

URBAN ENVIRONMENTAL QUALITY MAPPING: A PERCEPTION STUDY ON CHITTAGONG METROPOLITAN CITY

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ABSTRACT

Urbanization is a global phenomenon. It is taking place at a faster pace in the less developed countries of the world like Bangladesh. The implication of such urbanization are manifested in mass poverty, gross inequality, high unemployment, crowded housing, proliferation of slums and squatters, deterioration in the environmental condition, highly inadequate supply of water, over crowding in schools and hospitals, increase in traffic jams, road accidents, crimes and social tensions. These features are the characteristics of nearly all urban centers of Bangladesh. The study has endeavored to analyze both the factual status and the perceptual pattern of the environmental quality of Chittagong Metropolitan City. The factual data have been collected from various secondary sources; while the perceptual data are based on a questionnaire survey of opinions of 492 respondents at the household level by city ward. Finally, it has been statistically justified by the use of a satisfaction index to know the degree of satisfaction of the respondents and chi-square test to examine the relationship between the income groups and degree of satisfaction. The study of perception residents of the different environmental aspects, show variation of degree of satisfaction by income groups and by groups of environmental features. The expected growth of population in Chittagong city will have adverse impact on the quality of urban environment.

Key words: Environment, Chittagong, urban, environmental mapping

INTRODUCTION

The quality of urban environment depends a great deal on the quality of infrastructure and their appropriate management. Utility services like sanitation, sewerage, drainage, drinking water supply, garbage disposal, electricity, gas and fuel for cooking are important physical infrastructure for maintaining the urban environmental quality (Islam, 1997). In Chittagong City, various authorities have made some efforts to increase social or urban neighborhood facilities. However, the tremendous population pressure has far exceeded these facilities, which are deteriorating the quality of such services. In a recent government announcement, the Chittagong City is declared to be the commercial capital of Bangladesh. So it is important to know the real status of the environmental quality of the city. In view of the above situation, a study of environmental quality of a major city in Bangladesh is considered timely.

Chittagong Port City is not only the 2nd largest city but also the commercial capital of Bangladesh and is expanding rapidly as well as experiencing environmental pressures like other cities in Bangladesh. Further, the City of Chittagong being the home town of the researcher was selected for the case study. The quality of urban environment depends a great deal on the quality of the essential infrastructure and utility services like sanitation, sewerage, drinking water supply, garbage disposal, electricity and gas or fuel for cooking. With very rapid urban population growth and fast areal expansion of urban centers, low urban administrative and management skills and limitations of resources, the provisions of services in urban areas in Bangladesh quite obviously remain extremely unsatisfactory and highly inadequate (Islam,1992).

According to the Census of 2001, out of 123.85 million populations in the country, Bangladesh had 28.6 million living in its urban areas. Thus, only about 23.1 percent of the total population of Bangladesh lived in urban areas in 2001. Even with such low level of urbanization, the country has a massive size of urban population. The size is bigger than the national population of many countries of the world, including Australia (18.8million in 2000) (Nazem, 2003).The Urban population comprises of all people within a municipality, a town committee, a cantonment board, or a city corporation. Since the 1970s, it has grown more rapidly than the rural population. From 1970 to 1995, its average annual growth rate was some 2%. As a result, the urban population, 7.6% of the total in 1940, increased to 16.4% by 1990. It may reach 30.3% in 2010 and 38.2% in the year 2020, with an estimated growth rate of 5.37% between 2000 and 2005 (Barkat, 2003).

The degradation in the quality of the urban environment is the consequence of these economic activities, which may affect the environment either directly or indirectly. As the urban population grows the enhanced activities exceed the tolerable limits of the urban area. Proper management of such activities or their outcomes is no longer possible resulting in a degraded environment. Thus, rapid urbanization may lead to environmental degradation, which may be manifested in the deterioration of the physical as well as the human environment of the urban area and the rural environment encompassing it. It may also result in the destruction and degradation of different ecosystems having links with the urban area (Khuda, 2001).

The main objective of the study was to create urban environmental quality maps of 41 wards of city to show the spatial pattern of urban environmental quality in Chittagong Metropolitan City. It also aimed to identify and select the indicators of urban environmental quality for Chittagong Metropolitan City. The study tried get the perception and determine the level of satisfaction of environmental quality as expressed by its residents.

METHODS AND MATERIALS

The Study Area

For the present study, Chittagong City Corporation area was taken as the study area which is shown in Figure 1. Chittagong City is not only the principal city of the District of Chittagong but also the second largest city of Bangladesh. It is situated on the right bank of the river Karnafuli between 22°-14' and 22°-24'-30'' North Latitude and between 91°-46' and 91°-53' East Longitude. Historians have given various explanations as to the origin of the name Chittagong. Bernoli in his *Description Historique et Geographic de L'Inde* (1786) explained that the name Chittagong came from the Arabic word Shat (delta) prefixed to Ganga (Ganges), indicating the city at the mouth of the Ganges. The District received the name

‘Chittagong’ from the city. Yet, it evaluated in ancient time, it formed as a modern city after The Moghal period in 1666. The area of Chittagong District is 5209 sq. km. According to Chittagong city Corporation, the area of Chittagong City is 100 sq. km. According to BBS, the area of Chittagong city is 209.67 sq.km. Chittagong City has 41 wards in total. Chittagong Development Authority (CDA) has divided the area into 9 Zone on the basis of some facilities provided and problem arises (CDA Structure Plan, p-3.4.2, 1995). In the present study for the purpose of easier creation of the map and interpretation of the study area, 41 wards of the “Chittagong City Corporation” were taken as 41 wards of the study area.

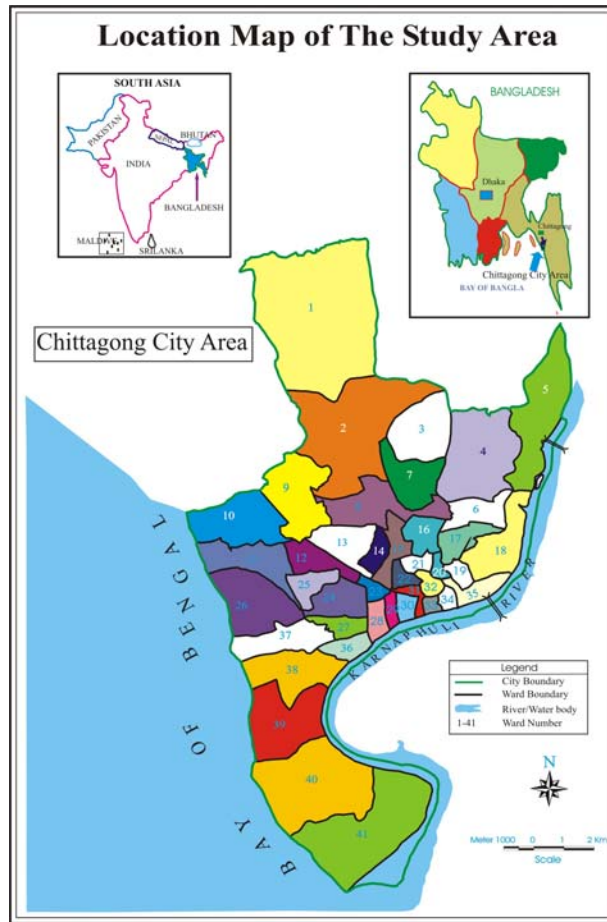


Figure 1: Showing the location of the study area

Data Collection

In the present study primary data were collected at the household level for resident’s perception of urban environmental quality considering 56 environmental variables. Secondary data also collected from various source on overall status of services and quality of environment of the city. For the primary sources of information, 492 households were surveyed in the study area with a questionnaire prepared on the basis of selected environmental variables. For the household survey all 41wards of Chittagong Metropolitan City were taken in to consider equally. For each ward 12 households were surveyed, representing at least 4 households from each income groups. For the selection of individual households, Stratified Random Sampling methods were adopted.

Creation of Income Groups

In order to collect data on the urban environment, questionnaires have been prepared for three income groups of the each ward of “Chittagong City Corporation”. For the household survey, the income groups used by Professor Nazrul Islam were used as a base with slight modification. He divided the household into 3 income levels in 1990 on the basis of monthly income (Islam, 1990). However, for the sake of present study some changes were made to these groups. Since income has increased by the year 2004 and the money value has risen internationally against dollar, the present household income groups were subjectively considered as follows:

Table: Level of household’s income in three income groups.

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

Selection of Individual Respondents

This study has identified the most of the time male heads of household as individual respondent. Because, the researcher being a male found it easier for him to conduct a long questionnaire interviews with male head. Although more than 16% respondent are female. The selection of the sample respondents was based on stratification. It was decided to take only the educated male heads of household as the study population. The only rationale behind was that, it would be easier to conduct the rather “sophisticated” scaled questionnaire survey. Thus it was more or less a limited elite population perception study. The selection was also justified partly in the sense that in a less developing society the ‘elite’ are important in the decision making process in nearly all spheres. A comparatively homogeneous respondent group is in a sense a controlled population and since all the 41 wards of the city. For the present study particularly, in the high and middle income group “Educated respondent of Household” was defined as having a maximum of graduation or Masters Degree and a minimum of primary education. In the low-income group “Educated Male Head of Household” was defined as having a minimum of primary education and illiterate also taken. The selection of the sample respondents also involved further stratifications. The respondents must have at least 21 years of age and must have been living in Chittagong City for more than 5 years, to give the correct opinion about environmental qualities.

Data Processing and Analysis

Questionnaire for the perception of quality of urban environment assessment was framed after through study of relevant literature. Tabulation and data processing were done both by hand and computer by using MS Excel and SPSS. Finally, collected data were analyzed and presented with the help of statistical (Satisfaction Index & Chi-Square test) and cartographic techniques.

Cartographic Presentation Data (Map)

Finally the data was presented in different Cartographic way. Graphical computer software “CorelDraw” and Arc/GIS were used for the Cartographic presentation of the data though it was a complex and time consuming work.

Index of Satisfaction

To determine the limit of satisfaction and dissatisfaction of the different environmental variables by the respondents, the following satisfaction index developed by **Hall, Yen and Tan (1975)** was selected.

$$I_s = \frac{f_s - f_d}{N}$$

Here,

I_s = Satisfaction Index.

f_s = Number of Satisfied Respondents.

f_d = Number of Dissatisfied Respondents.

N = Total Number of Respondents.

The highest value of this index is +1 and the lowest value is -1.

The above satisfaction index has been used by Khan, 1992, Hossain, 1995, Rahman, 1996, Hasan, 1999, Rahman and Islam, 2001 to determine the satisfaction index of respondents of various income groups.

Table: Variables by Environmental Groups

Environmental Groups	Environmental Variables
1.Physical Environment	1. Flash flood 2. Water logging 3. Air flow 4. Quality of air (smell) 5. Quality of air (dust particles/SPM) 6. Tree within the area 7. Number of garden/parks/open spaces. 8. Good water bodies (lake/river/ponds) 9. Water quality (taste) 10. Water quality (Physical Appearance) 11. Noise outside (traffic/laud speaker etc) 12. Noise inside (Human noise, radio, TV) 13. Temperature summer 14. Temperature (winter) 15. Traffic jam 16. Transport availability 17. Transport rent (within city) 18. Transport service system 19. Street condition (with, construction) 20. Earthquake 21. Hill Cutting Cyclone 22. Cyclone 23. Over all visual quality
2.Neighborhood Environment	1. Water supply 2. Electricity supply 3. Gas supply 4. Telephone services 5. Sewerage system 6. Drainage system 7. Sanitation 8. Cleaning & Maintenance

	<ol style="list-style-type: none"> 9. Solid waste Management (Garbage) 10. Recreational facilities 11. Educational facilities 12. Health care & Medical services 13. Housing condition (Rant, Quality) 14. Slum & Squatters 15. Postal facilities 16. Cyber cafe (Internet & e-mail) 17. Shopping center 18. Parking facilities 19. Religious places (Mosque/Temple) 20. Graveyards 21. Banking facilities 22. Employment facilities 23. Local security, law & order 24. Business facilities 25. Place of Worship
3.Social Environment	<ol style="list-style-type: none"> 1. How social the people 2. Privacy 3. Community feeling. 4. Community activities 5. Mastan problem 6. Prostitute problem 7. Nude poster problem 8. Religious conflict

RESULTS AND DISCUSSION

Environmental quality mapping

From the individual ranking of the ward for all 56 environmental variables finally three summarized environmental quality map were prepared and presented in **Figure 2(a,b,c,d)**. Those are Physical environmental quality map, Neighborhood environmental quality map and Social environmental quality map. **Figure 2(a)** shows the ranking of the wards for the Physical environmental quality and the top ranking three wards are respectively Jamal Khan (ward no-21), Chandgaon (ward no-4) and Sulakbahar (ward no-8). **Figure 2(b)** shows the ranking of the wards for the Neighborhood environmental quality and the top ranking three wards are respectively Jamal Khan (ward no-21), Anderkilla (ward no-31) Panchlaish (ward no-3). Similarly, **Figure 2(c)** shows the ranking of the wards for the Social environmental quality and the top ranking three wards are respectively Chandgaon (ward no-4), Sulakbahar (ward no-8), Panchlaish (ward no-4). Finally, **Figure 2(d)** shows the over all summarized environmental quality map by ranking the wards and the top ranking three wards are respectively Jamal Khan (ward no-21), Chandgaon (ward no-4), Panchlaish (ward no-3). The lower most three wards are respectively Rampur (ward no-25), Boxir hat (ward no-28), Pathantool (ward no-35)

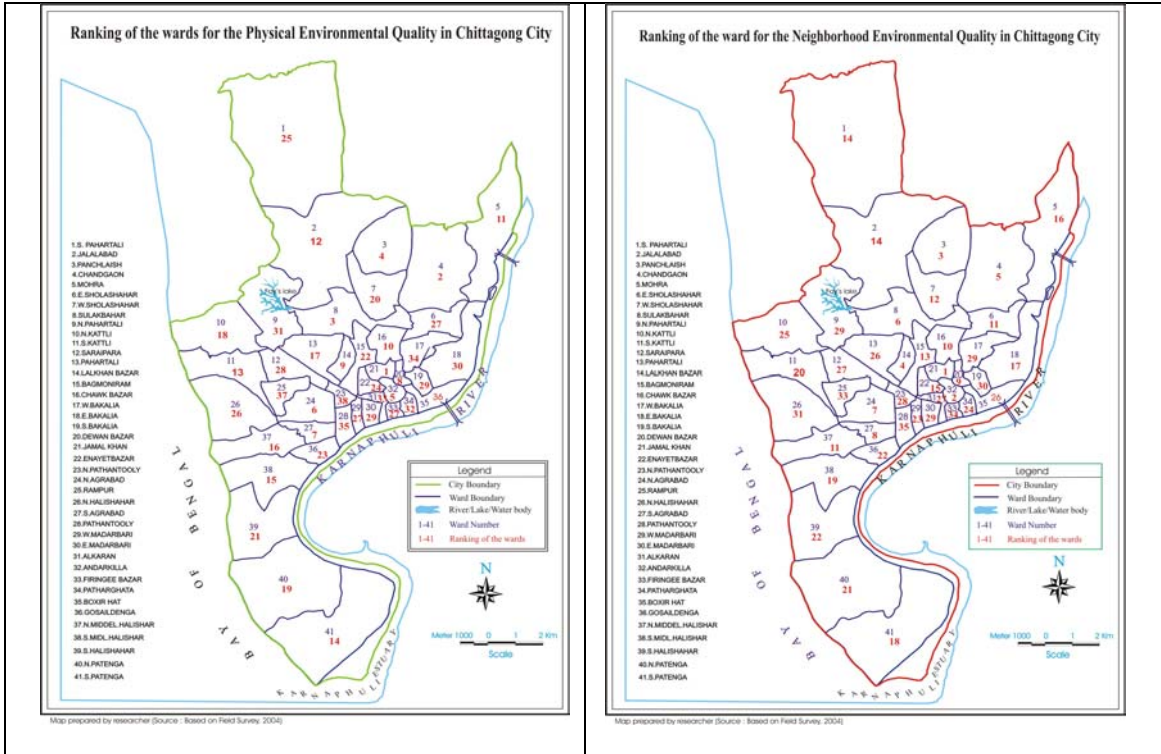


Fig. 2a

Fig. 2b

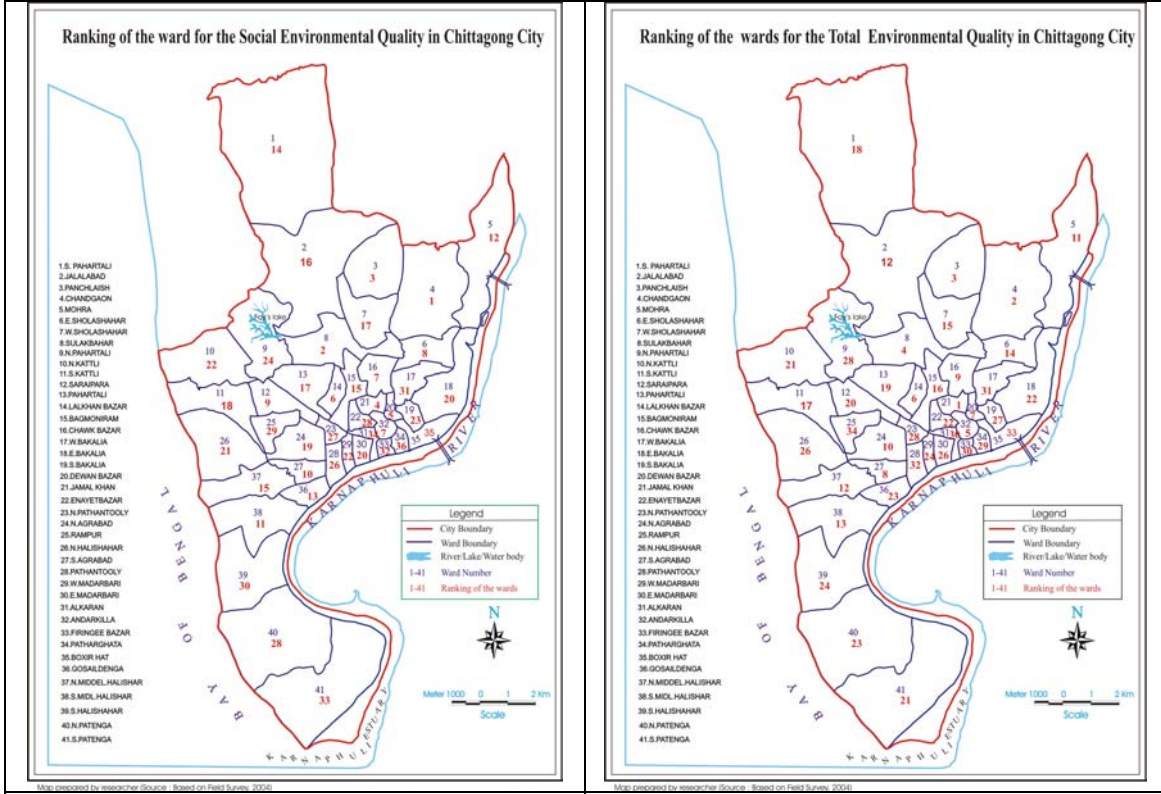


Fig. 2c

Fig. 2d

Figure 2 (a,b,c,d): Urban environmental quality maps of Chittagong City Corporation

Table 2: Ranks of the wards by Environmental Groups

Ward No	Ward Name	Ranks of the wards by Environmental Groups				
		Physical Environment.	Neighborhood Environment.	Social Environment.	Total Value	Total Rank
1.	S. Pahartali	25	14	14	53	18
2.	Jalalabad	12	14	16	42	12
3.	Panchlaish	4	3	3	10	3
4.	Chandgaon	2	5	1	8	2
5.	Mohra	11	16	12	39	11
6.	E.Sholashahar	27	11	8	46	14
7.	W.Sholashahar	20	12	17	49	15
8.	Sulakbahar	3	6	2	11	4
9.	N.Pathantooly	31	29	24	84	28
10.	N.Kattli	18	25	22	65	21
11.	S.Kattli	13	20	18	51	17
12.	Saraipara	28	27	9	64	20
13.	Pahartali	17	26	17	60	19
14.	Lal Khan Bazar	9	4	6	19	6
15.	Bagmoniram	22	13	15	50	16
16.	Chawk Bazar	10	10	7	27	9
17.	W.Bakalia	34	29	31	94	31
18.	E.Bakalia	30	17	20	67	22
19.	S.Bakalia	29	30	23	82	27
20.	Dewan Bazar	8	9	5	22	7
21.	Jamal Khan	1	1	4	6	1
22.	Enayet Bazar	24	15	28	67	22
23.	N. Pathantool	37	28	27	92	28
24.	N.Agrabad	6	7	19	32	10
25.	Rampur	38	33	29	100	34
26.	N.Halishahar	26	31	21	78	26
27.	S.Agrabad	7	8	10	25	8
28.	Pathantool	35	35	26	96	32
29.	W.Madarbari	27	23	25	75	24
30.	E.madarbari	29	29	20	78	26
31.	Alkaran	33	27	34	94	30
32.	Anderkilla	5	2	7	14	5
33.	Firingee Bazar	27	34	32	93	30
34.	Patharghata	32	24	36	92	29
35.	Boxir hat	36	26	35	97	33
36.	Gosaildenga	23	32	13	68	23
37.	N.Midl.Halishar	16	11	15	42	12
38.	S.Midl.halishar	15	19	11	45	13
39.	S.Halishahar	21	22	30	73	24
40.	N.Patenga	19	21	28	68	23
41.	S.Patenga	14	18	33	65	21
Total		824	766	753	-	-

Interpretation of Result by using Satisfaction Index and Chi-square Test

In present study we have used the Hall, Yeh and Tan (1975) index of satisfaction, as it is very applicable for the purpose of urban environmental quality assessment.

The results of the satisfaction index are as follows.

Table 3: Satisfaction Index of Various Environmental Variables in the High Income Group

Variables	Degree of satisfaction			Total Respondents (N)	Satisfaction Index (I _s)
	Satisfied respondents (f _s)	Acceptable respondents	Dissatisfied respondents (f _d)		
Physical	1886	956	930	3772	0.25
Neighborhood	1435	1045	1620	4100	-0.05
Social	634	306	372	1312	0.20

According to satisfaction index the highest value of satisfaction is +1 and the lowest value is -1. With respect to the satisfaction index, the respondents of high income group are very much satisfied with various environmental variables (For Physical environment this value is 0.25, Neighborhood environment -0.05 and Social environment 0.20) as shown in Table 3

Table 4: Satisfaction Index of Various Environmental Variables in the Middle Income Group

Variables	Degree of satisfaction			Total Respondents (N)	Satisfaction Index (I _s)
	Satisfied respondents (f _s)	Acceptable respondents	Dissatisfied respondents (f _d)		
Physical	1768	987	1017	3772	0.20
Neighborhood	1407	1057	1636	4100	-0.06
Social	635	282	395	1312	0.18

According to satisfaction index the highest value of satisfaction is +1 and the lowest value is -1. In the satisfaction index for middle-income group the respondents are very much satisfied with physical environmental (Satisfaction index value is 0.20). Neighborhood (Satisfaction index value is -0.06) and social environmental variables (Satisfaction index value is 0.18) as shown in table 4

Table 5: Satisfaction Index of Various Environmental Variables in the Low Income Group

Variables	Degree of satisfaction			Total Respondents (N)	Satisfaction Index (I _s)
	Satisfied respondents (f _s)	Acceptable respondents	Dissatisfied respondents (f _d)		
Physical	1709	971	1092	3772	0.16
Neighborhood	1379	1036	1685	4100	-0.07
Social	613	277	422	1312	0.15

According to satisfaction index the highest value of satisfaction is +1 and the lowest value is -1. It has been found that the respondents of lower income group are very much unsatisfied with various environmental variables (For physical environment this value is 0.16, Neighborhood environment -0.07 and Social environment 0.15) (Table 5).

Table 6: Satisfaction Index of Various Environmental Variables in the Three Income Group

Variables	Degree of satisfaction			Total Respondents (N)	Satisfaction Index (I _s)
	Satisfied respondents (f _s)	Acceptable respondents	Dissatisfied respondents (f _d)		
Physical	1788	971	1013	3772	0.21
Neighborhood	1407	1045	1648	4100	-0.06
Social	628	288	396	1312	0.18
Total	3823	2304	3057	9184	0.08

Perception on environment quality according to income group

To end with, it has found that the perception of quality of urban environment in three income group. With respect to the perception of quality of urban environment, in the high income group 50 % respondents were satisfied and 24.66% respondents were dissatisfied with physical environment. In the middle-income group, 46.85 % respondents were satisfied and 26.99 % of the respondents were dissatisfied with. In the low-income group, 45.28 % of respondents were satisfied with and 28.97%of the respondents were dissatisfied with the quality of physical environment (Figure 3).

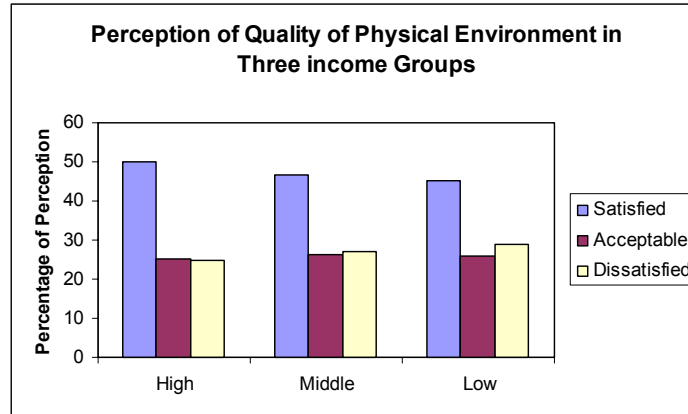


Figure 3: Perception on quality of physical environment in three income groups

The perception of quality of neighborhood environment/ facilities, 35 % of the respondents were satisfied with and 39.50 %of the respondents were dissatisfied with in high-income group. In the middle income group, 34.31%of the respondents were satisfied with and 39.89 %of the respondents were dissatisfied with. On the other hand, in the low income group 33.60 %of the respondents were satisfied with and 41.12 % of the respondents were dissatisfied with the neighborhood environment (Figure 4).

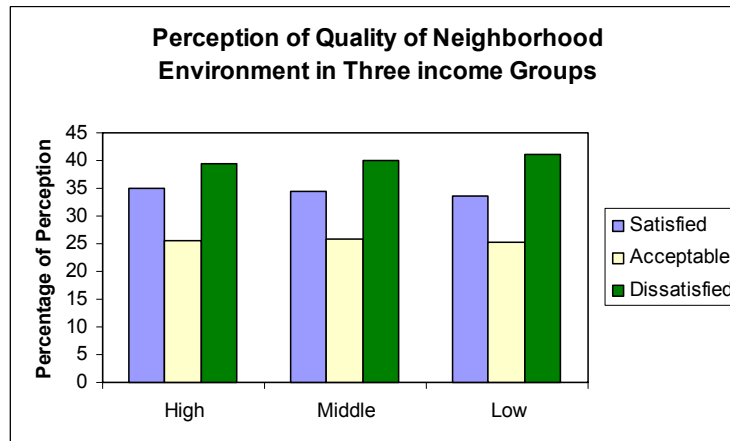


Figure 4: Perception of quality of neighborhood environment in three income groups

The perception of quality of social environment, 48.35 % of the respondents were satisfied with and 28.37 % of the respondents were dissatisfied with in the high income group. In the middle income group, 48.39 %of the respondents were satisfied with and 30.14 % of the respondents were dissatisfied with the social environment. In the low income group, 46.71

percent of the respondents were satisfied with and 32.11 % of the respondents were Dissatisfied with the social environment (Figure 5).

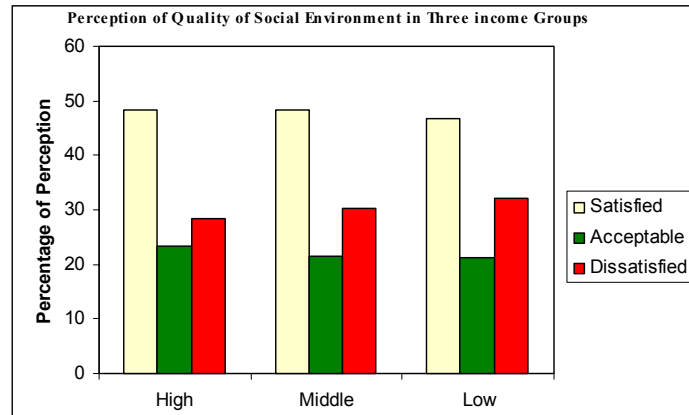


Figure 5: Perception of quality of social environment in three income groups

The perception of comprehensive environment, 43.44 %of the respondents were satisfied and 36.75 % of the respondents were dissatisfied with the comprehensive environment in the high-income group. In the middle income group, 40.34 % of the respondents were satisfied with and 38.88 % of the respondents were dissatisfied with the comprehensive environment. In the low income group, 38.16 % of the respondents were satisfied with and 40.37% of the respondents were dissatisfied with the comprehensive environment (Figure 6).

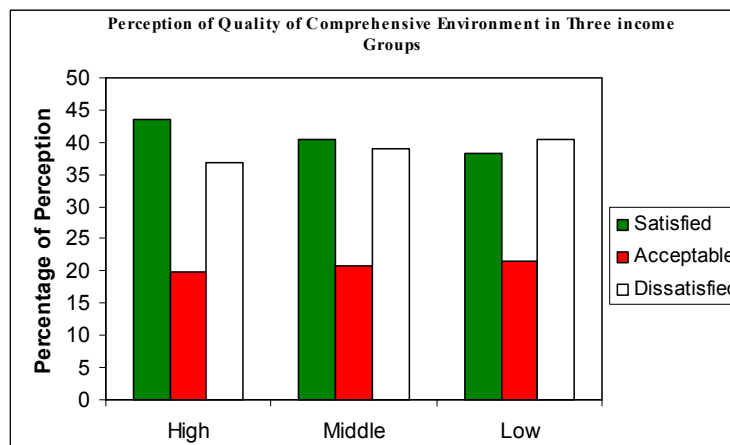


Figure 6: Perception of quality of comprehensive environment in three income groups

Urban environmental quality depends a great deal on the quality of the city’s physical, neighborhood as well as social environment. The present study has made an attempt to analyze the factual status, the perceptual pattern of the environmental quality of Chittagong Metropolitan city. The study makes the following findings:

- a). Based on secondary sources, the study shows the status of various quality of existing urban environmental aspects, such as physical environment (flood, rainwater stagnation, air quality, vegetation, noise, traffic and disaster factor etc.), neighborhood facilities (water supply, electricity, gas, telephone, sanitation, sewerage, garbage disposal, health, education and place of worship etc.) and social environment (society, privacy, community action,

community feeling etc.). The different facilities show inequality and inadequacy among the various wards in Chittagong City.

b) Based on primary field data, it has been observed that the characteristics of respondents in three income groups in terms of their age, education, occupation, family member and years living in Chittagong City describe variations such as the respondents of high income group have high educational qualification, doing better job, small family member and majority being native born in the city. On the other hand the respondents of low income group have low educational qualification, doing ordinary jobs, and large family member.

c) Of the different groups of environmental variables (physical, neighborhood and social) some of the wards (southern parts and northern parts) of Chittagong Metropolitan City seem to be particularly poor in the physical and neighborhood environments. But central parts of the city wards show better facilities.

d) By the survey of perception of respondents and from the observation it is clear that the residents of Chittagong Metropolitan City are in general dissatisfied with the overall quality of urban environment. They are Dissatisfied with the quality of physical environment as well as the quality of neighborhood facilities but satisfied with the quality of social environment.

e) The study also shows the highest value of satisfaction index for social environment and lowest value of satisfaction index for physical environment and neighborhood environment of three income groups but for low income group the various environmental factors show lowest value of satisfaction index.

f) The quality of urban environment is associated with the income of household heads and it has been statistically justified with the use of Chi-square (χ^2) test, that there is a relationship between the income and degree of satisfaction with regard to environmental variables.

CONCLUSION

The level of urbanization in Bangladesh is low, but the rate of growth of urban population is very high and due to large total population the absolute number of population is also large. As a Divisional Headquarters, port city and commercial capital city, the rate of urbanization is also high in Chittagong Metropolitan City. The impact of large influx of population in the city has been quite strong on the overall environmental situation in the city. The rather poor environmental situation in the city is evident from secondary data, field observation and from opinions of the residents. There is a crying need to address the overall environmental problems of Chittagong City. The municipal authority should take a lead in organizing a concerted and coordinated effort with other governmental and non-governmental agencies in solving the problem of the city as soon as possible. The community people should also be mobilized in such efforts, because people's participation is very much fruitful in improving the environmental situation.

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