812 | 0.2 | 0.4 | 16.76 | 0.20 | 0.37 | 0.00836 |
| Quintile 3 | 87.10 | 4815 | 0.2 | 0.6 | 17.42 | 0.20 | 0.57 | 0.01399 |
| Quintile 4 | 91.10 | 4867 | 0.2 | 0.8 | 18.22 | 0.21 | 0.78 | 0.01755 |
| Quintile 5 | 93.00 | 4812 | 0.2 | 1 | 18.60 | 0.22 | 1.00 | 0.00000 |
| | | 24061 | | | 85.36 | | | 0.04516 |
| Household wealth | Access rate | population | relative frequency | Rural cumulative frequency | f_access | cum_f_access | q | CI |
| Quintile 1 | 69.40 | 12452 | 0.2 | 0.2 | 13.88 | 0.17 | 0.17 | 0.00435 |
| Quintile 2 | 76.80 | 12588 | 0.2 | 0.4 | 15.36 | 0.19 | 0.36 | 0.00685 |
| Quintile 3 | 79.30 | 12491 | 0.2 | 0.6 | 15.86 | 0.20 | 0.56 | 0.01449 |
| Quintile 4 | 84.40 | 12599 | 0.2 | 0.8 | 16.88 | 0.21 | 0.77 | 0.02687 |
| Quintile 5 | 90.60 | 12740 | 0.2 | 1 | 18.12 | 0.23 | 1.00 | 0.00000 |
| | | 62870 | | | 80.10 | | | 0.05256 |

**2019**

| Household wealth | Access rate | population | relative frequency | Urban cumulative frequency | f_access | cum_f_access | q | CI |
|---|---|---|---|---|---|---|---|---|
| Quintile 1 | 76.90 | 11127 | 0.2 | 0.2 | 15.38 | 0.18 | 0.18 | 0.00325 |
| Quintile 2 | 84.40 | 11280 | 0.2 | 0.4 | 16.88 | 0.20 | 0.38 | 0.00604 |
| Quintile 3 | 87.40 | 11322 | 0.2 | 0.6 | 17.48 | 0.20 | 0.58 | 0.00799 |
| Quintile 4 | 88.80 | 11331 | 0.2 | 0.8 | 17.76 | 0.21 | 0.79 | 0.01506 |
| Quintile 5 | 92.60 | 11338 | 0.2 | 1 | 18.52 | 0.22 | 1.00 | 0.00000 |
| | | 56398 | | | 86.02 | | | 0.03233 |
| Household wealth | Access rate | population | relative frequency | Rural cumulative frequency | f_access | cum_f_access | q | CI |
| Quintile 1 | 67.50 | 12452 | 0.2 | 0.2 | 13.50 | 0.16 | 0.16 | 0.00691 |
| Quintile 2 | 79.70 | 12588 | 0.2 | 0.4 | 15.94 | 0.19 | 0.35 | 0.00925 |
| Quintile 3 | 82.10 | 12491 | 0.2 | 0.6 | 16.42 | 0.20 | 0.55 | 0.01701 |
| Quintile 4 | 87.40 | 12599 | 0.2 | 0.8 | 17.48 | 0.21 | 0.77 | 0.02795 |
| Quintile 5 | 93.00 | 12740 | 0.2 | 1 | 18.60 | 0.23 | 1.00 | 0.00000 |
| | | 62870 | | | 81.94 | | | 0.06111 |

***Source:*** Concentration Index

**Table 14: Estimation of Concentration Index - Hygiene**

**2011**

| Household wealth | Access rate | population | relative frequency | Urban cumulative frequency | f_access | cum_f_access | q | CI |
|---|---|---|---|---|---|---|---|---|
| Quintile 1 | 7.90 | 4025 | 0.2 | 0.2 | 1.58 | 0.04 | 0.04 | 0.00712 |
| Quintile 2 | 17.00 | 4023 | 0.2 | 0.4 | 3.40 | 0.08 | 0.12 | 0.03933 |
| Quintile 3 | 35.10 | 4040 | 0.2 | 0.6 | 7.02 | 0.16 | 0.27 | 0.13035 |
| Quintile 4 | 69.20 | 4040 | 0.2 | 0.8 | 13.84 | 0.31 | 0.58 | 0.22430 |
| Quintile 5 | 95.60 | 4005 | 0.2 | 1 | 19.12 | 0.43 | 1.00 | 0.00000 |
| | | 20133 | | | 44.96 | | | 0.40110 |
| Household wealth | Access rate | population | relative frequency | Rural cumulative frequency | f_access | cum_f_access | q | CI |
| Quintile 1 | 2.50 | 12569 | 0.2 | 0.2 | 0.50 | 0.03 | 0.03 | 0.01275 |
| Quintile 2 | 7.20 | 12563 | 0.2 | 0.4 | 1.44 | 0.09 | 0.12 | 0.02004 |
| Quintile 3 | 8.60 | 12537 | 0.2 | 0.6 | 1.72 | 0.11 | 0.24 | 0.07160 |
| Quintile 4 | 15.20 | 12562 | 0.2 | 0.8 | 3.04 | 0.20 | 0.43 | 0.36431 |
| Quintile 5 | 43.30 | 12577 | 0.2 | 1 | 8.66 | 0.56 | 1.00 | 0.00000 |
| | | 62808 | | | 15.36 | | | 0.46871 |

**2014**

| Household wealth | Access rate | population | relative frequency | Urban cumulative frequency | f_access | cum_f_access | q | CI |
|---|---|---|---|---|---|---|---|---|
| Quintile 1 | 9.60 | 4412 | 0.2 | 0.2 | 1.92 | 0.04 | 0.04 | 0.01059 |
| Quintile 2 | 22.50 | 4444 | 0.2 | 0.4 | 4.50 | 0.09 | 0.13 | 0.03901 |
| Quintile 3 | 39.70 | 4422 | 0.2 | 0.6 | 7.94 | 0.16 | 0.30 | 0.12302 |
| Quintile 4 | 73.60 | 4384 | 0.2 | 0.8 | 14.72 | 0.30 | 0.60 | 0.19935 |
| Quintile 5 | 96.70 | 4422 | 0.2 | 1 | 19.34 | 0.40 | 1.00 | 0.00000 |
| | | 22084 | | | 48.42 | | | 0.37197 |
| Household wealth | Access rate | population | relative frequency | Rural cumulative frequency | f_access | cum_f_access | q | CI |
| Quintile 1 | 5.60 | 11792 | 0.2 | 0.2 | 1.12 | 0.05 | 0.05 | 0.00415 |
| Quintile 2 | 7.30 | 11806 | 0.2 | 0.4 | 1.46 | 0.07 | 0.12 | 0.02314 |
| Quintile 3 | 12.20 | 11803 | 0.2 | 0.6 | 2.44 | 0.12 | 0.24 | 0.08884 |
| Quintile 4 | 23.50 | 11793 | 0.2 | 0.8 | 4.70 | 0.23 | 0.47 | 0.32992 |
| Quintile 5 | 54.60 | 11818 | 0.2 | 1 | 10.92 | 0.53 | 1.00 | 0.00000 |
| | | 59012 | | | 20.64 | | | 0.44605 |

ISSN 2664-3413 (Print) 2664-3421 (Online)
Daffodil International University Journal of Business and Entrepreneurship, Vol. 15, No. 2, PP 64-91 December-2022

**2018**

| Urban | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Household wealth | Access rate | population | relative frequency | cumulative frequency | f_access | cum_f_access | q | CI |
| Quintile 1 | 18.20 | 4892 | 0.2 | 0.2 | 3.64 | 0.06 | 0.06 | 0.01344 |
| Quintile 2 | 36.80 | 4896 | 0.2 | 0.4 | 7.36 | 0.13 | 0.19 | 0.03750 |
| Quintile 3 | 54.20 | 4896 | 0.2 | 0.6 | 10.84 | 0.19 | 0.37 | 0.09557 |
| Quintile 4 | 82.20 | 4901 | 0.2 | 0.8 | 16.44 | 0.28 | 0.66 | 0.13899 |
| Quintile 5 | 97.90 | 4895 | 0.2 | 1 | 19.58 | 0.34 | 1.00 | 0.00000 |
| | | 24480 | | | 57.86 | | | 0.28549 |
| Rural | | | | | | | | |
| Household wealth | Access rate | population | relative frequency | cumulative frequency | f_access | cum_f_access | q | CI |
| Quintile 1 | 11.10 | 12910 | 0.2 | 0.2 | 2.22 | 0.07 | 0.07 | 0.00807 |
| Quintile 2 | 17.50 | 12908 | 0.2 | 0.4 | 3.50 | 0.11 | 0.18 | 0.02169 |
| Quintile 3 | 22.90 | 12912 | 0.2 | 0.6 | 4.58 | 0.14 | 0.32 | 0.08562 |
| Quintile 4 | 39.80 | 12911 | 0.2 | 0.8 | 7.96 | 0.25 | 0.58 | 0.22434 |
| Quintile 5 | 67.30 | 12902 | 0.2 | 1 | 13.46 | 0.42 | 1.00 | 0.00000 |
| | | 64543 | | | 31.72 | | | 0.33971 |

**2019**

| Urban | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Household wealth | Access rate | population | relative frequency | cumulative frequency | f_access | cum_f_access | q | CI |
| Quintile 1 | 40.70 | 4412 | 0.2 | 0.2 | 8.14 | 0.12 | 0.12 | 0.00633 |
| Quintile 2 | 51.20 | 4444 | 0.2 | 0.4 | 10.24 | 0.15 | 0.27 | 0.01889 |
| Quintile 3 | 61.80 | 4422 | 0.2 | 0.6 | 12.36 | 0.18 | 0.45 | 0.06119 |
| Quintile 4 | 85.60 | 4384 | 0.2 | 0.8 | 17.12 | 0.25 | 0.71 | 0.09128 |
| Quintile 5 | 98.30 | 4422 | 0.2 | 1 | 19.66 | 0.29 | 1.00 | 0.00000 |
| | | 22084 | | | 67.52 | | | 0.17770 |
| Rural | | | | | | | | |
| Household wealth | Access rate | population | relative frequency | cumulative frequency | f_access | cum_f_access | q | CI |
| Quintile 1 | 29.20 | 11792 | 0.2 | 0.2 | 5.84 | 0.12 | 0.12 | 0.00625 |
| Quintile 2 | 37.80 | 11806 | 0.2 | 0.4 | 7.56 | 0.15 | 0.27 | 0.01682 |
| Quintile 3 | 44.40 | 11803 | 0.2 | 0.6 | 8.88 | 0.18 | 0.45 | 0.04971 |
| Quintile 4 | 58.10 | 11793 | 0.2 | 0.8 | 11.62 | 0.23 | 0.68 | 0.12110 |
| Quintile 5 | 80.40 | 11818 | 0.2 | 1 | 16.08 | 0.32 | 1.00 | 0.00000 |
| | | 59012 | | | 49.98 | | | 0.19388 |

***Source:*** Concentration Index