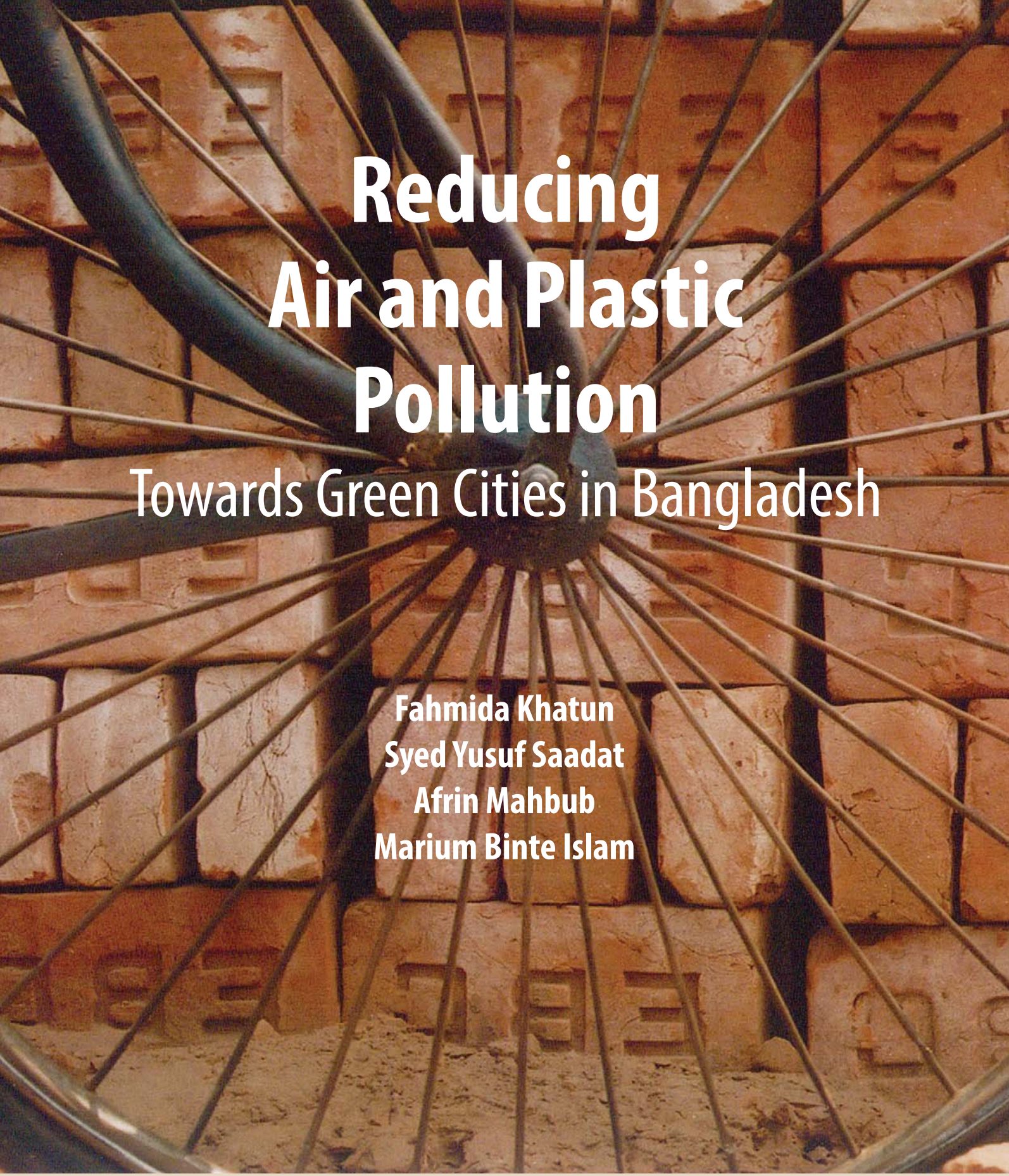

Reducing Air and Plastic Pollution

Towards Green Cities in Bangladesh

Fahmida Khatun
Syed Yusuf Saadat
Afrin Mahbub
Marium Binte Islam

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CPD's Green Cities Initiative

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Executive Summary

Air and plastic pollution pose a significant threat to Bangladesh.

Bangladesh's cities lead the world in levels of air and plastic pollution. Bangladesh was determined to have the most polluted air in the world in 2020 and 2021 according to IQAir, while Dhaka had the worst air quality of any city in 2021.

This poses a significant challenge for the country, in terms of both health outcomes and potential economic losses. Health problems associated with air pollution are responsible for reducing life expectancy in Bangladesh by 6.8 years on average. The symptoms of this burden of disease have a significant economic cost too, through lost productivity and reduced academic attainment.

Plastic pollution is an equally concerning issue as it affects the well-being of Bangladesh. The proliferating use of plastic products and the inadequate waste management system are leading to substantial environmental damage. This involves the obstruction of drainage systems, causing massive urban flooding during heavy rainfall in Bangladesh and endangerment of the marine ecosystems. Additionally, incineration of plastic waste is hazardous for human health and micro and nanoparticles of plastic may also enter the food chain through contaminated fish causing further health concerns for individuals.

As one of the countries most exposed to the impacts of climate change, reducing pollution should be a priority for Bangladesh.

The CPD's Green Cities Initiative was set up to better understand the drivers of air and plastic pollution in Bangladesh's cities and develop workable policy solutions to air and plastic pollution. Since its establishment, the Green Cities Initiative has brought together scientific evidence and economic analysis, producing a series of reports, policy briefs and events that have improved understanding of the problem among policymakers, journalists and members of the academic community. This report details much of the work so far to build up a useful body of evidence for those developing policy in Bangladesh.

In this final report, the Green Cities Initiative adds significantly to its study by presenting an analysis of the public attitudes and behaviours associated with air and plastic pollution, complementing the existing work focused on structural and systemic factors.

The Green Cities Initiative undertook a survey of 500 households in Dhaka city to understand the perceptions of the problem of pollution, and attitudes towards different policy solutions. This survey explored residents' perceptions of the scale of air and plastic pollution, their understanding of the causes and impacts of pollution and their willingness to change their own behaviour or support policies with the aim of reducing pollution in the city.

Key Findings

Both air and plastic pollution are a major concern for the residents of Dhaka

- Around three quarters of residents believe air (more than 76 per cent) and plastic pollution (73 per cent) have become 'much worse' in the past 2-3 years.
- Only 7 per cent believe air pollution has stayed the same or improved, while than 9 per cent believe the same for plastic pollution.
- Levels of concern about both air and plastic pollution were consistent across men and women.
- All age groups mostly reported that air pollution had become a lot worse in the last 2-3 years. This is aligned with the reality as the air quality index also suggests that air quality has worsened by 13 per cent since 2020. Moreover, the oldest cohort was also most likely to report that plastic pollution had become a lot worse too.
- Individuals are aware of the health implications of air pollution and take steps to reduce their exposure where possible, for example with 70 per cent ensuring to wear a face mask when outside.

Findings related to air pollution

Cars and other vehicles are the main cause of concern for residents

- Residents were most aware of vehicular pollution, with over 77 per cent believing motor vehicles are the most significant cause of air pollution in the city. At least 75 per cent of people across all age groups and both men and women pointed to vehicles as the main cause. Motivation to act on vehicular pollution is likely motivated by the high visibility of the problem within the city, experienced by many residents in the city's congestion.
- Fewer than 10 per cent of respondents saw construction sites or waste burning as the main driver. Less than 5 per cent of residents named brick kilns as the main cause, with women and younger people least likely to identify this issue.
- Respondents waste on average 46 minutes per day sitting in traffic jams – or 276 hours per year. This represents a huge economic loss of potential productive working time for the city, as this figure equates to almost 7 working weeks per person lost to traffic each year (based on working 5-day weeks at 8 hours per day).
- Almost half of private vehicle users surveyed said that improved mass transit would be most likely to encourage them to reduce their usage of private cars, and only around 10.9 per cent said no measures would make them drive less. However, many Dhaka residents (almost 70 per cent of those surveyed) do not own a private vehicle and already rely on buses, rickshaws and walking for their commute.
- Individuals deemed other measures including a fuel tax, congestion charge, number plate restrictions and improved public awareness were deemed to be much less likely to change their driving habits. While 50 per cent of vehicle owners said they would be willing to

pay BDT12.5 carbon tax on fuel on average, it is possible that higher prices would reduce consumption given 36 per cent of vehicle owners reduced their usage when the price of octane increased in 2022.

Individuals are experiencing negative health and economic impacts as a result of air pollution

- 67 per cent of respondents had experienced negative health symptoms attributed to air pollution in the past year, including respiratory problems, chest pain and eye irritation.
- The public health impacts of air pollution are significantly impacting Dhaka's productivity, demonstrated by the fact that the 500 survey respondents spent a total of 2,117 days absent from work and school due to these symptoms in the past year. This equates to just over 4 days per household per year.
- The cost to individuals in diagnosing and treating these health problems is also high. Across 500 households, approximately BDT 2.9 million or a total of BDT 4,000 per person was spent in the last year to manage these symptoms.

Households overwhelmingly believe that solutions to air pollution will require a mixture of personal behaviour change and government intervention and investment from the government and industry

- The majority of residents agreed that multiple actors are responsible for reducing air pollution in the city, including Dhaka City Corporation, the Ministry of Environment, Forest and Climate Change (MoEFCC), the private sectors, private vehicle owners and local communities.
- More than 33 per cent of respondents believe combating air pollution will not be possible without collaboration of both private and public sectors.
- Most individuals (70 per cent) stated they would be willing to pay BDT 239.4 per month in a scheme to improve air quality.

Findings related to plastic pollution

Awareness of responsible waste management practices is low

- About 79 per cent of Dhaka residents do not practice any kind of waste segregation, with 78 per cent believing there is no need to do so, while others citing that waste collectors do not ask them to do so.
- 63 per cent of households reported that they do not recycle durable plastic items, such as food-grade containers and toiletries, disposing of them with their organic waste.
- A small percentage (4 per cent) of individuals admitted to disposing of their household waste indiscriminately in a convenient place, rather than using appropriate channels.
- When outside the house, this number rose to 43 per cent who tend to discard plastic directly onto the streets.

Waste collection is fragmented, so efforts to improve waste management will require working with the informal sector

- While 44 per cent of households surveyed have their waste is gathered by city corporation representatives, the informal sector is responsible for collecting 47 per cent.

- At present, informal sector waste collectors may not be informed about the need to separate all kinds of plastic waste before taking the waste to secondary collection points or landfills and, in most cases, waste collectors will only separate the plastic products which are cleaner and easier to sort such as plastic bottles.

Individuals seem more aware of the environmental risks of plastic pollution, than the negative consequences for human health, and could therefore be exposing themselves to risks

- Respondents were largely aware of the impacts of plastic pollution on the environment, including burning waste leading to air pollution (74 per cent), blocking canals and sewage systems causing flooding (67 per cent) and contributing to water pollution (62 per cent). Fewer, however were aware that plastic breaks down into microplastics, endangering marine life.
- Remaining half knew that chemicals from plastic containers can leak out and enter the human bloodstream and only 40 per cent were aware that microplastics can enter the human body through the food chain.
- While relatively few individuals reported eating food from plastic containers at home, over a third (34 per cent) said they regularly use plastic utensils to eat, even though the numerous additives in plastic containers and utensils tend to leach out when exposed to heat.
- Among lower socio-economic groups, over half (54 per cent) reported not treating their water before consumption and may therefore be at increased risk from exposure to pollutants in the water supply. However, even some filtration methods, such as water cylinders, may be ineffective in removing microplastics, which emit hazardous chemicals and can cause various illnesses.
- In the 500 households surveyed, 572 individuals had experienced symptoms of waterborne diseases in the last year.

Polythene bags are the biggest contributor to single-use household plastic consumption

- Households reported acquiring an average of 17 polythene bags per week during grocery shopping trips, indicating the 2002 ban was not being adequately enforced.
- The vast majority (82 per cent) of respondents expressed a willingness to reduce their plastic consumption if alternative materials were available. However, 47 per cent admitted to accepting new polythene bags even when they have their own shopping bags on their person.
- A charge on shopping bags may be an effective solution in cutting down usage, as 85 per cent of respondents refused to pay anything for a new polythene bag, reporting they would prefer to take their own bags.

Conclusion

Across both air and plastic pollution, residents' high levels of concern are not matched with necessary behaviour changes to reduce their contribution to the problem. Awareness of the problem has not yet developed into action.

This points to the need for government and industry action to enable people to make more

environmentally-friendly choices. Sufficient investment in sustainable alternatives including an affordable and comprehensive public transit system and a well-organised waste management system will be necessary to encourage people to play their part in reducing air and plastic pollution within Bangladesh's cities.

To motivate individuals to begin to change their habits these "carrots" may need to be matched with "sticks" to discourage people from sticking to their old behaviours. Options should be explored, including measures to discourage private vehicle use and methods to ensure a ban on polythene bags can be well enforced.

While consumer behaviour change will be a key part of a transition to a greener city, we must not lose sight of the limits of individual behaviour. Alongside these policies, the Government of Bangladesh must also continue to work with the private sector to tackle industrial issues such as irresponsible construction practices and investment in sustainable alternatives to fossil fuels.

Key Policy Recommendations

Key policy recommendations for air pollution

Based on the results of the survey, the Green Cities Initiative recommends several policy changes that would empower individuals in Dhaka to change their behaviours and act in more environmentally friendly ways, commensurate with their concern about pollution in the city.

Policy recommendations to improve air pollution

Investment in public transit to reduce private vehicle usage

The results of the survey demonstrate that vehicle pollution is the main concern of residents, and that many vehicle owners would be less motivated to use their private vehicles if better public transit options were available. Given female vehicle owners were more hesitant to move towards using public transit, it is important to ensure new transit options are appealing to all, and have appropriate safety measures to encourage new passengers to use them.

Restrictions on high-polluting vehicles

A significant minority of vehicle owners reported that they would continue to use their vehicles regardless of any government interventions. Therefore, measures must be implemented to get the most polluting vehicles off the roads, including:

- Removing the import tariff on electric and hybrid vehicles would improve the affordability of such vehicles. The government will also need to make the necessary initial capital investment required for electric cars, for example through establishing charging points and, in the longer term, establishing a sustainable and renewable energy source to effectively power these electric vehicles.
- Introduce regular fitness testing of automobiles and measures to retire and replace older cars that do not meet fitness criteria. To comply with automotive pollution requirements, the government may also promote the widespread adoption of computerised emission testing in automobiles, buses, and trucks.

Policy recommendations to improve plastic pollution

Clamp down on plastic bag usage through a well-enforced charge on polythene bags

It is clear from the survey that polythene bags are the largest contributor to households' accumulation of single-use plastic items, with households gaining 17 bags per week on average. As individuals reported they would not pay for new plastic bags if a charge was

implemented, preferring to re-use their own bags, even a nominal charge of 5 per cent is likely to discourage use.

Coordinated waste management efforts to encourage recycling

The vast majority of individuals in Dhaka currently do not segregate their plastic waste, making it more likely to end up in landfill. The government could encourage plastic recycling by investing in waste management and working effectively with the city corporation and the informal sector. Initial measures should include:

- Establishing recycling centres, initially in all wards of all city corporations and eventually nation-wide. These recycling centres should provide trash-to-cash schemes to incentivise waste-collectors to collect more waste and increase overall recycling of waste. The government should aim to leverage the network of these recycling centres to create a market for single use plastic waste.
- Using the city corporations to provide informal sector workers with resources and training to separate plastic garbage from homes and secondary collection sites.
- Increasing demand for waste plastics in Bangladesh by increasing the customs duty on plastic waste coming into the country and investing in recycling technologies such as pyrolysis, which can regenerate petroleum fuel from plastic waste.

In addition to these measures aimed at changing behaviours, the Government and the private sector need to work together to tackle problems where individual behaviour change and consumer habits will have little impact.

Phase out fixed chimney brick kilns by 2028

Despite survey respondents believing that vehicles are the main cause of air pollution in Dhaka city, evidence demonstrates that brick kilns are the largest single contributor to particulate matter in the city. Fixed chimney brick kilns are the most rudimentary, most polluting and unfortunately most common form of brick kilns in Bangladesh. The Government of Bangladesh (GoB) should pass a regulation which requires the phasing out of all fixed chimney brick kilns in Bangladesh by 31 December 2028, and shift all brick manufacturing to less polluting available technologies.

Regulations to encourage the private sector to invest in sustainable alternatives to single-use plastic

The survey indicated that individuals opt for single-use plastics due to their convenience. To significantly row back the proliferation of plastic products in Bangladesh, the government and private sector will need to invest in convenient alternatives for consumers. To motivate the private sector, the GoB should pass a regulation which requires phasing out of single-use plastic products by 31 December 2028 and introduce a national framework for Extended Producer Responsibility thar requires manufacturers to take responsibility for the entire lifecycle of their plastic products, including collection and recycling.

Acknowledgements

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Contents

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1. About the CPD Green Cities Initiative

In light of the pressing concerns related to air and plastic pollution in Bangladesh, the Centre for Policy Dialogue (CPD) undertook a research study titled "Green Cities Initiative" which aimed to bring together scientific evidence, economic analysis and a focus on finding policy solutions. The goal of the CPD Green Cities Initiative is to be a useful source of evidence and ideas for policymakers, academics, journalists and others looking to understand the relationship between air and plastic pollution and the economy of Bangladesh, and develop policies to tackle these problems.

In this study, the key interest was to look at the drivers of air and plastic pollution in Bangladesh's major cities, understand the impact on the country's economy, public health and other metrics, and develop workable policy solutions to air and plastic pollution.

With this report, the research team presents a survey of households to understand the behavioural factors that contribute to air and plastic pollution in Dhaka city. This survey finds a significant level of awareness and concern among residents about the issues of pollution and explores the potential of different policies aimed at individual-level behavioural change, which could be implemented alongside more systematic approaches to reduce pollution.

The key objective of the study is to look at the drivers, impacts and solutions with regard to air and plastic pollution in major cities of Bangladesh, and recommend policies to reduce air and plastic pollution. The research, by and large, aims to support the Government of Bangladesh in identifying the implementation gaps towards incentivising the green investments, particularly to reduce carbon emissions in the energy sector.

After October 2023, CPD intends to sustain the Green Cities Initiative webpage on its website. Additionally, CPD intends to produce more knowledge outputs, such as a journal article, based on the data collected as part of the Green Cities Initiative. Additionally, Prothom Alo, the media partner of the CPD Green Cities Initiative will translate and publish a short book in Bangla based on the research conducted as part of the CPD Green Cities Initiative. It is anticipated that this book will be launched at Prothom Alo and CPD's stalls at the "Ekushey Boi Mela" 2024, which is the largest Bangla language book festival in Bangladesh held in February each year.

2. The Context of Air and Plastic Pollution

2.1 Context of air pollution

Air pollution occurs when the presence of contaminants or pollutant compounds endangers human health or welfare and has other adverse environmental effects. The escalation of ambient air pollution in urban areas has become a matter of great concern for many nations across the globe. In recent years, Bangladesh has experienced a notable escalation in air pollution. It has consistently been ranked among the top five most polluted countries in the world. This can be attributed to the rapid growth of industrialisation and the subsequent surge in energy consumption within major urban centres. The consequences of this phenomenon are multifaceted, encompassing significant health risks, economic implications, environmental degradation, and climate-related concerns. The declining air quality in urban areas primarily stems from the increase in urban population, the proliferation of motor vehicles, ongoing construction activities, biomass burning, and unregulated brick production. The apparent rise in economic growth and development in the country has been accompanied by a notable decline in air quality. In the absence of appropriate policy interventions and measures, it is likely that air pollution will increase further, which would present a heightened risk to human health, the environment, and the economy.

The presence of various key pollutants in the atmosphere, including particulate matter (PM2.5 and PM10), sulphur dioxide (SO2), oxides of nitrogen (NOX), ozone (O3), carbon monoxide (CO), and lead (Pb), has been shown to have detrimental effects on both air quality and human health, as well as the environment. These pollutants have been found to contribute to the degradation of air quality, with the extent of their impact varying depending on the specific location and duration of exposure. Of these pollutants, fine Particulate Matter (PM), specifically PM2.5 and PM10, exhibit a relatively higher concentration in the atmosphere. These particulate matters possess an aerodynamic diameter of less than 2.5 μm and 10 μm, respectively. These fine particulate matters have been identified as significant contributors to mortality rates associated with respiratory, cardiovascular, and other related ailments. The presence of these particulate matter, when in a state of suspension within the atmosphere, becomes intermingled with various organic and inorganic particles such as dust, pollen, soot, smoke, and liquid droplets, with the capability to deeply infiltrate the respiratory system, and pose a hazard to human health.

The primary sources of particulate matter (PM) in urban areas can be attributed to various anthropogenic activities. In cities, these include vehicular emissions, coal-fired power plants, industrial emissions from factories, and brick kilns. Furthermore, road dust, consisting of particles from vehicle wear and tear, as well as construction activities that generate dust and debris, are additional contributors to PM pollution in urban environments. Collectively, these sources play a pivotal role in the emission of PM and necessitate targeted mitigation strategies to address the associated environmental and health concerns.

The severity of air pollution in numerous developing nations has been recognised as a significant risk factor. The air quality in Bangladeshi cities is notably inferior when compared to other urban areas in both Asian and South Asian regions. This disparity raises significant concern among local residents due to the significant health and economic implications experienced within these geographical areas.

Air pollution levels in Bangladesh far surpass the annual Bangladesh National Ambient Air Quality Standard (BNAAQS) of 50 μg/m3 for PM10 and 15 μg/m3 for PM2.5 (DoE and The World Bank, 2018). Analysis of more than 10 years of hourly data of 17 air quality monitoring stations across Bangladesh shows that, on average, six stations had PM 2.5 concentrations above 100 μg/m3 or twenty times the WHO standard, and eleven stations had PM 2.5 concentrations above 50 μg/m or ten times the WHO standard. Weather and seasons affect air pollution. Weather conditions including rainfall, wind direction, wind speed, humidity, and temperature affect air pollution levels throughout the year (Majumder, Nayeem, Patoary, & Carter, 2020). Dhaka had high AQI, indicating higher levels of air pollution, in January, February, and March, but low AQI in July, August, and September during monsoon. Winter brings low temperatures and little rainfall, which increases concentrations of harmful particulate matter as pollution from brick kilns, cars, factories, and building sites produce dust, aerodynamic particles, and gases remains in the air (Islam, Afrin, Ahmed , & Ali, 2015).

2.2 Important facts on air pollution from the first phase outputs

Vehicular emission: The level of motorisation in Bangladesh has been growing over the years. Emission from vehicles has been disproportionately high in recent years. This is mostly due to the use of poorly maintained vehicles, adulterated fuels, improper traffic and road management and inadequate parking space. The study under the Department of Environment's project titled Clean Air and Sustainable Environment (CASE) revealed that around 10.4 per cent of particulate matter is emitted from vehicles in Dhaka city, whereas 7.7 per cent comes from road dust (DoE and the World Bank, 2019). Diesel-run vehicles are the worst polluters compared to CNG, Octane, or LPG-run vehicles. Nitrogen oxides and black diesel smoke are emitted into the air, plummeting the air quality of the cities. Most of the vehicles that

run on diesel fail to comply with the Vehicles Emissions Standard of Bangladesh, thereby releasing higher levels of contaminants into the air.

Brick kilns: Besides vehicles, another significant source of emission is the brick kiln industry. Due to increased development projects taken by the government of Bangladesh, the demand for construction materials has increased significantly in recent years (ESDO, 2020). There were about 8000 brick kilns operating all over Bangladesh in 2018, producing around 15 billion bricks annually (DoE and the World Bank, 2019). Hundreds of brick kiln clusters are located sparsely all over Bangladesh in various districts including Narayanganj, Gazipur, Dhaka, Rajshahi, and Khulna. These urban areas have higher proportion of construction activities and establishment of brick fields, so these districts are highly polluted compared to other districts of the country. In Bangladesh, bricks are manufactured in a primitive system using traditional methods (Darain, Rahman, Ahsan, Islam, & Yusuf, 2013). These outdated models and technologies are imposing serious damage to the environment by emitting large amounts of pollutants (Darain, Rahman, Ahsan, Islam, & Yusuf, 2013).

Construction activities: In Bangladesh, there are several on-going construction activities in urban cities including the construction of road, housing, and flyover (ESDO, 2020). Moreover, the government mega projects such as Metro Rail, Dhaka Elevated Expressway, Rooppur Nuclear Power Plant, Chittagong Cox's Bazar Rail Link, Padma Bridge Rail Link, Dhaka Airport Third Terminal, and Matarbari Coal Power Plant have been in construction for several years now. The construction of these projects contributes to air pollution by emitting high levels of PM2.5 and PM10. The construction sites are often very dusty because there are no specific guidelines or rules on the storage and transportation of construction materials (ESDO, 2020). This gives rise to dust pollution in urban areas. In a study, it was found that everyday 500 metric tons of dust settle on the ground and 2000 metric tons of dust floats in the sky in Dhaka city during winter seasons. The economic boom of Bangladesh contributes to the development of roads, railways and infrastructure of the country, but at the high opportunity cost of worsening the air quality.

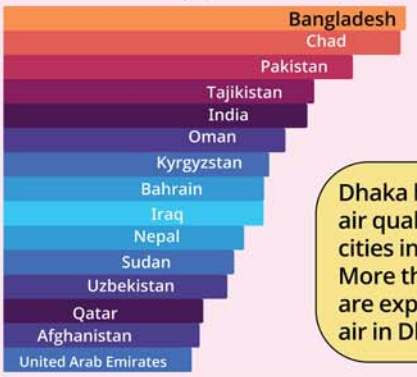
Transboundary sources: Transboundary air pollution is also a source of ambient air pollution in Bangladeshi cities. Around 40 per cent of the pollution in Bangladesh comes from the neighbouring countries like India, Nepal, and Bhutan. During dryer months, the air pollution in those countries is the highest, which also adds to the concentration of air pollution levels in Bangladesh. In Dinajpur city, it has been observed that a trail of polluted air comes from India each year during the winter months. Pollutants in South Asia throughout the winter season are transported towards Dhaka city through different routes. Much of the airborne pollutants travel a long distance and cause air quality degradation. Depending upon the heights, air pollutants can travel from 200 km to 500 km in a specified area (Sakib, 2021). The problem of transboundary air pollution may be exacerbated by Dhaka's high population density, low levels of economic development, poor infrastructural condition, and lack of pollution management at the source.

Other key sources: Other drivers of air pollution include construction activities, biomass burning, and waste burning. With rising economic growth, the energy consumption also rises in all sectors of the economy. The use of biomass, coal, oil and natural gases reflect economic growth and development of a country. However, the use of these natural resources without complying with the energy emission standards, results in discharge of high levels of pollutants into the air. This imposes various health and environmental costs to the economy. Open landfill incineration and plastic waste burning is also a contributing source to air pollution. Burning of municipal solid waste, which contains about 12 per cent plastic, releases toxic gases into the atmosphere such as dioxins, furans, mercury, methane, and polychlorinated biphenyls (ESDO, 2020). Airborne particulate emission (soot) and solid residue ash are byproducts of plastic combustion in Dhaka city. The contemporary waste disposal methods into landfills in Dhaka city insinuates an unrecoverable loss of essential raw materials and energy. Different sectors account for different levels of

Breathing Uneasy

The growing problem of air pollution in Bangladesh

World ranking of highest average PM2.5 concentration (in µg/m3) in 2021



Bangladesh was No. 1

for having the most polluted air in the world in 2020 and 2021, according to IQAir

How polluted is the air in Dhaka?

Dhaka had the second worst air quality among other cities in the world in 2021. More than 10 million people are exposed to poor quality air in Dhaka.

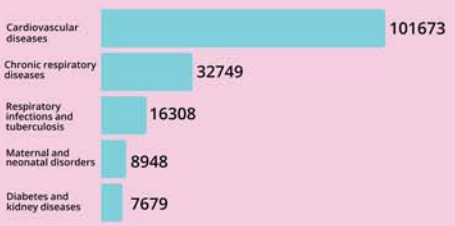
Major Sources of Air Pollution

Exposure to contaminated air causes health risks and deaths from diseases such as

This increases the burden of diseases, out–of–pocket expenditure on health, and reduces productivity of people who have been exposed to toxic air for a prolonged period of time

Air pollution contributes to cardiovascular diseases which caused a significant amount of deaths in 2019

Total deaths per 1,000 people in 2019 from diseases associated with air pollution



How can we achieve cleaner air in our cities ?

- **Promote hybrid or electric cars**
  Encouraging the use of hybrid or electric cars may help reduce vehicular emissions.
- **Upgrade brick kiln technologies**
  Efficient brick production technologies which emit less pollutants should be established
- **Regulate construction sites**
  Construction sites should be regulated to ensure proper storage, coverage, and transportation of construction materials
- **Switch to green energy and technology**
  It is important to shift from coal and move towards renewable energy and increase the use of green technologies
- **Monitoring and enforcement**
  Strict monitoring and enforcement of controlling the emission level of key pollutants (eg. PM) should be maintained

Green Cities Initiative

pollutant emission into the atmosphere. Among the four sectors, the manufacturing and power industry has the highest emission contribution and has released increasingly large volumes of pollutants over the years, from 2014 till 2018 (EDGAR, 2022).

Impact on health: Exposure to poor and contaminated air triggers adverse health risks, creating various symptoms and diseases. Both long-term and short-term exposure to poor air have detrimental health risks which may contribute to diseases such as type 2 diabetes, lower respiratory infection, pulmonary diseases, ischemic, cardiovascular diseases, and chronic obstructive pulmonary diseases (Boogaard, Walker, & Cohen, 2019). On top of that, the toxicity of the air pollutants may gradually reduce the functionality of our lungs, and may even develop lung cancer and chronic heart diseases (Hossain, et al., 2021). Children between the age of 1 year to 4 years, and the elderly between the age of 60 years to more than 95 years, are the most vulnerable groups, as their mortality increases when exposed to ozone, particulate matter, and dust pollution (HEI, 2020). Deaths from numerous diseases associated with air pollution in Bangladesh have risen by 9 per cent over the last 20 years (IHME & GBD, 2019). The highest causes of death are cardiovascular diseases, followed by chronic respiratory diseases. According to the Air Quality Life Index (AQLI) study, it is estimated that the citizens of Dhaka city are losing more than 8 years of life expectancy on average due to air pollution (AQLI, 2022).

Impact on the environment: During January, the meteorological condition is the worst in Bangladesh. Some heavy metals like lead and mercury are commonly found with road dust and other pollutant samples. When this dust falls into flowers, it disturbs their pollinating process. Air pollution also effects the photosynthesis, growth and reproduction of plants (Gurjat, Molina, & Ojha, 2010). Additionally, ground-level ozone is a highly reactive pollutant that hinders the growth of agricultural crops and reduces the yield of many crop species such as wheat, rice, soyabean, and cotton. During the months of January to March, the ground-level ozone concentration increases, and therefore the production of crops and winter vegetables are adversely affected in Bangladesh (Gurjat, Molina, & Ojha, 2010). In addition to that, acid rain becomes increasingly prevalent in areas with extremely high air pollution (Gurjat, Molina, & Ojha, 2010).

Impact on economy: Urban air pollution imposes high economic costs on society. In a study by the World Bank, it was found that loss of welfare due to air pollution accounted for about 6.14 per cent of the total GDP of Bangladesh in 2013 (IHME and World Bank, 2016). The economic cost of air pollution is often attributed to the cost of healthcare. Bangladesh's average annual out-of-pocket expenditure has drastically risen over the years. Each person in Bangladesh had to spend BDT 8,334 per year on average on healthcare from their own pocket in 2019 (The World Bank, 2022). Healthcare expenses have become a huge burden on the poor and marginalised people of the country. Moreover, if people suffer from health problems due to air pollution, their cost and health expenditure would most likely rise, which in turns puts a strain on their work productivity. Due to pollution and environmental degradation in urban areas, the annual loss of productivity was estimated to be USD 1.44 billion for Dhaka city, and approximately USD 6.52 billion, or 3.4 per cent of GDP for Bangladesh in 2015 (The World Bank, 2018).

2.3 Context of plastic pollution

The economic landscape globally, and in Bangladesh, has undergone a significant transformation characterised by a shift towards urbanisation, heightened production capabilities, and the adoption of advanced technologies. Alongside positive, impacts, various trade-offs become apparent, in the form of pollution, environmental degradation, and inadequate waste management.

The increasing challenge of mismanaged waste, specifically plastic waste, has correlated with the expansion of urban areas and industrial sectors, and is a challenge facing both developed and emerging economies.

In the context of Bangladesh, a prevalent throwaway culture, characterised by the deliberate disposal of waste materials in the streets, is evident. This phenomenon gives rise to a substantial burden on city corporations and municipalities. The recycling of plastic poses significant challenges in Bangladesh due to the absence of a comprehensive waste management system and a lack of waste segregation at source.

Plastic remains in the environment for an extended period of time because it does not biodegrade. Commercially utilised plastics are widely recognised for their non-biodegradable nature, leading to their accumulation in landfills. While packaging materials play a crucial role in the preservation and containment of food products, it is important to acknowledge their contribution to the escalating issue of plastic waste, particularly in the context of its accumulation in rivers and water bodies.

Plastic materials found in oceans and rivers can manifest in two primary forms: macroplastics and microplastics. Macroplastics typically comprise sizable PET bottles, which can either submerge beneath the water's surface or remain afloat on it. On the other hand, microplastics are minuscule particles that pose challenges in terms of immediate visual detection.

Plastic waste poses a significant threat to marine organisms, which are susceptible to entanglement in plastic nets and ingestion of microplastics. The escalating phenomenon of plastic accumulation poses a significant concern for the survival of a variety of species reliant on marine life.

Humans are exposed to ingesting mircroplastics through drinking water and through the consumption of other organisms within the food chain, resulting in the build-up of plastic particles within the human body. There is significant concern that prolonged exposure to plastic might have detrimental effects on human health. The presence of microplastics in the atmosphere also allows for the potential inhalation of these particulate pollutants by human beings. This extended exposure to plastic may exacerbate the human immune system.

2.4 Important facts on plastic pollution from the first phase outputs

Water systems acting as a medium of plastic pollution: Rivers play a significant role in being one of the key drivers of plastic pollution by directing mismanaged plastic wastes from one region to another. The river Ganges is the second largest river source of plastic pollution to the world's oceans (Chowdhury, et al., 2020). The Ganges branches out into Padma and Meghna which consequently converges into the Bay of Bengal. According to a study, about 89 per cent of plastic waste is mismanaged in the coastal areas of Bangladesh (Jambeck, et al., 2015). Wastewater is often discharged into the river systems of Bangladesh from urban and industrial areas. Amidst different variants of pollutants, mismanaged plastic waste is identified to be a significant source of contamination in the water system (Kibria, 2017). It should be mentioned that most of the rivers in Bangladesh are transboundary rivers, and therefore, a significant amount of the plastic waste near coastal areas is not locally produced but it is coming from neighbouring countries. Managing plastic waste that is entering Bangladesh from other countries is an additional burden on Bangladesh. Since India has recently outlawed single-use plastics, Bangladesh might end up becoming the next single-use plastic hotspot.

Unregulated production of plastic products: Plastic industries also contribute considerably to the growing mismanaged plastic waste in Bangladesh. There are about 5,000 plastic manufacturers that are operating in Bangladesh and employing about 1.2 million individuals (BIDA, 2021). These manufacturing units are producing a great volume of plastic products to meet both domestic and international consumer demand. The average per capita consumption of plastic has increased from 3 kilograms (kg) per year in 2005 to 9 kg per year in 2020. In Dhaka alone, the average consumption of plastic has increased from 9.2

kg annually in 2005 to 22.25 kg per year in 2020 (The World Bank, 2021). Plastic manufacturers produce an array of plastic products such as kitchen and tableware, lids, bottles, sanitary products, toys, packaging, and construction materials. Manufacturers also produce accessories such as plastic hangers and clear film, buttons, conveyance materials and other plastic parts for other sectors including textiles, pharmaceuticals, and electronics (BIDA, 2021). Total plastic export increased from 56.8 million kg in July 2018 to about 63 kg in December 2019. The plastic sector grew slowly during the initial wave of COVID-19. With the easing of constraints, however, the production of plastic has begun to rise dramatically once more. The total weight of plastic goods exported from Bangladesh to foreign nations as of July 2021 was 55 million kg. The growth in plastic output that is being exported indicates that pre-COVID levels of plastic production may soon be surpassed (EPB, 2021).

Excessive consumption and indiscriminate disposal of single-use plastics: Single-use plastics are the most frequently used plastic products in not just Bangladesh but all over the world. Single-use plastics such as plastic bags, clear plastic thin wraps, coffee cups and lids, utensils, straws, coffee stirrers, caps, and bottles, are generally used once and then disposed. As of 2019, a survey suggested that individuals throw away about 87,000 tons of single-use plastics every year in Bangladesh. Approximately 96 per cent of this waste comes from consumer items, 33 per cent of which are non-recyclable sachets. A major fraction of the single-use plastic is not disposed of properly and therefore these end up as wastes in landfills and river systems further polluting the environment.

The surge in the use of single-use plastics driven by COVID-19: The plastic scenario in urban areas of Bangladesh has been a growing concern, which was exacerbated by COVID-19. The informal sector is mostly responsible for the collection of waste from households and landfills in Bangladesh. However, during the pandemic, most of the waste collectors were unable to work owing to the infection and associated lockdown restrictions which made plastic waste collection less frequent. Due to the fear of infection, individuals changed their lifestyles and began to be more reliant on single-use plastics. Single-use personal protective equipment (PPE), medical masks, plastic gloves, and polythene bags have all become increasingly popular. This change in consumption choices has increased the volume of plastic wastes leading to plastic pollution. Despite the ban on polythene bags in Bangladesh since 2002, the use of these disposable single-use plastic bags has only increased. Polythene bags are the main source of single-use plastic waste in Bangladesh (ESDO, 2021).

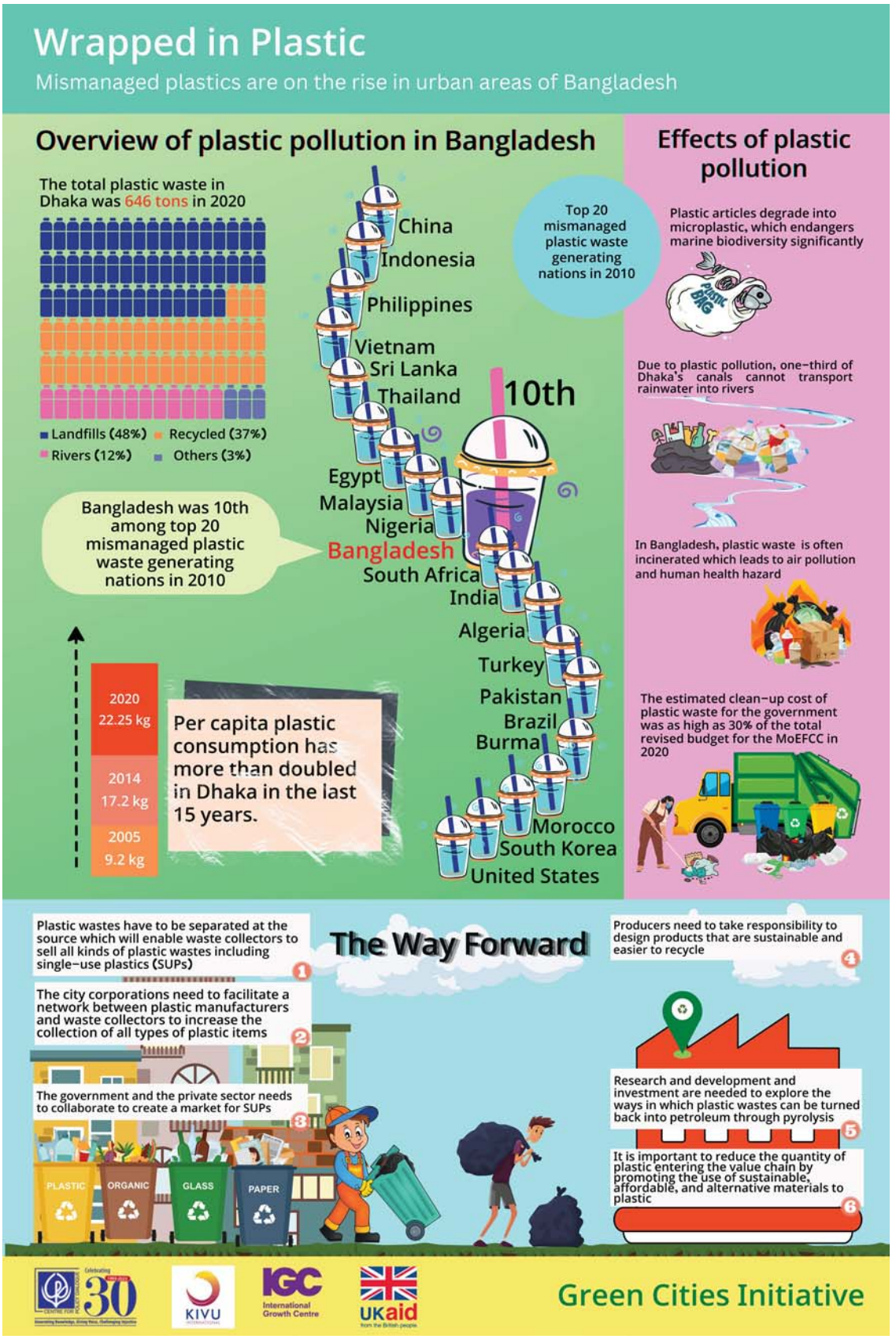
Inadequate waste management: Another major driver of plastic waste generation is the lack of awareness and initiatives taken at the household level. In Bangladesh, plastic is not segregated at the source. Households compile all their wastes together before disposing of it. This also contaminates the plastics that could have been separated and recycled at a later stage of waste treatment. The informal sector mostly collects PET bottles as they have a high market value and can be cleaned easily even if they are soiled. Materials such as polythene packaging, Low Density Polyethene (LDPE) items, and multilayer plastic (MLP) products are often not collected by waste collectors as they supposedly have a lower market value, do not melt easily, and require a lot of time to separate and collect. MLP such as packaging for crisps and other food products are difficult to recycle as the recycling industry does not have the proper technology. As a result, a major proportion of polythene bags, packaging, wrappers, and MLPs accumulate in landfills (The World Bank, 2021).

Environmental impacts: The most harmful effect of plastic waste on the surrounding air may be ascribed to deliberate or unintentional open-fire burning. Burning solid waste is a prevalent practice in Bangladesh to minimise the amount of litter in landfills and urban areas. However, due to a lack of awareness and segregation, these wastes contain plastic items, which are also burned. Incinerating plastics made of PVC presents the greatest threat to air pollution (Hossain S. , Rahman, Chowdhury, & Mohonta, 2021).

The most apparent effect of plastic waste mismanagement has been observed in water bodies. Plastic waste accounts for much of the marine pollution in coastal areas of Bangladesh. In areas such as in Cox's Bazar, tourists and visitors throw away single-use plastic items on the beach which ultimately ends up in the sea. Due to rainfall, plastic waste from landfills in Bangladesh are also deposited in canals and riverways in the surrounding urban cities. Plastic wastes clog canals and sewage systems as well. In the city of Dhaka 22 out of 65 canals are now transformed into dumping zones mostly, due to plastic pollution (Hossain S. , Rahman, Chowdhury, & Mohonta, 2021). Plastic articles degrade into microplastic, which endangers marine biodiversity significantly. Microplastics are mistaken for food by marine species, who eventually suffer from indigestion and digestive system damage from cellular necrosis, swelling, and tearing. According to a survey conducted in Bangladesh's three major cities of Dhaka, Chittagong, and Sylhet, larger fish such as catfish were found to have more microplastic in their bodies as opposed to the smaller fish (ESDO , 2016).

Health impacts: Products made from plastic contain various additives such as Bisphenol A (BPA), phthalates, and other chemicals which can be hazardous to both the environment and to human health. Often street vendors in Bangladesh serve tea and coffee in plastic cups. Under heat, these additives can leach out and enter the human bloodstream which may cause negative health impacts (Proshad, et al., 2018). Plastic affects human health at every stage: from extraction to production to utilisation and to disposal (Azoulay, et al., 2019). From the consumer end, the impact of plastics is felt either through skin contact or inhalation and ingestion. Plastic pollutants can also enter the human body through the food chain as individuals may consume fish contaminated with plastic particles. Burning plastic wastes releases toxins such as furans and dioxins like persistent organic pollutants (POPs) that worsen the respiratory diseases, and heart ailments, and can damage the nervous system (Verma, Vinoda, Papireddy, & Gowda, 2016). Plastic wastes have collapsed sewage systems by disrupting natural channels and suffocating drainage systems. This causes flooding during the monsoon season, in the streets of Dhaka and Chittagong for several days. Flooded streets lead to mosquito-borne diseases such as dengue and malaria (Hossain S. , Rahman, Chowdhury, & Mohonta, 2021). Another current concern is that single-use plastics may contribute to the spread of the SARS-CoV-2 virus. The COVID-19 virus can survive up to 3 days or 72 hours on plastic wastes which can be hazardous to human health considering how single-use plastics are disposed of indiscriminately (Prata, Ana L.P. Silva, Walker, Duarte, & Rocha-Santos, 2020). The virus can potentially spread through disposed face masks, plastic hand gloves, as well as other discarded PPE which are collected by waste collectors or other representatives from the municipalities without taking any cautionary measures. The informal sector in Bangladesh comes under great risk to be exposed to the infection while potentially spreading the virus to those they are encountering (ESDO, 2020).

Economic impacts: Most literature pivot more towards the environmental and health impacts of plastic pollution, yet the economic costs of plastic pollution are seldom debated over. In Bangladesh, the tourism business has a huge potential to not only contribute significantly to the country's GDP but also to provide jobs and employment for millions of individuals. However, plastic pollution or improper waste management may have a significant negative impact on the tourism, and aquaculture and fishing industries. The persistent accumulation of plastic debris near coastal areas with the associated putrid odour can make such regions less appealing to tourists. Furthermore, the increasing prevalence of microplastic-contaminated fish may render marine creatures unfit for human consumption. This may also affect the export volume for fishes in the long run as Bangladesh may not meet the sanitary and phytosanitary (SPS) measures of partner countries. Additionally, the expense of clean-up costs can be a burden on local governments and municipalities. Municipalities in every region are stipulated to a designated budget. However, it is often seen that most of the budget is used up to cover the expenses of clean-up costs, as waste collectors transport wastes from the streets and secondary dumping stations to landfills. The highest estimated clean-up cost for Bangladesh was estimated in 2020 to be as high as 30 per cent of the


Wrapped in Plastic
Mismanaged plastics are on the rise in urban areas of Bangladesh
Overview of plastic pollution in Bangladesh
The total plastic waste in Dhaka was 646 tons in 2020
Landfills (48%)
Recycled (37%)
Rivers (12%)
Others (3%)
Top 20 mismanaged plastic waste generating nations in 2010
China
Indonesia
Philippines
Vietnam
Sri Lanka
Thailand
10th
Egypt
Malaysia
Nigeria
Bangladesh
South Africa
India
Algeria
Turkey
Pakistan
Brazil
Burma
Morocco
South Korea
United States
Bangladesh was 10th among top 20 mismanaged plastic waste generating nations in 2010
2020 22.25 kg
2014 17.2 kg
2005 9.2 kg
Per capita plastic consumption has more than doubled in Dhaka in the last 15 years.
Effects of plastic pollution
Plastic articles degrade into microplastic, which endangers marine biodiversity significantly
Due to plastic pollution, one-third of Dhaka's canals cannot transport rainwater into rivers
In Bangladesh, plastic waste is often incinerated which leads to air pollution and human health hazard
The estimated clean-up cost of plastic waste for the government was as high as 30% of the total revised budget for the MoEFCC in 2020
The Way Forward
1 Plastic wastes have to be separated at the source which will enable waste collectors to sell all kinds of plastic wastes including single-use plastics (SUPs)
2 The city corporations need to facilitate a network between plastic manufacturers and waste collectors to increase the collection of all types of plastic items
3 The government and the private sector needs to collaborate to create a market for SUPs
4 Producers need to take responsibility to design products that are sustainable and easier to recycle
5 Research and development and investment are needed to explore the ways in which plastic wastes can be turned back into petroleum through pyrolysis
6 It is important to reduce the quantity of plastic entering the value chain by promoting the use of sustainable, affordable, and alternative materials to plastic
PLASTIC
ORGANIC
GLASS
PAPER
Green Cities Initiative

total revised budget for the Ministry of Environment, Forest, and Climate Change (MoEFCC) in 2020 (The Ocean Cleanup , 2022; MoF, 2021).

A further unevaluated cost of plastic pollution is the cost of treatments for health conditions caused by plastic pollution, especially for the waste collectors in the informal sector. Although further research is required to analyse the direct health costs of plastic particles, clogged drains and sewage system due to plastic wastes do increase the potential for waterborne diseases in urban areas. Such a health burden will increase out-of-pocket expenditure towards medical bills which will affect the savings for waste collectors further pushing them towards poverty.

3. The Green Cities Initiative Survey

The Green Cities Initiative aimed to make cities green and environment-friendly through the reduction of pollution from air and plastic. As part of this study, CPD conducted research based on data collected through a survey of 500 households in Dhaka city to build an extensive database that would facilitate the integration of research evidence into policy. To facilitate this, a survey implementation firm was recruited to conduct the survey in Dhaka city. The enumerators of the survey firm were trained by the CPD Green Cities Initiative Research Team.

This survey explored residents' perceptions of the scale of air and plastic pollution, their understanding of the causes and impacts of pollution and their willingness to change their own behaviour or support policies with the aim of reducing pollution in the city.

Overall, the survey found that air and plastic pollution is a major concern for the residents of Dhaka, and that they understand the impact of both on the environment and, particularly in the case of air pollution, the risks it poses to human health. Those surveyed overwhelmingly believed that solutions to the problem will require a mixture of personal behaviour change and intervention and investment from the government and industry. These results suggest that with the right policies in place, such as improved transportation infrastructure and waste management individuals would be willing to make appropriate changes to their behaviour, for example to reduce private vehicle usage and plastic bag consumption.

The Green Cities Initiative placed significant emphasis on robust data collection through an extensive structured survey questionnaire from residents of 500 randomly selected households. The survey aimed to reach a representative sample of households in Dhaka city. Interviews were carried out in Bangla language by means of face-to-face surveys using internet-connected and global positioning system (GPS) enabled Android tablets running SurveyCTO.

The survey had the following objectives:

- To understand perceptions of households towards plastic and air pollution
- To evaluate households' contribution to plastic and air pollution
- To identify health impacts of plastic and air pollution on households
- To assess the economic cost of plastic and air pollution on households
- To judge the level of awareness of plastic and air pollution among households
- To estimate households' willingness to pay for causing plastic and air pollution
- To validate households' support or opposition to policies related to plastic and air pollution

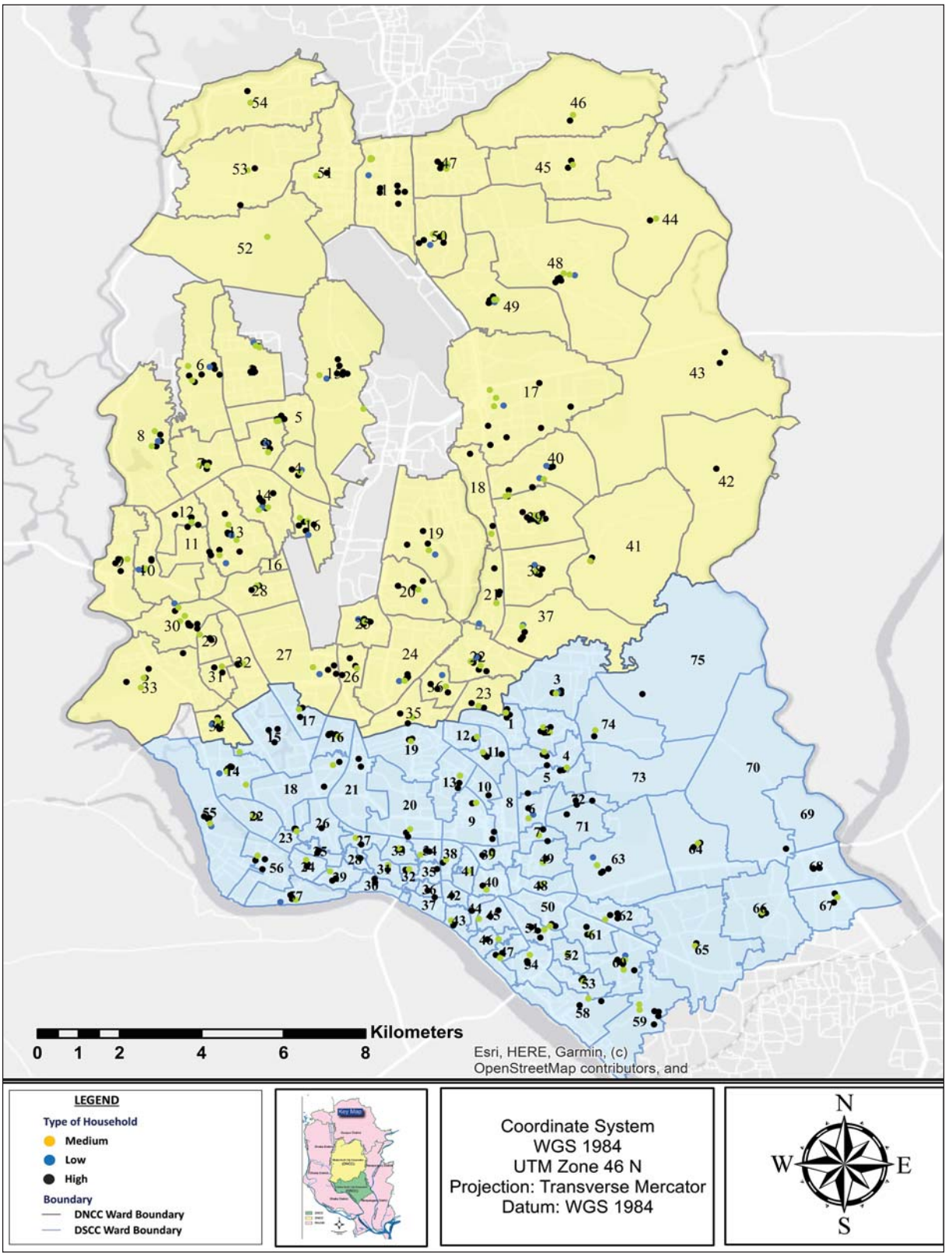
The data collected through this survey facilitated the identification of the underlying factors contributing to air and plastic pollution, as well as their respective impacts, and thereby provided valuable insights for the development of effective policy measures aimed at mitigating air and plastic pollution. The empirical evidence generated through this survey will be conducive towards raising the salience of air and plastic pollution in the general public discourse, and ultimately facilitate behavioral change and policy change that will create a roadmap for green cities in Bangladesh.

A module-based structured questionnaire to be used for data collection in the survey was prepared by the CPD Green Cities Initiative Research Team. A draft version of the questionnaire initially prepared by CPD Research Team was reviewed by a high-level committee of experts consisting of environmental economists, academics, air and plastic pollution experts, researchers, statisticians, and government officials. The committee meticulously reviewed each individual question in the draft questionnaire and provided comments, feedback, insights, and suggestions. All inputs from the committee of experts were incorporated into the draft questionnaire to prepare the final questionnaire.

The CPD Green Cities Initiative Research Team developed the survey questionnaire with the aim of gathering a comprehensive array of observable attributes pertaining to households and their members. The purpose of this exercise was to facilitate an enhanced comprehension of the correlation between households and air and plastic pollution.

Computer-Assisted Personal Interviews (CAPI) Equipment and Software was used and the survey questionnaire was administered via internet-connected and GPS-enabled Android tablets running SurveyCTO. The data was electronically collected using tablet computers and was uploaded to a server instantaneously allowing for remote quality control and real-time remote tracking of the enumerator team by the CPD Green Cities Initiative Research Team.

Figure 3.1: Map showing the locations of the households which participated in the survey conducted as part of the CPD Green Cities Initiative



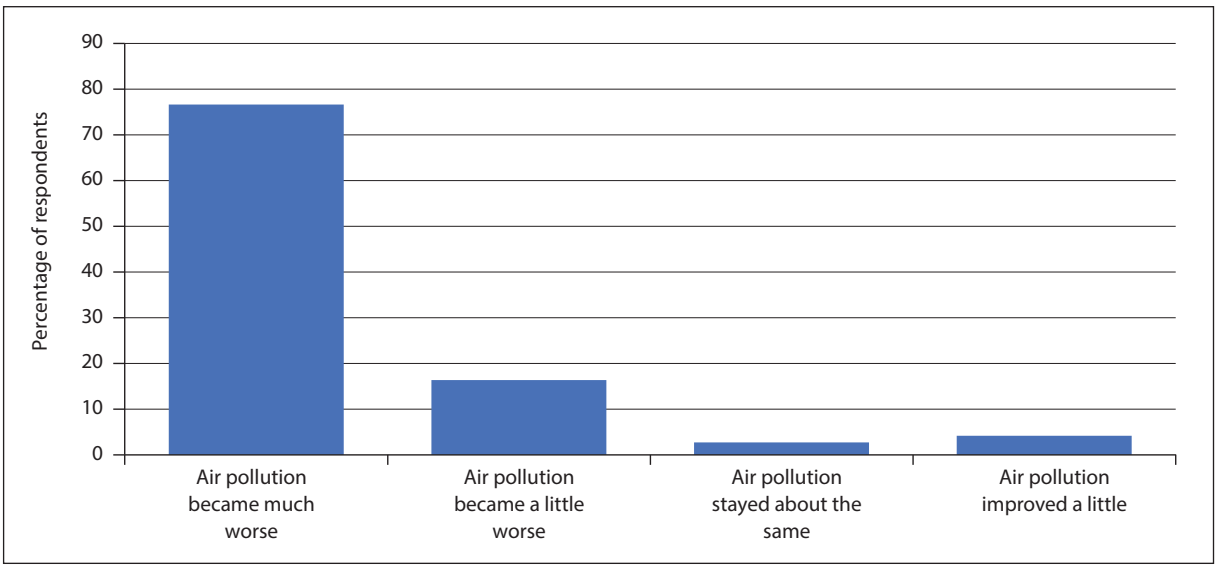
Source: Authors' illustration based on survey data.

Figure 3.1 shows the locations of the households which participated in the survey conducted as part of the CPD Green Cities Initiative.

4. Findings of the Survey for Air Pollution

4.1 Perception of air pollution

Figure 4.1: Perception of air pollution in Dhaka city in the past 2-3 years (in per cent)

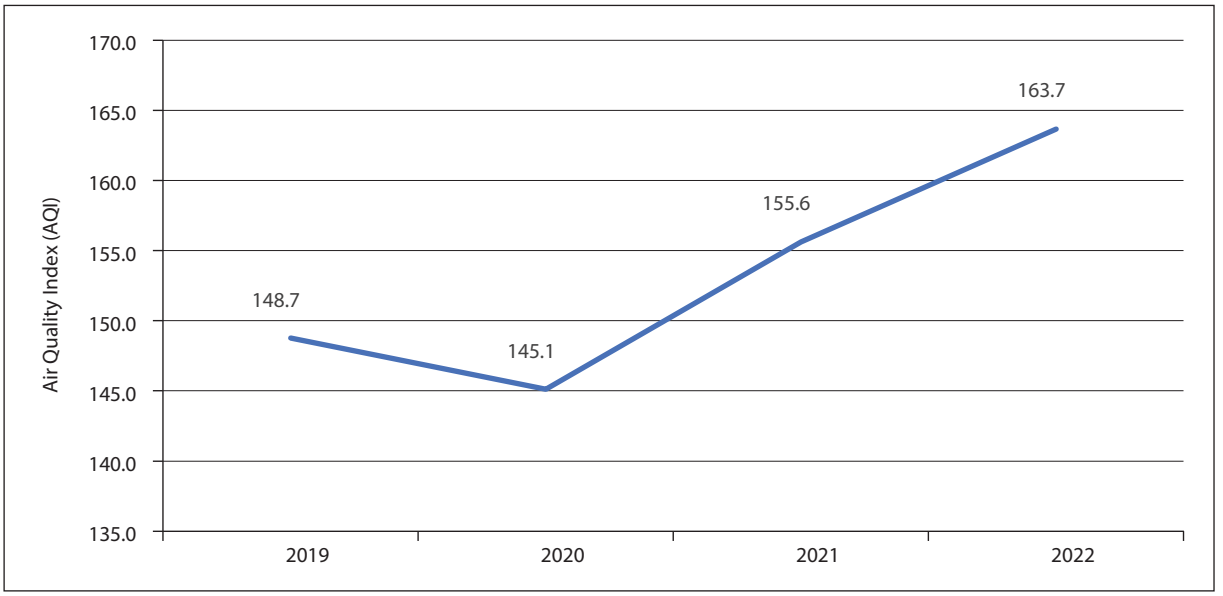


Source: Authors' own illustration based on survey data.

More than 76 per cent, thought that air pollution in Dhaka city became much worse in the past 2-3 years. In contrast, only 2.8 per cent thought that the level of air pollution stayed the same over the 2-3 years. Around 4.2 per cent thought that the air quality improved a little in the past 2-3 years (Figure 4.1).

The figure 4.2 illustrates a 13 per cent increase in the annual Air Quality Index (AQI) in Dhaka from 2020 to 2022. This increase suggests a deterioration in air quality over the past 2-3 years in the city. The AQI is measured on a scale from 0 to 500, taking into account four major air pollutants including ground-level ozone, particle pollution, carbon monoxide, and sulfur dioxide (EPA, 2014). A higher AQI value indicates a

Figure 4.2: Annual Air Quality Index (AQI) trends from 2019 to 2022 in Dhaka city



Source: Authors' illustration using data from U.S. Embassy Bangladesh Air Quality (AirNow, 2022).

lower air quality. Therefore, the respondents' perception of increased air pollution in Dhaka city over the past 2-3 years aligns with empirical data.

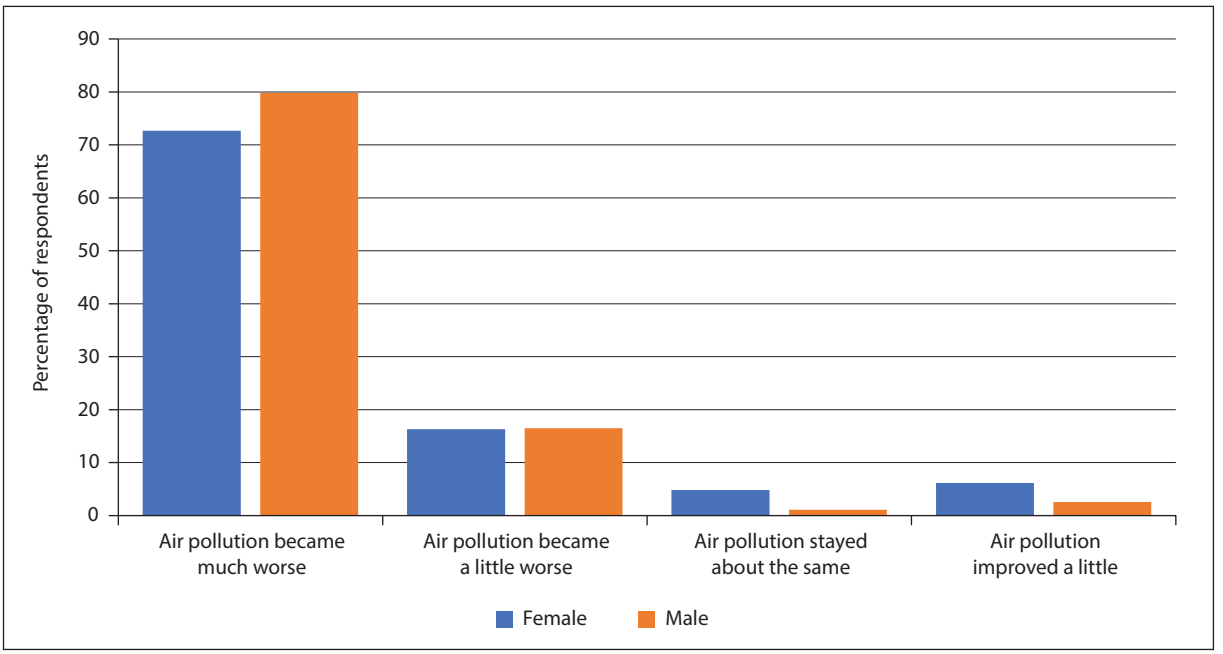
An AQI value of 163.7 falls under the "unhealthy" category for air quality. According to health experts, an unhealthy AQI level can have serious health effects, particularly for sensitive groups such as children, the elderly, individuals with lung diseases, and those who are active outdoors (EPA, 2014).

The majority of both female and male respondents believed that air pollution in Dhaka city had worsened in the past 2-3 years (Figure 4.3). The survey findings show that 73 per cent female respondents and 78 per cent male respondents believed that air pollution became much worse in the last 2-3 years. This is the most significant response from both female and male respondents, indicating that a substantial portion of the population perceived a significant deterioration in air quality. Possible reasons for this perception could include increased industrialisation, population growth, vehicular emissions, construction activities, and other factors contributing to higher pollution levels.

A smaller but still substantial percentage of respondents believed that air pollution had slightly worsened, as the survey findings show that 17 per cent female and 19 per cent male respondents believed that air pollution became a little worse in the past 2-3 years. This may suggest that while the majority perceived a significant change, others have noticed a more gradual decline in air quality. Factors like urban development and traffic congestion might have contributed to this perception.

Very few respondents believed that air pollution remained constant. It is possible that these individuals did not observe significant changes in their immediate surroundings. Finally, a small percentage of respondents thought that air pollution improved slightly.

Figure 4.3: Perception of air pollution in the last 2-3 years by gender (in per cent)



Source: Authors' own illustration based on survey data.

These findings can be attributed to a combination of factors such as rapid urbanization, industrialisation, vehicular emissions, inadequate environmental regulations, and weather conditions. Dhaka is known for its severe air pollution problems, including high levels of particulate matter and smog, which can have serious health consequences for its residents. Effective measures need to be taken to address the worsening air quality and protect the health of the city's residents.

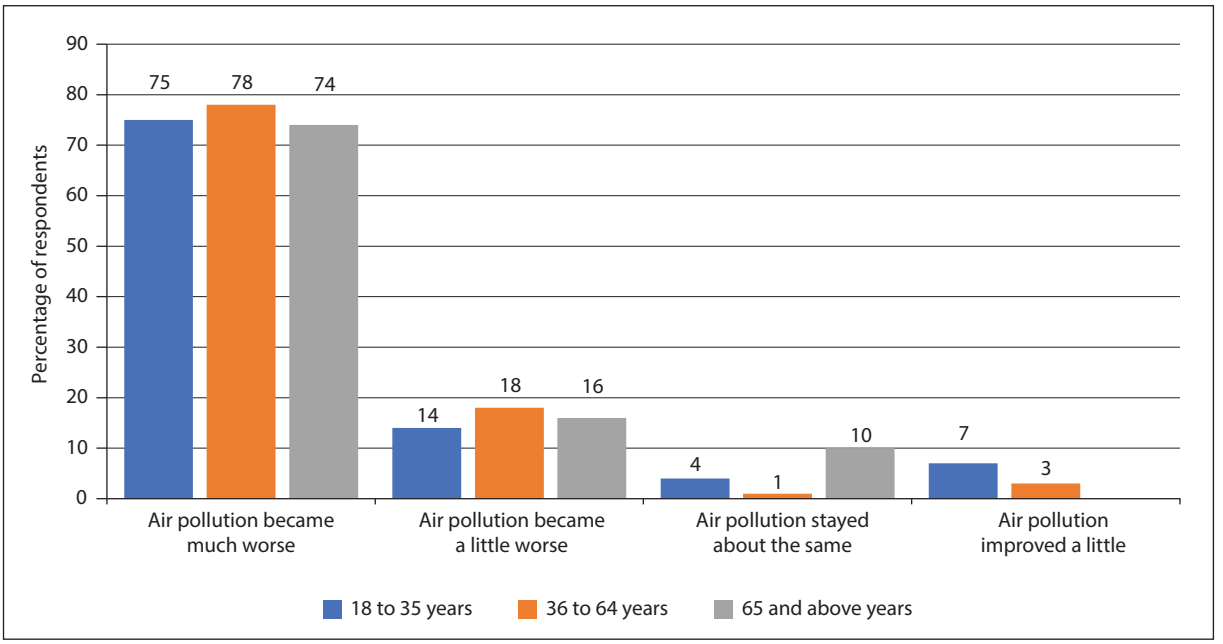
The figure 4.4 shows the perceived changes in air pollution in Dhaka city over the past 2-3 years, disaggregated by different age groups. Across all age groups, the majority of respondents believed that air pollution had become much worse. In the 65 and above years group, 74 per cent respondents thought that air pollution became much worse, indicating a strong perception of significant deterioration in air quality in this older demographic. The 36 to 64 years group also expressed a high level of concern, as 78 per cent of the respondents thought that air pollution became much worse, suggesting that middle-aged individuals were similarly affected by the worsening air quality. The youngest age group compromising of individuals aged 18 to 35 years was slightly less concerned, with 75 per cent perceiving a significant decline in air quality.

A smaller but notable portion of respondents in all age groups believed that air pollution had slightly worsened. Very few respondents across all age groups believed that air pollution had remained constant.

Interestingly, only the 18 to 35 years and 36 to 64 years age groups reported that air pollution had improved slightly. The 65 and above years group did not indicate any improvement. This suggests that younger respondents may have noticed specific local improvements or changes in their daily environments.

These findings highlight a consistent perception among different age groups that air pollution has generally worsened in Dhaka city over the past 2-3 years. This shared concern may be due to factors such

Figure 4.4: Perception of air pollution in the last 2-3 years by age group (in per cent)



Source: Authors' own illustration based on survey data.

as increasing urbanisation, industrialisation, vehicular emissions, and a lack of effective environmental regulations. Additionally, older age groups, who are often more vulnerable to the health effects of air pollution, seem to be particularly concerned about the worsening air quality.

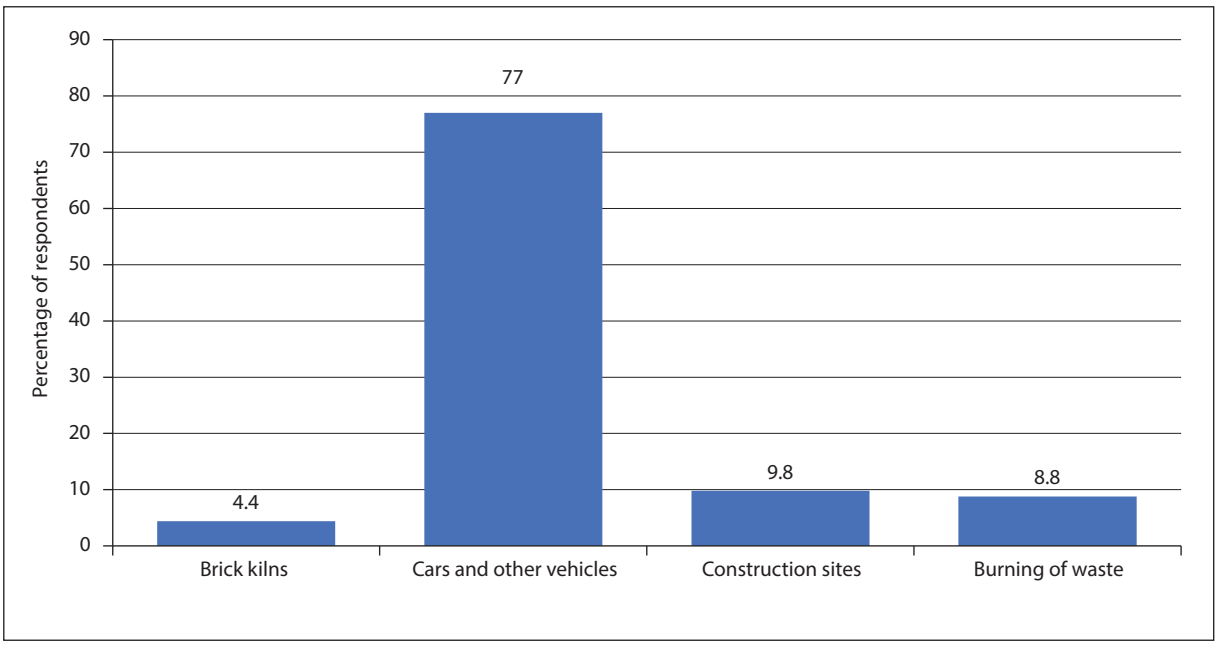
It is important to note that these findings are based on respondents' perceptions and may not necessarily reflect scientifically measured air quality data, although the studying the AQI trends over the same period demonstrates that perceptions are generally in line with observable air quality monitoring data. Additionally, these perceptions are valuable as they reflect public awareness and concern, which can drive advocacy for cleaner air and policy changes to address air pollution in Dhaka city.

About 77 per cent of the respondents identified car and other motor vehicles as the major cause of air pollution in Dhaka city. Only 4.4 per cent recognised brick kiln as the most responsible for Dhaka's poor air quality, while others think it is the mismanagement of construction sites and burning of waste which are responsible. However, in reality, brick kilns release the highest concentration of fine particles, accounting for about 58 per cent of the total emissions into the air in Dhaka city. (DoE and the World Bank, 2019).

When the respondents were asked who should be responsible for reducing air pollution in Dhaka, the majority said it is the responsibility of everyone including Dhaka City Corporation, Ministry of Environment, Forest and Climate Change (MoEFCC), factory and brick kiln owners, private vehicle owners, and local communities. More than 33 per cent of them thought that combating air pollution will not be possible without collaboration of both private and public sectors.

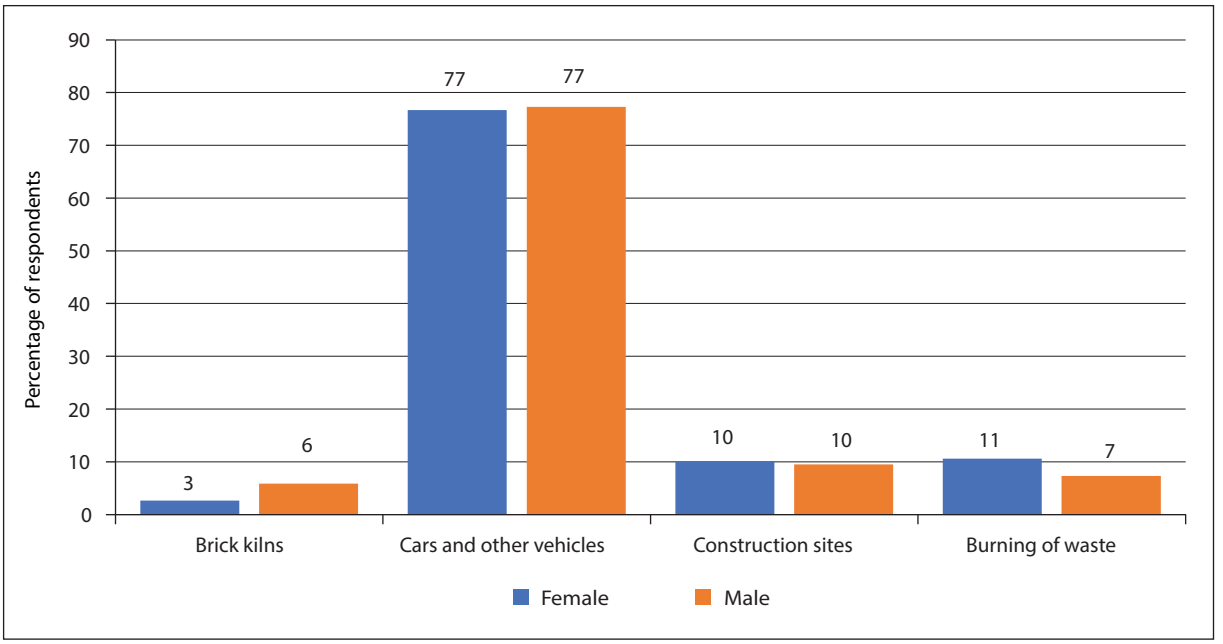
From Figure 4.6, it appears that both female and male respondents in Dhaka city predominantly believed that cars and other vehicles were the main cause of air pollution. The survey findings show that 79 per cent female and 78 per cent male respondents believed that cars and other vehicles were the primary source of air pollution. This is a common perception in many urban areas worldwide. Dhaka is known for its

Figure 4.5: Perception of the main cause air pollution in Dhaka city



Source: Author's own illustration based on survey data.

Figure 4.6: Perceived reasons for the main cause of air pollution by gender



Source: Authors' own illustration based on survey data.

high population density and traffic congestion, which can lead to increased emissions from automobiles. Factors such as the widespread use of older, less fuel-efficient vehicles and a lack of proper emission controls contribute to this perception.

The survey findings also show that 10 per cent female and 8 per cent male respondents identified construction sites as contributing to air pollution. Construction activities can generate dust and emissions, which can impact air quality, especially in densely populated urban areas like Dhaka. The relatively higher female response in this category may be due to greater awareness or concern about construction-related pollution among female respondents.

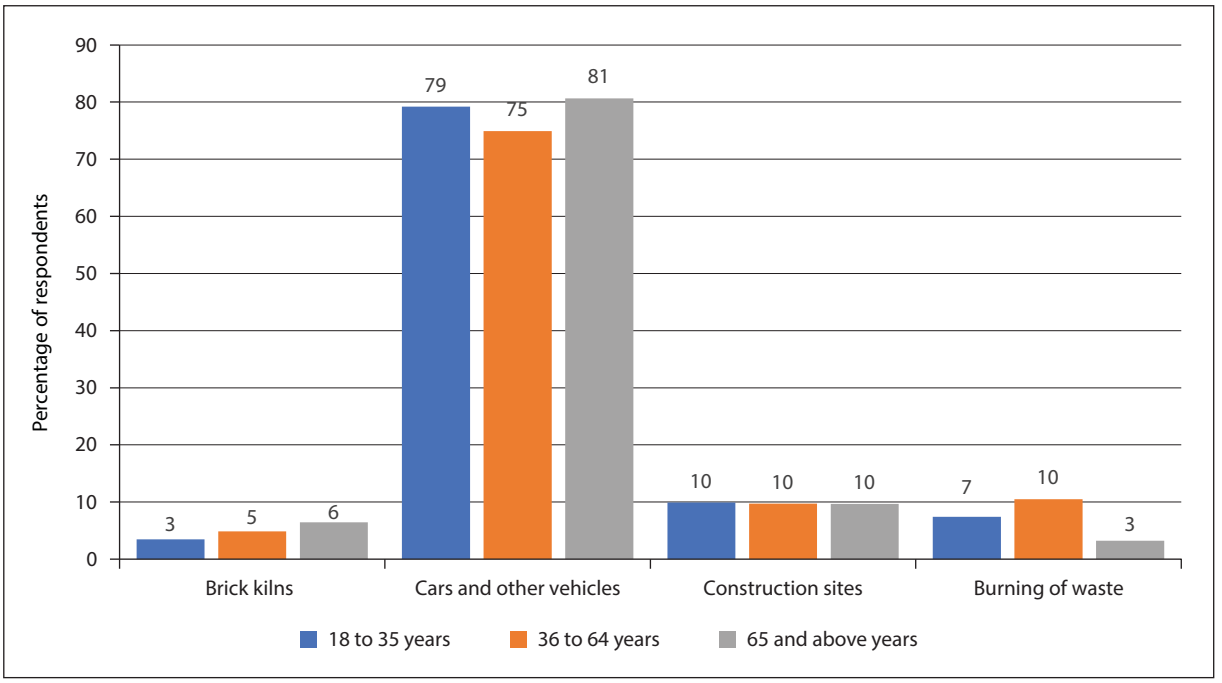
Burning of waste was recognised by 9 per cent female and 7 per cent male respondents as a source of air pollution. The burning of waste, especially in open areas or informal disposal sites, can release harmful pollutants into the air. This perception may reflect growing awareness of the environmental impact of waste disposal practices.

Finally, only 2 per cent female respondents and 6 per cent male respondents mentioned brick kilns as a source of air pollution. Brick kilns are indeed a significant source of air pollution in Dhaka and other parts of Bangladesh, emitting particulate matter and pollutants like sulphur dioxide. The gender difference in perception could be due to varying levels of awareness or exposure to brick kiln activities.

These findings underscore the multifaceted nature of air pollution in Dhaka city, where various factors contribute to deteriorating air quality. Cars and other vehicles are perceived as the primary culprits, likely due to their ubiquitous presence and well-documented impact on urban air pollution. However, other sources such as brick kilns, construction sites, and waste burning also play significant roles in exacerbating the problem.

Addressing air pollution in Dhaka requires comprehensive measures, including stricter emission standards for vehicles, improved public transportation, cleaner industrial practices, and better waste management.

Figure 4.7: Perceived reasons for the main cause of air pollution by age group



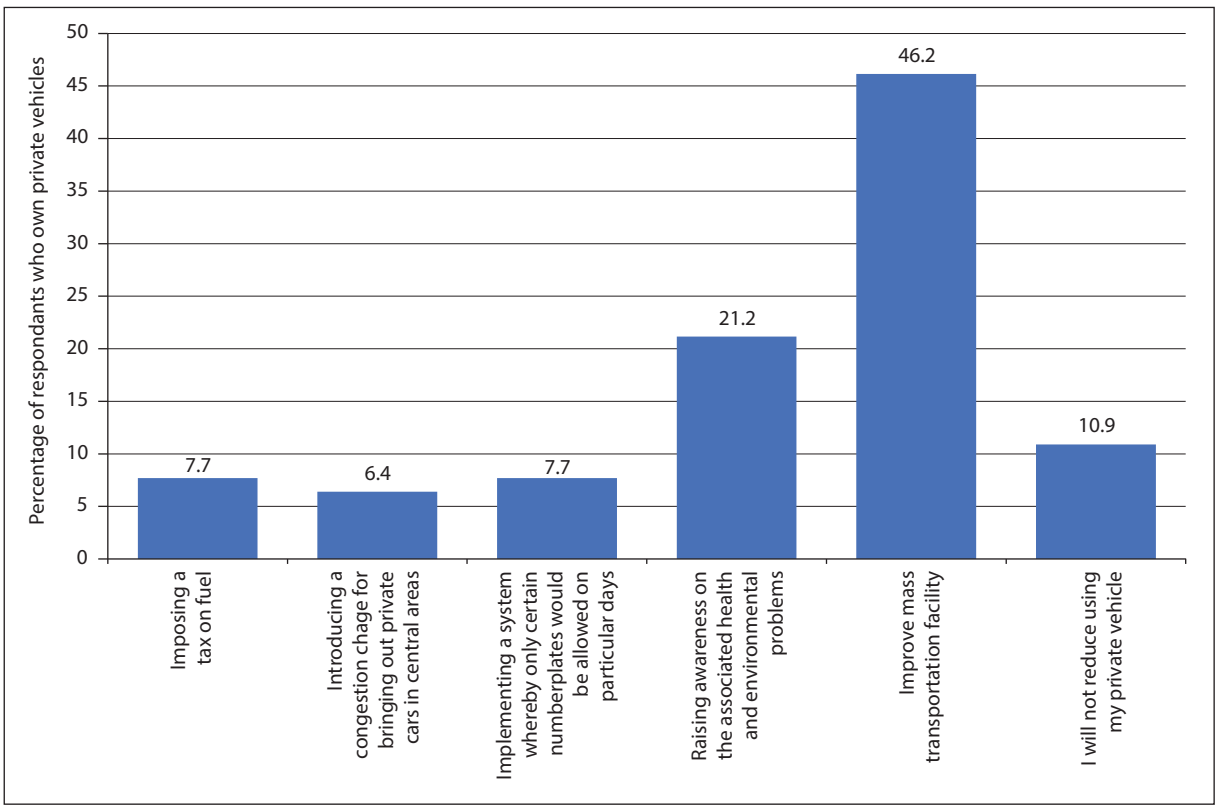
Source: Authors' own illustration based on survey data.

Additionally, raising public awareness about the sources and consequences of air pollution can help drive collective efforts towards cleaner air in the city.

Figure 4.7 shows the perceived main causes of air pollution in Dhaka city across different age groups. Across all age groups, the majority of respondents believed that cars and other vehicles were the primary cause of air pollution in Dhaka city. The survey findings show that 81 per cent respondents in the 65 and above years group, 79 per cent of the respondents in the 18 to 35 years group, and 75 per cent of the respondents in the 36 to 64 years group believed that cars and other vehicles were the primary cause of air pollution in Dhaka city. This overwhelming agreement across age groups suggests a widespread perception that vehicular emissions are a significant contributor to air pollution in Dhaka. This perception aligns with the common understanding that traffic congestion, the prevalence of older and less fuel-efficient vehicles, and a lack of robust emissions controls contribute to poor air quality in the city.

The survey findings show that 10 per cent of respondents in the 36 to 64 years group, 10 per cent of the respondents in the 18 to 35 years group, and 10 per cent of the respondents in the 65 and above years group considered construction sites as the main source of air pollution in Dhaka. Construction-related dust and emissions can contribute to local air pollution, especially in densely populated urban areas. The varying levels of concern across age groups may reflect differences in exposure to construction activities or awareness of their environmental impact.

Figure 4.8: Incentive to reduce the usage of private vehicles



Source: Author's own illustration based on survey data.

Burning of waste was perceived as a cause of air pollution by 10 per cent of respondents in the 36 to 64 years group, 7 per cent of the respondents in the 18 to 35 years group, and 3 per cent of the respondents in the 65 and above years group. The burning of waste materials, especially in open areas, can release harmful pollutants into the air. The variation in perceptions across age groups might be due to differences in waste management practices and awareness.

The data shows that brick kilns are mentioned by only a small percentage of respondents as a cause of air pollution, regardless of age group. While brick kilns are indeed a significant source of air pollution in Dhaka, it appears that they are less prominently recognised compared to other sources, possibly due to varying levels of awareness or exposure to this particular issue.

Overall, these findings demonstrate a broad consensus across age groups that cars and other vehicles are the primary cause of air pollution in Dhaka city. This consensus aligns with the well-documented impact of vehicular emissions on urban air quality. However, it is also important to consider the contributions of other sources, such as construction sites and the burning of waste, and address them collectively through comprehensive air quality management strategies to improve the city's air quality.

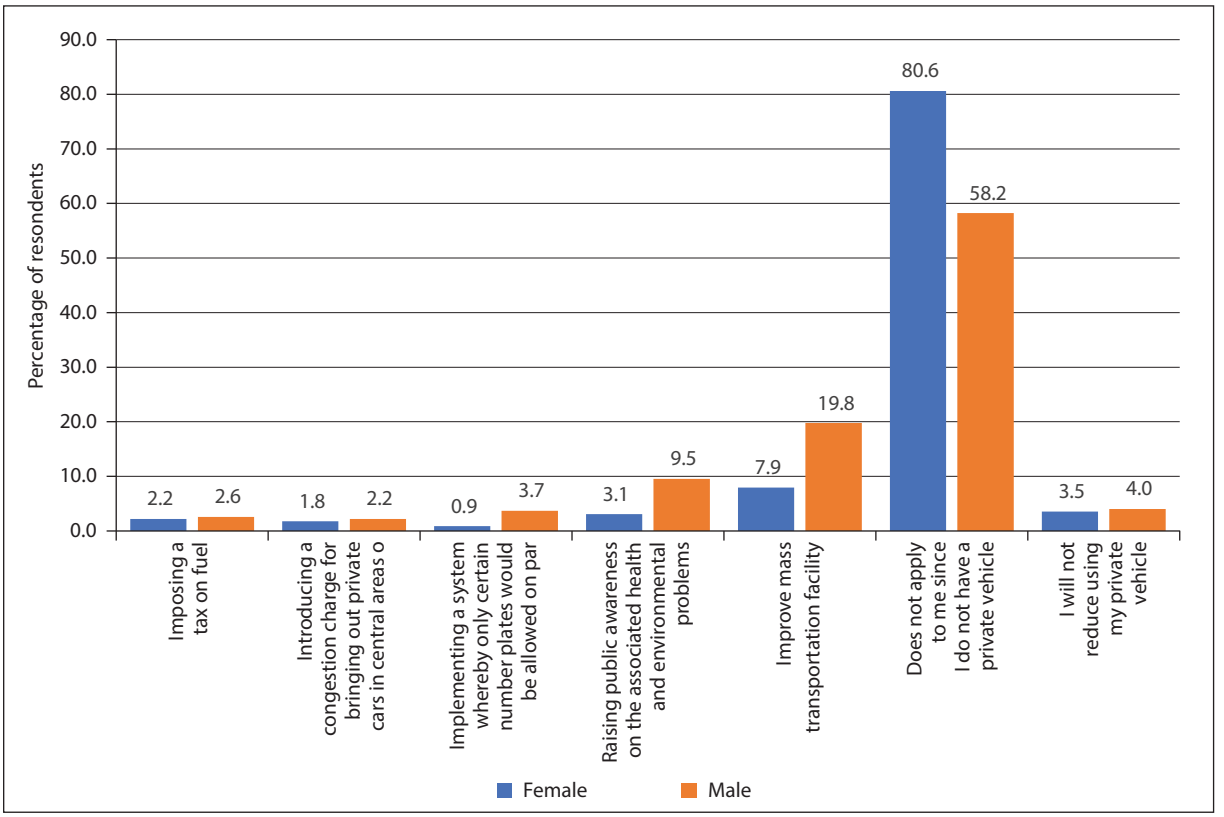
Most respondents (68 per cent) did not own their own vehicles. However, when private vehicle owners were asked about their opinion on what may reduce the usage of private vehicles on the streets of Dhaka, it was found that almost half (46 per cent) believed that improving mass transportation facility would lead to a substantial reduction in private vehicle usage, potentially improving the city's air quality (Figure 4.8). Approximately 21 per cent of private vehicle owners were of the opinion that increasing public awareness regarding the health and environmental hazards associated with air pollution caused by private vehicles could result in a reduction in their usage. A mere 7.7 per cent of those surveyed thought that implementing a fuel price tax would act as an effective deterrent for private vehicle owners, discouraging them from frequently using their cars on the streets of Dhaka. There remained a minority of private vehicle owners (10.9 per cent) who believed none of the measures suggested would encourage them to reduce their usage of their vehicle.

Figure 4.9 shows the factors that could potentially reduce the use of private vehicles among respondents, categorised by gender. A significant portion of both male and female respondents stated that the options presented in this survey question did not apply to them because they did not own private vehicles. This response suggests that a substantial number of people in Dhaka city may rely on other modes of transportation or do not have access to private vehicles.

Enhancing public transportation options is a widely recognized way to reduce private vehicle use. Around 8 per cent females and 19 per cent males said that they would reduce using their private vehicles if the mass transportation facilities in Dhaka were improved. This difference between men and women suggests that women may have more hesitation towards using public transit as compared with men, which could be due to safety concerns. Therefore, any expansion of public transit should consider how to make these options as appealing as possible to both men and women, including ensuring adequate safety measures.

Among the survey respondents who owned a private vehicle, 3.5 per cent females and 4 per cent males expressed a clear intention not to reduce their private vehicle usage, regardless of the proposed measures. This indicates resistance to changing transportation mode among a minority of respondents.

Figure 4.9: Incentives to reduce using own private vehicle by gender



Source: Authors' own illustration based on survey data.

Educating the public about the health and environmental issues associated with private vehicle use may lead to behavioural change. Among the survey respondents who owned a private vehicle, 3.1 per cent females and 9.5 per cent males agreed that raising public awareness on the health and environmental problems associated with car use could make them reduce using their car. Males showed significantly more support for this approach compared to females, suggesting that they may be more responsive to awareness campaigns in this context.

Congestion charges are fees imposed on private vehicles entering certain high-traffic areas, with the aim of reducing traffic congestion. In this survey, both females and males had limited support for this measure, suggesting that it may not be a highly popular option among respondents.

A tax on fuel is a common strategy to discourage the use of private vehicles by making fuel more expensive. Another strategy to reduce traffic is restricting access to certain areas based on license plate numbers. However, neither female nor male private vehicle owners showed much support for either of these strategies.

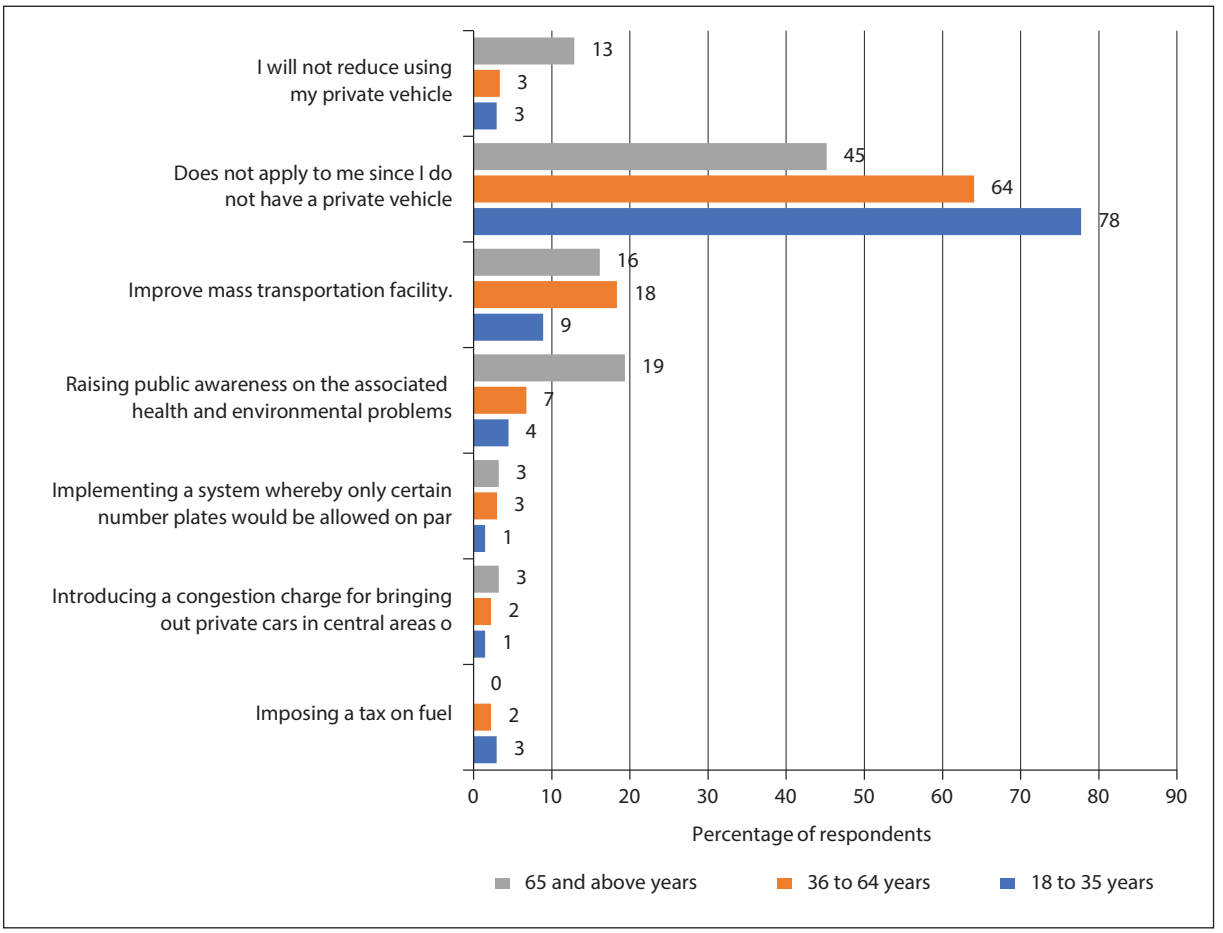
In summary, these findings suggest that improving mass transportation facilities and raising awareness about health and environmental concerns appear to be the most favoured strategies for reducing private vehicle use in Dhaka city. However, there is also a significant portion of respondents who do not own

private vehicles, and a minority who are unwilling to reduce their private vehicle usage, regardless of the measures implemented. Gender differences are apparent in the level of support for certain measures, with males generally expressing stronger support for these strategies.

Figure 4.10 shows the factors that could potentially lead to a reduction in the use of private vehicles among respondents, classified by age groups. Once again, a significant portion of respondents in all age groups indicated that the options presented did not apply to them because they did not own private vehicles. This suggests that a substantial number of people in Dhaka city rely on other modes of transportation or do not have access to private vehicles, regardless of age.

Among the survey respondents who owned a private vehicle, 9 per cent respondents aged 18 to 35 years, 18 per cent respondents aged 36 to 64 years, and 16 per cent respondents aged aged 65 and above years said that they would reduce using their private cars if the mass transportation facilities in Dhaka were improved. There was general support for improving mass transportation facilities across all age groups, with the 36 to 64 age group showing the highest level of support. This indicated that better public transit options were seen as a viable solution by respondents of all ages.

Figure 4.10: Incentives to reduce using own private vehicle by age group



Source: Authors' own illustration based on survey data.

Public awareness campaigns appear to be more effective among older age groups, with 19 per cent of the respondents aged 65 year who owned a car saying that raising public awareness on the health and environmental problems associated with car use could make them reduce using their car. This suggests that older individuals may be more receptive to information about health and environmental issues related to private vehicle use.

Some respondents in each age group expressed a clear intention not to reduce their private vehicle usage, regardless of the measures implemented. The 65 and above age group had the highest number of respondents in this category, indicating greater resistance to changing transportation behaviour among older individuals.

None of the age groups were particularly keen on reducing the private car use if a tax on fuel was imposed, a congestion charge was introduced, or if a lottery on license plate numbers was implemented.

In summary, these findings reveal variations in preferences and support for different measures to reduce private vehicle use in Dhaka city among different age groups. Younger respondents generally showed less support for certain measures, while older respondents were more supportive of measures such as raising public awareness. Improving mass transportation facilities had relatively broad support across all age groups, indicating its potential effectiveness as a solution to reduce private vehicle usage. Additionally, a significant portion of respondents in all age groups did not have private vehicles, and some expressed a clear reluctance to reduce their private vehicle use.

4.2 Household practices

The survey respondents were asked about the electronic appliances they possessed at home. This inventory of electronic appliances was recorded with the aim of gaining insights into their indirect contributions to air pollution, considering that energy generation from fossil fuels is a significant factor contributing to pollution.

The findings presented in Figure 4.11, show that approximately 25 per cent of the households owned air conditioners (ACs) in Dhaka city. Moreover, the survey also found that most of the ACs had a cooling capacity of 1.5 tonne. Notably, around 24 per cent of these AC units did not have an inverter, implying that 24 per cent of the households owned ACs that were energy inefficient. ACs equipped with inverters consume less energy and therefore emit less carbon dioxide (CO2) in the atmosphere (Almogbel, Alkasmoul, Aldawsari, Alsulami, & Alsuwailem, 2020).

Moreover, the Figure 4.11 also shows that nearly 90 per cent households owned refrigerators, 28 per cent had an oven, 82 per cent possessed television (TV), 4 per cent had a heater, 13 per cent used washing machines, 35 per cent owned a computer, 15 per cent owned a geyser and 49 per cent had an iron. It is evident from the survey that all households had a fan, and the majority of households had refrigerators and TVs. Conversely, ownership of heaters and geysers in the households was rare, primarily due to the predominantly hot weather in Bangladesh. In June 2023, the average electricity bill of the households was BDT 2,118 and the maximum electricity bill was BDT 25,000.

Additionally, 12 per cent households owned an instant power supply (IPS), among which only 5 per cent were operated using solar power and the rest were electric powered (Figure 4.12).

Figure 4.11: Household practices

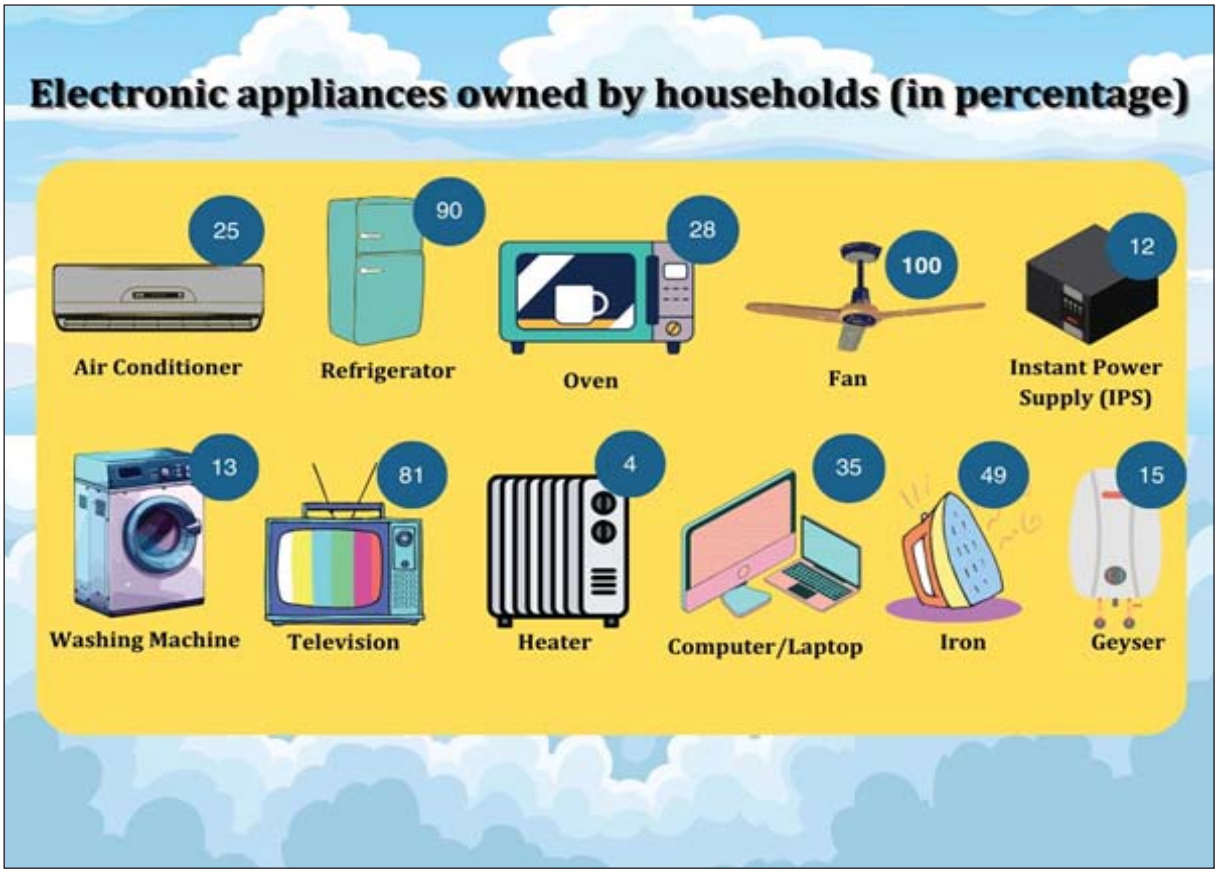
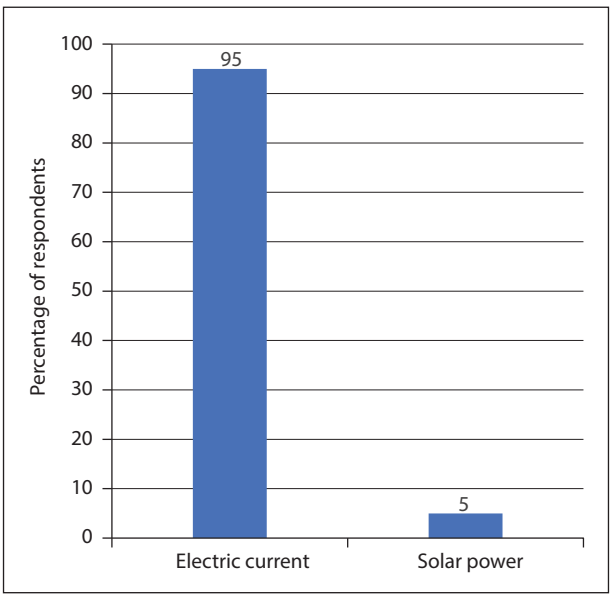


Figure 4.12: Instant Power Supply (IPS) owned by the households (in percentage)



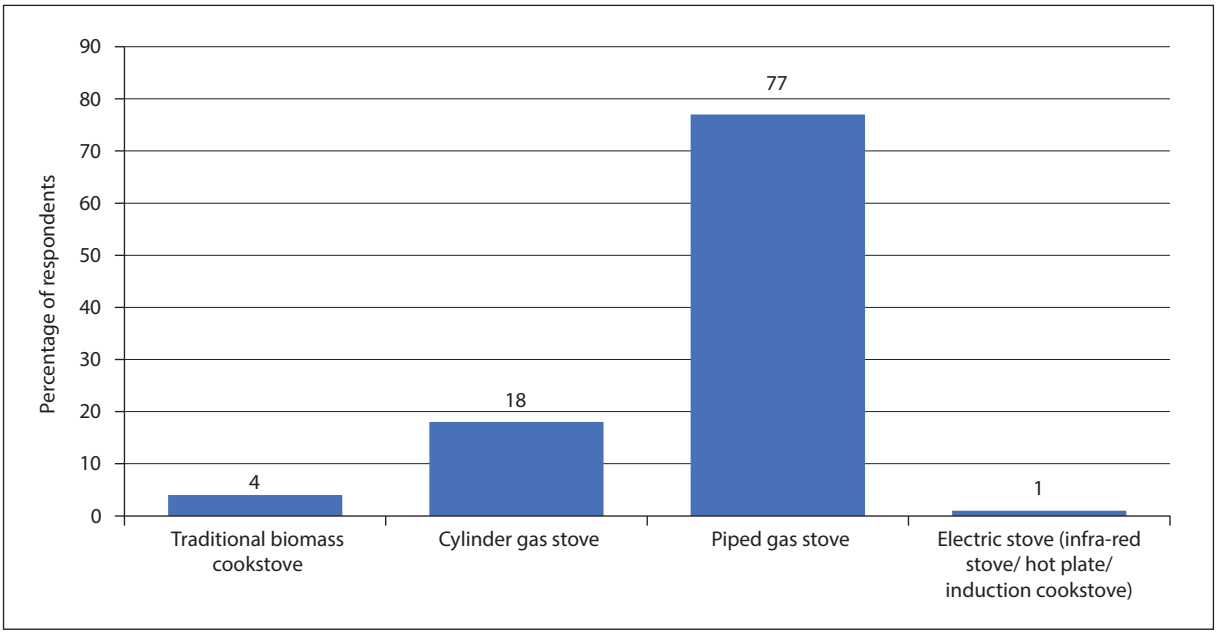
Source: Author's own illustration based on survey data.

Incandescent light bulb is the most inefficient type of lighting currently still available in some households in Dhaka city. Incandescent bulbs create 4,500 lbs. of CO2 per year (Bolt, 2023). Compact fluorescent lamps (CFLs) create slightly less at 1,051 lbs. of emissions per year (Bolt, 2023). It was found from the survey that about 98 per cent of the households used light-emitting diode (LED) lights but a few households still had CFL and incandescent bulbs, which was about 17.2 per cent and 5.8 per cent respectively.

Around 77 per cent households had piped gas stove and 18 per cent households had a cylinder gas stove. It was found that 4 per cent households still used traditional biomass cookstoves in Dhaka city (Figure 4.13).

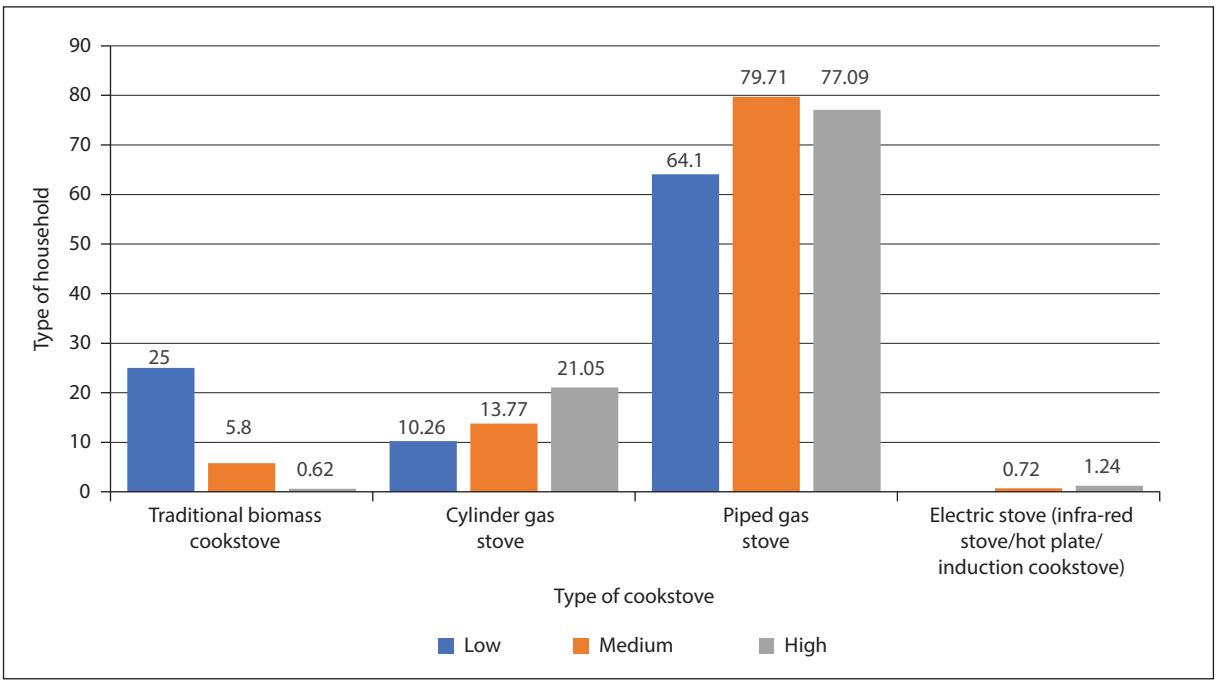
Figure 4.14 illustrates that 25 per cent of the low stratum households used traditional biomass cookstoves, which emit deadly pollutants and

Figure 4.13: Types of cookstoves used by the households (in percentage)



Source: Author's own illustration based on survey data.

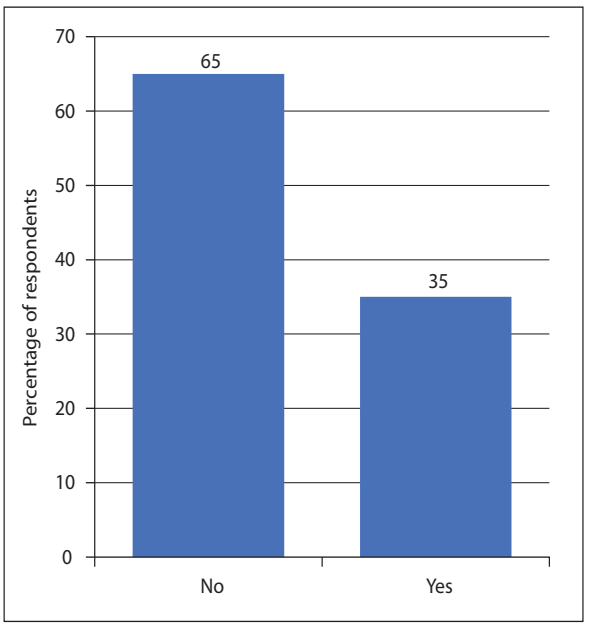
Figure 4.14: Types of cookstoves used by the households by types of households (in percentage)



Source: Authors' own illustration based on survey data.

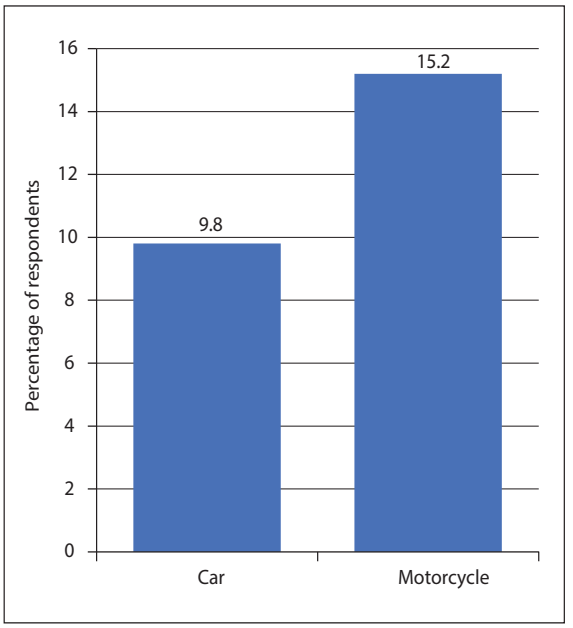
cause indoor air pollution. Piped gas stove is the most used cookstove among all types of households whereas, electric stove is the least used stove.

Figure 4.15: Household kitchen with exhaust fan (in percentage)



Source: Authors' own illustration based on survey data.

Figure 4.16: Vehicles owned by households (in percentage)

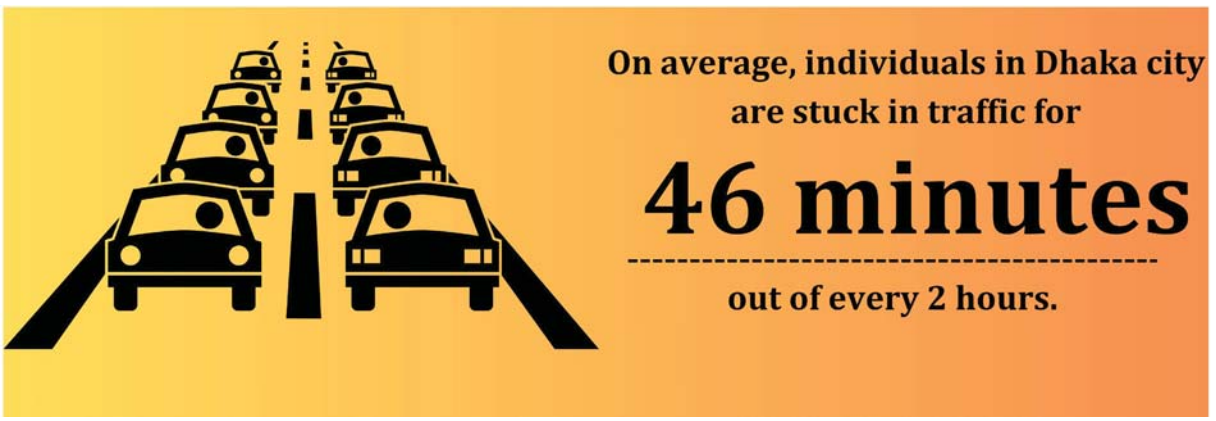


Source: Author's own illustration based on survey data.

As cookstoves may cause indoor air pollution, it is necessary to have an exhaust fan in the kitchen to drive the gases away. However nearly 65 per cent of the household surveyed did not have an exhaust fan in their kitchen (Figure 4.15).

Approximately 39 per cent of households had at least one member who smoked cigarettes, cigars, e-cigarettes, vapes, hookahs, or pipes. Such smoking habits increased the risk of household members being affected by respiratory diseases.

Only 9.8 per cent households in Dhaka city owned a private car and 15.2 per cent households owned a private motorcycle (Figure 4.16).



It was reported that, on average, individuals in Dhaka spent more than 2 hours outdoors daily, with over 46 minutes of that time spent stuck in traffic congestion. This indicated that city dwellers in Dhaka waste approximately 276 hours a year just sitting in traffic congestion. Moreover, the survey also found that people tend to be outdoors most frequently between 8 am and 12 pm, making this the peak hour.

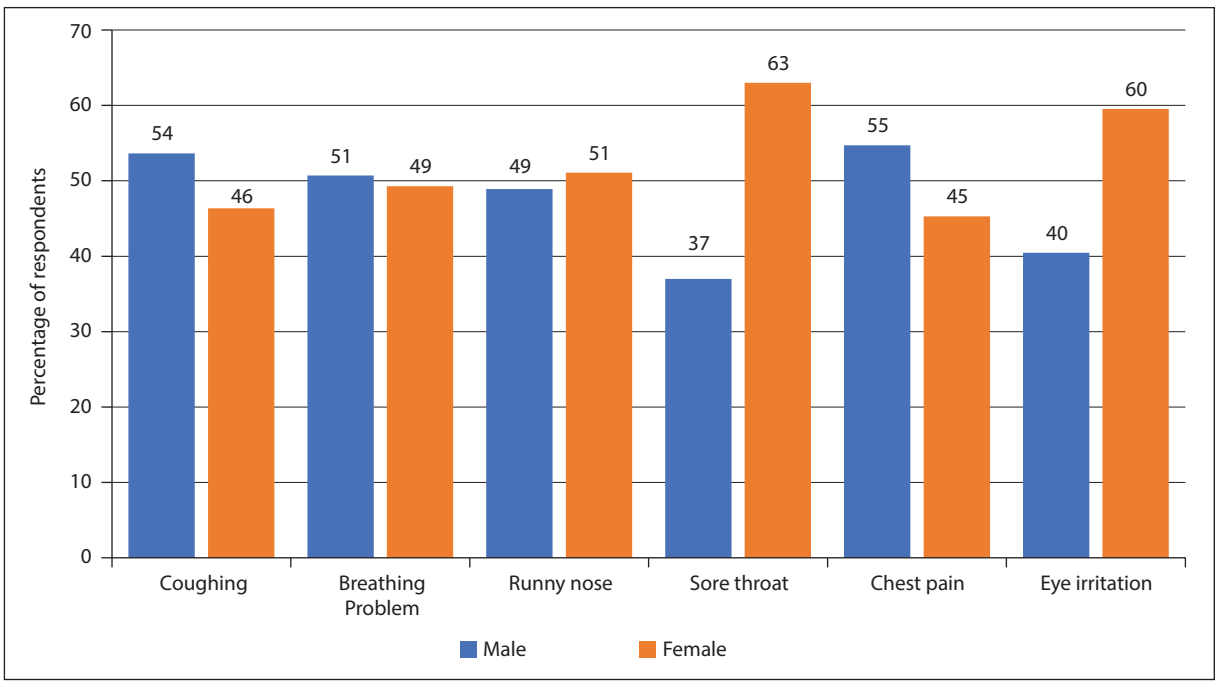
4.3 Economic cost

Around 49 per cent of the households serviced their AC once a year, spending BDT 1,850 on average. More than 33 per cent of the households serviced their private vehicles twice a year, spending BDT 8,472 on average

4.4 Health concerns

It has been evident through research and experiments how detrimental air pollution is to human health. A recent study by World Bank found that exposure to high level of air pollution affects both physical and mental health (Raza, Mahmud, & Rabie, 2022). Air pollution was the largest cause of deaths and disability in Bangladesh in 2019 (The World Bank, 2022). Children under five years and elderly people above 65 years are considered to be at the highest risk of getting respiratory diseases due to air pollution. Air pollution increases the risk of stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma, the primary symptoms of which include coughing, breathing problem, wheezing, sore throat, chest pain and eye irritation (WHO, 2022); (NIH, 2023); (Government of Quebec , 2022). In 2019, more than 80 thousand deaths were caused by air pollution in Bangladesh (The World Bank, 2022). According to the survey around 67 per cent of the respondents reported that they have suffered from these symptoms in the last one year. The high number shows the severity of air pollution in Dhaka city.

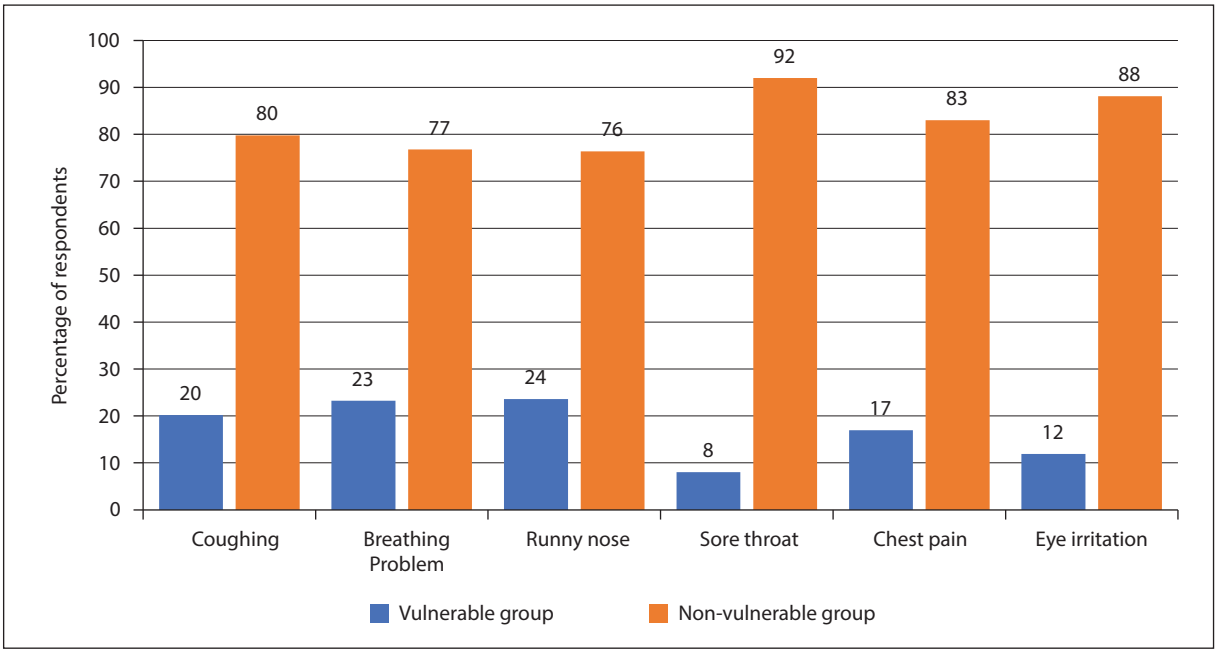
Figure 4.17: Symptoms attributed to air pollution by gender (in percentage)



Source: Authors' own illustration based on survey data.

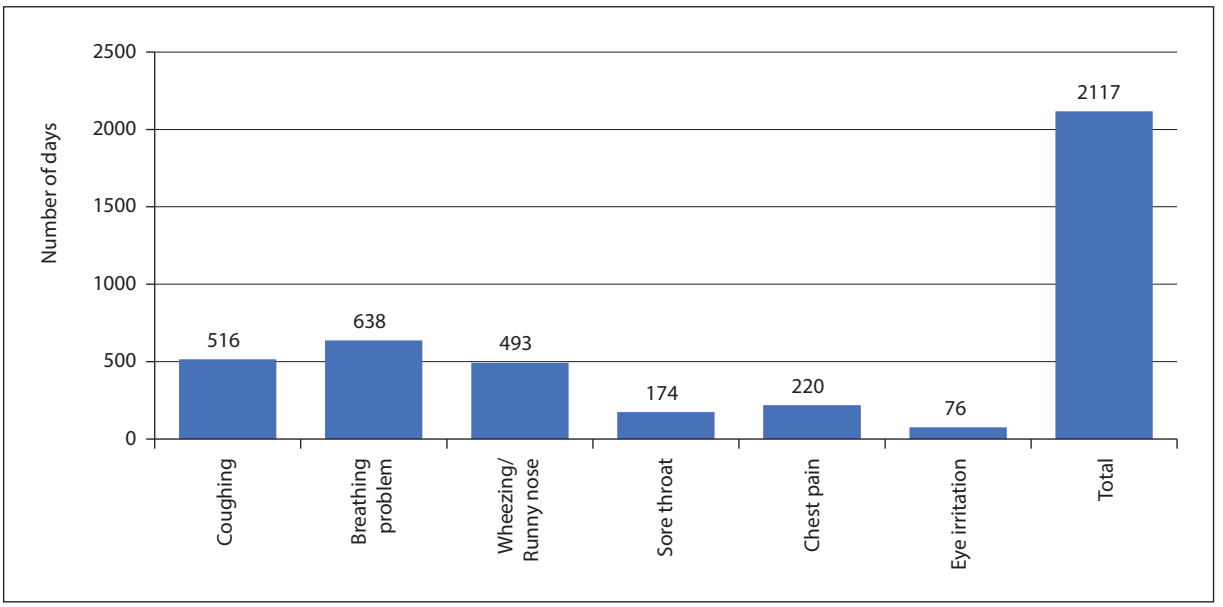
Disaggregating by gender, it is seen that symptoms attributed to air pollution were nearly the same for both male and female respondents except for sore throat and eye irritation. Having a sore throat and eye irritation seemed to be more common in women more than men. Whereas, males were more likely to have

Figure 4.18: Symptoms attributed to air pollution by age group (in percentage)



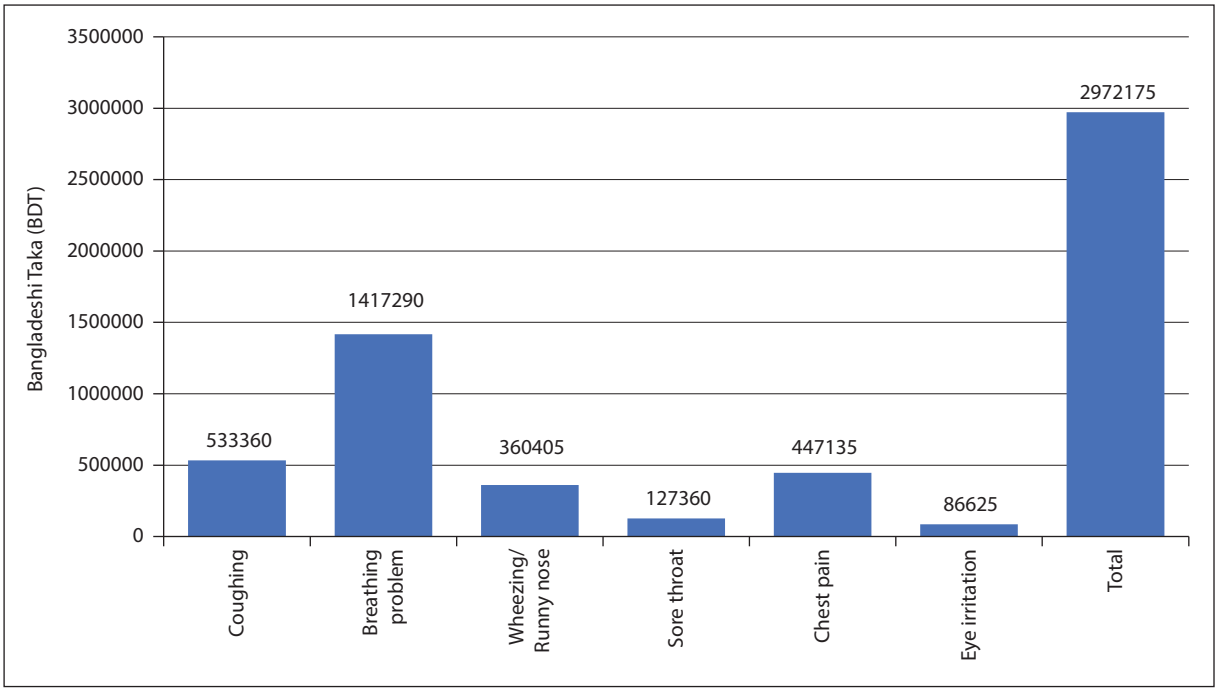
Source: Authors' own illustration based on survey data.

Figure 4.19: Number of days the sick household members took off in the last year due to symptoms attributed to air pollution



Source: Authors' own illustration based on survey data.

Figure 4.20: Health cost borne by the households due to symptoms attributed to air pollution (in BDT)



Source: Authors' own illustration based on survey data.

chest pain than females. Overall, 51 per cent of the sick members were female. Among all the symptoms, the respondents were found to be suffering from wheezing or runny nose the most, followed by coughing (Figure 4.17).

Moreover, Figure 4.18 shows the symptoms attributed to air pollution by age group. By categorising the age groups by vulnerability, children under five years and elderly people above 65 years were grouped as vulnerable group and the rest were categorised as non-vulnerable age groups. The survey found that the most common health problems among the vulnerable age group were runny nose and breathing problem, which were about 24 per cent and 23 per cent respectively. On average, 20 per cent of the sick family members were from the vulnerable age group. The study also found out that residing with someone who smoke in the same household increase the risk of getting affected by these symptoms by 86 per cent.

The respondents reported that they took 2117 days off from their work or school due to symptoms attributed to air pollution in the last year which leads to a great productivity loss (Figure 4.19). It is evident that individuals tend to take more leaves for breathing problem than any other symptoms attributed to air pollution.

Figure 4.20 shows the amount of money households spent on health services including purchasing medicines, visiting doctors, admitting to hospitals and taking diagnostic tests due to the symptoms attributed to air pollution. Overall, approximately BDT 2.9 million was spent by individuals in the last year due to these symptoms, which is BDT 4000 per person. Individuals spent about BDT 14,17,290 in a year for treating and diagnosing breathing problems.

4.5 Awareness

Around 42 per cent of the respondents responded said that they were aware of the drivers and impacts of air pollution in Bangladesh as presented in a video.

More than 90 per cent of the respondents expressed their concerns regarding the rising air pollution in the cities of Bangladesh. It was found that around 70 per cent respondents wore a face mask while stepping out of their houses.

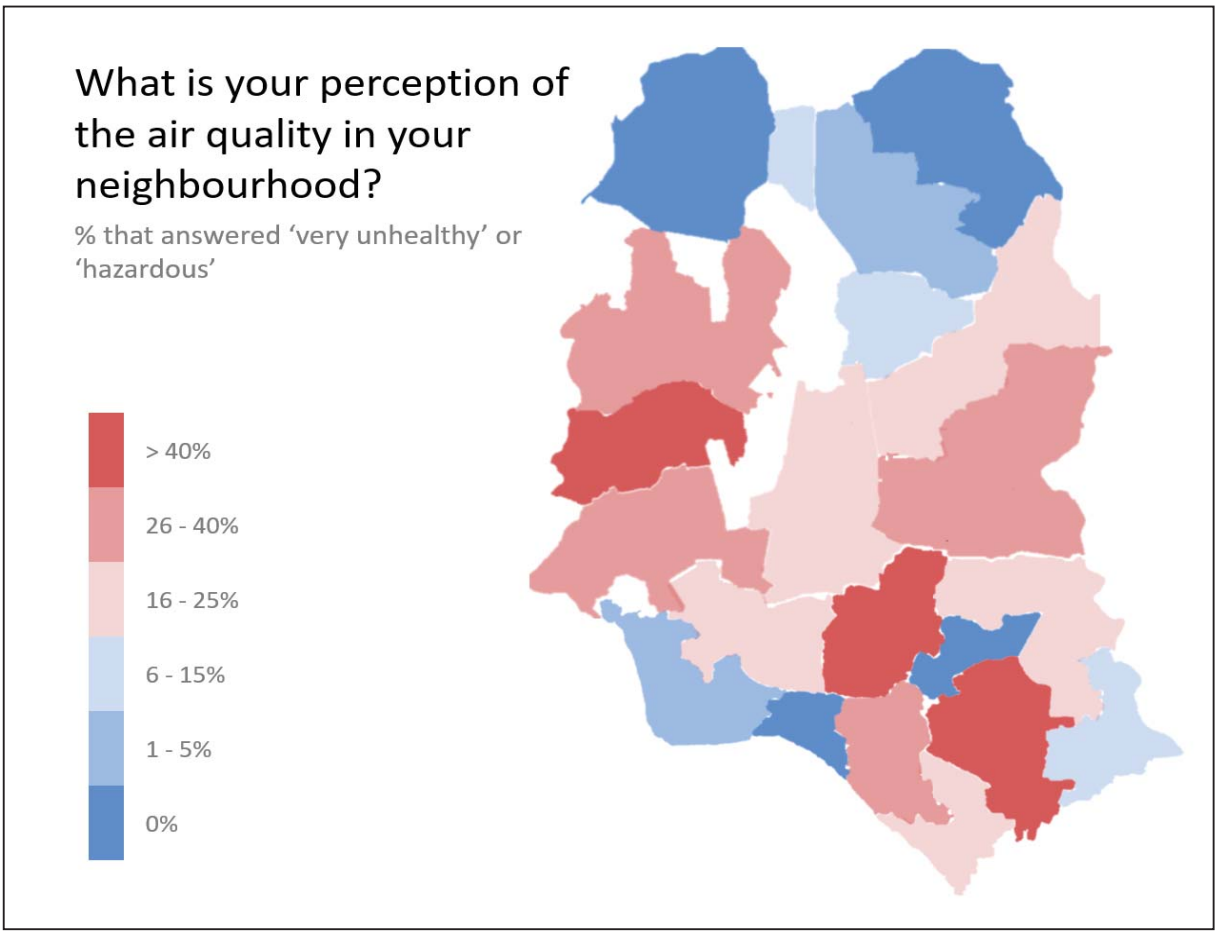
In alignment with the measures of the Air Quality Index (AQI), respondents were asked to categorise the air quality in their neighbourhood, and about 40 per cent of them rated the air quality in their neighbourhood as unhealthy (Figure 4.21).

Most of the city dwellers in Dhaka city preferred to use rickshaw and bus to commute, on simply commuted on foot.

4.6 Willingness to pay

Vehicular emission is one the major causes of air pollution in Dhaka city. Areas with persistent traffic have the worst air quality (Raza, Mahmud, & Rabie, 2022). However, the number of registered vehicles is increasing every year. As of August 2023, a total of 244,999 vehicles have already been registered in Dhaka city, with private cars and motorcycles comprising 3 per cent and 86 per cent respectively (BRTA, 2023). Motorcycles along with all types of diesel vehicles were found to be the worst polluters among all the vehicles according to the emission testing programme conducted by Clean Air and Sustainable Environment (CASE) project (DoE and the World Bank, 2019).

Figure 4.21: Perceptions of air quality by ward



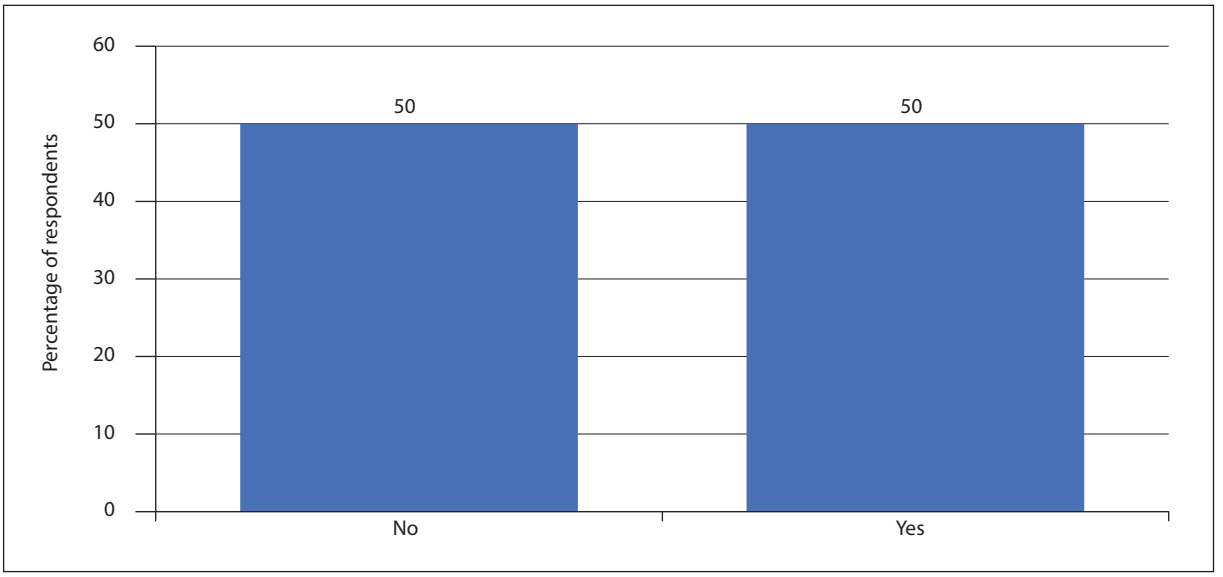
Source: Authors' illustration based on survey data.

The survey found that the private vehicle owners primarily used their vehicles for commuting to work, with over 81 per cent of them using petrol or octane as their fuel choice. On average, city vehicle owners spent approximately BDT 7,031 on fuel for their vehicles. As the price of octane was increased from BDT 89 to BDT 130 on August 2022, about 36 per cent of the vehicle owners reduced using their vehicles. Hence, it can be assumed that an increase in the price of fuel tax may reduce the usage of private by vehicles on the road and therefore, reduce air pollution from vehicular emission.

With a view to above context, the study created a hypothetical scenario where the government has imposed a carbon tax on the price of fuel (petrol/diesel/LPG/CNG) per unit/litre with the aim of reducing the usage of private vehicles in order to decrease air pollution. The respondents were asked what would be the maximum amount they would be willing to pay as a carbon tax on per litre in addition to the price of fuel they are paying per litre.

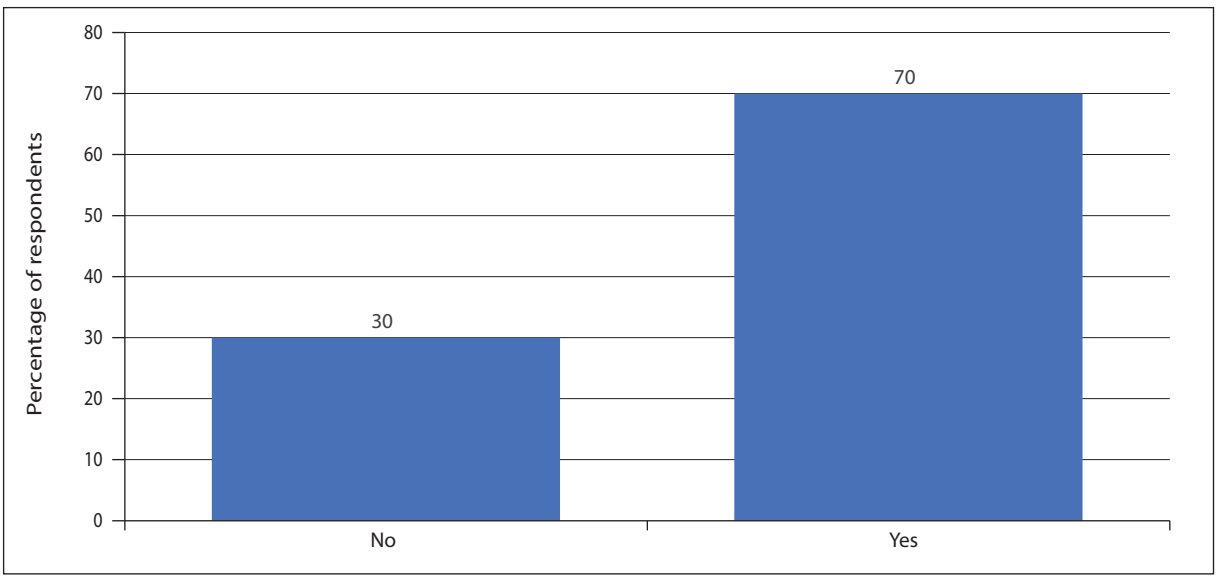
Approximately 50 per cent of vehicle owners expressed their willingness to pay a carbon tax on fuel (Figure 4.22). On average, the willingness to pay for a carbon tax on per litre of fuel was BDT 12.5. The maximum amount they were willing to pay was BDT 500, and the minimum amount was BDT 1 per litre of fuel as a carbon tax. The vehicle owners who expressed their disinterest in paying the tax mostly mentioned inflation and global financial instability as reasons of not willing to pay the tax.

Figure 4.22: Willingness of private vehicle owners to pay a carbon tax



Source: Authors' illustration based on survey data.

Figure 4.23: Willingness of all the respondents to pay for a monthly scheme to improve air quality



Source: Authors' own illustration based on survey data.

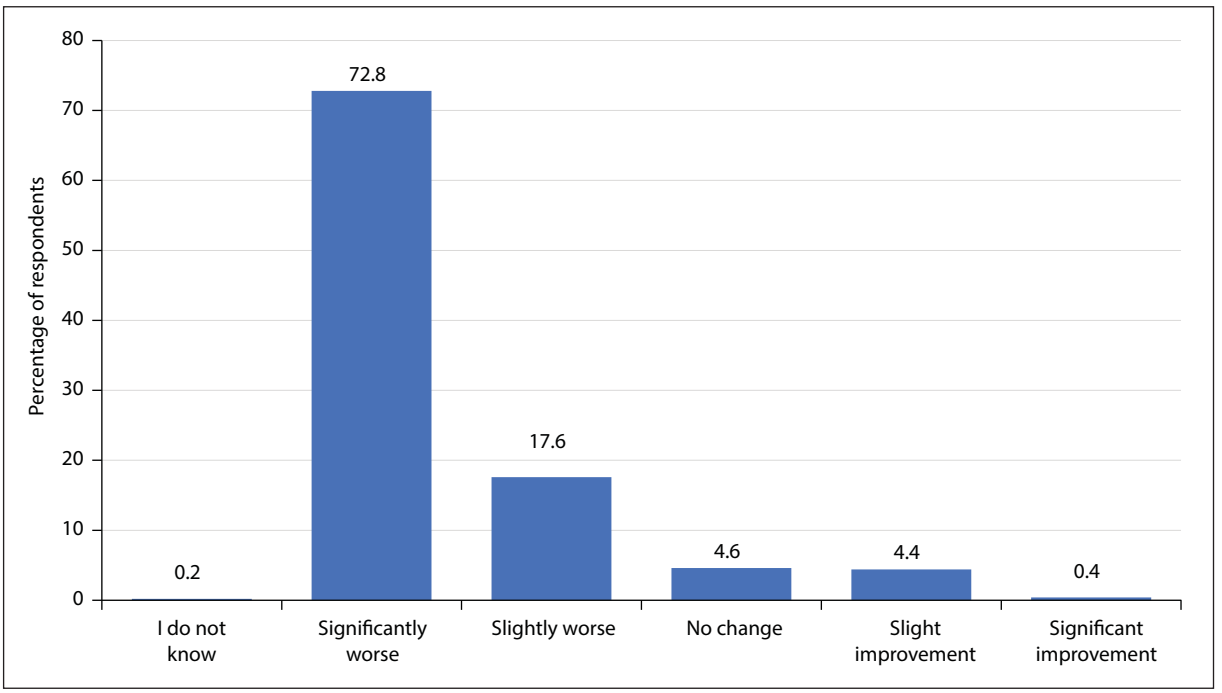
As the percentage of private vehicle owners is small in Dhaka city, another hypothetical scenario was built where a Non-Government Organisation (NGO) initiated a scheme focusing on the improvement of air quality that will reduce child mortality caused by air pollution. Children are most vulnerable to lung infections caused by air pollution as their respiratory system is not fully developed. A study by the World Bank found that children living near major construction and traffic sites tend to get lower respiratory tract infections more than other areas in the country (The World Bank, 2022).

When the respondents were asked if they would be willing to pay for the scheme, approximately 70 per cent of the respondents agreed to pay BDT 239.4 per month on average (Figure 4.23). The maximum amount they were willing to pay was BDT 5000, while the minimum was BDT 5 per month.

5. Findings of the Survey for Plastic Pollution

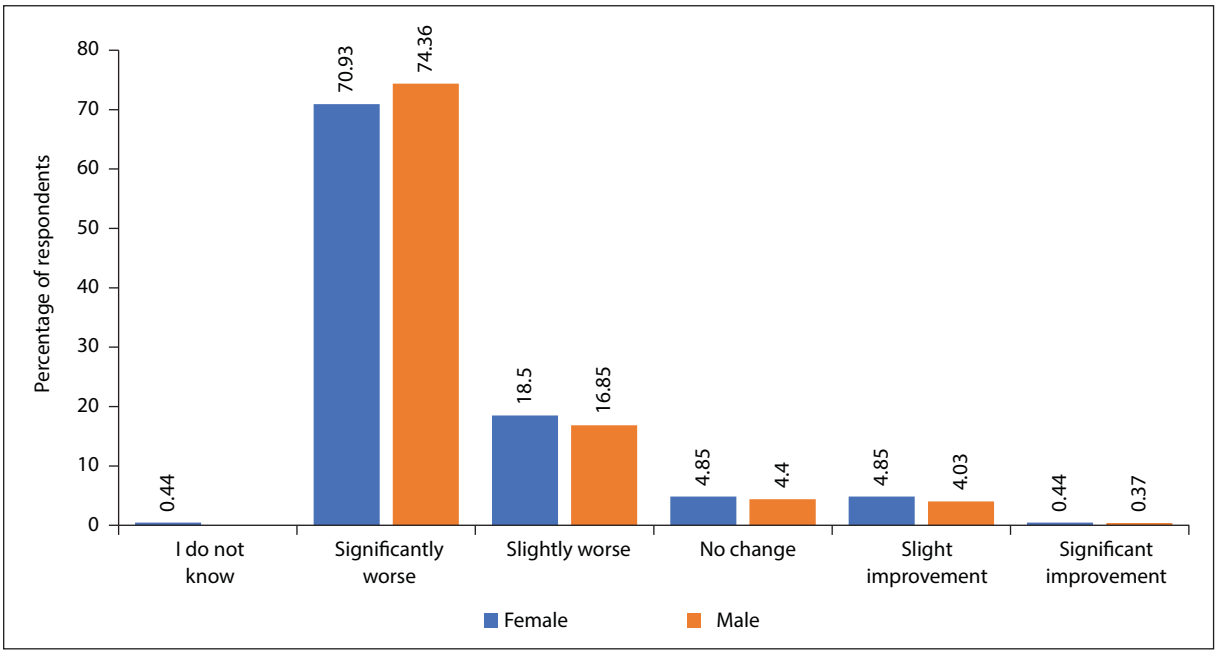
5.1 Perception of plastic pollution

Figure 5.1: Perceived change of plastic pollution in surrounding neighbourhoods in the last 2-3 years



Source: Authors' own illustration based on survey data.

Figure 5.2: Perceived change of plastic pollution in surrounding neighbourhoods in the last 2-3 years by gender



Source: Authors' own illustration based on survey data.

With the rapid process of urbanisation in Bangladesh, plastic pollution has become increasingly pervasive in urban areas. When survey participants were asked to assess the level of plastic pollution in their neighbourhoods, approximately 73 per cent stated that plastic pollution had worsened over the past 2 to 3 years (Figure 5.1). Only a negligible proportion (4 per cent) of the respondents indicated they had seen a slight improvement in plastic pollution.

When disaggregating this perception by age and gender, it was discerned that approximately 74 per cent of male respondents believed that plastic pollution has notably worsened in the past 2 to 3 years, whereas their female counterparts constituted about 71 per cent (Figure 5.2). Notably, the marginal difference in

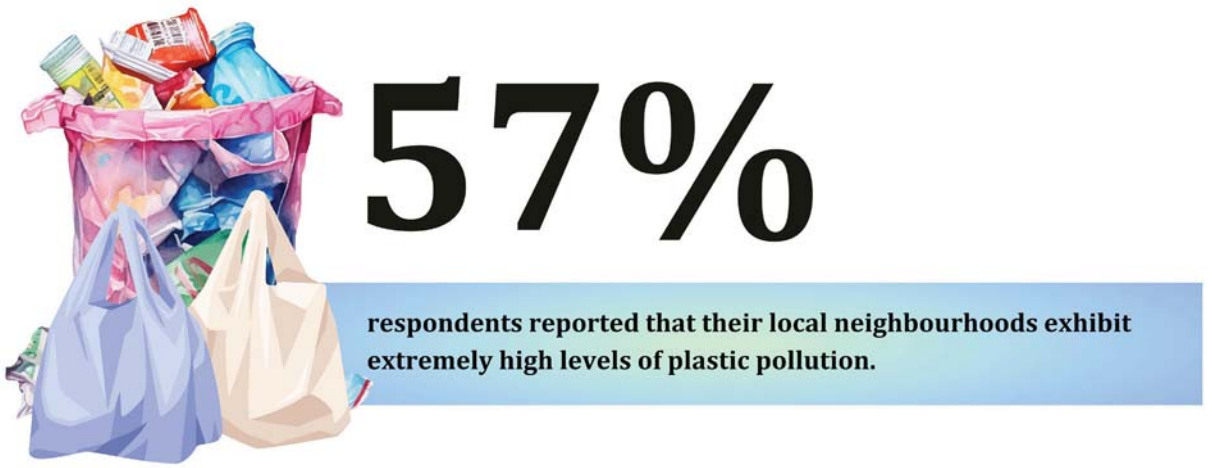
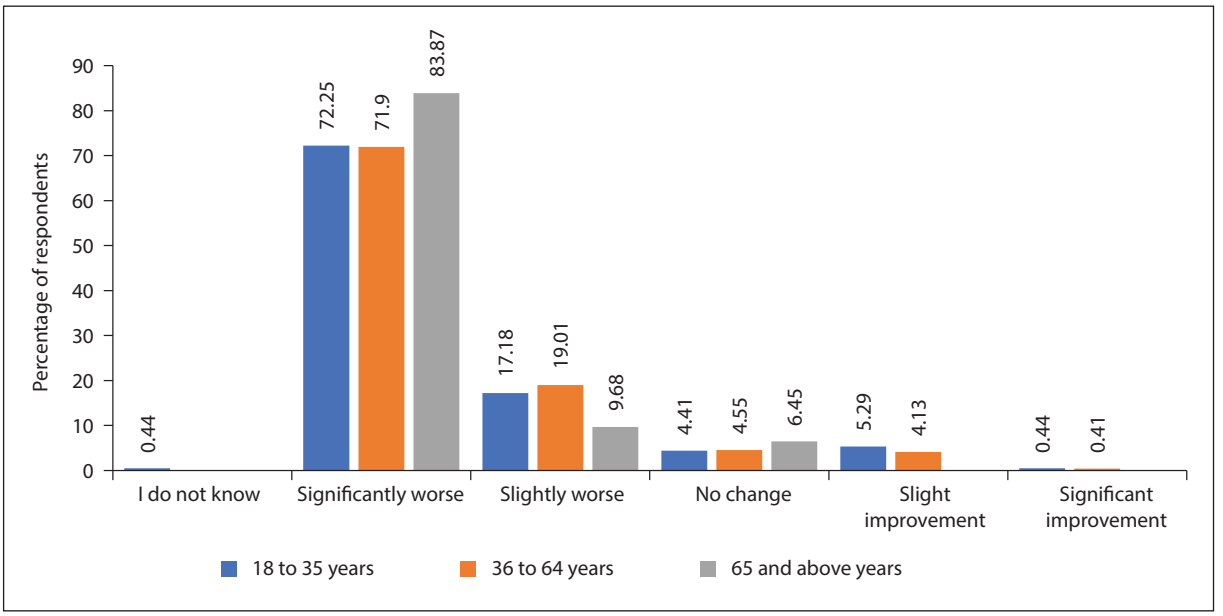
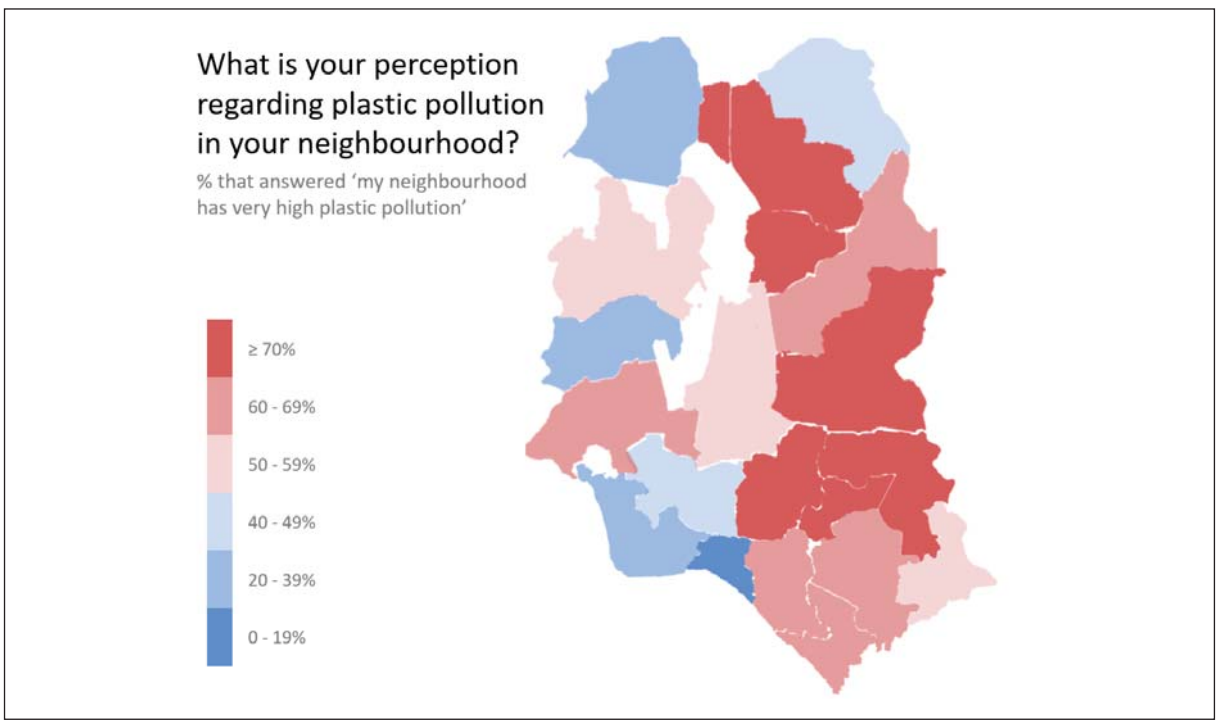


Figure 5.3: Perceived change of plastic pollution in surrounding neighbourhoods in the last 2-3 years by age



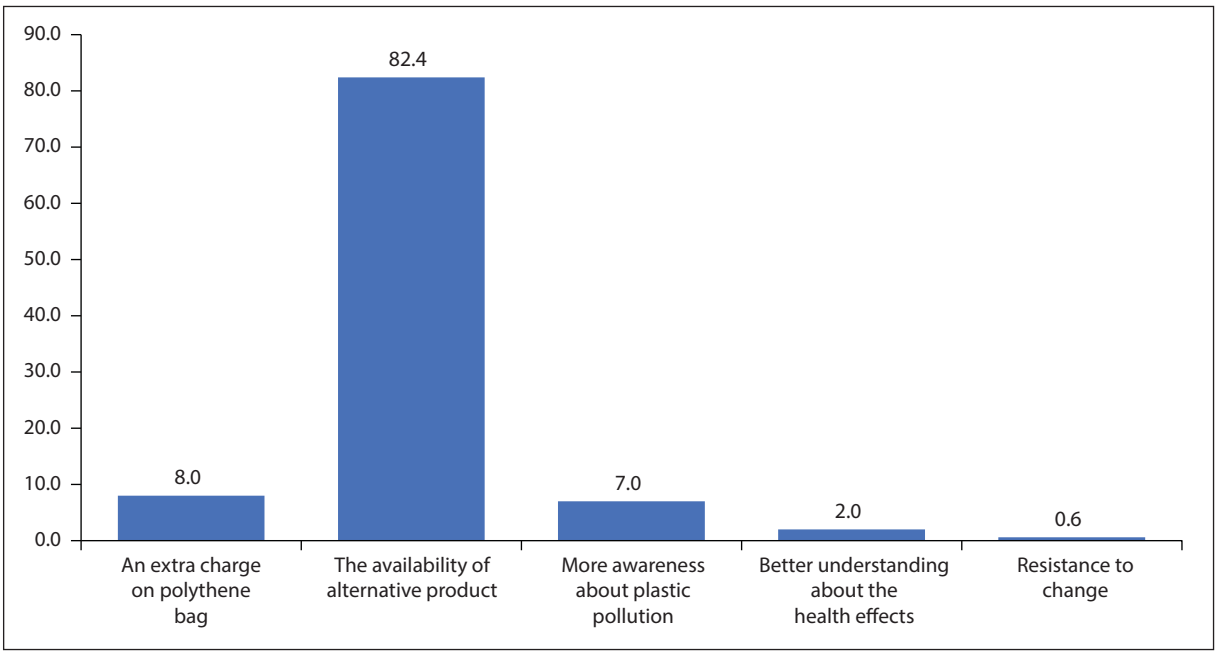
Source: Authors' own illustration based on survey data.

Figure 5.4: Current perceived level of plastic pollution by region



this percentage between men and women suggests that both demographic cohorts acknowledge the escalating issue of plastic pollution. Furthermore, this viewpoint is also widely shared among respondents

Figure 5.5: Incentives to reduce the usage of polythene bags



Source: Authors' own illustration based on survey data.

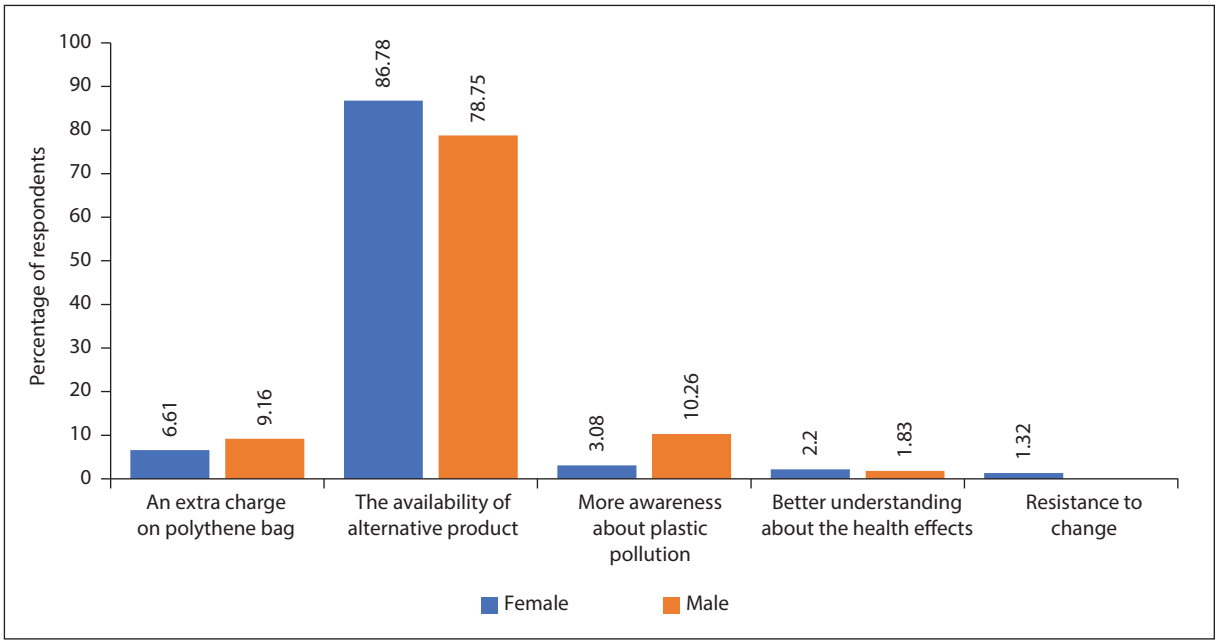
aged 65 and above, comprising 84 per cent of this age group. Meanwhile, the youth segment (18 to 35 years) and adults (36 to 64 years) exhibited similar sentiments, accounting for 72 per cent, concurring with the notion that plastic pollution has been on the rise (Figure 5.3).

The data indicates that respondents who claimed their neighbourhoods had a high level of plastic pollution were predominantly located in the eastern part of Dhaka (Figure 5.4). Both the North City Corporation and South City Corporation regions showed a similar prevalence of high plastic pollution. However, it was notable that the eastern areas of Dhaka appeared to be more severely affected by plastic pollution compared to the western areas. Furthermore, 57 per cent of the surveyed households have reported that their local neighbourhoods exhibit extremely high levels of plastic pollution.

Most of the streets in the urban centre of Dhaka are now visibly marred by plastic waste, including items like polythene bags and disposable plastic products. This accumulation of plastic waste is a direct consequence of human disregard for environmental concerns and a persisting throw-away culture. Additionally, it reflects the inadequacies in the city's waste management system. Addressing the issue of excessive polythene bag usage and the resulting plastic waste may require the implementation of multiple policy measures that work in conjunction with one another. For example, the survey findings revealed that over 82 per cent of respondents expressed a willingness to reduce their plastic consumption if alternative materials were available (Figure 5.5). Furthermore, about 8 per cent of respondents also asserted that having to pay an extra charge for a polythene bag will also incentivise them to reduce its usage, while about 7 per cent supported the idea that more awareness of plastic pollution would reduce polythene bag use.

In terms of gender and age-related perspectives, it was noted that 87 per cent of female respondents perceived the availability of alternatives to plastic as a more robust solution to address plastic pollution (Figure 5.6). This percentage slightly surpassed the perspective of male respondents, which stood at

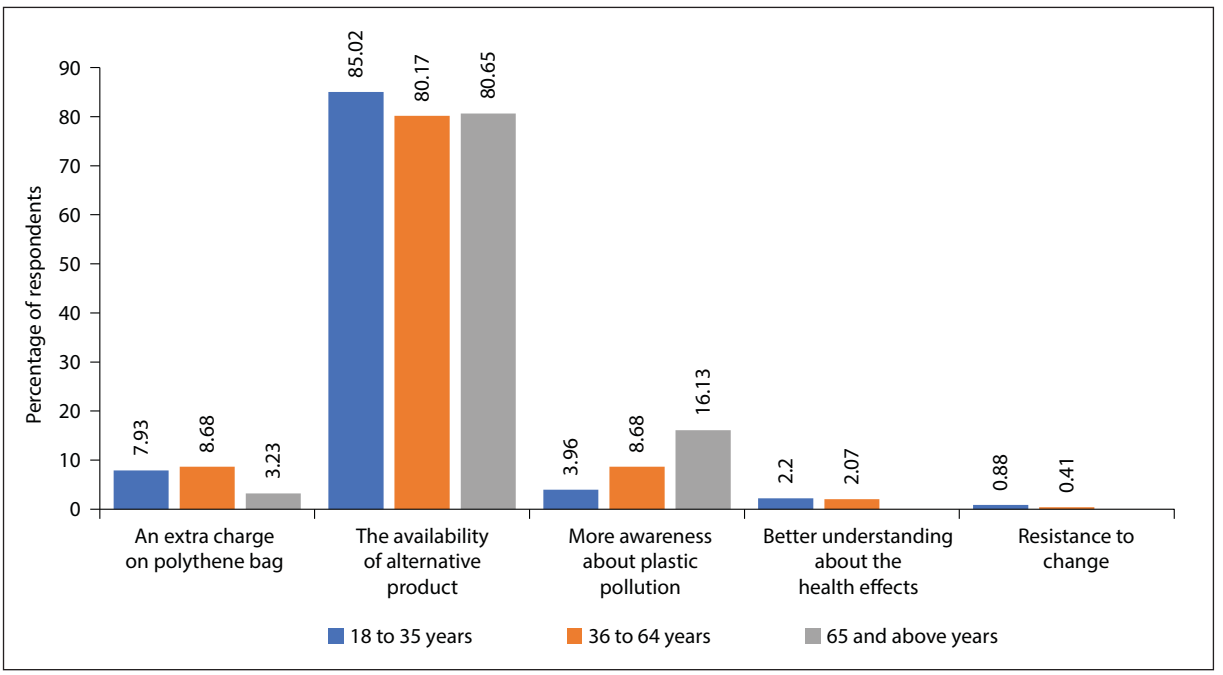
Figure 5.6: Incentives to reduce the usage of polythene bags by gender



Source: Authors' own illustration based on survey data.

approximately 79 per cent. Conversely, a smaller proportion of male respondents (9.2 per cent) leaned towards the notion that imposing an additional charge for single polythene bags would be effective in curbing their consumption, compared to female respondents, who accounted for 6.6 per cent.

Figure 5.7: Incentives to reduce the usage of polythene bags by age



Source: Authors' own illustration based on survey data.

Furthermore, when this perspective was examined across different age brackets, it became evident that respondents aged between 18 to 35 years exhibited a slightly stronger inclination towards the belief that the introduction of alternatives is imperative to reduce plastic consumption (Figure 5.7).

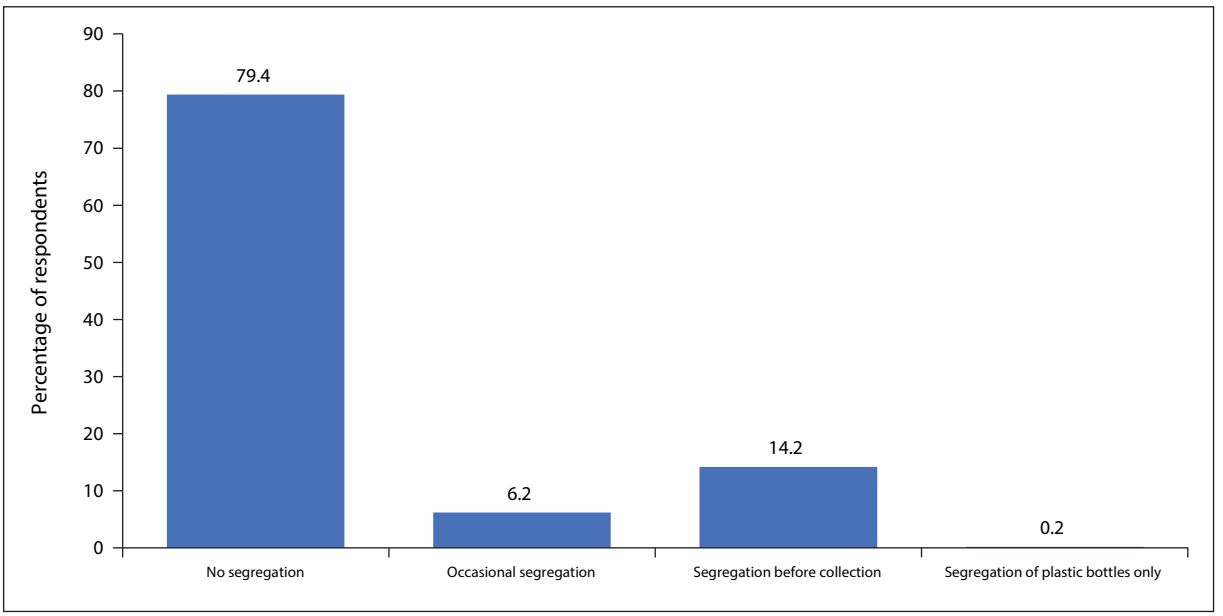
In summary, respondents collectively emphasise the necessity of addressing the pervasive issue of plastic pollution by first ensuring the availability of alternative materials to replace plastic. The survey also unveiled that this perspective resonates broadly across various age groups and both genders within the population. This underscores a significant trend in consumer behaviour, which policymakers can potentially leverage to implement effective policy measures. Furthermore, it underscores the growing awareness among individuals regarding the detrimental impact of plastic waste and the increasing recognition of the imperative need for sustainable alternatives.

5.2 Household practices

The prevalence of waste, particularly plastic waste, is significantly influenced by household practices in Dhaka. In this urban setting, households generally lack the habit of segregating waste at its source and often have limited awareness regarding appropriate methods for disposing of plastic waste. According to the survey findings, approximately 79 per cent of respondents admitted not separating their household plastic waste (Figure 5.8). Additionally, about 14 per cent indicated that they only begin separating their household plastic waste just before waste collectors arrive to collect it. A mere 6 per cent of respondents stated that they occasionally segregate their household plastic waste.

Interestingly, the survey results revealed that the majority of individuals, constituting 78 per cent, believed that there was no necessity to separate plastic waste. Conversely, over half of the respondents (53 per cent) admitted that they did not consciously consider segregating plastic waste at the household level. In several instances, people also cited reasons for not separating plastic waste, including the perception that it was time-consuming, the absence of suitable resources for segregation, or the fact

Figure 5.8: Practices to separate household plastic waste



Source: Authors' own illustration based on survey data.

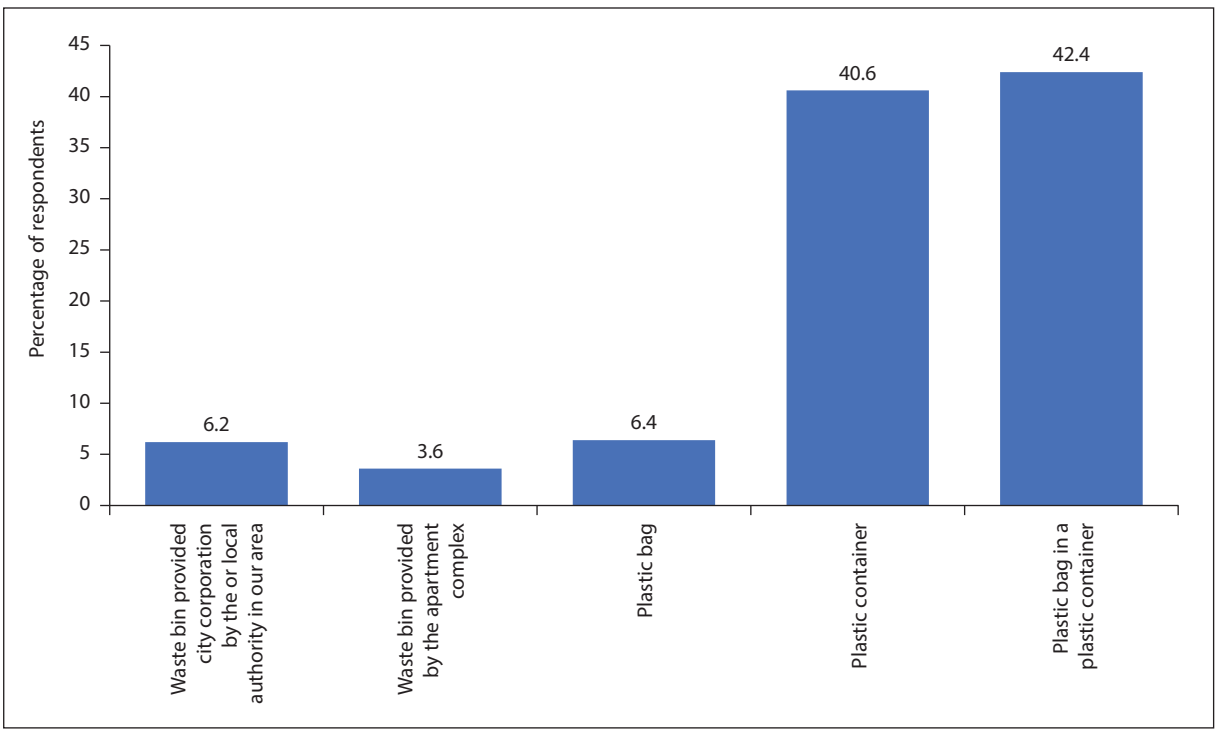
that waste collectors did not request such separation, leading them to believe it was unnecessary. This suggests that a public information campaign on the importance of separating waste may be beneficial for improving household practices.

Waste collection primarily involves two channels: the city corporation's representatives and informal waste collectors, with collections typically occurring daily. As indicated by the survey, approximately 44 per cent of household waste is gathered by city corporation representatives, while the informal sector is responsible for collecting 47 per cent of the waste. This underscores the substantial reliance on the informal sector within Dhaka's waste management system. Regrettably, 4 per cent of individuals admitted to the habit of indiscriminately discarding their household waste wherever convenient.

While assessing whether households have a waste segregation system is crucial, understanding how households store their waste is equally important. Many households opt to use plastic containers to store their household waste. This observation is reinforced by the survey results, which indicate that approximately 41 per cent of households used plastic containers to store various types of waste (Figure 5.9). Additionally, roughly 42 per cent of households stored their waste in plastic bags placed within a plastic container. Surprisingly, only 6 per cent of households utilised the waste bins provided by the city corporation or local authorities in their area for waste storage.

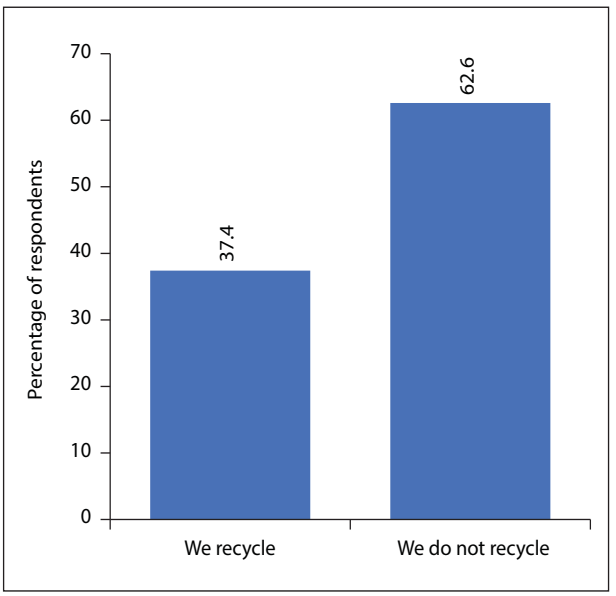
Households possess a substantial quantity of long-lasting plastic goods. These durable plastic products typically consist of rigid plastics that are more robust compared to disposable plastic items. Durable plastic is commonly employed for items such as toiletries, cleaning agents, food-grade containers, plastic furniture, and other similar commodities. When survey participants were inquired about their actions regarding damaged durable plastic items, approximately 63 per cent disclosed that they did not engage

Figure 5.9: Methods of storing waste by households



Source: Authors' own illustration based on survey data.

Figure 5.10: Household practices to dispose of durable plastic items



Source: Authors' own illustration based on survey data.

in recycling such items (Figure 5.10). Instead, they disposed them along with other organic waste.

To gain insights into individuals' behavioural patterns, respondents were also surveyed regarding their actions concerning plastic waste when they are outside. The findings indicated that in approximately 61 per cent of the respondents had a practice of responsibly disposing of plastic waste in available street bins or other suitable receptacles. However, nearly 43 per cent of respondents acknowledged a tendency to discard waste directly onto the streets. This underscores the pervasive throw-away culture that individuals frequently exhibit in Bangladesh. This observation additionally stresses the limited involvement of individuals in recycling practices at the household level, which could stem from either a lack of awareness or a lack of sufficient incentives. Only a small percentage of the survey respondents (6 per cent) indicated that when they are outdoors, they make an effort to hand over their plastic waste to informal sector representatives or take the waste back home for segregation into a dedicated bin.

A substantial portion of the plastic waste generated in the urban environment of Dhaka predominantly comprises of single-use plastics, notably polythene bags. The widespread utilisation of polythene bags has led to the saturation of city streets, causing disruption not only to the ecological balance but also impeding the progress of urban development. As an example, the escalating consumption of polythene bags has resulted in the blockage of numerous city canals, impeding the natural drainage of rainwater. Consequently, this situation has exacerbated severe urban flooding, inflicting damage on properties and creating favourable conditions for the spread of waterborne diseases such as dengue and malaria.

Every survey participant unequivocally indicated their practice of accepting polythene bags offered by shopkeepers when buying groceries or other consumer goods. Despite respondents affirming their

practice of bringing additional shopping bags when visiting markets or grocery stores, they continued to accept polythene bags offered by sales representatives. This is a noteworthy concern, as it indicates that despite individuals participating in sustainable behaviour, it is insufficient to eliminate the use of polythene bags. Consequently, approximately 47 per cent of respondents have acknowledged accepting polythene bags even when they have their own shopping bags in their possession. This observation stresses the notion that despite respondents expressing their willingness to reduce plastic consumption if alternative materials were available, this intent does not appear to align consistently with their subsequent actions. The continued use of polythene bags, even in the presence of alternatives, suggests a divergence between stated preferences and actual behaviour. Additionally, about 42 per cent of the respondents also reported carrying water bottles made of plastic.

The survey's objective also encompassed an assessment of the prevalence of single-use plastic items within households. In pursuit of this objective, respondents were asked to enumerate various categories of single-use plastic items that were present in their households at the time of the survey. These items encompassed polythene bags, plastic plates and wraps, plastic food containers, drinking straws, drinking cups, disposable cutlery, beverage bottles, and cans, as well as cotton buds and dental floss with plastic sticks. Among the 500 households that were surveyed, the results indicate that, on average, households primarily had cotton buds with plastic sticks and lightweight polythene bags. The cumulative count of cotton buds with plastic sticks amounted to 9,727, while polythene bags totalled 7,403 in households.

Figure 5.11: The total number of single-use plastic items at household level

Source: Authors' own illustration based on survey data.

Furthermore, households possessed 2,656 plastic bottles, 817 dental floss items with plastic sticks, 384 plastic drinking cups, and 292 plastic wrappers. It is crucial to emphasise that all of these plastic items are single use, meaning they are disposed of immediately after use. This illustration provides a more vivid depiction of the substantial plastic waste generated by households. However, it is essential to recognise that the overall generation of single-use plastic waste across all sectors of the economy is significantly higher (Figure 5.11).

Inquiries regarding the utilisation of polythene bags revealed that approximately 64 per cent of respondents used polythene bags quite frequently, in contrast to their less frequent use of other aforementioned single-use plastic items. This highlights that polythene bags offer significant utility to individuals. However, this utility is not without its consequences, as these polythene bags predominantly contribute to the accumulation of waste in urban streets and sewage systems. Respondents cited several primary reasons for their use of polythene bags. Foremost among these reasons was the availability and cost-effectiveness of polythene bags. The third most commonly reported rationale was the lightweight nature of these bags.

5.3 Health concerns

In discussions surrounding plastic pollution, there tends to be a focus on its environmental impact and its consequences for marine biodiversity. Nevertheless, it is equally crucial to emphasise the significance of plastic pollution's effects on human health. Recent research has shed light on the health risks associated with plastic products. Plastic items are not capable of natural biodegradation, and their breakdown occurs solely through physical processes, resulting in the formation of much smaller micro or nano-sized particles. These minuscule particles have the potential to infiltrate living organisms and navigate through the intestinal walls, eventually reaching various organs, including lymph nodes. Subsequently, the primary routes of human exposure to these particles include ingestion through food consumption, particularly seafood for the general population, inhalation into the lungs, and penetration through the skin (Yuan, Nag, & Cummins, 2022). Furthermore, another research investigation has identified the presence of plastic particles in the bloodstream of humans, underscoring the fact that specific plastic particles that individuals come into contact with can infiltrate their bodies and persist within, surpassing the body's mechanisms for removal, such as digestion, or kidney filtration (Leslie, et al., 2022). This highlights the potential for a substantial impact on human health, as the transfer of microplastic particles has extended to the point of infiltrating human placentas. These minuscule plastic particles were detected in every section of the placenta, encompassing the maternal, fetal, and the protective membranes enveloping the baby. What is worrisome is that these microplastics frequently contain detrimental substances capable of interfering with the hormonal balance, possibly resulting in enduring health issues (Ragusa, et al., 2021).

Furthermore, plastic food containers and utensils contain numerous additives that have a tendency to leach out when exposed to heat. These additives are deemed unsuitable for human consumption and give rise to a multitude of health-related issues (Proshad, et al., 2018). In Dhaka city, households predominantly utilise plastic utensils in conjunction with their food. These plastic utensils are usually a form of thermoset known as melamine which are polymers that form strong bonds and, as a result, cannot be remodelled or remelted, making it difficult to recycle these materials (Geyer, 2020). The melamine industry is a growing market in Bangladesh and offers several consumer items, with dinner sets being mostly popular.

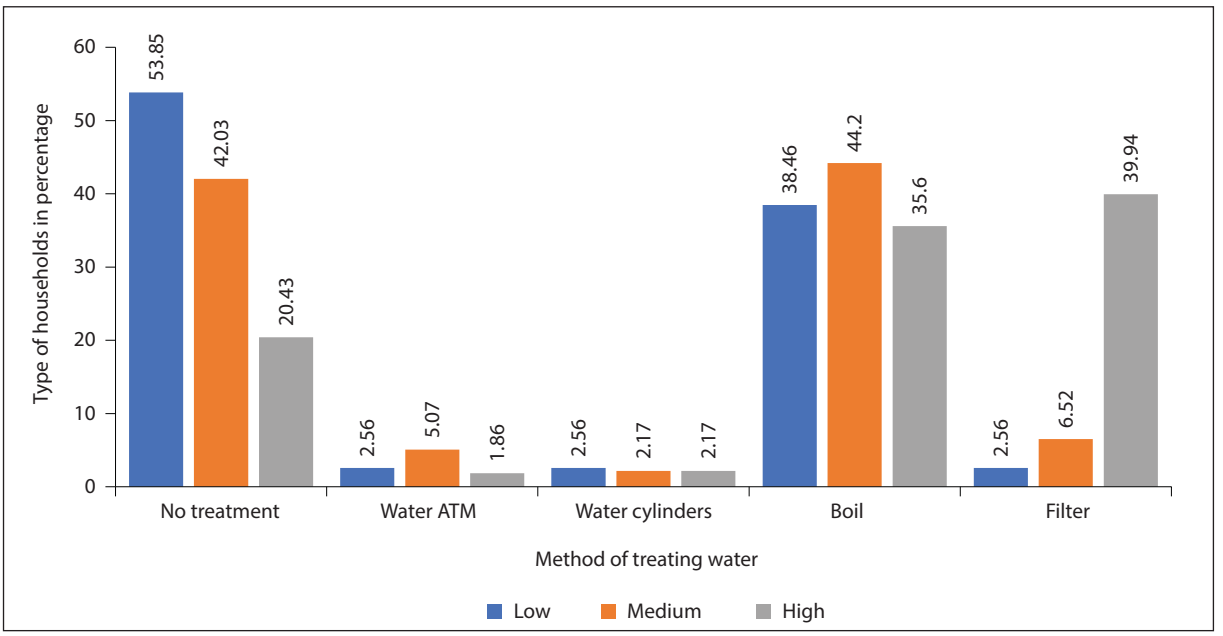
As validated by the survey findings, approximately 34 per cent of the households confirmed a frequent practice of utilising plastic utensils with meals. However, it is noteworthy that a substantial majority, specifically 92 per cent of the households, stated that they refrain from heating food in plastic containers.

Moreover, 59 per cent indicated that they do not consume heated food from plastic containers, and 78 per cent reported that they do not use plastic cups for hot beverages.

Plastic pollution has a notable influence on the quality of water, with a particular emphasis on groundwater. Microplastics and nano-plastics are prevalent constituents of groundwater, and it is rather questionable whether the existing conventional filtration systems in Dhaka can effectively eliminate these exceedingly small plastic particles. Microplastics and nano-plastics have a range of adverse effects. They can contaminate drinking water sources, accumulate in the food chain, and emit hazardous chemicals that may contribute to illnesses, including specific forms of cancer. Furthermore, these minute plastic particles can also induce short- and long-term health issues, associations with carcinogenicity, genetic damage, and interference with the developmental processes of organisms, particularly during their initial life stages (Yuan, Nag, & Cummins, 2022).

As such a substantial concern pertains to the absence of adequate household water filtration systems. The survey outcomes unveiled that approximately 38 per cent of households opt to boil their drinking water, while a mere 28 per cent indicated the presence of a filtration system within their residences. Notably, around 29 per cent of households lacked any method to treat their potable water. Interestingly, the survey data showed that in the lower socioeconomic stratum, 54 per cent of respondents do not employ any water treatment method before consumption. In contrast, about 39 per cent resort to boiling their water, and an almost negligible proportion of households in this socioeconomic stratum possess filtration appliances (Figure 5.12). In the medium socioeconomic cohort, 42 per cent of the households reported not treating their drinking water while 44 per cent reported boiling their water before drinking. A mere 6.5 per cent of the households in the medium stratum admitted to having an appliance for filtering their drinking water. In the high socioeconomic stratum, expectedly most households have an appliance to filter their water before drinking. However, intriguingly 20 per cent of the households belonging to this stratum also admitted to not treating their water at all before drinking it. Additionally, about 36 per cent of the households in the high stratum reported to boil their drinking water.

Figure 5.12: Methods of treating drinking water by type of households



Source: Authors' own illustration based on survey data.

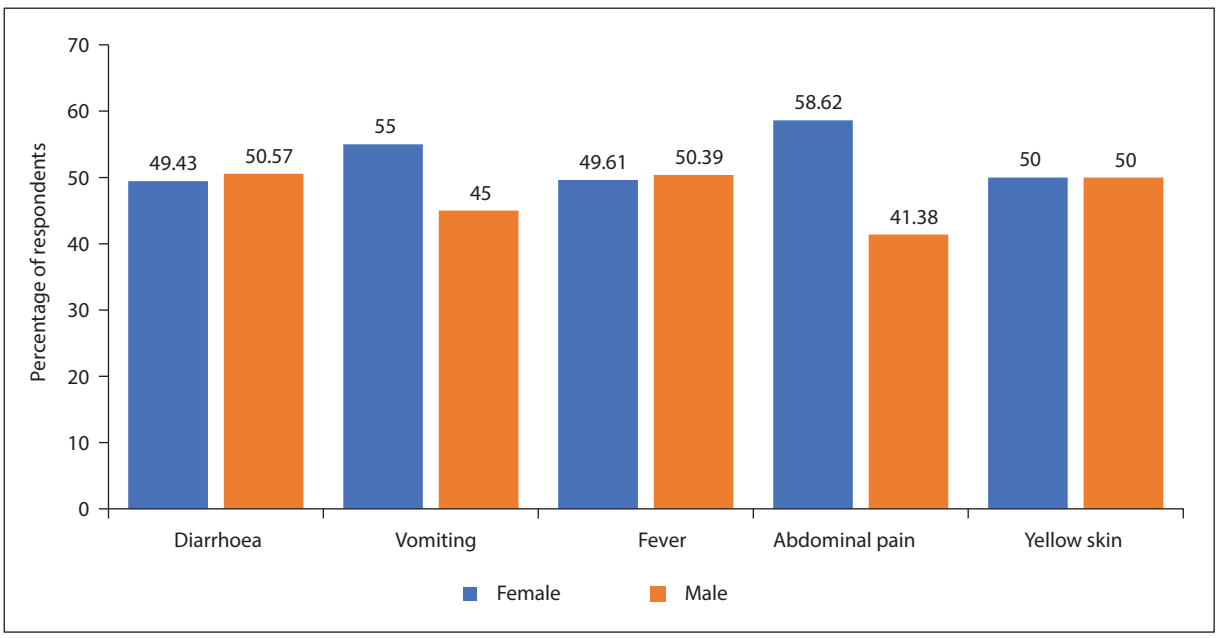
Water cylinders are not as commonly used nowadays as a source of drinking water. Households which purchased water cylinders reported that they spent an average of BDT 77 per month for one cylinder and required about an average of 30 cylinders per month. This brings their total average monthly cost to BDT 2,310 on drinking water.

In households that do have a filtration system, 36 per cent apply a form of passive filtration or use activated carbon, while 28 per cent own a reverse osmosis machine.

The absence of a reliable method for water treatment can potentially result in the proliferation of various waterborne diseases. While the specific diseases or associated symptoms linked to plastic pollutants remain uncertain, it is crucial to address this issue. Even though the precise health impacts of plastic pollutants are not yet fully understood, it is imperative not to dismiss the possibility that they may contribute to waterborne diseases. Therefore, respondents were subjected to a series of inquiries regarding any instances in which they or members of their households exhibited symptoms commonly associated with specific waterborne diseases, including diarrhoea, vomiting, fever, abdominal pain, and yellow skin or eyes which is indicative of jaundice.

Among the 500 surveyed households, a total of 572 household members experienced symptoms associated with one or more waterborne diseases. In approximately 67 per cent of individuals primarily reported fever as their most common symptom during the year preceding the survey. Notably, these cases typically lasted for a duration of less than one month, and the majority of respondents did not find it necessary to take time off from their work or school commitments during this period. Furthermore, diarrhoea was identified as the second most frequently reported symptom, accounting for about 31 per cent of respondents. However, similar to fever, these instances of diarrhoea typically subsided within one month. Other reported symptoms among household members included abdominal pain, yellowing of the skin, and vomiting, although the prevalence of these symptoms was not as extensive as that of

Figure 5.13: Symptoms attributed to diseases caused by water pollution by gender



Source: Authors' own illustration based on survey data.

fever and diarrhoea. On average, those who experienced fever incurred medical expenses amounting to approximately BDT 2,048, while those suffering from diarrhoea faced medical costs averaging BDT 1,036.

Furthermore, it was noted that regardless of gender, both male and female household members encountered similar symptoms linked to water contamination to a similar extent. For instance, the percentage of respondents reporting experiences of symptoms like yellowing of the skin, fever, and diarrhoea was approximately 50 per cent for both male and female family members (Figure 5.13).

5.4 Awareness of plastic pollution

The rampant use of plastic products, to some extent, does stem from a lack of general awareness. Apart from the health impacts previously mentioned, plastic waste has damaging impacts on the environment and the associated clean-up can be a burden to the city corporations. However, through the survey, it was revealed that while respondents may have not been aware of all the impacts of plastic pollution, they were still aware of at least one impact. In relation to the environmental impacts, nearly 74 per cent of the respondents stated their awareness about burning plastic waste leading to air pollution. On the other hand, in about 67 per cent of the individuals were also aware that plastic wastes have caused canals and urban sewage systems to be blocked, giving rise to urban flooding. Additionally, 62 per cent reported that individuals were aware of the fact that plastic waste is a concern for water pollution. However, very few individuals were aware that plastic breaks down to microplastic which is later ingested by marine species endangering them.

Likewise, in relation to the health concerns of plastic pollution, in 58 per cent of the respondents asserted that they were aware that burning plastic waste releases toxins which worsen respiratory diseases, and heart illness, and can damage the nervous system. On the other hand, in 52 per cent of the respondents knew that chemicals from plastic containers can leak out and enter the human bloodstream which may have negative health impacts. Moreover, 40 per cent reported that they had prior knowledge about the fact that microplastics can enter the human body through the food chain. However, surprisingly, only 4 per cent of the individuals reported being aware that single-use plastic can contribute to the spread of the COVID-19 virus.

5.5 Willingness to pay

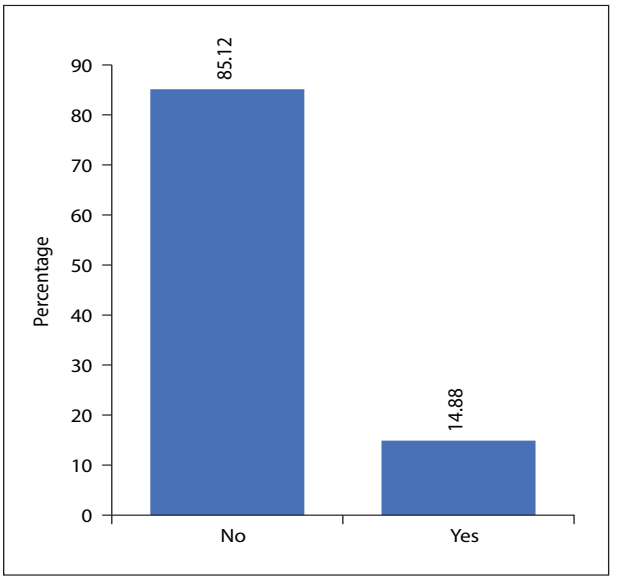
Nearly every day, polythene bags are used and discarded, contributing to the rising amount of waste in the streets of Dhaka and tarnishing the visual appeal of the urban infrastructure. Consumers receive polythene bags with every transaction they make from street sellers, department stores, small eateries, and wholesale or retail grocery stores.

As per the findings of the survey, individuals, on average, engage in grocery shopping for their households approximately five times a week. During these shopping trips, they spend an average amount of BDT 3,722 and acquire an average of 17 polythene bags for packaging. Notably, some households receive as many as 56 polythene bags per week along with their groceries. This substantial consumption of lightweight plastic bags raises significant policy concerns.

In urban areas, it is frequently observed that polythene bags have blocked the sewage system and the rivers, causing flooding and waterborne illnesses. To decrease the use of polythene bags, the Government of Bangladesh (GoB) outlawed their use in 2002. While this was a step in the right direction, it proved to be unsuccessful due to lax implementation. Thus, it is essential to cut back on the use of polythene bags to prevent plastic pollution.

Therefore, within the context of the survey, a hypothetical scenario was presented to respondents to gauge their consumer behaviour in relation to plastic pollution. This scenario served as a reference point for evaluating the importance attributed to the urban environment. The hypothetical policy initiative outlined in this scenario aimed to decrease the demand for polythene bags and subsequently enhance the urban environment and water quality within Dhaka City. Under this proposed initiative, consumers would incur an additional fee for each polythene bag provided to them during their purchases. Evidently, 85 per cent of the respondents were not willing to pay anything for a polythene bag (Figure 5.14). Even those who were willing to pay an extra charge for a polythene bag, refused to pay anything above BDT 1 on average.

Figure 5.14: Willingness to pay for a polythene bag



Source: Authors' own illustration based on survey data.

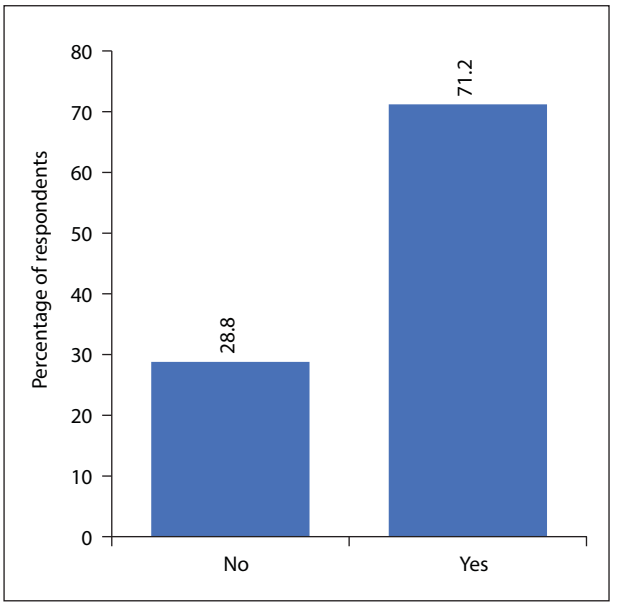
Therefore, it is safe to say that if a similar initiative was proposed to perhaps discourage consumers from taking a shopping bag and curb the intensity of plastic pollution, any amount higher than BDT 1 would, at least in theory, instantly discourage individuals.

Respondents exhibited reluctance to bear the additional cost associated with polythene bags due to several underlying factors. Some respondents reiterated their environmental concerns, emphasising that polythene bags contribute to plastic pollution, and they prefer to abstain from using them altogether. Others clearly indicated that the convenience offered by polythene bags did not justify the extra charge. This underscores the notion that individuals are willing to prioritise environmental conservation over their own convenience, especially if it entails incurring additional economic expenses. Furthermore, a significant portion of respondents expressed their disinclination to pay any fee for polythene bags, as they have traditionally received them at no cost. In the event of such a policy being implemented, they indicated a preference for transitioning to more sustainable bag alternatives.

This further substantiates the hypothesis that an extra payment will gradually reduce the demand for as consumers may choose to carry their own shopping bags instead of taking a shopping bag from the market. This will consequently reduce the supply of polythene bags in the long run and eventually, may reduce the pace of plastic waste accumulation on the streets of Dhaka city.

Regarding long-term objectives, it is paramount not only to diminish the influx of plastic into the value chain initially but also to devise strategies for effectively handling the escalating plastic waste that has already inundated the streets of Dhaka. The North and South City Corporations in Dhaka are responsible for the collection and management of waste. However, it is often the case that waste collection from households is done by the informal sector waste collectors who may not have enough knowledge to make an informed choice of separating all kinds of plastic waste before taking the waste to secondary collection points or landfills. In most cases, the informal sector waste collectors will only separate the plastic products which are cleaner and easier to sort, such as plastic bottles over other single-use plastic items. Thus, the waste management system in Dhaka city is inadequate and is polluting streets, neighbourhoods, and urban water bodies with plastic waste.

Figure 5.15: Willingness to pay to clean the community from plastic waste



Source: Authors' own illustration based on survey data.

Within the domain of waste management, the ultimate responsibility for overseeing and addressing the escalating volume of plastic waste in urban streets primarily rests with the dormitories of the two city corporations. Nevertheless, the challenge of mounting waste also assumes the character of a community concern. Given the burgeoning population of Dhaka, it becomes imperative for multiple stakeholders to engage collaboratively in the sustainable management of plastic waste.

In this context, the survey introduced an entirely different hypothetical scenario, proposing an initiative aimed at cleaning Dhaka city neighbourhoods and collecting plastic products for recycling purposes. Under this proposed scheme, each household would be required to make monthly contributions to their respective community body. This community body would comprise key representatives from within the community itself, fostering a sense of accountability and trust. According to the survey, 71 per cent of the respondents showed their willingness to pay to clean up their community from plastic waste (Figure 5.15). When the respondents were directly asked how much they would be willing to pay, they reported an average amount of BDT 118.

This suggests that if there were such an initiative introduced within certain communities, then perhaps it is best to stipulate BDT 118 a month for cleaning communities of plastic waste.

6. Conclusions and Policy Recommendations

6.1 Conclusions

In Dhaka, the growing concerns of its residents are centred around two significant issues: air pollution and plastic pollution. According to the findings from the survey, an overwhelming majority of the population, approximately 75 per cent, believed that both air and plastic pollution have deteriorated significantly over the past 2-3 years. Interestingly, only a small fraction, a mere 7 per cent, of the residents believed that air pollution has remained the same or improved during this time frame. Similarly, only 9 per cent held a similar belief regarding plastic pollution. These figures highlight the pervasive sense of worsening environmental conditions in the city.

What is notable is that these concerns are consistent across different demographics, as both men and women express similar levels of apprehension about the state of air and plastic pollution in Dhaka. However, about 74 per cent of individuals aged 65 and above believed that air pollution has significantly worsened in the past few years, compared to 75 per cent of those between the ages of 18 and 35. This variance might be attributed to the fact that older people are more susceptible to the adverse health effects of air pollution. Surprisingly, the oldest age group was also the most likely to report that plastic pollution has worsened considerably.

It is heartening to note that the residents of Dhaka are not oblivious to the health implications of air pollution. Approximately 70 per cent of them take proactive steps to reduce their exposure by ensuring they wear face masks when venturing outside. This indicates a strong recognition of the importance of personal health and well-being amidst the environmental challenges faced in the city.

The findings related to air pollution in Dhaka shed light on the predominant concerns and the tangible impact it has on the lives of its residents. First and foremost, it's evident that cars and other vehicles are at the forefront of residents' concerns regarding air pollution. Over 77 per cent of respondents identified motor vehicles as the primary cause of air pollution in the city. This perception was consistent across all age groups and genders, with at least 75 per cent of people pointing to vehicles as the main culprits. In contrast, fewer than ten per cent attributed the pollution to construction sites or waste burning, and even fewer – less than 5 per cent – singled out brick kilns as the primary source, with women and younger individuals less likely to identify this issue.

One compelling factor motivating residents to address the problem of vehicle pollution is the stark visibility of the issue, notably experienced in Dhaka's notorious traffic congestion. Survey data revealed that respondents spent an average of 46 minutes per day stuck in traffic jams, equating to a staggering 276 wasted hours per year.

Interestingly, almost half of private vehicle users surveyed indicated that improved mass transit options would be the most effective incentive for them to reduce their car usage. Only 10.9 per cent stated that no measures would convince them to drive less. However, it is worth noting that a substantial portion of Dhaka's population (70 per cent of those surveyed) did not own a private vehicle and already relie on buses, rickshaws, and walking for their daily commute.

When it comes to potential solutions, other measures like a fuel tax, congestion charge, number plate restrictions, and improved public awareness were seen as less likely to change driving habits. However, 50 per cent of vehicle owners expressed a willingness to pay an additional BDT 12.5 as carbon tax on fuel, though it is possible that higher prices could lead to reduced consumption, considering that 36 per cent of vehicle owners had already reduced their usage when the price of octane increased in the previous year.

On the distressing side of the findings, individuals in Dhaka are experiencing both negative health and economic impacts due to air pollution. A significant 67 per cent of respondents reported suffering from health symptoms attributed to air pollution in the past year, including respiratory issues, chest pain, and eye irritation. These public health impacts are taking a toll on Dhaka's productivity, as respondents collectively missed a total of 2,117 days of work and school due to these symptoms in the past year.

The economic burden on individuals is also substantial, with approximately BDT 2.9 million spent across 500 households in the last year to manage these health symptoms. This translates to a considerable cost of BDT 4000 per person, highlighting the financial strain imposed on residents as they grapple with the consequences of air pollution in their daily lives.

In addressing the pressing issue of air pollution in Dhaka, households resoundingly believed that the solution lied in a multifaceted approach that combined changes in personal behaviour with significant interventions and investments from government and industry.

The consensus among the majority of residents was that a multitude of stakeholders shared the responsibility for reducing air pollution in the city. This includes entities like the Dhaka City Corporation,

the Ministry of Environment, Forest and Climate Change (MoEFCC), private sector companies, private vehicle owners, and local communities. Recognising the complexity of the problem, over 30 per cent of respondents emphasized that tackling air pollution would not be feasible without the collaborative efforts of both the private and public sectors.

Moreover, a substantial 70 per cent of individuals expressed their willingness to contribute financially to participate in a scheme aimed at improving air quality. However, it's noteworthy that most of these respondents (70 per cent) indicated that they were only willing to contribute up to BDT 239.4 per month. This underscores the desire for collective action and shared responsibility in combating air pollution, with residents willing to invest in initiatives that promise tangible improvements to the city's air quality.

The findings related to plastic pollution in Dhaka reveal a complex picture, marked by low awareness of responsible waste management practices, a fragmented waste collection system, and varying degrees of awareness regarding the environmental and health impacts of plastic pollution.

Starting with waste management practices, it is evident that there is a significant lack of awareness among Dhaka residents. Nearly 84 per cent of them do not engage in any form of plastic waste segregation, with 78 per cent believing that such practices are unnecessary, often citing the fact that waste collectors do not request it. Furthermore, 63 per cent of households admitted to not recycling durable plastic items like food containers and toiletries, instead disposing of them with their organic waste. A smaller percentage centage (4 per cent) confessed to indiscriminately dumping their household waste in convenient locations rather than using proper channels. When venturing outside their homes, this number increased to 43 per cent, who tend to discard plastic directly onto the streets.

The waste collection system in Dhaka is fragmented, with 44 per cent of households having their waste collected by city corporation representatives, while the informal sector is responsible for collecting 47 per cent of waste. Currently, informal sector waste collectors may not be adequately informed about the importance of separating all kinds of plastic waste before taking it to secondary collection points or landfills. In most cases, they only separate the cleaner and easier-to-sort plastic products, such as plastic bottles.

Interestingly, there is a disparity in awareness between the environmental risks of plastic pollution and the potential negative consequences for human health. Respondents were well-informed about the environmental impacts of plastic pollution, including the role of burning waste in air pollution (74 per cent), blocking canals and sewage systems leading to flooding (67 per cent), and contributing to water pollution (62 per cent). However, fewer were aware that plastic breaks down into microplastics, which pose a threat to marine life.

Furthermore, only half of the respondents were aware that chemicals from plastic containers can leach out and enter the human bloodstream, and only 40 per cent were aware that microplastics can enter the human body through the food chain. This lack of awareness is concerning, especially as over a third (34 per cent) admitted to regularly using plastic utensils, despite the potential for harmful additives to leach out when exposed to heat. In lower socio-economic groups, more than half (54 per cent) reported not treating their water before consumption, potentially increasing their exposure to pollutants in the water supply. However, even some filtration methods may be ineffective in removing microplastics, which can emit hazardous chemicals and lead to various illnesses.

The study also revealed that polythene bags remain a major contributor to single-use household plastic consumption, with households acquiring an average of 17 polythene bags per week during grocery

shopping trips, despite a ban dating back to 2002 that does not appear to be effectively enforced. Fortunately, the majority (82 per cent) of respondents expressed a willingness to reduce their plastic consumption if alternative materials were available. However, 47 per cent admitted to accepting new polythene bags even when they had their own shopping bags with them.

In an effort to reduce plastic bag usage, a shopping bag charge could be a viable solution, as 85 per cent of respondents stated that they would refuse to pay for a new polythene bag and would instead prefer to use their own bags. This suggests that financial incentives could effectively cut down on plastic bag consumption and promote more sustainable practices among Dhaka residents.

In examining the issue of air and plastic pollution, it becomes evident that despite the heightened levels of concern expressed by residents, there appears to be a lack of corresponding behavioural modifications aimed at mitigating their individual contributions to these environmental challenges. The current state of affairs indicates that while there is a growing recognition of the issue at hand, the corresponding implementation of concrete measures or initiatives to address the said problem has yet to materialise.

The aforementioned statement underscores the imperative for collaborative efforts between governmental bodies and industries to facilitate individuals in making conscientious decisions that prioritise environmental sustainability. In order to effectively mitigate air and plastic pollution within the urban areas of Bangladesh, it is imperative to allocate adequate resources towards sustainable alternatives. This entails prioritising the development of an accessible and all-encompassing public transit system, as well as establishing a meticulously coordinated waste management infrastructure. By doing so, individuals will be incentivized to actively participate in pollution reduction efforts.

In order to effectively incentivize individuals to initiate behavioural changes, it may be necessary to complement positive reinforcements, or "carrots," with negative consequences, or "sticks," to discourage the persistence of old habits. Various options should be thoroughly examined in order to address the issue at hand. This includes investigating potential strategies to discourage the use of private vehicles, as well as devising effective methods to enforce the implementation of the ban on polythene bags.

The incorporation of consumer behaviour change is crucial in facilitating the transition towards a more environmentally sustainable urban environment. However, it is imperative to acknowledge the inherent limitations associated with individual behaviour in this context. In addition to the aforementioned policies, it is imperative for the government of Bangladesh to persist in its collaboration with the private sector in addressing industrial concerns, including the promotion of investments in sustainable alternatives to fossil fuels.

6.2 Policy recommendations and corresponding findings for air pollution

Dhaka City has suffered from severe air quality challenges for a long time. Solving this problem will take a holistic approach that includes government policy, public awareness, and community involvement. Some policy recommendations to address air pollution include the following:

Regulatory measures

Phasing out fixed chimney brick kilns by 2028: Fixed chimney brick kins are the most rudimentary form of brick kilns which produce the greatest amount of air pollution. Unfortunately, fixed chimney brick kilns are the most common form of brick kilns in Bangladesh. The Government of Bangladesh (GoB) should pass a regulation which requires the phasing out of all fixed chimney brick kilns in Bangladesh by 31

December 2028, and completely shifting all brick manufacturing to less polluting forms of brick kilns, such as Improved Zigzag Kilns, Hybrid Hoffman Kilns, and Vertical Shaft Brick Kiln. Setting a concrete goal and a well-defined target will motivate brick manufacturers to adopt more environment-friendly manufacturing processes urgently.

Phasing out coal-based powerplants: The GoB should immediately stop approving any new coal-based powerplants, and gradually decommission and phase out all existing coal-based powerplants, including the Rampal powerplant near Sundarbans which is apprehended to destroy the ecosystem.

Formulating regulations for construction sites and implementing those: Construction sites should be subject to regulation in order to guarantee the appropriate storage, covering, and transportation of building materials. Furthermore, it is essential for the government to establish a comprehensive regulatory framework and implement effective dust control measures in order to effectively manage and regulate emissions stemming from construction operations.

Economic measures

Exempting VAT for renewables: The government should fully implement the commitments which it made in the Renewable Energy Policy 2008. Currently, VAT exemption exists on solar panels and batteries, but there are no exemptions on solar inverters which are a crucial component of solar power plants. Moreover, the import duty on inverters (HS 85044090) was raised to 37 per cent in the budget of fiscal year 2022. An extensive policy that considers VAT exemption on all types of equipment in a renewable power plant, especially solar power plants, should be considered.

Offering incentive tariff to renewables: An incentive tariff can be considered for electricity generated from renewables according to the Renewable Energy Policy 2008, which allows electricity generated from renewable sources to be priced 10 per cent higher than the highest purchase price of electricity generated from fossil fuel sources.

Implementing environment surcharge: The Finance Act of 2014 set a 1 per cent surcharge on the goods produced by industries polluting the environment. This environment protection surcharge should be fully implemented.

Introducing carbon tax: Bangladesh can implement a carbon tax equivalent to 3 per cent of the price of fossil fuels starting from the next fiscal year, in order to gradually meet the government's target set out in the Eighth Five Year Plan which aims to implement a 5 per cent carbon tax on the price of fossil fuels by 2025 and 15 per cent carbon tax on the price of fossil fuels by 2041.

Phasing out fossil fuel subsidies: The government should phase out fossil fuel subsidies starting from the next fiscal year in line with recommendations from the International Monetary Fund (IMF). Initially, all fossil fuels may be sold at the international market price and this price may be updated each month. Instead, the government can redirect the funds currently allocated to fossil fuel subsidies to the development of green energy.

Encouraging hybrid, electric vehicles, and hydrogen vehicles: In order to reduce air pollution originating from the transport sector, the government should reform the advance income tax (AIT) structure on private motor vehicles so that the AIT on fossil fuel driven motor vehicles is 5 per cent to 50 per cent higher than the AIT on hybrid, fully electric vehicles, and hydrogen vehicles, depending on the size of engine and electric motor of the vehicle.

Table 10.1: Proposed advance income tax structure for the owners of private motor cars

Type and engine capacity or electric motor power of motor car	AIT for hybrid, fully electric vehicles, and hydrogen vehicles (in BDT)	AIT for conventional fossil fuel vehicles (in BDT)
A car or a jeep, not exceeding 1500cc or 75kw	25,000	26,250
A car or a jeep, exceeding 1500cc or 75kw but not exceeding 2000cc or 100 kw	50,000	55,000
A car or a jeep, exceeding 2000cc or 100 kw but not exceeding 2500cc or 125 kw	75,000	90,000
A car or a jeep, exceeding 2500cc or 125 kw but not exceeding 3000cc or 150 kw	125,000	162,500
A car or a jeep, exceeding 3000cc or 150 kw but not exceeding 3500cc or 175 kw	150,000	210,000
A car or a jeep, exceeding 3500cc or 175 kw	200,000	300,000
A microbus	30,000	36,000

Source: Authors' compilation.

Introducing advance income tax for motorcycles: In addition to the AIT on private motor vehicles, the government should also consider imposing a small AIT on all motorcycles.

Table 10.2: Proposed advance income tax structure for the owners of motorcycles

Type and engine capacity of motorcycle	Yearly AIT (in BDT)
A motorcycle with engine up to 100cc	1,500
A motorcycle with engine from 101cc to 150cc	3,000
A motorcycle with engine from 150cc to 200cc	5,000
A motorcycle with engine from 200cc and above	9,000

Source: Authors' compilation.

Institutional measures

Introducing computerised emissions testing of automobiles: The Bangladesh Road Transport Authority (BRTA) should consider implementing computerised emissions testing for all vehicles. Fitness certificates should be issued only to vehicles which are able to pass computerised emissions testing.

Improving air quality monitoring: The Department of Environment (DoE) should establish more air quality monitoring stations from next year. This may initially be in every ward of Dhaka city and eventually nationwide. Such a network of air quality monitoring stations should publicly display the air quality parameters in real-time on large screens, and also publish air quality data online in real time.

Promoting non-motorised transport: Dedicated cycling lanes and pedestrian-friendly infrastructure should be developed wherever possible, to encourage walking and cycling as alternative modes of transportation.

Creating and protecting green spaces and urban planning: Urban green spaces in established cities like Dhaka and Chittagong should be protected from encroachment. Burgeoning cities across the country should be designed with at least one-third of urban built-up areas reserved for green spaces. All city

corporations across the country should be instructed to develop more parks, green spaces, and urban forests to absorb pollutants and provide oxygen.

Social measures

Increasing public understanding of air pollution: It is vital to generate widespread public understanding and disseminate information to the citizens of our country on the detrimental impacts of air pollution on human well-being. The GoB should launch nationwide public awareness campaigns to educate citizens about the health risks of air pollution and the importance of reducing their personal contributions.

Broadcasting and publishing air quality indicators with weather forecasts: The Ministry of Information and Broadcasting should instruct all television channels and radio stations to broadcast air quality indicators along with weather forecast reports.

International measures

Tackling pollution at the regional level: Transboundary air pollution must be addressed via talks among policymakers of neighbouring countries. The GoB should collaborate with neighbouring countries to address transboundary air pollution issues and establish regional agreements for air quality improvement.

6.3 Policy recommendations for reducing plastic pollution

Like in many other cities, Dhaka city faces the difficult problem of reducing plastic pollution, which can only be met by a mix of regulations, public awareness initiatives, and sustainable alternatives. Some policy recommendations to address plastic pollution include:

Regulatory measures

Enforcing ban on polythene bags: The GoB should strictly enforce ban on polythene bags. Polythene bag manufacturing equipment should be seized and destroyed. All retailers offering polythene bags should be fined heavily. Once polythene bags are completely out of the market, there will be a conducive environment for alternatives to flourish.

Promoting polythene alternatives: Alternatives to polythene bags, such as paper bags, cloth bags, and bags made of other sustainable materials should be sold to consumers at a nominal price in order to make it more feasible for all retailers to adopt and provide them to customers. Provision of free shopping bags should be prohibited by law, to encourage consumers to carry their own bags and reuse bags.

Developing a national framework for Extended Producer Responsibility (EPR): The GoB, in consultation with the private sector and experts should develop and implement a national framework for EPR that requires producers and manufacturers to take responsibility for the entire lifecycle of their plastic products, including collection and recycling.

Phasing out single-use plastic by 2028: The GoB should pass a regulation which requires phasing out of single-use plastic products by 31 December 2028. Such single-use plastic products may include, inter alia, forks, knives, spoons, chopsticks, plates, straws, beverage stirrers, sticks to be attached to and to support balloons, food containers made of expanded polystyrene, beverage containers made of expanded polystyrene, and cups for beverages made of expanded polystyrene. Setting a concrete goal and a well-

defined target will motivate manufacturers to come up with environment-friendly alternatives to these single-use plastic products urgently.

Promoting the use of sustainable materials: To promote sustainability in Bangladesh, regulations mandating a minimum amount of recycled materials to be used in product packaging should be formulated.

Making government offices plastic-free: The GoB should lead by example by making all government offices and agencies plastic-free zones, and implementing policies to eliminate single-use plastics in government operations.

Economic measures

Introducing a plastic tax: With the goal of reducing plastic pollution, the government should consider bringing plastic products made with less than 30 per cent recycled plastic under taxation. Such a measure will encourage recycling of plastic and reduce the use of virgin plastic.

Reinstating 5 per cent supplementary duty on plastic bags: The 5 per cent supplementary duty on plastic bags which was withdrawn in fiscal year 2023 should be reinstated immediately.

Increasing customs duty on plastic wastes: The relatively low customs duty on plastic waste need to be raised. This will raise the cost of importing plastic wastes, causing plastic makers to find their raw materials domestically, boosting domestic plastic recycling.

Investing in technology to support recycling of multi-layer plastic (MLP): Bangladesh requires the appropriate technology to recycle MLP. The usage of virgin plastic resin may potentially decline substantially if firms acquire such technological support to recycle MLP.

Investing in technology for pyrolysis: Pyrolysis may regenerate petroleum from plastic waste for fuel. This is important because it will raise demand for all plastics and lessen Bangladesh's dependence on imported petroleum. It is crucial to note that such a procedure requires advanced equipment and might be costly to scale up.

Providing low interest loans to plastic recycling industries: Bangladesh Bank should instruct commercial banks to provide low-interest loans to encourage the growth of plastic recycling industries and innovation in plastic recycling technologies.

Institutional measures

Establishing recycling centres: The GoB should establish waste recycling centres, initially in all wards of all city corporations and eventually nation-wide. These recycling centres should provide trash-to-cash schemes to incentivise waste-collectors to collect more waste and increase overall recycling of waste. The government should aim to leverage the network of these recycling centres to create a market for single use plastic waste.

Improving links between recyclers and manufacturers: Links between the local recycling shops and manufacturers need to be established and strengthened on a national scale in order to increase the collection of polythene bags and PET bottles.

Engaging the informal sector: The informal sector should be formalised by municipalities by providing resources and training to separate plastic garbage from homes and secondary collection sites. The city corporation has the means and capacity to teach trash collectors to separate plastic waste.

Monitoring and reporting: The government should establish a system for monitoring and reporting plastic pollution levels, including regular assessments of rivers, water bodies, and public spaces. Such data should be shared with the public and stakeholders to maintain transparency and accountability.

Social measures

Launching public awareness campaigns: The government should launch educational campaigns to raise awareness about the environmental impact of plastic pollution and promote responsible plastic use. Such campaigns should engage schools, community based organisations, non-government organisations, and media in spreading the message.

International measures

Taking joint initiatives: The budget should allocate additional funding for the Joint Rivers Commission to establish a bilateral plastic waste reduction initiative with India. The Government of India should also contribute to this initiative with funding, as well as technical and logistical support, in order to ensure the reduction of plastic waste in the 54 transboundary rivers shared between Bangladesh and India.

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Annexes

Annex 1. Policy Influence and Impact

The CPD Green Cities Initiative's theory of change is based on its goal of reducing air and plastic pollution in urban areas of Bangladesh by promoting beneficial behavioural patterns and prudent policies. Therefore, by change it is meant that as a result of CPD Green Cities Initiative's programmes, policymakers will undertake policies and activities in a manner that is conducive to the reduction of pollution.

The CPD Green Cities Initiative generated knowledge through research studies and disseminated findings through policy dialogues and various outreach initiatives. CPD Green Cities Initiative acknowledges that only tacit knowledge cannot bring in any change. Therefore, it used various platforms such as networks of various organisations and the media in an attempt to influence policies and aim to bring about changes in them. CPD Green Cities Initiative's research, dialogue and outreach programmes worked as catalysts to such changes.

Given that policy changes in Bangladesh often take place at a slow pace, the Green Cities Initiative was limited by its 18-month duration in terms of creating meaningful and major changes in government policies. However, despite its short time span, the Green Cities initiative was able to raise the salience of air and plastic pollution within the policymaking discourse through its innovative communication strategies which target various policy stakeholders using tailor-made tools.

While it is not possible to directly attribute the work of the Green Cities Initiative to be responsible for policy changes, or to scientifically establish a causal relationship between the outputs of the Green Cities Initiative and the corresponding policy changes, a number of measures have been taken by the Government of Bangladesh (GoB) that were aligned with the policy recommendations provided by the Green Cities Initiative. Some of these measures are highlighted in the successive sections of this report. Additionally, Annex 1.3 also highlights how the CPD Green Cities Initiative Research Team directly engaged with a key policymaker, Mr Atiqul Islam, the Mayor of Dhaka North City Corporation (DNCC).

Annex 1.1 Policy influence and impact pertaining to air pollution

In the first phase of the Green Cities Initiative, CPD emphasised the role of vehicular emissions as a major contributor to air pollution in Dhaka, and recommended the government to adopt fiscal measures to discourage the purchase and use of private cars.

In the budget for the fiscal year 2024, the government announced that surcharge would be levied on owners of multiple vehicles (Table 6.1) (Kamal, 2023).

Annex Table 1: Environmental protection surcharge for multiple cars (in BDT)

Type and engine capacity or electric motor power of motor car	Environmental protection surcharge (in BDT)
A car or a jeep, not exceeding 1500cc	25,000
A car or a jeep, exceeding 1500cc but not exceeding 2000cc	50,000
A car or a jeep, exceeding 2000cc but not exceeding 2500cc	75,000
A car or a jeep, exceeding 2500cc but not exceeding 3000cc	150,000
A car or a jeep, exceeding 3000cc but not exceeding 3500cc	200,000
A car or a jeep, exceeding 3500cc	350,000
A microbus	30,000

Source: Authors' compilation based on information from Ministry of Finance (MoF, 2023)

In this first phase outputs of the Green Cities Initiative, CPD highlighted how brick kilns are a major source of air pollution in Dhaka.

A prohibition on the use of fuel woods in brick kilns and the operation of all unlawful brick kilns was ordered by the High Court on 12 November 2022, with notices to be sent by all district deputy commissioners within seven days (New Age, 2022). The court also ordered the deputy commissioners to report back to it within two weeks on the progress made in carrying out its order. The court also ordered the government to provide an explanation within four weeks as to why it should not be ruled unlawful for it to not put a halt to the use of fuel woods in brick kilns and the operation of illegal brick kilns.

Annex 1.2 Policy influence and impact pertaining to plastic pollution

In the first phase of the Green Cities Initiative, CPD recommended the government to reduce plastic pollution through international collaboration with neighbouring countries.

Between 29 May 2023 to 2 June 2023, representatives from GoB attended the Second Session of the Intergovernmental Negotiating Committee (INC) to develop an international legally binding instrument on plastic pollution, including in the marine environment, in Paris (UNEP, 2023). Taking into account the principles of the Rio Declaration on Environment and Development, as well as national circumstances and capabilities, the committee's goal is to create an international legally binding instrument on plastic pollution, including in the marine environment, that could include both binding and voluntary approaches. The work of this committee is driven by the UNEA Resolution 5/14 entitled "End plastic pollution: Towards an international legally binding instrument" (UNEP, 2022). Given that the representatives from GoB are actively participating in the work of the INC, it is hoped that Bangladesh will eventually become a signatory to any international legally binding instrument that intends to end plastic pollution.

During the launch event of the Green Cities Initiative, Mr Zaved Akhtar, CEO and Managing Director, Unilever Bangladesh Limited, participated as a distinguished discussant. In the first phase of the Green Cities Initiative, CPD recommended city corporations to facilitate a network between plastic manufacturers and waste collectors to increase the collection of all types of plastic items.

At a ceremony held at the Radisson Blu Chattogram Bay View on June 23, 2023, Unilever Bangladesh Limited, Chattogram City Corporation, and Young Power in Social Action signed a Memorandum of Understanding (MoU) to enhance plastic circularity in Chattogram City Corporation (The Business Standard, 2023). The goals of the MoU between Unilever and Young Power in Social Action are to collect 10 per cent of Chattogram's plastic garbage, improve the working conditions of 5,000 waste workers, raise public awareness, and formally establish Chattogram's informal recycling value chain (The Business Standard, 2023).

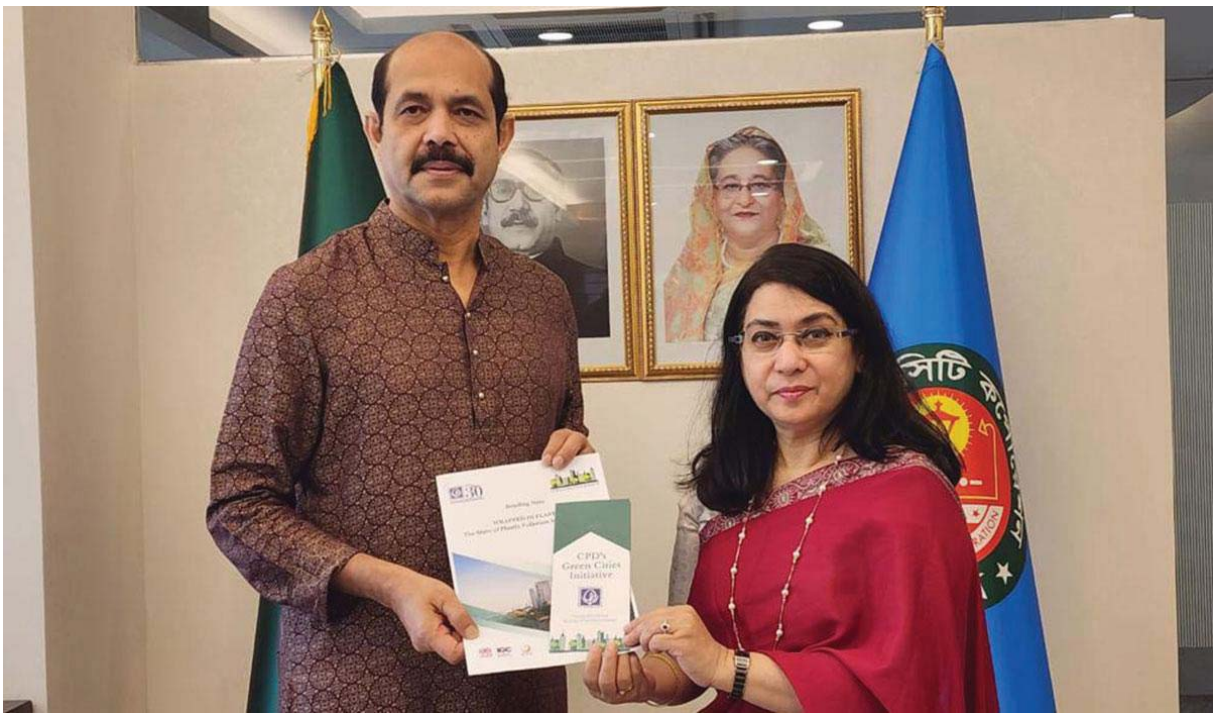
Annex 1.3 Meeting with the Dhaka North City Corporation Mayor

As part of its target of policy engagement with government officials, the CPD Green Cities Initiative team held a meeting with Mr Md Atiqul Islam, Mayor, Dhaka North City Corporation (DNCC), to discuss the progress and future plans of the CPD Green Cities Initiative. The meeting was held on Tuesday, 28 March 2023, from 12:30pm to 1:30pm at the Mayor's Office, DNCC, Gulshan 2, Dhaka.

Two briefing notes, a brochure of CPD's Green Cities Initiative and a copy of the survey questionnaire were presented to the Mayor to initiate the discussion. Two briefing notes, a brochure of CPD's Green Cities Initiative and a copy of the survey questionnaire were presented to the Mayor to initiate the discussion.

The CPD Green Cities Initiative Team mentioned that the first phase of the Green Cities Initiative was complete and work in the second phase was currently ongoing. The Mayor appreciated the Green Cities Initiative's work and assured that he would be available for support if needed.

The Mayor recalled his recent visit to Miami, USA, where he met the local city officials. He described that in Miami, the city authorities were trying to create awareness among the youth and new generation in order



to prevent and control mosquitoes. He emphasized that cities will become green in the future if the next generation is concerned about the state of cities. He suggested that the Green Cities Initiative should also try to build awareness about the state of cities among the youth, taking the example of Miami.

The Green Cities Initiative Team assured the Mayor that they would take his suggestion into account. They also mentioned that the second phase of the Green Cities Initiative involved a poster contest for university students, which would be conducive towards building awareness about the state of cities among youth.

The Mayor highlighted how methane emissions from fecal sludge dumped into lakes and other water bodies inside Dhaka city were causing air pollution and contributing to overall greenhouse gas emissions. He requested the Green Cities Initiative Team to look into this issue in their final report. The Green Cities Initiative took note of his suggestion.

The Mayor shared his recent success story of cleaning a lake in Baridhara, a posh area of Dhaka city, by blocking illegal pipelines which were carrying fecal sludge from ultra-rich households into a nearby lake causing severe pollution and disrupting aquatic life. He mentioned how he personally visited the area and oversaw the blocking of the illegal pipelines using banana tree trunks. He emphasised how he went ahead with the operation in the greater interest of the city, despite getting repeated phone calls from the rich and powerful residents of the area to act otherwise.

The Mayor mentioned that he wanted to set a good example, and so he set up an effluent treatment plant in his own house to ensure that the fecal sludge from his house was adequately treated and any waste water from his house was harmless for the environment and for aquatic life.

Mr Md Atiqul Islam, Mayor, DNCC, Commodore SM Sharif-ul Islam, Chief Waste Management Officer, DNCC, Dr Fahmida Khatun, Executive Director, CPD, Mr Syed Yusuf Saadat, Research Fellow

CPD, Ms Afrin Mahbub, Programme Associate (Research), CPD, Ms Marium Binte Islam, Research Associate, CPD, and Mr Mohammad Abu Tayeb Taki, Research Associate, CPD, were present at the meeting.

Annex 2. First Phase Activities

Annex 2.1 Launch event

CPD launched the Green Cities initiative at a dialogue on Monday 31 October 22.

Summary of proceedings

On behalf of the study team, Mr Syed Yusuf Saadat, Research Fellow of CPD, delieverd the keynote presentation based on evidence on the relationship between air and plastic pollution, and public health in the economy of Bangladesh. He mentioned that the objectives of the study are to identify issues that impede green growth in the cities of Bangladesh, to maximise the scope of policy-influencing by focusing on concrete problems that have a direct impact on people's daily lives, and to design policy solutions on "clean air" and "plastic pollution" in the upcoming years through further research and development.

The study places emphasis on the drivers, impacts and existing policies in Bangladesh for air and plastic pollution. The presentation showed, Dhaka's air quality is getting worse due to vehicular emissions, brick kilns, emissions caused by the construction sector and many other reasons including coal-fired power plants, biomass burning, and waste burning. Furthermore, both plastic usage and plastic waste are increasing with the growth of our economy. Use and indiscriminate disposal of single-use plastics, growth in plastic production, lack of proper management in recycling, and poor waste management are the main drivers of this pollution. The pollutions lead to severe environmental damage along with adverse economic and health impacts.

The study puts forward several recommendations. These include—encouraging hybrid cars by increasing their affordability and by lowering the import duty; regular fitness testing of vehicles; maintaining strict monitoring and enforcement of controlling emission levels; ensuring better waste management and reuse of plastic wastes; increasing collection of all types of plastic items and creating a market for discarded single-use plastics with the help of the government and the private sector; and investing in renewable energy and green technology.

The dialogue was chaired by Dr Fahmida Khatun, Executive Director, CPD. In her welcome remarks, Dr Fahmida highlighted the nexus between rapid growth of urbanisation in Bangladesh and the alarming rise in pollution. She called for a concerted and coordinated effort from all levels of relevant stakeholders, including the government, the private sector, and the citizens as it is necessary to engage all of them in terms of transforming Bangladesh's urban areas into green cities. She congratulated the Mayor, on winning the C40 Cities Bloomberg Philanthropies Awards 2022 under the category of "Building Climate Resilience".

Mr Md. Atiqul Islam, Hon'ble Mayor, Dhaka North City Corporation (DNCC) attended the dialogue as the chief guest. While sharing his concerns over the severity of the problem, he mentioned that a large number of people migrate to Dhaka city every day on an average due to climate change. He shared some his future plans including a ten per cent tax rebate on rooftop gardening and rainwater harvesting initiatives as a strategy for greening cities. He encouraged more research on developing plastic alternatives at a feasible rate. He persuaded everyone's collaboration in terms of transforming Dhaka into a liveable city.

Mr Md. Jashim Uddin, President, Federation of Bangladesh Chambers of Commerce & Industries (FBCCI) attended the dialogue as a distinguished discussant. He remarked, brick kilns are an enormous source of air pollution. Concrete blocks can be a possible alternative building material, and he proposed that policymakers could consider a reduction in the import duty for the rock particles used in concrete blocks. He also talked about the negligence of Bangladesh Road Transport Authority (BRTA) in terms of electric cars and emphasised proper management of the plastic wastes.

Mr Zaved Akhtar, CEO and Managing Director, Unilever Bangladesh Ltd., another distinguished discussant at the dialogue demonstrated Unilever's business plan considering environment-friendly solutions. They are trying to build a three-phased business model: (i) better plastic creation focusing on recyclable plastic; (ii) less plastic creation introducing new size of containers using less plastic; and (iii) no plastic creation encouraging to reuse containers through changing consumer behaviour. He also laid emphasis on stakeholders' collaboration and finding innovative ways to reduce plastic waste.

Dr Dibalok Singha, Executive Director, Dushtha Shasthya Kendra (DSK), focused on the significance of extended producer responsibility. Plastic producers need to be held accountable for generating plastic wastes. He mentioned, 8 per cent of the city corporation budget is for solid waste management, which is 190 taka per household, whereas 35-50 per cent of the budget needs to be allocated for effective waste management.

Mr Md Masud Rana, an air quality expert, pointed out that the pollutants emitted from the industries are more hazardous. He made a suggestion, drawing attention of the municipality towards air pollution caused by dusty fields in the dry seasons, which can be easily manageable by implanting grass. He mentioned, "Around 2 lakh people die due to air pollution in Bangladesh every year."

Mr Fahim Uddin Shuvo, CEO of Garbageman, said, "We need both top-down and bottom-up approaches to address waste management." He mentioned, the linear system of waste management needs to be made circular. It is important to raise greater awareness among the citizens, incentivise waste collectors and implement adaptive policies in order to reduce waste in the city. He emphasised that the lack of data regarding waste management is a problem itself.

The event was followed by an interesting open-floor discussion, in which high-level policymakers, diplomats, foreign delegates, researchers, development practitioners, academics, business leaders, civil society representatives, international development partners, and journalists participated.

Major points discussed

Mr Md. Jashim Uddin
President
Federation of Bangladesh Chambers of Commerce & Industries (FBCCI)

Major points

- Concrete blocks can be a possible alternative to traditional bricks which are an enormous source of air pollution.
- Electric cars can substitute cars which run on fossil fuels and cause air pollution.
- Per capita income in Bangladesh has risen over the years, leading to an increase in demand for plastic products.
- In the future, when per capita income rises further, the demand for plastic products will increase more. Hence, policy measures are required to manage plastic waste before the plastic pollution problem goes out of hand.

Dr Dibalok Singha
Executive Director
Dushtha Shasthya Kendra (DSK)

Major points

- In Bangladesh, most plastic waste ends up in the natural environment and causes pollution.
- Public awareness campaigns have been successful in reducing plastic pollution in other cities, such as Indore city in India.
- Plastic manufacturers should accept extended producer responsibility for plastic pollution and take necessary steps accordingly.

Mr Zaved Akhtar
CEO & Managing Director
Unilever Bangladesh Ltd

Major points

- We need to start with better plastic, then move to less plastic, and finally transition to no plastic.
- The biggest challenge is to change consumer behaviour.

Mr Fahim Uddin Shuvo
Chief Executive Officer
Garbageman

Major points

- We need both top-down and bottom-up approaches to plastic waste management.
- Waste management is necessary not only for aesthetic reasons, but also for health and economic reasons.
- Better coordination between all actors involved in waste management may be able to reduce plastic pollution.

Mr Md Masud Rana
Monitoring & Evaluation Consultant
Clean Air and Sustainable Environment Project
Department of Environment

Major points

- Pollutants released by industrial emissions are often highly toxic and extremely hazardous to human health.
- The momentum of our early achievements in reducing air pollution were not maintained in later years, and as a result air pollution has been on the rise.
- So pollutants which cause air pollution also contribute to climate change, so there is a link between air pollution and climate change.

Mr Md. Atiqul Islam
Hon'ble Mayor
Dhaka North City Corporation (DNCC)

Major points

- Dhaka does not have sufficient green open spaces that is needed in any city.
- There is a serious problem of air, water, and plastic pollution in even the most elite areas of Dhaka, including Gulshan, Banani, and Baridhara.
- Using school buses could reduce air pollution from vehicular emissions, but parents are unwilling to let their children go to school on buses due to security concerns.
- The mayors of all the cities of the world are worried about COVID-19, climate change, and conflict.
- Dhaka receives a disproportionately large number of climate refugees on a regular basis.

Policy recommendations from the launch event

Mr Md. Jashim Uddin
President
Federation of Bangladesh Chambers of Commerce & Industries (FBCCI)

Policy recommendations

Import tariffs on concrete blocks should be reduced in order to make them a commercially viable alternative to traditional bricks.
Bangladesh Road Transport Authority (BRTA) should decide on the import tariff, registration fee, and advance income tax amounts for electric cars and begin the registration of electric vehicles.

Dr Dibalok Singha
Executive Director
Dushtha Shasthya Kendra (DSK)

Policy recommendations
A guideline for the management of medical waste, which is often plastic waste, is urgently needed.
At least 35 per cent of the budget of each city corporation should be allocated for urban waste management.

Mr Zaved Akhtar
CEO & Managing Director
Unilever Bangladesh Ltd

Policy recommendations
Some single-use plastic waste may be reduced by avoiding single-use plastic products such as drinking straws.

Mr Fahim Uddin Shuvo
Chief Executive Officer
Garbageman

Policy recommendations
The linear system of waste management needs to be made circular.
The government needs to provide incentives to waste collectors who are now working informally.
Policies should adapt to changing circumstances in order to be effective.

Mr Md Masud Rana
Monitoring & Evaluation Consultant
Clean Air and Sustainable Environment Project
Department of Environment

Policy recommendations
Grass should be planted on open fields in the city so that they do not become dusty during the dry seasons. Private corporations should come forward and plant this grass, in return for some publicity.
Some climate change funds should be allocated toward reducing air pollution in urban areas.

Mr Md. Atiqul Islam
Hon'ble Mayor
Dhaka North City Corporation (DNCC)

Policy recommendations
Each residential building should have its own effluent treatment plant which should be set-up entirely using pooled funds from private individual who live in a particular building.

The city corporation may consider giving tax breaks to people who making roof-top gardens and doing rainwater harvesting. However, no such guideline is in place at this moment.

The government may consider subsidizing biodegradable bags in order to make them a feasible alternative to plastic bags.

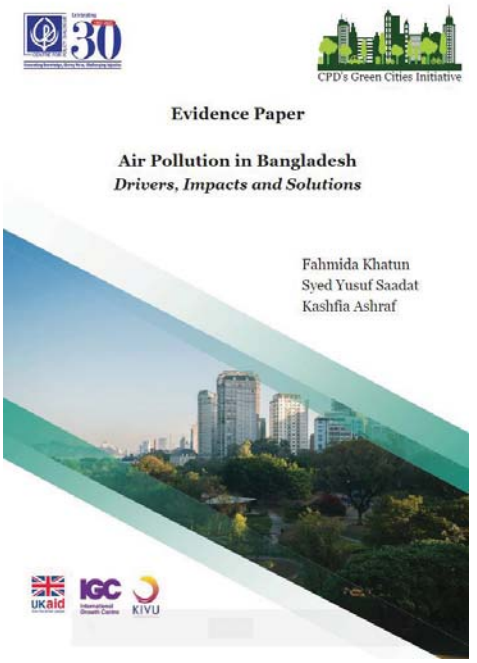
In order to ensure climate justice, the developed countries of the world should increase their funding support for cities like Dhaka which are severely affected by the adverse impacts of climate change, but are not major contributors to carbon emissions.

2.2 First Phase Publications

In the first phase of the CPD Green Cities Initiative, two evidence papers, two briefing notes, two infographics, one brochure, and two videos were published.

Air Pollution in Bangladesh: Drivers, Impacts and Solutions

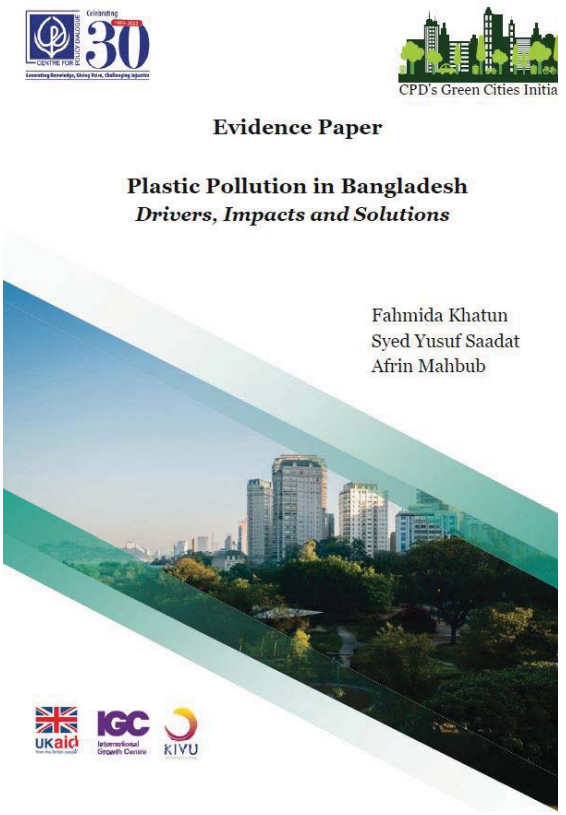
Bangladesh, particularly its capital city Dhaka, has been on the top of the mantle for having the worst air quality in the world. Economic development induced by rapid industrialisation, urbanisation and energy consumption is responsible for the degradation of air quality in major cities of Bangladesh. This imposes huge economic and social cost, along with the burden of diseases when citizens are exposed to poor air for a prolonged period. Key pollutants such as particulate matter (PM2.5 and PM10), sulfur dioxide (SO2), oxides of nitrogen (NOX), ozone (O3), carbon monoxide (CO), and lead (Pb), are responsible for degrading the air quality and imposing substantial threat on human health, environment, and the economy of the country. Effective policies and actions by the government, private sector and other stakeholders are paramount to improve the air quality, and eliminate the threat on human health, environment, and the economy of Bangladesh.



https://cpd.org.bd/publication/air-pollution-in-bangladesh-drivers-impacts-and-solutions/

Plastic Pollution in Bangladesh – Drivers, Impacts and Solutions

Plastic pollution is quite widespread in Bangladesh, as the country exhibits a pervasive throwaway culture where waste is deliberately discarded on the streets of urban cities. In 2020, the total plastic waste collected in Dhaka alone was 646 tons which accounts for only 10 per cent of the total waste. About 48 per cent of this waste ends up in landfills, while only 37 per cent of the plastic waste is recycled. About 12 per cent of the plastic waste is dumped in small rivers, and the rest 3 per cent is disposed of indiscriminately. Although city corporations are responsible for waste management, most of the waste including plastic waste is collected by the informal sector. Furthermore, there are insufficient information, knowledge and policy considerations which directly address the issue of plastic pollution in Bangladesh. The practice of using alternatives to plastics must be put into effect by further policy initiatives and market based incentives. This will help limit plastic products from entering the value chain and reduce plastic pollution in urban cities of Bangladesh.



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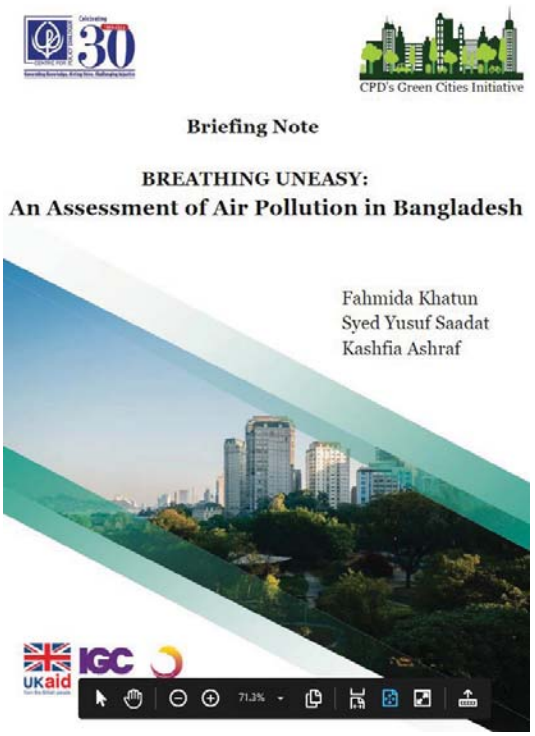
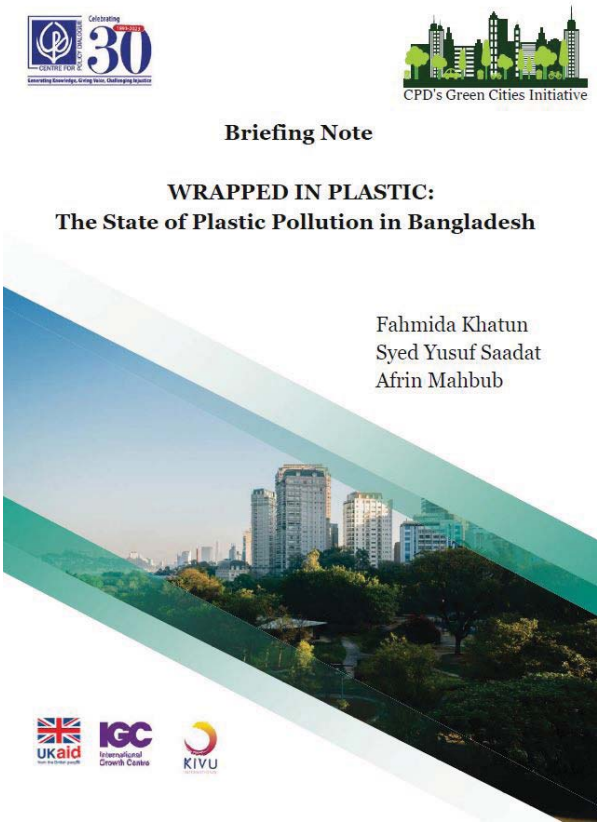


Breathing Uneasy – An Assessment of Air Pollution in Bangladesh

Bangladeshi cities have extremely poor air quality compared to other cities in Asian and South Asian countries, posing serious health and economic concern for the citizens. Air pollution is a major health risk in the world and the death tolls in Bangladesh are rising as diseases are being aggravated by polluted air. Effective measures and policies are imperative for achieving cleaner air in major cities of Bangladesh.

https://cpd.org.bd/publication/breathing-uneasy-an-assessment-of-air-pollution-in-bangladesh/



Wrapped in Plastic: The State of Plastic Pollution in Bangladesh

The production of plastic products needs to be minimised as recycling alone is not sufficient to tackle plastic pollution. City corporations bear a substantial amount of the clean-up cost due to indiscriminate disposal of single-use plastic products. In Bangladesh, there is a potential to create a circular market for single-use plastic products if there is a proper network between waste collectors or local recycling shops and plastic manufacturers.

https://cpd.org.bd/publication/wrapped-in-plastic-the-state-of-plastic-pollution-in-bangladesh/

Annex 3. Second Phase Activities

Annex 3.1 Journalist workshop

The media has substantial power to bring forth pressing environmental concerns such as air and plastic pollution into the limelight of public and political discourse and thus magnify their significance in policy debates. Moreover, media not only have the power to shape public perception but also can help influence the policymakers and their understanding of air and plastic pollution by highlighting the major health, environmental, and economic consequences. In this regard, the Centre for Policy Dialogue (CPD), as part of its Green Cities Initiative, arranged a knowledge sharing workshop titled "Promoting Green Cities through Awareness Building on Air and Plastic Pollution" on 9 July 2023, to equip journalists in Dhaka with the knowledge and skills necessary to report on air and plastic pollution in the city.

During the opening remarks, Dr Fahmida Khatun, Executive Director, CPD, began by emphasising the concerning levels of environmental pollution in Bangladesh and how significant its intensity has become, especially regarding risks to human health and threats to biodiversity.

'It is often seen that Dhaka is among the top cities to have persistent levels of air pollution which is quite concerning', said the Executive Director. Although air pollution is reported more often, plastic pollution is also an underlying issue that requires equal attention.

Dr Fahmida Khatun also underscored that the government had imposed a ban on the use of polythene bags, yet the policy lacked adequate implementation. Furthermore, plastic products are continuously being used and thrown away at the consumer level which further adds on to the level of plastic pollution in urban areas. Therefore, it is important to not only conduct research on such emerging issues but to also create a dialogue with the media to help raise awareness on such environmental matters.

In his keynote presentation, Mr Syed Yusuf Saadat, Research Fellow of CPD, highlighted the role of the media in building awareness and said 'Through consistent media coverage of air pollution and plastic pollution stories, the journalists have the power to bring these pressing issues to the forefront of public and political discourse, thereby amplifying their significance in policy debates'.

In the open discussion, the journalists expressed concerns about the lack of data availability, specifically mentioning that the Department of Environment (DoE) typically reports on the air quality index after a 24-hour delay, rendering it irrelevant for the public on the next day. One journalist proposed that increasing understanding about the health impacts of air pollution could be an effective way to raise awareness among the public. The discussants agreed on the importance of raising awareness on a larger scale to address air and plastic pollution. As many people might not find the environment to be an important issue, it was also suggested that if the citizens of Dhaka city were more aware of the health and economic consequences associated with air and plastic pollution then perhaps real behavioural change could be observed.

During the discussion, the journalists also highlighted some of the key solutions to plastic and air pollution. It was stated that if landfills had a solid waste treatment plant, then perhaps they would be able to manage the waste more effectively which could reduce plastic pollution. With the increasing affordability and usability of plastic, people do not bother to carry their own shopping bags while visiting the groceries and small tea stalls offer single use cups — a practice which has developed in more recent years. Furthermore, the journalists recommended that paying waste collectors a higher wage and providing them with proper safety equipment could also encourage proper waste management. Plastic pollution is now not only an urban concern but has permeated rural areas as well. Currently, in Bangladesh there are only a few designated media outlets that specifically report on pollution and environmental matters. Hence, there is a scope to increase dedicated reporting on pollution and environmental matters.

The discussion also highlighted that while brick kilns may be the greatest source of air pollution, construction sites are on equal par as a major source of air pollution. Especially, during the construction of the Metro Rail and the elevated highway, air pollution became significantly worse.

Additionally, the journalists emphasised the need to establish a dedicated authority comprising environmental experts and policymakers actively involved in government projects, who possess comprehensive knowledge of the impacts and effects of environmental pollution while maintaining transparency in data collection and dissemination. The journalists mentioned that the concern of air and plastic pollution are being reported for the last three to four years in Bangladesh. However, because of lack of updated data and in-depth research, they cannot report on these issues regularly. Drawing from their experience of working on environmental issues for an extended period, they highlighted how journalism contributed to curbing deforestation in Sylhet in recent years. Finally, they urged private organisations and non-governmental organisations to conduct further research on air and plastic pollution to facilitate more frequent reporting on these issues.

The workshop was attended by CPD researchers and journalists from both print and electronic media.

Annex 3.2 Student Research Poster Exhibition and Contest

As future leaders and professionals, students can play a crucial role in generating knowledge and solutions to pressing environmental issues such as air pollution and plastic pollution. As part of this study, CPD in collaboration with the Earth Club of North South University (NSU), organised a three-day Student Research Poster Exhibition and Contest with undergraduate and graduate students centered around air and plastic pollution. The objective of this student research poster exhibition and contest was to provide a platform for undergraduate and graduate students to showcase their research on air and plastic pollution in Dhaka city.

The competition unfolded through two distinct stages. The first stage involved an exhibition of research posters at NSU's recreation hall on 23-24 August, 2023. During this time, students from multiple universities and diverse disciplines converged to unveil their findings regarding air and plastic pollution. As this phase concluded, a rigorous selection process identified six exceptional posters which were moved to the final round.

The final round took place at AUDI 801 within NSU campus on 27 August, 2023, where the six chosen posters were showcased to the esteemed judges. Each presenter explained their work, discussed their ideas, and defended their findings.

The Guest of Honour, Dr Fahmida Khatun, Executive Director, CPD, said 'CPD organises programmes and events, fostering a platform for comprehensive discussions on policy recommendations. This competition exemplified our endeavor to stimulate the participation of young intellectuals, facilitating the exchange of their valuable perspectives and recommendations on air and plastic pollution.'

'Contrary to a common misconception, Economics plays a significant role in environmental sustainability. It offers a range of vital tools that, when effectively applied, can contribute to pollution reduction' said the Chair of the session, Dr M. Ismail Hossain, Professor, Department of Economics, and Former Pro-Vice Chancellor, NSU.

Dr Helal Ahammad, Professor, Department of Economics, Dean, School of Business and Economics, and Director, Economics Research Platform, NSU said, 'It's crucial to clearly explain to the decision makers why pollution reduction is essential and how we can go about achieving it.'

'While achieving a completely pollution-free world might be challenging, our focus should remain on minimising pollution as much as possible' said Dr Hasan Mahmud Reza, Professor, Department of Pharmaceutical Sciences, Dean, School of Health & Life Sciences, NSU.

Dr Asad Karim Khan Priyo, Associate Professor and Chair Department of Economics, NSU, recommended 'We should establish incentive systems to encourage pollution reduction'.

'Lives are being lost due to indoor air pollution, which can be up to 10 times more harmful than outdoor pollution' said Dr Firoz Khan, Associate Professor, Department of Environmental Science and Management, NSU.

While discussing about plastic pollution, Dr Mohammad Sujauddin, Associate Professor and Chair, Department of Environmental Science and Management, NSU, said 'When we suggest alternatives to plastic, like metal, it's important to remember to take into account the carbon footprints of these alternatives as well'.
Mr Md Shiyan Sadik, Lecturer, Department of Environmental Science and Management, and Faculty Advisor, NSU Earth Club opined 'The environment and economics can indeed converge to jointly pursue sustainability goals'.

'We need people from all disciplines to come together and work on solutions to reduce pollution' said Mr Syed Yusuf Saadat, Research Fellow, CPD.

Mr Muntaseer Kamal, Research Fellow, CPD said 'In suggesting practical solutions for air and plastic pollution, it's imperative to leverage the existing technology available to us.'

One of the joint first prizes of the contest was claimed by the poster on 'Air Pollution in Dhaka City: Its Sources, Impact and Mitigation' by Ms Rifa Tamanna and Md. Shadman Sakib Chowdhury of the department of Civil and Environmental Engineering, Bangladesh University of Engineering and Technology (BUET). They recommended that industries should aim to reduce use of enivornmentally harmful packaging materials. They also suggested that incentivising public transport will reduce use of private cars and hence reduce emission.

The other joint first prize was awarded to Md. Sabbirul Hasan of the department of Microbiology, NSU, for his poster titled 'Potential Use of Microbial Enzymes for Controlling Plastic Pollution in Bangladesh'. He suggested that microbial degradation of plastics is better than chemical processes, burning or landfilling, because it consumes less energy and is an environment-friendly option for Bangladesh. But the diversity of microbes and enzymes that can degrade plastic is still limited. So, the future prospects include identification, isolation and modification of microbes against all the synthetic plastics.

Among the participants, there were other noteworthy contributors who showcased insightful posters, delving into the pressing concerns of air and plastic pollution in Dhaka. These individuals were acknowledged for their valuable engagement and were presented with certificates in recognition of their efforts.

The poster titled 'Unchain the Air, Banish Plastic's Snare' was presented by Mr Ahmad Shams Qadir of the department of Water Resources Engineering, BUET.

Focusing on the topic of recycling, Ms Noor -E -Lubna Asha of the department of Education, University of Dhaka (DU), presented her poster on 'Trash to Treasure: Students Recycling Plastics into Teaching-learning Materials, Saving Dhaka City from Plastic Pollution'.

The poster on 'Exposing the Dangers of Improper Waste Management and Unhygienic Embankment that Cause Air and Plastic Pollution: A Case Study in Mohammadpur, Dhaka' was presented by Ms Naznin Akter Nisa of the department of Public Administration, Shahjalal University of Science and Technology.

The poster on 'Pollution Revolution: How to Combat Air and Plastic Pollution' was presented by Ms Shams Arban Ithila of the department of Geography and Environment Science, DU.

Researchers, academics and faculties were present at the contest, many of whom participated in the question-and-answer session and shared their insights.

This student research poster exhibition provided an opportunity for undergraduate and graduate students to showcase their research on air and plastic pollution in Dhaka. By fostering interdisciplinary collaborations and identifying potential solutions and policy recommendations, the poster exhibition contributed to the development of effective strategies for addressing air and plastic pollution in Dhaka. Moreover, it inspired and motivated future generations of students to engage in research and innovation to solve the most pressing environmental challenges of our time.

By the end of the poster exhibition and contest, the participants gained a better understanding of the current state of knowledge on air and plastic pollution in Dhaka. They also learned about innovative research methods and technologies for studying air and plastic pollution, and developed networks with peers and faculty members working on these issues. Moreover, the poster exhibition and contest identified potential solutions and policy recommendations for addressing air and plastic pollution in Dhaka, which can inform future research and policy decisions.

Annex 3.3 Student Photography Exhibition and Contest

As future leaders and professionals, students can use their creativity and visual storytelling skills to raise awareness about these critical environmental issues. As part of this study, CPD organised a student photography exhibition with undergraduate and graduate students. This student photography exhibition provided an opportunity for undergraduate and graduate students to showcase their work on air and plastic pollution in Dhaka. By raising awareness, promoting interdisciplinary collaborations, and inspiring viewers to take action, the exhibition contributed to the development of effective strategies for addressing air and plastic pollution in Dhaka. Moreover, it inspired and motivated future generations of students to use their creativity and visual storytelling skills to advocate for a healthier and more sustainable environment.

The goal of this student photography exhibition was to showcase the impact of air and plastic pollution in Dhaka city through a series of powerful images. The exhibition covered the following objectives:

- Raise awareness about the impact of air and plastic pollution on the environment and public health in Dhaka
- Promote the use of photography as a tool for environmental advocacy and social change

- Encourage interdisciplinary collaborations among students and faculty working on environmental issues in Dhaka
- Inspire viewers to take action to reduce air and plastic pollution in their communities

The photography exhibition featured the work of undergraduate and graduate students from different universities in Dhaka. The exhibition was open to all photography styles, including documentary, street photography, portraiture, and landscape. The photography exhibition provided an opportunity for students to showcase their work, receive feedback from their peers and faculty, and engage in interdisciplinary discussions about the challenges and opportunities of using photography for environmental advocacy.

The photographs were organised according to the following themes:
The impact of air pollution on public health in Dhaka
The impact of plastic pollution on the environment in Dhaka
Community-based solutions to reduce air and plastic pollution in Dhaka
The role of individuals and institutions in addressing air and plastic pollution in Dhaka

By the end of the photography exhibition, the participants raised awareness about the impact of air and plastic pollution on the environment and public health in Dhaka. They also learned about the power of photography as a tool for environmental advocacy and social change. The exhibition encouraged interdisciplinary collaborations among students and faculty working on environmental issues in Dhaka, and inspired viewers to take action to reduce air and plastic pollution in their communities.

The top two photographs selected by the panel of judges, one related to air pollution and another related to plastic pollution, received prizes. Additionally, some shortlisted photographs were published on CPD's website and social media accounts.

The exhibition was a two-day event held at Drik Gallery, DrikPath Bhobon, 16 Sukrabad, Level-6, Panthapath, Dhaka-1207, Bangladesh.

Annex 3.4 Second Phase Publications

In the second phase of the Green Cities Initiative, CPD published a special report and a briefing note.

Green Cities in Bangladesh: Policy Recommendations in the Context of IMF's RSF

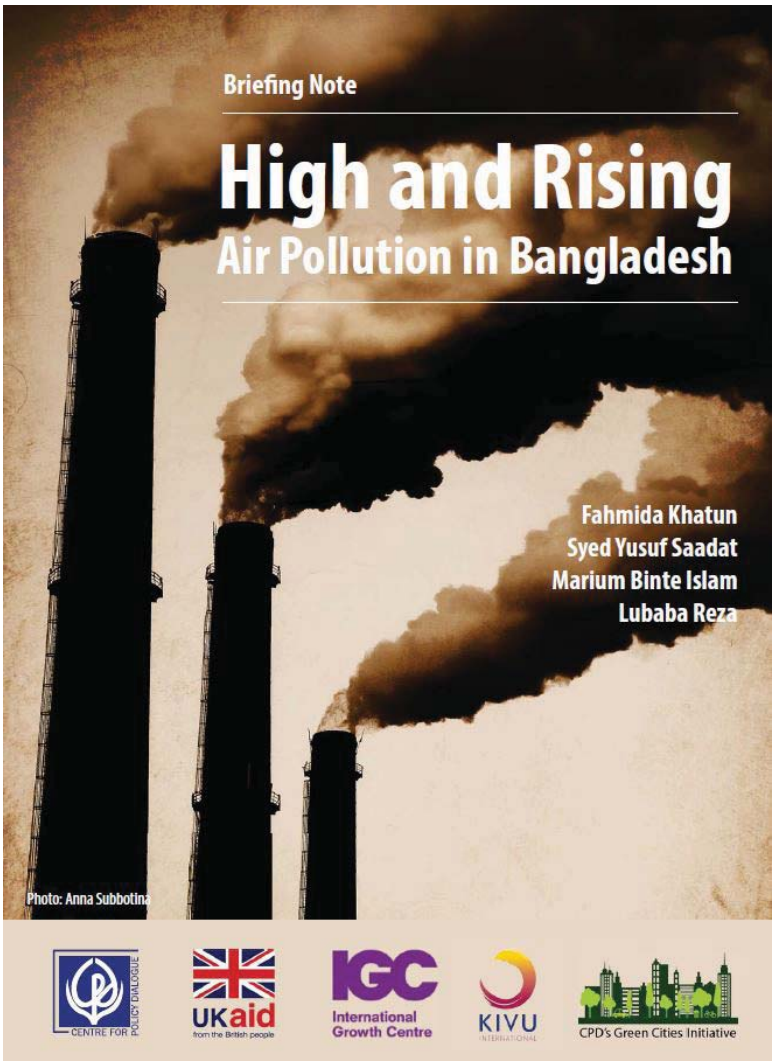
IMF has approved of Bangladesh's request for a USD 4.7 billion loan in January 2023 with the aim of preserving its macroeconomic stability, protecting the vulnerable and promoting inclusive and green growth. The fund has been approved under the provisions of the Extended Fund Facility (EFF), the Extended Credit Facility (ECF), and the Resilience and Sustainability Facility (RSF) arrangements. RSF is particularly designed for combating climate change challenges and strengthening private climate investments. However, access to the fund will be ensured only if the reform measures stipulated by IMF are implemented. There are 11 reform measures (RM) under the RSF based on the Government of Bangladesh (GOB)'s 3 reform priorities. Under this context, the Centre for Policy Dialogue (CPD) has come up with a set of policy recommendations for reducing air and plastic pollution in light of the reform measures suggested by IMF. The recommendations by CPD involve revenue raising options as a part of ECF and EFF while also emphasising infrastructure, climate fiscal management, and private climate finance in green cities as a part of RSF.

https://cpd.org.bd/publication/green-cities-in-bangladesh-policy-recommendations-in-the-context-of-imfs-rsf/

High and Rising: Air Pollution in Bangladesh

Air pollution has emerged as a pressing concern in Bangladesh in recent years. Bangladesh has consistently been ranked among the top five most polluted countries in the world in terms of air pollution since 2018 (IQAir, 2022). Air pollution harms humans, the environment, and the economy. Particulate matter (PM), the worst air contaminant, endangers new-borns and pregnant women. Increased respiratory and cardiovascular disorders are the main health risks. However, a recent study by the World Bank has identified that air pollutants worsen mental health as well (World Bank, 2021). Due to this disease burden, individuals spend more on healthcare and miss more work, costing the economy.

https://cpd.org.bd/publication/high-and-rising-air-pollution-in-bangladesh/



Annex 4. Partnerships

The Green Cities Initiative allowed CPD to form new partnership with key stakeholders.

Annex 4.1 Media partnership with Prothom Alo

CPD brokered a tripartite media partnership agreement between KIVU, CPD, and Prothom Alo. In brokering this deal, CPD invested substantial time and effort, and judiciously leveraged its goodwill and strong connections. CPD's goal was to ensure that the Green Cities Initiative is associated with a dynamic and dedicated media partner who will enable CPD and KIVU to improve outreach and increase dissemination, particularly among hitherto unexplored audiences. The quintessential role of the media partner would be to amplify the voices and messages emanating from the research findings and policy recommendations of the CPD Green Cities Initiative. It was anticipated that the presence of a good media partner would be complementary to the role and activities of CPD, and would be conducive towards raising the salience of air pollution and plastic pollution in the general public discourse.

The tripartite nature of the media partnership would entail that Prothom Alo would be receiving funding support from KIVU and research support from CPD. The scope of Prothom Alo's work would include: i) four episodes of news/feature/Op-ed to be published in the Daily Prothom Alo print, online and Facebook page; ii) two live shows to be telecasted on ABC radio and Prothom Alo Facebook page; iii) two news

reports (from the shows) to be published in Daily Prothom Alo print and online version; iv) one English language research output produced by CPD to be translated into Bangla; and v) one Bangla research output (500 copies book) to be published by Prothoma publication, sister concern of Daily Prothom Alo. The duration of the partnership would be from March to September 2023.

Prothom Alo is a popular daily newspaper in Bangladesh that has a reputation for publishing news and information with accuracy and integrity. Prothom Alo has the largest readership base of any newspaper in Bangladesh and the largest number of followers of any Facebook page from Bangladesh. This means that the Green Cities Initiative's research and analysis would reach a wider audience through the newspaper's print and digital platforms. This would help CPD Green Cities Initiative to disseminate its research findings and recommendations to a larger audience and contribute to informed public debate and policy dialogue. Prothom Alo has a reputation for being a credible news source in Bangladesh. By partnering with Prothom Alo, CPD's Green Cities Initiative can reach out to policymakers, academics, civil society actors, and other stakeholders who may be interested in the research on air and plastic pollution. Prothom Alo has a team of experienced journalists and editors who can work closely with CPD researchers to develop engaging and informative articles, features, and op-eds. This collaboration can help the Green Cities Initiative to communicate its research findings in a way that is accessible and understandable to a wider audience.

Annex 4.2 Academic partnership with North South University

The Green Cities Initiative allowed CPD to closely interact with North South University (NSU), the first and largest private university in Bangladesh. As a result of these interactions, as well as the successful

collaboration between CPD and NSU during the Green Cities Initiative Student Research Poster Exhibition and Contest, CPD was able to develop stronger ties with NSU.

With the objective of promoting and strengthening mutual cooperation in areas such as research and organisation of academic events, CPD and NSU signed a Memorandum of Understanding (MoU).

The MoU signing ceremony took place on Monday, 4 September 2023, at NSU campus. Dr Fahmida Khatun, Executive Director, CPD, and Professor Atiqul Islam, Vice Chancellor, NSU, signed the MoU on behalf of their respective organisations.

Professor Atiqul Islam expressed his excitement about the collaboration saying: "This partnership marks a pivotal moment in NSU's journey towards excellence in academia and research." He also hoped that this partnership with CPD will yield groundbreaking outcomes and contribute to the development of our nation.

Dr Debapriya Bhattacharya observed that this collaboration aligns perfectly with CPD's mission of promoting evidence-based policy research and advocating for sustainable development. "Together with NSU, we aim to address critical socio-economic challenges facing Bangladesh", he said.

Dr Fahmida Khatun pointed out that CPD's partnership with NSU is a testament to its commitment to fostering innovative research and knowledge exchange. "We are enthusiastic about the opportunities this alliance will create for both institutions. We want a close relationship with young students."

Dr Katherine Li, Director, Office of External Affairs, NSU, hosted the session, while Professor Dr Norman Kenneth Swazo, Director, Office of Research, NSU moderated the open floor discussion. All the speakers at the event highlighted that collaboration between CPD, one of the leading independent civil society think tanks in Bangladesh, and NSU, one of the leading universities in Bangladesh, would be a win-win partnership.

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