

Conception Survey on Willingness to Pay for Improved Air Quality in Dhaka City, Bangladesh

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Abstract- It is a matter of concern for the mega cities in the world especially Dhaka City in Bangladesh that the quality of air is deteriorating in disruptly day by day. Because of growing unplanned urbanization and for implementation mega development projects like metro rail, elevated express way and the establishment of brick fields adjacent to this city etc. For implementing these type of projects, Dhaka's air has been contaminated with Particulate Matter (PM) which is very much injurious to health. Besides this rapid increase of motor vehicle are also responsible to contaminate the air quality. To reduce the air pollution of Dhaka City, This survey was conducted for identifying to know how the city duelers want to overcome this situation and who are agreed to pay for this. So, assess of the willingness to pay (WTP) for improved air quality among the living people of this city associated factors influencing their WTP. A cross-sectional questionnaire survey was conducted in combination with contingent valuation in between January to March of 2020. A face-to-face interview was conducted to obtain basic demographic information from manufacturing workers and to understand their WTP for air quality improvement. A total of 50 effective questionnaires were collected in this study and showed that more than 94% of the respondents expressed their WTP for improved air quality. Multivariable logistic regression analysis revealed that the main factors associated with manufacturing workers' WTP were their residence areas, education level, annual household income and travel experience. These findings have provided (a) important information of the concern and desire for air pollution control through their WTP from manufacturing workers, (b) baseline information for the policy-maker and local government for their development of more effective policy in air pollution prevention and control and (c) the need for more study for WTP among different population groups in future.

Index Terms- Air Pollution, Air Quality Index (AQI), Willingness to Pay (WTP), Particulate Matter (PM).

I. INTRODUCTION

At present, there have been observing a competition relating to development like materialistic development among the nations of the world. For bearing the development competition and the desire of dominate others most of the nation's mainly the developed nations are ignoring the rules of nature of the ecology and physical environment. These types of activities are greatly responsible to create degradation of the ingredients of ecology like water, air, soil etc. and making the world atmosphere hotter and hotter. The impacts of these deeds are very harmful to us. Green house effects, melting to the glaciers, sea level rising, cyclone, flooding are the common phenomena of the world. Dhaka is one of the developing mega cities of the world. Different types of infrastructural development are doing now. For doing these activities the quality of the air of Dhaka city is becoming contaminated and Dhaka has become the second contaminated city of the world. This condition is very alarming for the city duelers of Dhaka.

Rapid and unplanned urbanization of the Dhaka city deteriorate severe air quality have increased citizens' concern towards air pollution. As one of the most densely populated countries in the world, Bangladesh has been struggling with air pollution for a long time. Dhaka continuously ranks among the world's most polluted cities. Dhaka has ranked 5th worst on the world Air Quality Index (AQI) as extreme air pollution makes it one of the most polluted cities on 31st May 2020 (UNB News & Dhaka Tribune). Dhaka had an AQI score of 154 at 08:41am and the air was classified as 'unhealthy'. A numerical value between 151 and 200 indicates that everyone may begin to experience health effects and also the members of sensitive groups may experience more serious health effects as per AQI. Air quality between 201 and 300 is classified as "very unhealthy." If the score is between 301 and 500, then it is classified as "hazardous." In Bangladesh, the AQI is based on five criteria pollutants. Particulate Matter (PM10 and PM2.5), NO₂, CO, SO₂, and Ozone (O₃).

The study aimed to develop relationship between degraded air quality and resident's willingness to pay for improved air quality in the city of Dhaka, Bangladesh through contingent valuation method to quantify an individual's willingness to pay for improved air quality (S. Akhtar et al, 2017). Willingness to pay (WTP) is the maximum amount an individual is willing to hand over to procure a product or service. The price of the transaction will thus be at a point somewhere between a buyer's willingness to pay and a

seller's willingness to accept (Chaoji Cao, et al, 2021). Among the nine factors that affect a customer's willingness to pay, environmental factor is considered for this study. Hypothetical market was created and 50 respondents, selected through random sampling, were asked to respond to pre tested questionnaire. Results exposed that 99% of respondents showed positive willingness to pay which was 1% of their mean monthly income. Stepwise cause and effect model was used to develop relationship between independent variables and willingness to pay. Most parameters accompanied by econometric analysis elaborated expected results. Results disclosed that annual household income, symptoms of respiratory diseases and self-observed air pollution pointedly impact willingness to pay. It is concluded that despite of the fact that Bangladesh is among the lower income countries with no rigid budget allocation for improvement in air quality, people of Bangladesh are willing to pay to reduce air pollution load. One of the factor which effected the positivity of willingness to pay is that, a quite large number of people were suffering from pollution related respiratory disorders like asthma, chronic bronchitis, wheezing, cough, and chest congestion. Only 7.5% of respondents were not interested to pay for improved air quality which reported unconcerned attitude and lack of environmental awareness.

II. METHODOLOGY

Dhaka, the capital of Bangladesh is located Latitude: 23°42'37" N and Longitude: 90°24'26" E (Banglapedia) and is a culturally rich, socially diverse and wealthiest city of Bangladesh, which contributes a one fifth portion to the national GDP annually (John Roome et al 2019). There are two kinds of pollutants responsible for the pollution of outdoor (ambient) air: gaseous and particulate pollutants. The presence of gaseous pollutants, like Carbon Monoxide (CO), Sulphur Dioxide (SO₂), Nitrogen Oxide (NO₂), Ozone (O₃) and Methane (CH₄) has been found by the DoE in the air of Dhaka city in alarming quantity (Daily Star, 2017).Due to high population density, the number of people which are exposed to air pollution is quite large. As air pollution causes serious economic loss hence investment in pollution control technologies is increasing while the public pressure on local government is mounting to take immediate mitigation actions to crack down pollutant levels (Quratul Ain, et al, 2021). This significant degradation of air quality is also posing inevitable health impacts on the residents (Zhihua Xu et al 2021). Hence the area has been chosen for the valuation of household WTP for improved air quality.

When the AQL value is between 151 and 200, everyone may begin to experience health effects while members of sensitive groups may experience more serious health effects according to the World Air Quality Index. Considering this matter this study was conducted to the Residential areas like Malibagh, Ibrahimpur adjacent to Dhaka Cantonment and Bashundhara areas of Dhaka City showed AQL scores of 168, 155 and 169 respectively.

III. OBJECTIVES

All the research design may be developed on its targeted objectives. So, the following objectives were selected to complete the study which are:

- To address the eagerness of Willingness to Pay WTP of the city dwellers of Dhaka;
- To determine the amount of money which they want to pay;
- To identify the recommendations on WTP.

IV. RESULTS, FINDINGS AND DISCUSSION

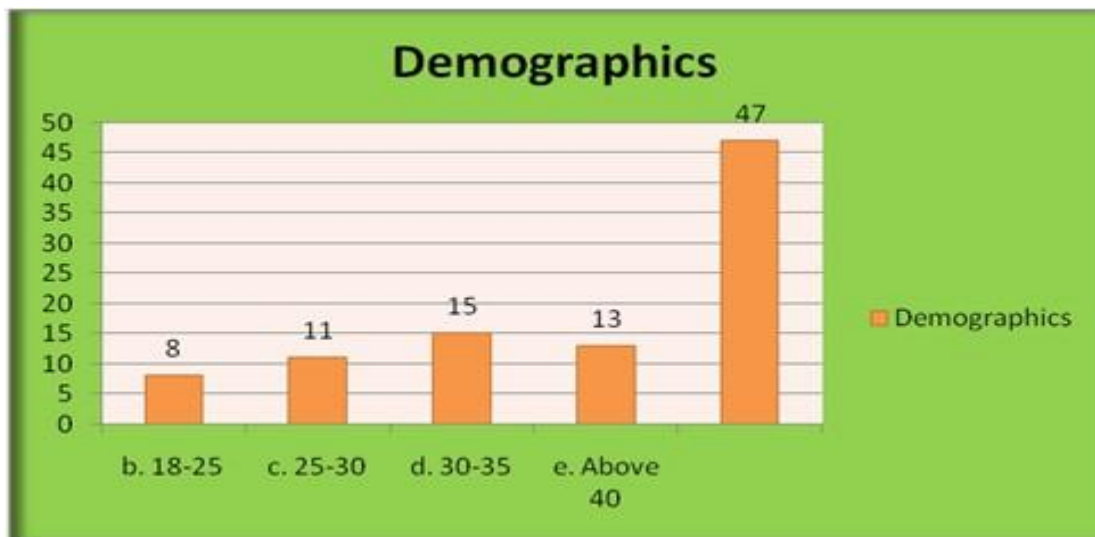


Figure-1

This figure shows the demographics of the respondents where the variation of ages is visualized. Among 50, 47 respondents showed interest to express their opinion. All of them we have to categorize them into four segments. Here age limit 30-35 takes the highest position and 18-25 takes the lowest position in this figure.

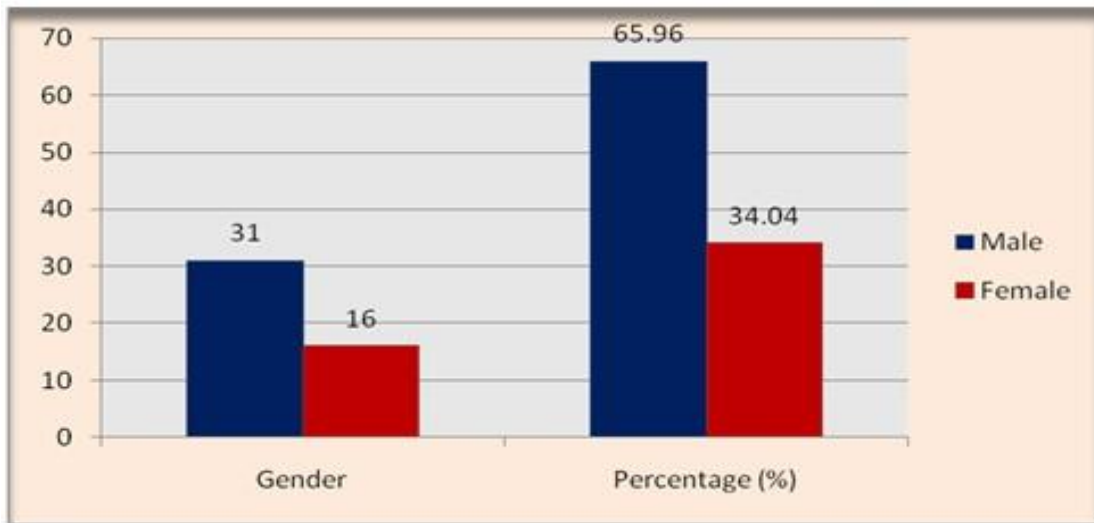


Figure-2

The figure above shows the gender values of the respondents. In which we can see the male and female ratio of the study. Here male is higher than the female where the female ratio is almost half of the male.

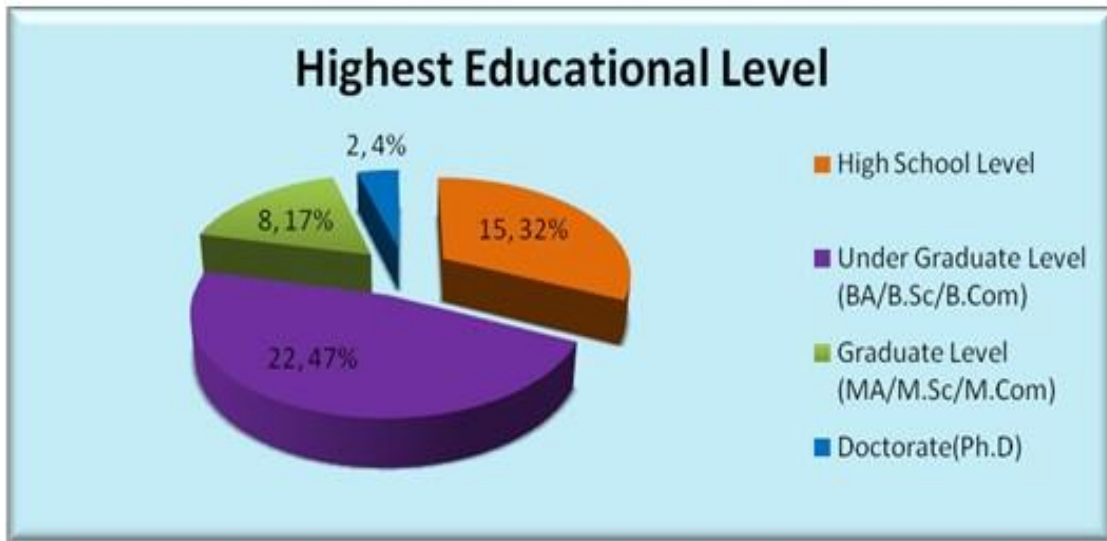


Figure-3

This chart refers the educational condition of the respondents those who had given interest to enhance their expression on WTP. Most of the conducted household duelers were under graduate levels which are belonging 47% and the lowest one is highly educated level like Ph.D. or doctorate degree holder they are 4% in the figure above.



Figure-4

In this above chart we can see the current occupation status level where categorizes five types of occupational condition like students, private job holders, job holders in public sectors, employed in educational institutions and self employed. Employed in the Private Sector is the major portion to occupy. Many students were interested to express their opinion during the survey was conducted but there was given emphasis conduction to them who involved in different job sectors.



Figure-5

WTP depends on one's income and his expenses capability. In the figure above reflects the monthly expenses of the respondents. Average monthly expenses including house rent have been calculated here. The candidates who gave their opinion are divided into five categories on scale of their monthly expenditure range. Most of the family members who are capable to pay their expenditure are staying BDT10,000 to BDT25,000. A few number of them who are able to pay expense highly amount per month whose range is between BDT 75,000 to BDT 1,00,000.



Figure-6

The figure above refers the contribution to monthly expense of their family. Here 15 respondents 32% people who maintain almost all of their family expenditures which belongs within (75-100) % expenses range. On the other hand 8% of the respondents who are mainly students have no contribution to their family expenses directly as well. Besides these, the people who contribute their family expenditures as less than 25% they have been belonging 13% among the whole.

Decision Makers to the Household in Relation to the Health Safety Issues		
Indicators	Number	Percentage
None	4	8.51%
Less than 25%	6	12.77%
(25 - 50)%	9	19.15%
(50 - 75)%	13	27.66%
(75 - 100)%	15	31.91%
Total	47	

Table-1

This table indicates the health safety issues of their households where they can take decision or be realized their opinion for the family health condition. Here 31.91% people can take decision in relation to the household health safety issues. On the other hand about 60% people who can partially take part decision making issues in relation to the Household Health Safety and 8.51% people they do not take part or giving no interest to take decision in their health safety issues to their family as well.

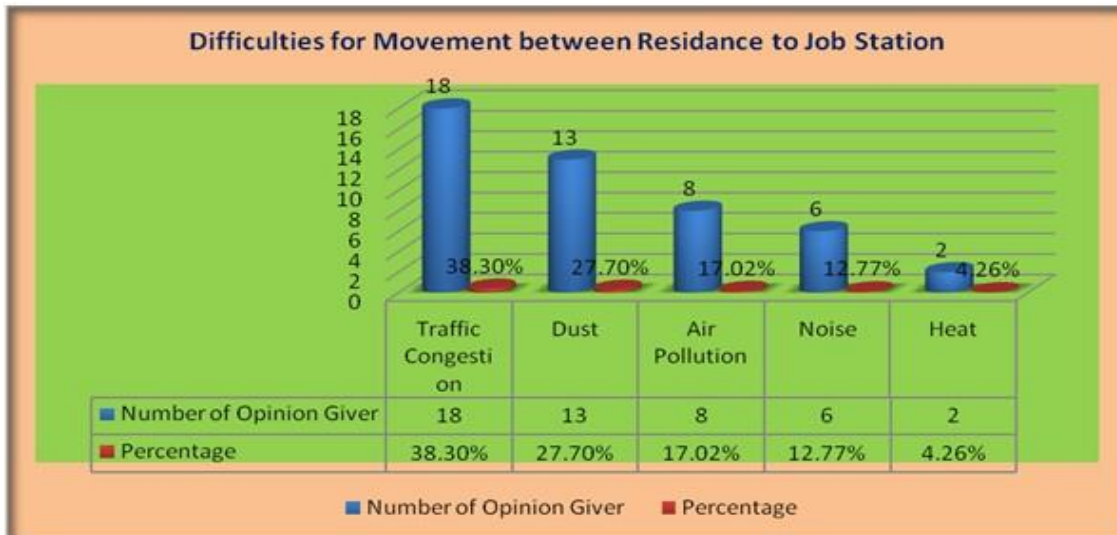


Figure-7

Everyone needs to be appeared at his job station to meet the deeds but different types of obstacles may hinder them. In the Dhaka city, there are several difficulties to smooth moving. Traffic congestion, dust in the air, air pollution due to different reasons, noise pollution, heat and some other else are generally responsible for this. The figure above indicates the difficulties of easy to move in Dhaka City. Congestion of traffic is the main and foremost issue to discuss for concerning to us. A lot of time has been lost for this. So, this graph reflects the same where 38.30% have given opinion that traffic congestion is the main obstacles for easy to move and dust is the another obstacles which one is the second position belonging 27.70% of them. Bangladesh is one of the tropical countries of the world so, heat wave may sometimes causes of hindrance to easily movement in Dhaka City.

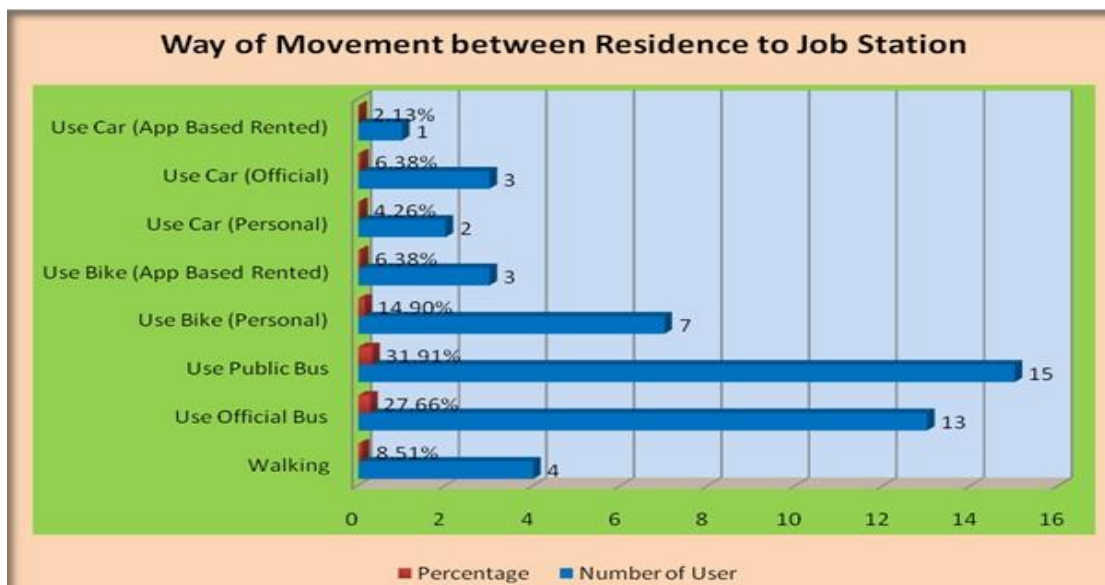


Figure-8

Way of movement means how they can appear at their office or go residence from the office. In the figure above way of movement between residences to Job stations has been divided into eight categories like walking, using official bus or public bus, using personal bike or rented app based bike, using personal car or official car or rented app based car. Most of the people who have given their opinion that they use public transport which is 31.91% of all. Someone use personal car but it is very small in the figure only they are 4.26%. Now a days app based rented bike or car has become very popular to the city duelers but it is very expensive and beyond of the capacity to the general people. In spite of this someone use it and it's got about 8% both of rented bike and car user. A very little number of people who use personal car and motor bike which implies 14.90% here. And the rest one gets opportunity to use official bus and cars which is 19.38% as total.

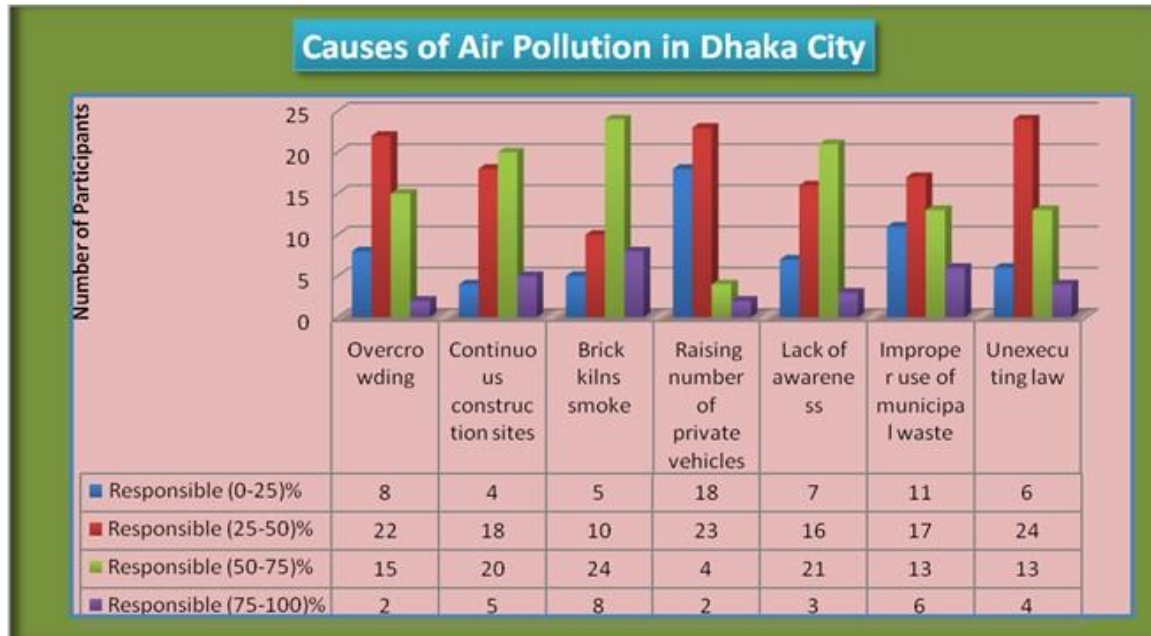


Figure-9

Dhaka is known for its air pollution. Many reasons such as overcrowding, continuous construction sites, brick kilns, raising number of private vehicles, lack of awareness and executing law et cetera are behind this catastrophic problem. In the figure above shows the main causes of creating air pollution in Dhaka City. Here seven indicators have been used to identify how far they can responsible for polluting air in this city. All of the respondents have been voted to all the indicators but it differs against its responsible percentage. Among the indicators, in overcrowding highest 22 respondents have given their opinion against (25-50)% responsibility range and lowest 2s are in the (75-100)% range, in the continuous construction sites 20s are in the highest between (50-75)% range and 4s are in the lowest against (0-25)% range. Against the indicators brick kilns smoke, most of the respondents are staying in the range of (50-75)% range in which 5s are staying in (0-25)% range. In the other indicators most of them are staying in the range of (25-50)% range as highest except lack of awareness in which (50-75)% range is the highest one. Almost all of the indicators, the lowest are staying between (75-100)% ranges except overcrowding and continuous construction sites.

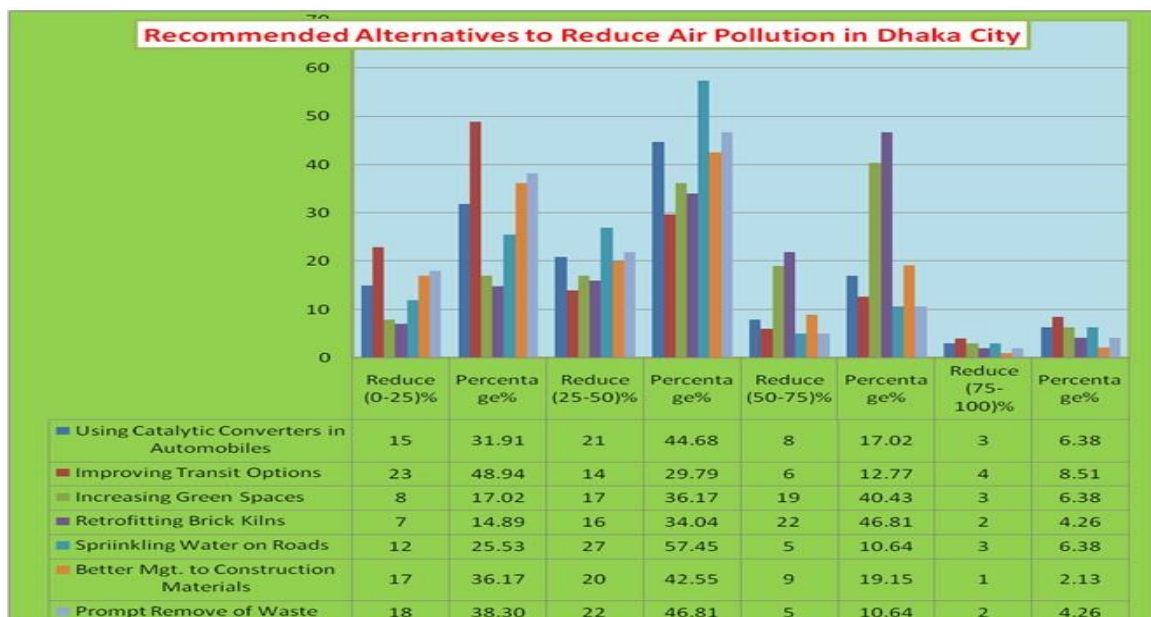


Figure-10

To make our Dhaka City clean and ensuring polluted free air different alternatives may be prescribed such as Using Catalytic Converters in Automobiles, Improving Transit Options, Increasing Green Spaces, Retrofitting Brick Kilns, Sprinkling Water on Roads, Better Mgt. to Construction Materials, Prompt Remove of Municipality Waste etc. in this above figure refers reducing range which the respondents prefer and its percentage values. In the range of (0-25)%, the indicators improving transit options refers highest 48.94%, range of (25-50)%, sprinkling water on roads refers highest 57.45%, within the range of (50-75)%, the indicators retrofitting brick kilns belongs highest 46.81% and the range (75-100)% refers all of the lowest range of them.

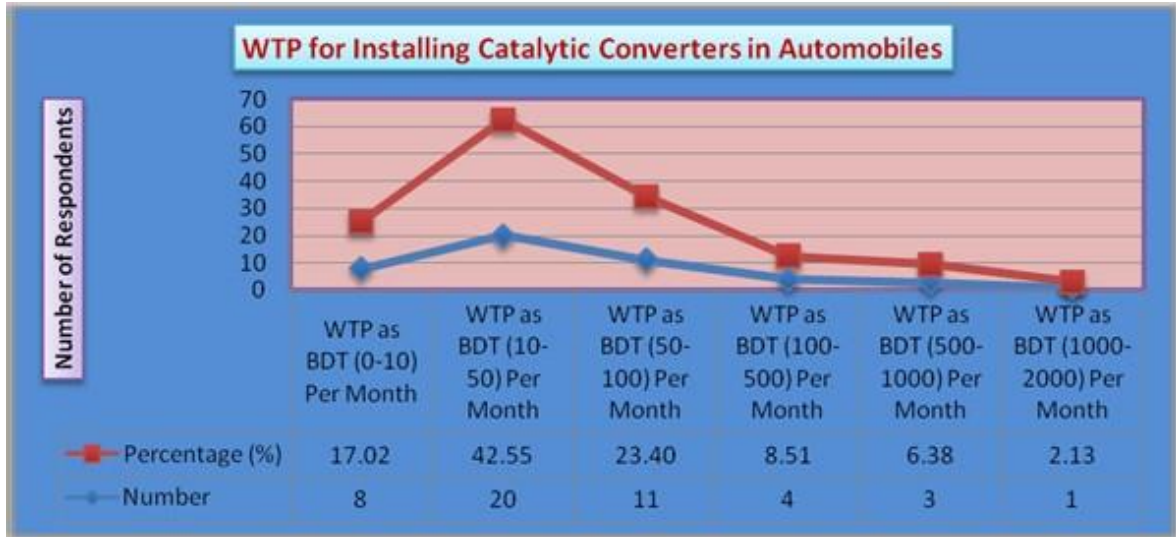


Figure-11

Every initiative may be effective when it initiates to implement but it needs financial support. Every person wants to pay for ensuring pollution free air to the mega City Dhaka as his own capacity. The figure above refers that Willingness to pay (WTP) for installing catalytic converters in automobile which are running on the roads of Dhaka. Most of the people who want to pay for this activity within BDT range 10-50 per month which belongs 42.55% here. But in the range of BDT 1000-2000 a few number show willingness to pay.

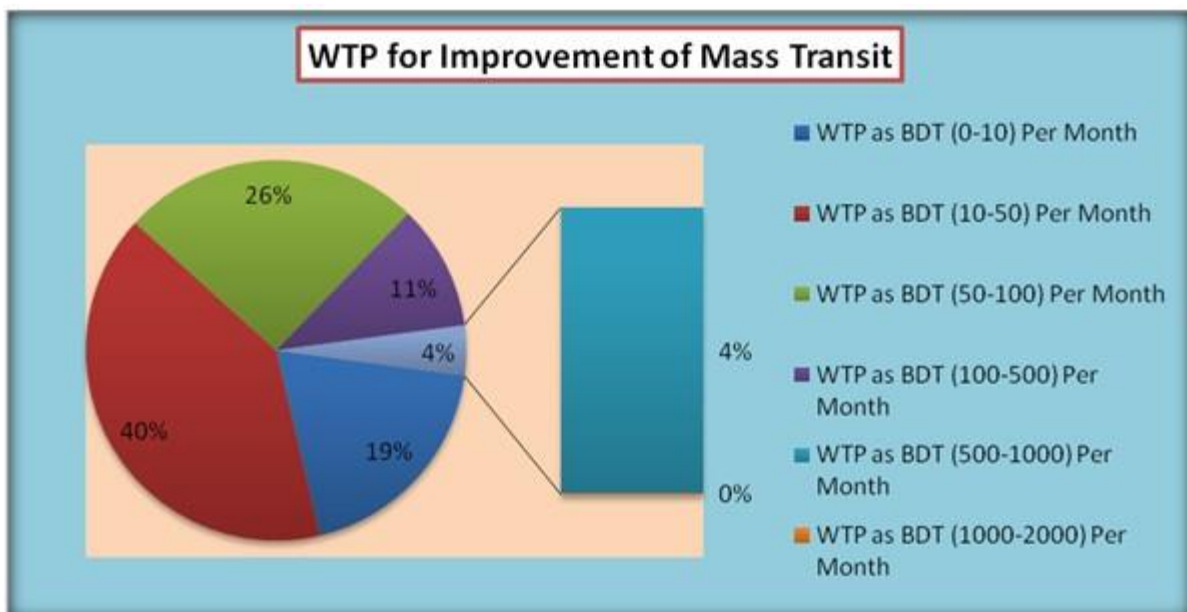


Figure-12

This figure refers willingness to pay for improvement of mass transit of Dhaka city and most of the people have shown their capacity range between BDT 10-50 which got 40% and none can show interest against the range between BDT 1000-2000.



Figure-13

Without having a number of green space no city can be achieved minimum range of pollution free air of its own and for ensuring this every city dueler have to pay directly or indirectly. The participants who have shown eagerness to pay for conducting this study is 100% but as their own capacity against the different ranges. In this figure indicates the highest range as BDT 50-100 which is belonging 36.17% and the lowest range is BDT 1000-2000 as well.

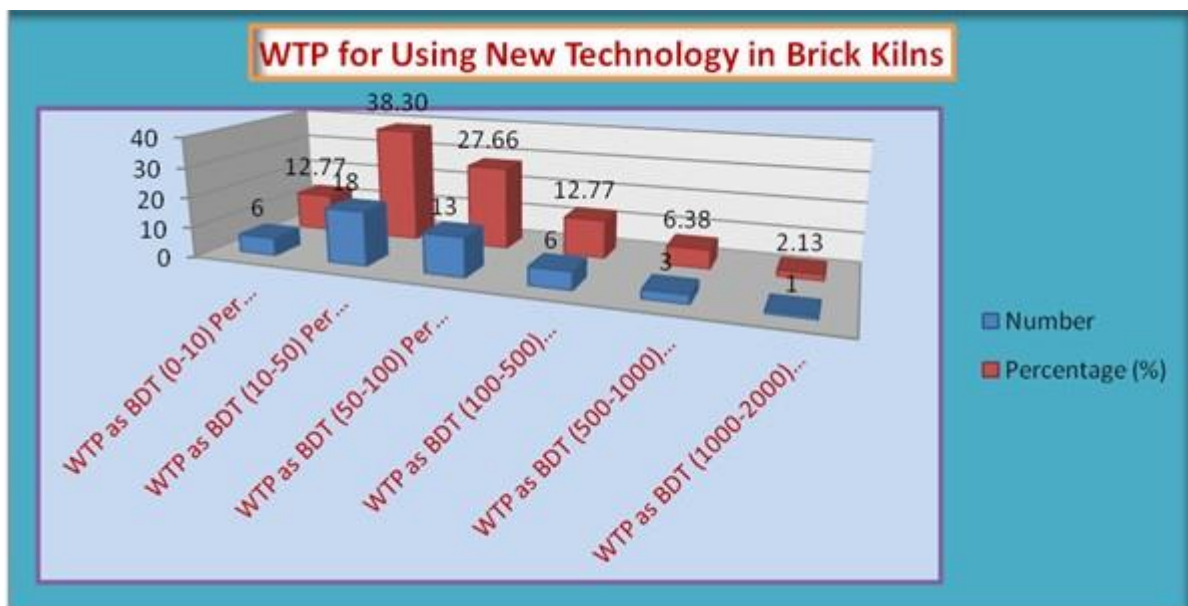


Figure-14

By using modern technology, most of the mega city of the developed countries in the world is initiating to free pollution of the city's air and for this our city duelers of Dhaka do not keep disagree to pay for it. They show their eagerness as their capacity. For initiating this activity most of the respondents are staying between the range of BDT 10-50 & BDT 50-100 which indicates the total 65.96% of both. And a very few number are staying within the range between BDT 500-1000 and BDT 1000-2000 which indicates the total 8.51% of both.



Figure-15

Bad construction practices may one of the major causes to create pollution of a city's air or environment. So, a better management policy can be changed this condition. In the Dhaka city miss management is a common scenario during to construction activities initiated by different authorities. To overcome this type of miss management for ensuring pollution free air every person wants to pay for this. For this activity the WTP of the respondents is staying between BDT range 10-50 and BDT range 50-100 which indicates 68.08% of both.

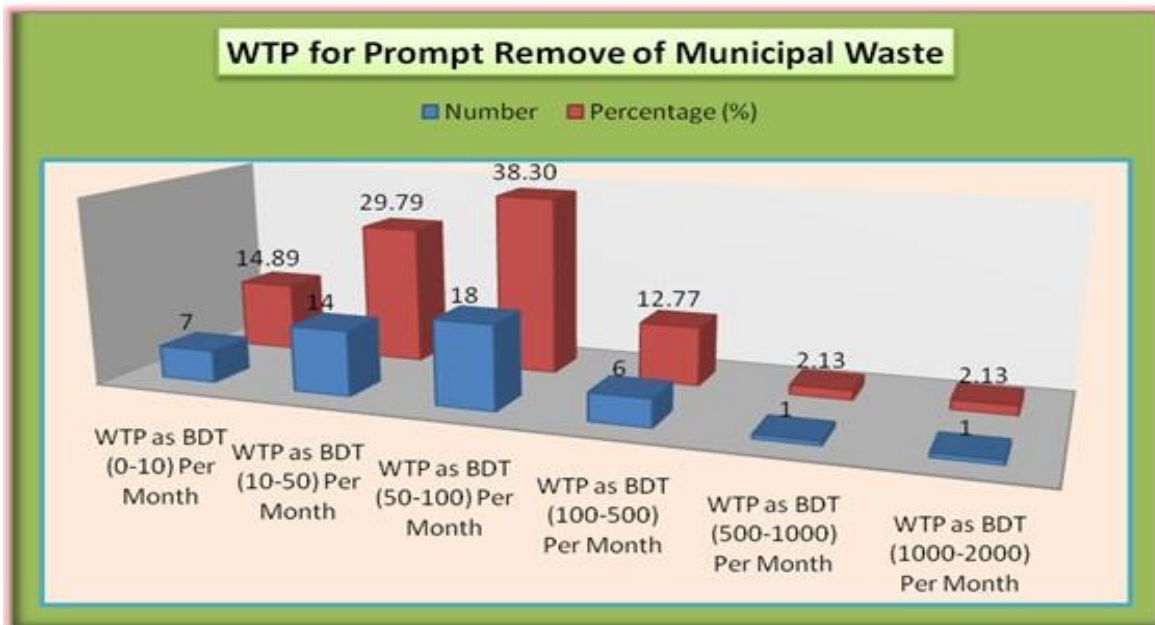


Figure-16

Municipality wastes and garbage are very much responsible for creating air pollution of a city but it may be adjusted by applying better waste management policy. But the waste management policy of Dhaka City is very poor and unhygienic. A lot of open dustbins have been kept on road side here and there in this city which creates severe air and environment pollution of its ecology. To solve this condition everyone wants to pay for removing this malpractice as their own capacity. The figure above shows that every person shows eagerness to pay for cleaning the city to the every range of BDT of 10-2000. Although the WTP to the range of BDT 1000-2000 is very little but it is not nil yet. The highest range is staying within the range BDT 50-100 which refers 38.30%.

V. CONCLUSION

This study included open-ended and close ended questionnaires had been used to determine individual's WTP for air quality enhancement in the City of Dhaka. Among 50 questionnaires 47 that were filled by residents, which referred 94% showed response as they were in favor of WTP for improved air quality of this city and also demonstrate their great apprehension on this intensifying issue. Only 6% of respondents were not filled up the questionnaires. Among the entire respondents 99% people who showed willing to pay the cost for upgrading air quality. 1% of alternative respondents seemed to be unconscious of environmental protection as they raised this anxiety that it is obligation of government to pay for cost. The analysis make known that gender, age and household size differences did not administrate and persuade on chances of a positive WTP which were put forward to explain the results. The results can give indispensable implication to influence researchers and decision-makers to choose improved air pollution control projects and also practical intuitions about implementation of environmental policies effectually and proficiently in Bangladesh.

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