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(RESEARCH ARTICLE)

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The terrible air pollution in Dhaka city is getting worse

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Abstract

This study concentrated on the serious air pollution problem in Dhaka, Bangladesh, which profoundly impacts both public health and the economy. The main causes of this problem are rapid urbanization, poor infrastructure, vehicle emissions, and traffic jams. When it comes to particulate matter, notably PM2.5, typical concentrations above national guidelines, directly endangering respiratory health. Stricter emission standards, increased support for cleaner transportation, and infrastructural improvements are all necessary in the fight against pollution. Green spaces and pedestrian-friendly zones should be given priority in urban development schemes. For long-term mitigation, increasing knowledge and encouraging responsible conduct are essential. Although the Bangladeshi government has made some progress in lowering emissions, more work has to be done. To protect public health and secure a sustainable future, immediate action is required. This includes enforcing strict rules regarding air quality and promoting sustainable urban growth.

Keywords: Dhaka; Air pollution; Particulate matter; Ambient air quality; Transportation; Urbanization.

1. Introduction

Of the 57 transboundary rivers in Bangladesh, 54 originate in India, and three of the country's rivers—the Sangu, Matamuhuri, and Naf enter from Myanmar. Bangladesh is a highly populated riverine country with a total of 405 rivers and 230 tributaries and distributaries [1]. Crop productivity is disrupted by contaminated soil including heavy metals i.e. lead pollution [2], microplastics, Trichloropropane (TCP), organic pollutants, etc. Contaminating soil conditions result from the mixing of natural river or lake water with industrial wastewater. For instance, hazardous wastewater from DEPZ's many companies first enters the Dhalai Beel, where its combined effects first influence the environment and subsequently the waterways. [3] With a population of more than 21 million, Dhaka is among the cities in the world that is expanding the fastest. The city's explosive growth has brought forth a number of issues, one of which is traffic congestion, which is now a significant challenge for both locals and commuters. The severity of Dhaka's traffic issue and the harm it causes to the environment, public health, and economy of the city are well-known. [4] The majority of living things on Earth, including humans, need air to survive. Both natural and human-caused factors have contributed to the decline in ambient air quality. Coal-fired power stations release carbon dioxide (CO_2), nitrogen oxides (NOx), sulfur oxides (SOx), airborne particulates, and chlorofluorocarbons (CFCs), all of which contribute to air pollution and global warming. [5] Concern should be expressed about particulate matter (PM), one type of air pollution. Particulate matter with an aerodynamic diameter of 2.5 micrometers or less is referred to as PM2.5. An essential component of managing

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air quality and safeguarding the public's health is tracking and regulating PM2.5 levels in the atmosphere. Comprising a complex amalgamation of organic and inorganic constituents, suspended particulate materials (SPM) constitute a significant portion of Dhaka's air pollution. These microscopic particles, suspended in the atmosphere, pose a direct threat to respiratory health when inhaled. Their composition, ranging from liquid to solid states, underscores the diverse sources and the potential variability in their health impacts. Along with this health cost, air pollution has a significant financial impact. According to World Bank research, losses from air pollution in 2019 ranged from $11.5 billion to $13 billion, or 3.9% to 4.4% of Bangladesh's GDP. [6] In Dhaka, the average concentration of PM2.5 was between 165 and 175 g/m^3 in the winter and between 30 and 35 g/m^3 in the monsoon. [7]

While the economic and environmental toll of air pollution is widely acknowledged, the health ramifications, particularly concerning life expectancy, demand a closer examination. Dhaka's residents are confronted with a daily struggle for clean air, and understanding the intricate dynamics between traffic-induced particulate matter and its impact on health is imperative for formulating effective interventions. The objective of this research is to present an extensive examination of the air pollution in Dhaka, including a look at the underlying causes and their effects. We hope to further the existing discussion on ways to improve Dhaka's citizenry's quality of life and lessen traffic by taking this action.

2. Literature Review

The major environmental issue that Dhaka, the vibrant capital of Bangladesh, must deal with is air pollution. Regional air quality in Dhaka from 2015 to 2019 has the highest concentration of PM10 and PM2.5, with the annual Bangladesh National Ambient Air Quality Standard (BNAAQS) set for PM10 and PM2.5. This demonstrates that the quantity is significantly greater than 50 μg/m^3 and 15 μg/m^3, respectively. [8] Furthermore, there was a modest increase in ozone values from 7 μg/m^3 in 2015 to 10.5 μg/m^3 in 2019. [9]

The level of motorization in Dhaka is increasing year by year. Vehicle emissions have increased disproportionately in recent years. This is mainly due to the use of poorly maintained vehicles, adulterated fuel, improper traffic and road management, and inadequate parking spaces. A study under the Ministry of Environment's Clean Air and Sustainable Environment (CASE) project found that around 10.4 percent of particulate matter is emitted from vehicles in Dhaka city, and 7.7 percent comes from road dust. [10] Diesel-powered vehicles are the biggest polluters compared to CNG, Octane, or LPG-powered vehicles. Nitrogen oxides and black diesel smoke enter the air, worsening air quality in cities. Most vehicles running on diesel do not meet Bangladesh's 'Vehicle ' emission standards, resulting in higher levels of pollutants being released into the air.

In Bangladesh, several construction activities are underway in cities, including the construction of roads, housing, and viaducts [11]. In addition, there are mega projects of the government such as Metro Rail, Dhaka Elevated Expressway, Dhaka Airport Terminal 3, etc. It has been under construction for years. It's been many years now. The construction of these projects generates high levels of $PM_{2.5}$ and contributes significantly to air pollution. Due to the lack of specific guidelines and regulations regarding the storage and transportation of construction materials, construction sites are often very dusty. [11] This results in dust pollution in urban areas. According to the study, 500 tons of dust settles on the ground and 2,000 tons of dust floats in the sky every day in Dhaka city during winter. Bangladesh's economic recovery has contributed to the development of roads, railways, and domestic infrastructure, but at the high opportunity cost of worsening air quality.

3. Methodology

In conducting our investigation, we want to utilize both original and secondary materials. The literature review and analysis process, which is a comprehensive process meant to find, examine, assess, and synthesize previous research on a certain topic or research issue, is used in this study. Academic studies, official documents, and news stories about Dhaka's air pollution will be our secondary sources.

4. Result and discussion

According to the BRTA, the total number of registered vehicles in Dhaka was 1,716,688 in 2019 and 1,923,693 in October 2022. [12] The majority of these vehicles are reconditioned or old and lack proper maintenance. Congested traffic, bad parking management, contaminated fuels, overloading, and the dust generated due to friction with the roadways contribute to air pollution [13].

Table 1 Number of registered motor vehicles in Dhaka [12]

Sl. No	Type of Vehicles	Upto-2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Up to Oct/22	Grand Total
1	Ambulance	1277	137	114	188	253	355	284	399	456	548	599	614	379	**5603**
2	Auto Rickshaw	6571	112	110	59	56	428	582	42	5637	6839	114	112	170	**20832**
3	Auto Tempo	1405	1	0	0	0	0	0	0	0	0	0	0	0	**1406**
4	Bus	15018	1498	1217	968	1363	2219	3487	3294	2322	2951	1792	1213	1895	**39237**
5	Cargo Van	3123	477	278	675	600	396	999	1286	1224	3	1	0	0	**9062**
6	Covered Van	4505	2033	1250	1916	2422	1940	2673	4068	4386	2529	1688	3350	3514	**36274**
7	Delivery Van	11070	869	601	754	949	1531	1928	2207	1884	1292	967	1269	902	**26223**
8	Human Hauler	2097	568	145	115	109	502	786	217	211	0	2	0	0	**4752**
9	Jeep(Hard/Soft)	17839	1699	1242	1105	1582	3110	4217	4712	4863	5038	4450	6927	8090	**64874**
10	Microbus	44015	3526	2630	2220	3833	4563	5162	4926	3583	3241	2407	4455	5724	**90285**
11	Minibus	8293	135	103	83	136	103	155	158	185	186	133	186	125	**9981**
12	Motor Cycle	210879	34707	32808	26330	32891	46758	53718	75251	104051	99252	78551	99810	105059	**1000065**
13	Pick Up (Double/Single Cabin)	18688	7128	5069	4814	7185	7711	8370	10248	9598	8748	8024	8514	6785	**110882**
14	Private Passenger Car	160170	11421	8179	9232	12972	18423	18013	19570	16318	15016	11150	14321	13024	**327809**
15	Special Purpose Vehicle	525	59	28	78	50	66	224	233	500	410	144	123	71	**2511**
16	Tanker	737	151	85	133	162	143	203	187	323	235	177	157	182	**2875**
17	Taxicab	29551	52	43	3	301	53	30	3	94	6	0	0	0	**30136**
18	Tractor	7109	4168	2841	1634	1443	1637	2510	2754	3359	2503	2445	2556	1301	**36260**
19	Truck	23836	4078	2740	3390	5704	4334	4306	7010	8725	6228	3327	4336	3010	**81024**
20	Others	8793	786	666	651	961	1300	2559	3145	3593	3382	2283	2618	1865	**32602**
TOTAL		**575501**	**73605**	**60149**	**54348**	**72972**	**95572**	**110206**	**139710**	**171312**	**158407**	**118254**	**150561**	**152096**	**1932693**

Data from 2002 to 2007 showed that 30-50% of PM collected from different areas of Dhaka city are fine particles generated from transport-related sources, especially from diesel buses and trucks (45%) and auto-rickshaws (40%) [14]. Petrol-fueled light-duty vehicles (cars/vans) and auto-rickshaws contribute 85% of total carbon monoxide (CO), while diesel-fueled buses and trucks contribute 84% of total Nitrogen oxides (NOx). In the late nineties, Dhaka was the most polluted city globally, including having the highest levels of lead in the air (463 ng/m^3). The government banned leaded gasoline in 1999, followed by an embargo on the two-stroke engine auto-rickshaws. As a result, the lead concentration in the air was reduced. [15]

There are around 1000 –1200 brick kilns in the Dhaka area, out of the 8122 total in Bangladesh. [16,17] Urbanization and fast industrial growth have led to an increase in brick kilns. Between September 2010 and July 2012, brick kilns accounted for over 58% of Dhaka's air pollution; other significant sources included unregulated urbanization, pollutants from major construction projects, and brick kilns. [18,19] In order to fire bricks, biomass fuels like coal, wood, or other fuels are burned in brick kilns. A significant amount of particulate matter, particularly fine particles, are released during this combustion. Black carbon, often known as soot, is produced when fuels in brick kilns are not completely burned, adding to air pollution. In brick kiln combustion processes, nitrogen oxides (NOx) and carbon monoxide (CO) are released into the environment. In brick kilns, the combustion process and the usage of specific fuels can emit volatile organic compounds (VOCs), which can lead to the development of secondary pollutants such as ground-level ozone. Approximately 2.2 million tons of coal are burned, yielding tons of PM, sulfur dioxide, carbon monoxide, volatile organic compounds, and other toxic substances such as furans and dioxin.[20]

Road dust is a significant contributor to air pollution in Dhaka, primarily due to the city's high vehicular traffic and road conditions. The continuous movement of vehicles on unpaved or poorly maintained roads generates particulate matter (PM10 and PM2.5), contributing to elevated levels of air pollution. The resuspension of dust particles into the air, especially during dry and windy conditions, further exacerbates the problem.

The textile and dyeing industries in Dhaka contribute to air pollution through the release of various pollutants such as volatile organic compounds (VOCs) and particulate matter. These pollutants are released during the dyeing and finishing processes, and inadequate pollution control measures often lead to the emission of harmful substances into the atmosphere.

Tanneries in Dhaka, particularly in the Hazaribagh area, have been a longstanding source of air pollution. The use of various chemicals in leather processing, coupled with inadequate waste management practices, results in the release of noxious fumes and particulate matter. The impact is not only confined to local air quality but also extends to the health of nearby residents.

In nearly every high-rise structure in the city of Dhaka, diesel generators are in use. It is frequently utilized for water pumps, elevators, backup power supplies, and other small-scale building operations. The concentrations of PM2.5 and PM10 increased by 50–100% if they were used for several hours, and the PM levels stayed high all day in homes that used diesel generators for longer than eight hours. According to Jha (2018), the mean concentrations of PM2.5 and PM10 were 130 μg/m^3 and 300 μg/m^3, respectively, whereas their peak values were 300 μg/m^3 and 1900 μg/m^3, respectively. [21]

Table 2 Power Generation Units (Fuel Type Wise)

Fuel Type	Capacity(Unit)	Total(%)
Coal	5987.00 MW	22.59%
Gas	11686.00 MW	44.09%
HFO	6492.00 MW	24.49%
HSD	490.00 MW	1.85%
Hydro	230.00 MW	0.87%
Imported	1160.00 MW	4.38%
Solar	459.00 MW	1.73%
Wind	0.00 MW	0%
Total	26504 MW	100%

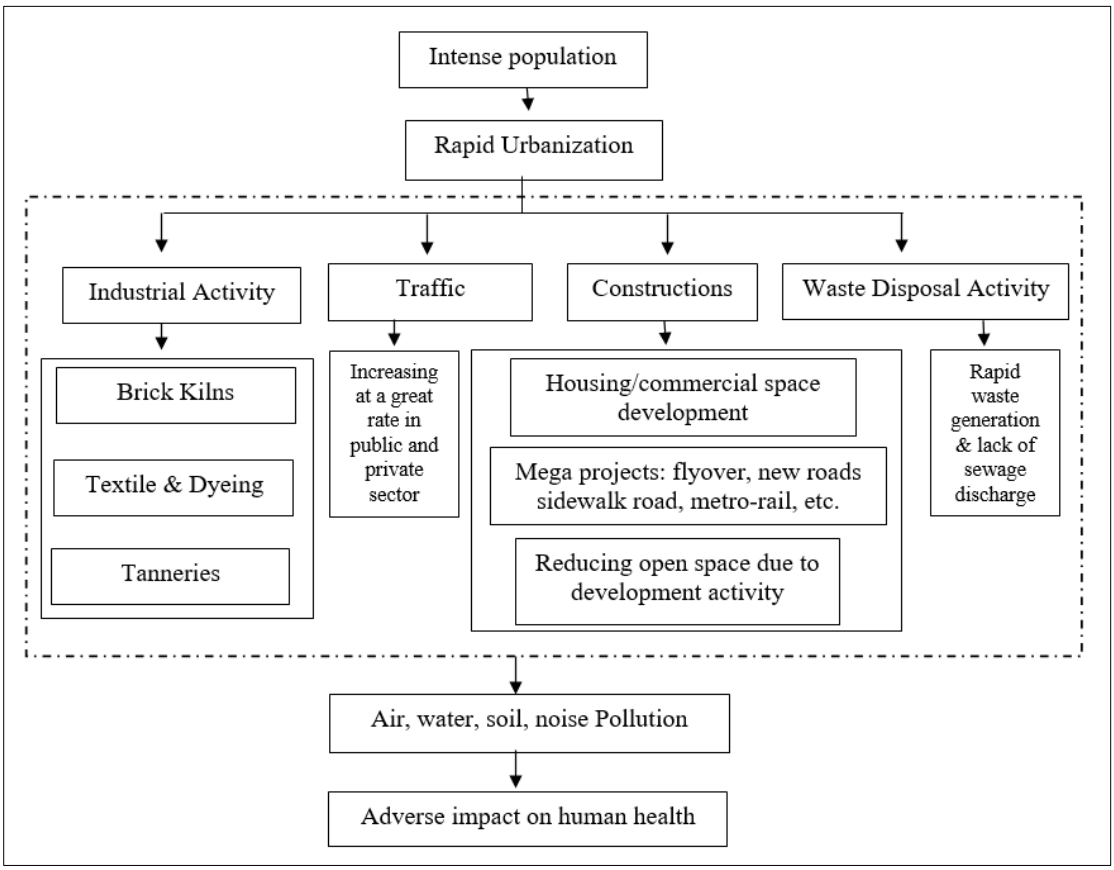

Figure 1 Schematic graphic showing the detrimental effects of air pollution on human health.

Bangladesh is primarily a gas-fired power plant nation, meaning that a large portion of its electricity is produced by natural gas. The nation's capacity to generate electricity is largely derived from natural gas. In Bangladesh, gas and coal

account for 68% of power generation, with the remaining coming from liquid fuel, furnace oil, hydro, and imported. [22] Together with off-grid (mostly captive) electricity, the nation's total power generation climbed by roughly 5000MW in 2023 to reach a new record of 30,700 MW. However, because consumption could not keep up with this increase, the government is projected to pay more for capacity. [23]

Insufficient and poorly designed road infrastructure is a major contributor to traffic jams. Narrow roads, lack of proper signaling systems, and inadequate traffic management exacerbate congestion issues. There are few highways or expressways to help with traffic flow, therefore the roads are small and clogged. The issue is also made worse by the inadequate maintenance of the roadways.

Figure 2 Dhaka US Consulate Air Pollution: Real-time Air Quality Index (AQI). (Saturday, February 18, 2024) [24]

As of right now, Dhaka is the 10th most populous city in the world and the 26th megacity. Without the proper direction, the city's unplanned development is growing rapidly, becoming 73% entirely unplanned, and causing severe issues with land use and transportation. Huge densification (around 45 thousand per sq. km), lack of buildable land (75% below natural water level and 95% within 5 to 7m flood level), and the mushrooming development of residential (62%), commercial (8%) and other infrastructure areas reduced the opportunity to build new roadway infrastructure or to introduce modern systems for improving the overall transportation system. [25] Although there are only 1286 km of roads in the DCC area, 52% of them are inaccessible to motorized vehicles, accounting for roughly 6.5 percent of the total city area, just 2% of it is made up of functional roads. Although buses make up the majority of the mass transit system in Dhaka, only around one-third of the city's metropolitan areas are covered by the 120 km total road length of bus operating routes, which includes 22 east-west links. Additionally, there is very little chance of increasing roadway capacity and functionality by implementing inexpensive traffic control techniques.

According to Business Inspection, traffic congestion has been a major source of hardship in Bangladesh, particularly in Dhaka, but it has recently taken on a dreadful form. Dhaka is ranked ninth out of 246 countries in the world's traffic index as of the World Traffic Index 2022. [26] On the other hand, the top cities are Sharjah in the United Arab Emirates, Delhi, and Kolkata in India, and Los Angeles in the United States. However, significant traffic bottlenecks are a cause for concern in a growing nation such as Bangladesh. Over 19 million working hours are lost in Bangladesh daily due to this traffic gridlock, hurting the national economy. Every year, traffic congestion costs the nation between 6 and 10 percent of its GDP.

Traffic congestion is contributing to the increase in air pollution in Dhaka. High vehicle density and slow traffic speeds increase pollutant emissions, negatively impacting air quality and public health. According to the World Bank and the

Bangladesh government, traffic congestion is one of the main causes of air pollution in Dhaka city. The Ministry of Environment and Forests says that vehicles in Dhaka travel at an average speed of 7 km/h, which is very slow and therefore consumes more fuel and contributes to air pollution. Unless the situation improves, the average speed could drop to 4 km/h by 2025. The Department estimates that reducing pollution by 20% could save at least 1,200 to 3,500 lives and avert 80 to 230 million cases of respiratory illness each year.

Traffic congestion in Dhaka leads to increased noise levels, which affects the quality of life of residents. Prolonged exposure to traffic noise can cause stress, sleep disturbances, and other health problems. The use of hydraulic horns in cars in Bangladesh was banned by the Supreme Court in 2017. This is because the volume of a hydraulic horn can reach 120 decibels, and exposure to this volume for more than 60 seconds can cause immediate injury or hearing loss. Idling for long periods in traffic jams leads to increased fuel consumption, which leads to increased fuel costs for vehicle owners. This also exacerbates environmental concerns related to carbon emissions. According to the Bangladesh Bureau of Statistics, 40% of additional fuel is burned during traffic congestion every day in Dhaka city.

The five primary pollutants that determine the air quality index (AQI) in Bangladesh are particulate matter, nitrogen dioxide, carbon monoxide, sulfur dioxide, and ozone. For these five pollutants, the Bangladeshi government adopted the WHO guideline value, and the Air Quality Index (AQI) is based on those criteria.

Table 3 National Ambient Air Quality Standards for Bangladesh

Pollutant	**Standards for preserving quality**
Carbon monoxide (CO)	40 mg/m^3 (35 ppm) average in 1 hour
Particulate Matter 10 (PM10)	50 µg/m^3 average in 1 year
Particulate Matter 2.5 (PM2.5)	15 µg/m^3 average in 1 year
Ozone (O_3)	235 µg/m^3 (0.12 ppm) in 1 hour
Sulfur dioxide (SO_2)	365 µg/m^3 (0.14 ppm) average in 1 year
Nitrogen dioxide (NO_2)	100 µg/m^3 (0.053 ppm) average in 1 year

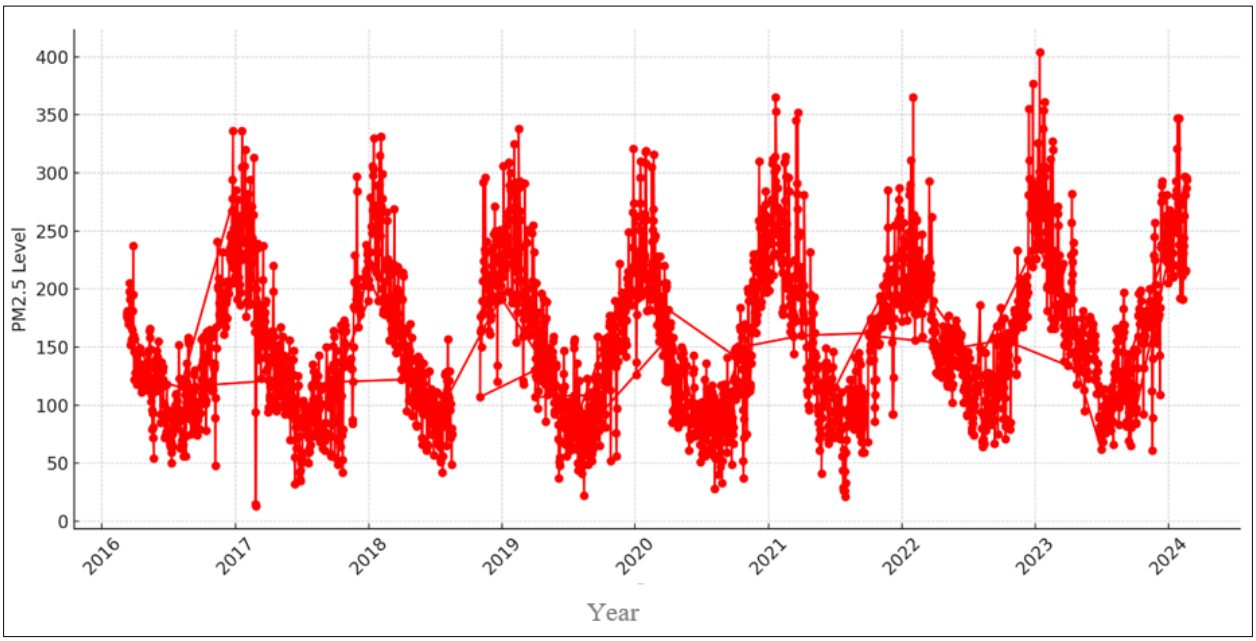

Figure 3 PM2.5 Air Quality Index in Dhaka over time (24)

The comprehensive Air Quality Index (AQI) data for Dhaka spanning 2016 to 2024 reveals a disconcerting pattern characterized by a significant number of days categorized as unhealthy or worse, surpassing 1,000 in total. [24] This alarming frequency highlights a persistent challenge with air quality in the city.

Furthermore, Dhaka experiences prolonged periods of exposure to air quality levels deemed hazardous, unhealthy for sensitive groups, and generally unhealthy. This extended exposure raises serious concerns about potential long-term health impacts on the city's residents, particularly vulnerable groups such as children and the elderly. The data unveils a noteworthy variability in air quality, ranging from excellent to hazardous conditions. This fluctuation underscores the intricate and multifaceted nature of the factors contributing to air pollution in Dhaka. The extended duration of poor air quality conditions implies a heightened risk of adverse health effects, emphasizing the urgent need for comprehensive interventions. The elevated number of days with very unhealthy and hazardous conditions underscores severe concerns about respiratory and cardiovascular health. Beyond health implications, the data suggests potential environmental and economic consequences, including increased healthcare costs, reduced productivity, and environmental degradation. Addressing these challenges demands immediate and sustained efforts in implementing effective air quality management strategies and intensifying public awareness campaigns to safeguard the overall well-being of Dhaka's population.

Recommendations

Measurements of high fine PM concentrations in Dhaka indicate that they could have a significant influence on public health. [27] Air pollution in the workplace can exacerbate respiratory conditions, leading to pneumoconiosis in coal miners, chest pain, asthma attacks, coughing, and dyspnea. In Bangladesh in 2012, ambient air pollution resulted in 37,449 deaths. [28] It's critical to reduce air pollution for both environmental protection and life safety. We suggest the following actions in response to the air pollution problem in Dhaka.

- **Promote Sustainable Transportation**
  - Invest in and expand public transportation infrastructure.
  - Encourage the use of electric vehicles and improve the efficiency of existing public transportation systems.
  - Implement and enforce strict emission standards for vehicles.
- **Traffic Management and Urban Planning**
  - Implement and enforce traffic management strategies to reduce congestion.
  - Develop and maintain well-designed roads with proper drainage systems to minimize road dust.
  - Encourage walking and cycling through the creation of pedestrian-friendly zones.
- **Industrial Emission Control**
  - Enforce stringent emission standards for industries, particularly for high-polluting sectors like textiles, dyeing, and tanneries.
  - Promote the use of cleaner technologies and encourage industries to adopt sustainable and environmentally friendly practices.
  - Regularly monitor and enforce compliance with emission standards.
- **Waste Management**
  - Improve solid waste management practices to reduce open burning of waste, a significant contributor to air pollution.
  - Implement recycling programs and waste-to-energy initiatives.
  - Raise public awareness about proper waste disposal practices.
- **Green Spaces and Urban Greening**
  - Increase the number of green spaces and urban trees to absorb pollutants and enhance air quality.
  - Implement and enforce strict regulations against the unauthorized cutting of trees.
  - Promote rooftop gardens and green building initiatives.
- **Air Quality Monitoring and Early Warning Systems**
  - Strengthen and expand the air quality monitoring network in Dhaka.
  - Establish an early warning system to inform the public about periods of high air pollution.
  - Provide real-time air quality data through public platforms for increased awareness.
- **Public Awareness and Education**
  - Launch public awareness campaigns on the impacts of air pollution and ways to reduce individual contributions.
  - Conduct educational programs in schools and communities about the importance of clean air and sustainable practices.
- **Policy and Governance**
  - Strengthen environmental governance through effective enforcement of existing environmental laws.

- Develop and implement comprehensive air quality management plans.
- Foster collaboration between governmental bodies, industries, and the public for a coordinated approach to air quality improvement.

- **International Cooperation**
- Collaborate with international organizations and neighboring countries to address regional air quality issues.
- Seek technological and financial support for implementing sustainable practices and infrastructure.

- **Research and Innovation**
- Invest in research to understand specific local sources of pollution and their impacts.
- Promote innovation in air quality monitoring technologies and pollution control measures.
- Implementing these recommendations collectively and with sustained effort can contribute to significant improvements in air quality in Dhaka. It requires the commitment of the government, industries, communities, and individuals to work together towards a cleaner and healthier environment.

- **Clean air Management**
- Clean air management involves a systematic approach to monitoring, regulating, and reducing air pollution. Here's a step-by-step guide on how to implement effective clean air management:

- **Air Quality Monitoring**
- Establish a comprehensive air quality monitoring network across the region, utilizing advanced monitoring technologies.
- Monitor key pollutants such as particulate matter (PM10, PM2.5), nitrogen dioxide (NO2), sulfur dioxide (SO2), ozone (O3), carbon monoxide (CO), and volatile organic compounds (VOCs).
- Provide real-time data to the public through accessible platforms, creating awareness and facilitating informed decision-making.

- **Data Analysis and Assessment**
- Analyze air quality data to identify sources and patterns of pollution.
- Assess the health and environmental impacts of different pollutants.
- Conduct periodic reviews and assessments to track progress and identify areas that require attention.

- **Emission Inventories**
- Develop comprehensive emission inventories that catalog and quantify pollutant sources.
- Regularly update inventories to reflect changes in industrial, transportation, and other activities.
- Use emission inventories to prioritize and target interventions.

- **Regulatory Framework**
- Establish and enforce stringent air quality standards and emission limits for various pollutants.
- Develop and implement regulations to control emissions from industrial sources, vehicles, and other significant contributors to air pollution.
- Periodically review and update regulations to reflect evolving scientific understanding and technological advancements.

- **Industrial Control Measures**
- Implement emission control technologies and best practices in high-polluting industries.
- Encourage industries to adopt cleaner production methods and invest in sustainable technologies.
- Conduct regular inspections and audits to ensure compliance with emission standards.

- **Transportation Strategies**
- Promote sustainable transportation modes, such as public transit, cycling, and walking.
- Implement and enforce vehicle emission standards.
- Develop infrastructure for electric vehicles and alternative fuels.
- Introduce congestion pricing and other measures to reduce traffic congestion.

- **Urban Planning and Green Spaces**
- Integrate air quality considerations into urban planning to reduce pollution hotspots.
- Increase green spaces, parks, and urban forestry to absorb pollutants and improve air quality.
- Encourage green building practices and urban design that minimize pollution.

- **Waste Management**
- Implement effective solid waste management practices to reduce open burning.
- Promote recycling and waste-to-energy initiatives.
- Enforce regulations against illegal dumping and burning of waste.

- **Public Awareness and Education**
- Conduct public awareness campaigns on the health impacts of air pollution.
- Educate communities about individual actions to reduce pollution.
- Encourage citizen participation in reporting pollution incidents.

- **International Collaboration**

- Collaborate with neighboring regions and international organizations to address transboundary air pollution.
- Share best practices, technologies, and expertise.
- Seek support for capacity building and technology transfer.

- **Continuous Improvement**
- Regularly review and update clean air management plans based on evolving science and technological advancements.
- Encourage research and innovation to develop new and effective pollution control measures.

- **Monitoring and Evaluation**
- Continuously monitor the effectiveness of implemented measures.
- Evaluate the impact of clean air management strategies on air quality and public health.
- Adjust strategies as needed to address emerging challenges.

Clean air management requires a collaborative effort involving government agencies, industries, communities, and individuals. It's an ongoing process that demands commitment, awareness, and adaptability to effectively mitigate air pollution and improve overall air quality.

5. Conclusions

In conclusion, Dhaka City faces an extreme and multifaceted challenge of discussing contamination, essentially driven by a combination of variables such as fast urbanization, lacking street framework, and the particulate component of vehicular emanations. The causes of contamination in Dhaka are profoundly established within the city's quick development, populace thickness, and deficient measures to address natural concerns. The results of this inescapable discussion of contamination have far-reaching impacts on the well-being, economy, and by and large quality of life for the inhabitants. The city's street framework, frequently deficiently and ineffectively arranged, plays a critical part in compounding discussion contamination. The tall volume of vehicles, counting obsolete and emission-intensive modes of transportation, contributes to the discharge of destructive toxins into the environment. This particulate component, comprising of fine particles and poisons, poses a genuine well-being chance to the populace.

The results of the discussion of contamination in Dhaka are apparent in expanded respiratory issues, cardiovascular infections, and other well-being issues among the inhabitants. The financial effect is imminent, with higher healthcare costs, diminished efficiency, and expanded costs related to relieving the impacts of contamination. The particulate matter not as it were influences human well-being but also contributes to natural corruption, affecting environments and biodiversity**.**

Endeavors to address contamination in Dhaka must prioritize changes in the street framework, the advancement of economical and cleaner transportation options, and the execution of exacting emanation guidelines. Urban arranging techniques ought to center on making green spaces, pedestrian-friendly zones, and efficient open transportation frameworks. Furthermore, raising mindfulness about the results of discussing contamination and advancing dependable hones among the open and businesses is significant for long-term moderation.

In rundown, handling the complex issue of contamination in Dhaka requires a comprehensive approach that addresses the root causes, emphasizes economic advancement, and cultivates a collective commitment to making a more advantageous and decent urban environment.

Compliance with ethical standards

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Disclosure of conflict of interest

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