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Assessment of people's perception on water logging in Chittagong city corporation area, Bangladesh

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Abstract
Port city Chittagong, the second largest city of Bangladesh is facing various socio-environmental problems due to rapid growth of urbanization. Thus, planning for limited natural and physical resources along with management issues have been considered as the foremost concerns by this city authority. In recent year, it is suffering from extensive water logging problem during the monsoon season which has been creating adverse impacts on the biophysical, economic and social activities. This study aimed to assess the status of water logging with people's perception (N=492) based on their income in 41 wards of Chittagong City Corporation (CCC). The study found that East Sholashahar, East Bakalia, South Patenga are most water logging prone areas by their rank whereas Chandgaon, Lal Khan Bazar, Jamal Khan are at low risk. Besides, most of the people (> 75%) of high and medium income groups in different wards expressed their negligible impacts caused by water logging, whereas none of people from low income group satisfied with this situation for being severely hampered by income generation. This study is important for urban planning in consideration with all types of income groups for achieving sustainable development goals.

Keywords: Chittagong, corporation, perception, socio-environmental

Introduction
Chittagong is 2nd largest city in Bangladesh which is known as port-city of Bangladesh. Topographically Chittagong is a hilly city which is bordered by the Karnafuli river and Bay of Bengal to the southern part (Papry *et al*., 2015) [6] and demarcated by Feni river from GBM delta. It contains most important Karnafuli and Halda river originated from India. The climate condition of Chittagong city is prejudiced by the strong tropical monsoon which is characterized by the heavy rainfall, high temperature in association with humidity (Rashid, 1991) [3]. Chittagong city facing a lot of socio-environmental problems in which water logging during rainy season is the biggest problem (Papry *et al*., 2015) [6].
Nowadays, water logging is a big problem all over the world including Bangladesh in 21st century. It can be considered as a bad consequence of technological usages and economic development at present scenario. Recently, there are many reasons have been identified for increasing water logging problem such as different structural development such as embankments, polders, bridge, culverts, and roads etc. those cause to demise of water drainage system. Hence, unplanned urban development is the main problem for water logging in any developing city or country (Rahman *et al*., 2015).
The Chittagong City Corporation (CCC) maintains their drainage system beside of houses, roads, infrastructure etc. Along with CCC the Chittagong Development Authority (CDA) are jointly working for improving primary and large canals for the drainage system. This drainage system has been using for discharge of sewage from urban area, although it creates water logging due to heavy rainfall because of the weakness of drainage system.
Chittagong City has experienced water logging for last few years which creates infrastructure problem for the city and economic losses of production system with huge amount of damage of existing property and goods (Mowla and Islam 2013) [2]. Most of the area of Chittagong City Corporation are low land and near to the Bay of Bengal. In the central part of Chittagong, there are some low-lying areas i.e., Chawkbazar, Muradpur, Bahaddarhat, Bakalia and Shulokbohor those are mostly suffered from waterlogging during rainy season. Consequently, infrastructure, houses, schools, colleges, shops, business premises are submerged from three to four feet and eventually cause of sufferings to millions inhabitants (Papry *et al*., 2015) [6]. People of low-income group, particularly grocery shop owners, vegetable venders and day labourers are the main sufferers for the water logging problem. Even if, this problem has been increasing gradually day by day while very measures have been taken to improve this situation. In this vein, this study sets aims to identify the water logged areas in Chittagong City Corporation (CCC) and to find out the perception on Water Logging from the various income groups.

Study Area
The study area Chittagong City is situated on the right embankment of the Karnafuli river between 22°-14′ and 22°-24′-30′′ North Latitude and between 91°-46′ and 91°-53′ East Longitude with an area of 100 km^2 for 41 wards (Figure 1). Chittagong Development Authority (CDA) has divided the area into 9 zones based on available facilities and existing problems (Structure Plan, p-3.4.2, 1995).

Fig 1: 41 wards of CCC (***Source*:** Banglapedia)

Methodology of the study

This study is designed based on primary data sources collected through questionnaire survey and direct field observation. There are 492 households from all i.e., 41 wards from CCC were taken into consideration equally for closed questionnaire survey designed on selected environmental variables. This closed questionnaire survey conducted on three types of classified income groups according to their level of incomes (Table 1). For each ward, there are 12 households were selected by stratified random sampling method comprising at least 4 households from each income groups. So, the total number of respondents being 451 and in addition of it 41 cheek list were taken from 41 ward commissioner of the CCC. So, the total respondent is 492.

Table 1: Three income groups based on household's level of income

Income group	Level of Income (Tk. per month)
High income Group	Above 20,000
Middle income Group	5,000 to 20,000
Lower income Group	Less than 5,000

Besides, questionnaire for the perception of quality of urban environmental assessment was framed after through study of relevant literatures. Tabulation and data processing were done both by hand and using MS Excel. Finally, collected data were analysed and presented with the help of statistical (Satisfaction Index & Chi-Square test).

Result and Discussion

Meanwhile, 20 percent respondents are in 20-30 age groups in total, 14 percent are in 30-40 age groups and the rest 66 percent are in 40+ age group respectively (Figure 2).

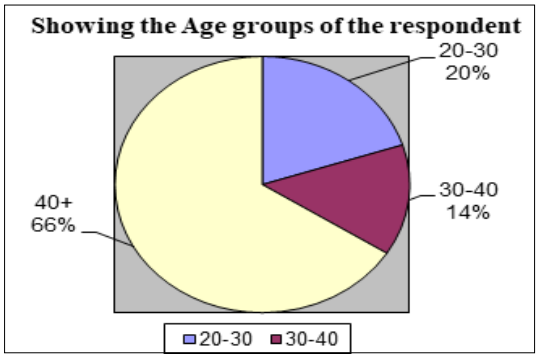

Fig 2: Age Group

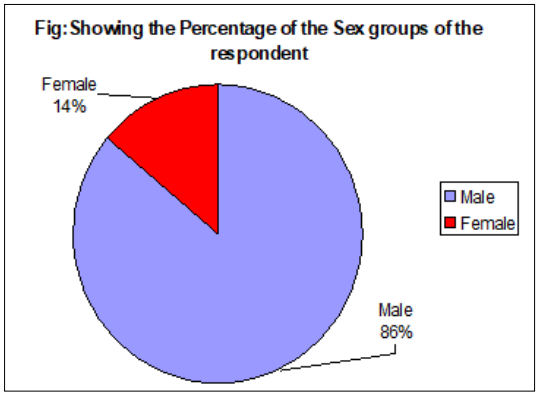

Fig 3: Sex ratio

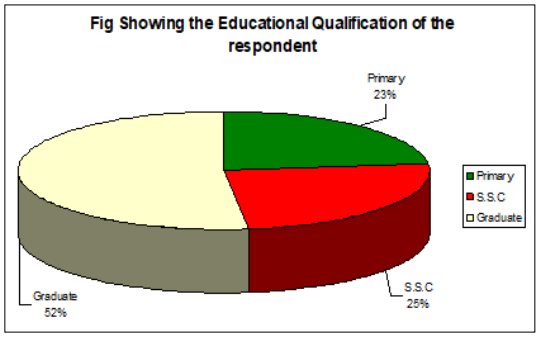

Fig 4: Education

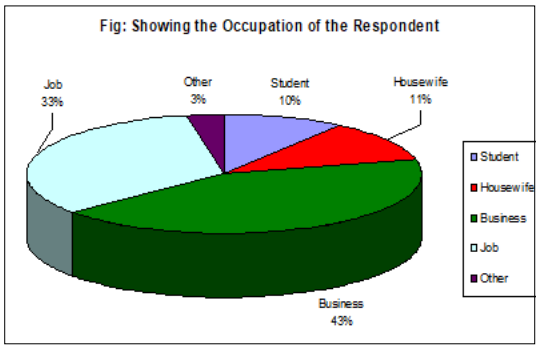

Fig 5: Occupation

Most of the respondents of this study are male (84%) for being available and get easy access to conduct a long questionnaire interviews to them while 16% respondents are female (Figure 3). However, all respondents were educated (Figure 4), eventually this "sophisticated" scaled questionnaire survey were easier to conduct. In addition, there were a number of people from 'elite' society who are actively involved with decision making processes.

23 percent respondents have primary education while 23 percent have passed the SSC and 52 percent are graduates in the total respondent (Figure 4). Besides, 10 percent respondents are found student where 11 percent are housewife, 43 percent are engaged in business and 33 percent are engaged in service (Job) and the rest of the respondent are engaged in other occupation (Figure 5).

In the High-income group, above 75 % respondents were found satisfied with Water logging situation in the ward 1, 2, 4, 6, 10, 14, 21, on the other hand in the ward 25, 40; above 75% respondents were found dissatisfied with Water logging situation. Besides, in the Middle-income group, above 75 % respondents were found satisfied with Water logging situation in the ward 4, 10 while 75% respondents in 16, 17, 19, 25, 40, 41 wards were found dissatisfied with Water logging situation. Moreover, there is no ward has found in which more than 75% of Low income group were satisfied even though 75% respondents from 6, 16, 17, 18, 25, 40 wards were found dissatisfied with Water logging situation. The water logging score is shown in Table 2.

Table 2: Ranking of Water Logging in 41 wards, CCC (***Source***: Field Survey, 2004)

Ward No	Ward Name	Water Logging	Ward No	Ward Name	Water Logging
1.	S. Pahartali	20	21.	Jamal Khan	2
2.	Jalalabad	0	22.	Enayet Bazar	23
3.	Panchlaish	16	23.	N. Pathantool	36
4.	Chandgaon	1	24.	N.Agrabad	9
5.	Mohra	6	25.	Rampur	34
6.	E.Sholashahar	40	26.	N.Halishahar	33
7.	W.Sholashahar	19	27.	S.Agrabad	10
8.	Sulakbahar	18	28.	Pathantool	35
9.	N.Pathantooly	8	29.	W.Madarbari	24
10.	N.Kattli	4	30.	E.madarbari	25
11.	S.Kattli	7	31.	Alkaran	26
12.	Saraipara	5	32.	Anderkilla	11
13.	Pahartali	0	33.	Firingee Bazar	27
14.	Lal Khan Bazar	3	34.	Patharghata	28
15.	Bagmoniram	20	35.	Boxir hat	29
16.	Chawk Bazar	37	36.	Gosaildenga	13
17.	W.Bakalia	38	37.	N.Midl.Halishar	14
18.	E.Bakalia	39	38.	S.Midl.halishar	15
19.	S.Bakalia	30	39.	S.Halishahar	32
20.	Dewan Bazar	17	40.	N.Patenga	31
21.			41.	S.Patenga	40

Note: Low Value corresponds to the satisfactory perception score.

This study revealed that Water logging is severe problem at South Patenga and East Sholashahar. During rainy season these areas inundate by water. Conversely, the minimum percentage score the Jalalabad and Pahartali wards demonstrate the satisfactory water drainage system as well as being situated in high elevation.

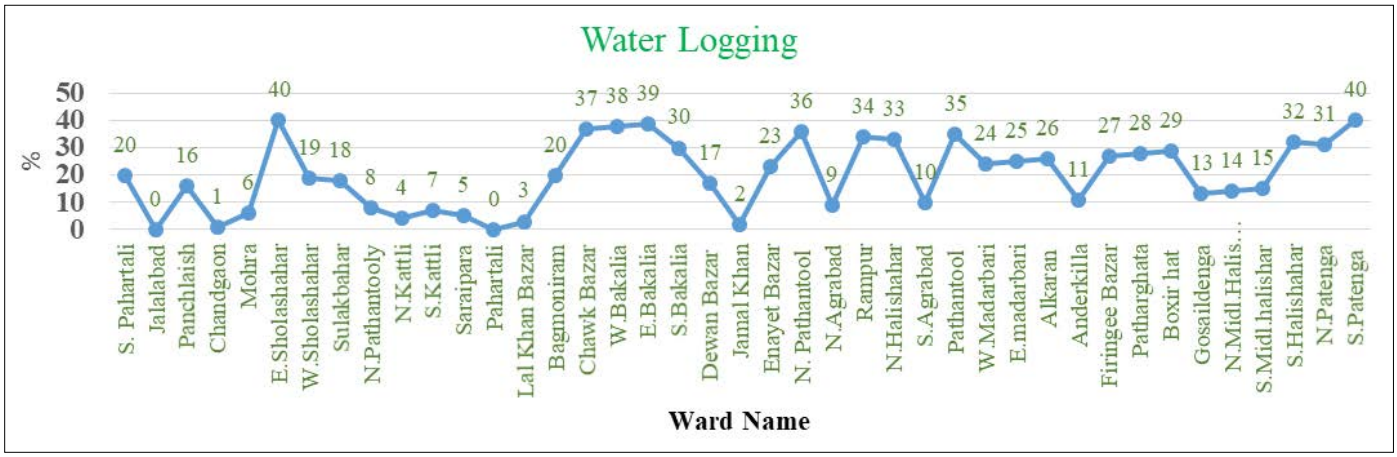

Fig 5: Percentages of Water Logging

Conclusion

Water logging in Chittagong city is the result of unplanned development. Rapid urbanization with unplanned construction has led to congestion of most water drainage that cause to Water logging during heavy rainfall. Consequently, inhabitants during rainy season in every year are suffering from unbearable adverse social, physical and economic losses. Although there are many canals for storm water discharge in CCC but most of the canals are poured by different materials during developmental activities. The Water logging problem in CCC is one of big problem which will be causes of devastating impact on environment. A close coordination among with urban authorities and agencies and collaboration between public and private sector is needed for effective management and sustainable development of the drainage system to reduce water logging in CCC.

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