

ENVIRONMENTAL CRISIS, ENVIRONMENTAL DEMOCRACY AND NEED FOR SUSTAINABLE DEVELOPED SOCIETIES: A SPECIAL REFERENCE TO AIR POLLUTION IN DELHI

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Abstract

An environmental problem in Delhi, India, is a serious threat to the well-being of the capital of the country. An air pollutant is a material in the air that can have adverse effects on humans and the ecosystem. The major reasons for the rise in pollution in Delhi that have been identified in this study are industrial emissions, climatic factors and average temperatures prevailing in the months of summer and winter, anthropogenic factors like motorization and vehicular traffic, policy-induced prices of fossil fuels, burning of agricultural residue in surrounding states, traffic congestion, population density, industrial activity, housing and type and nature of housing, clustering and spatial interdependence, among others. Delhi for instance has one of the country's highest volumes of particulate matter especially PM 2.5 and PM 10 pollution. So, this determined a situation as an environmental crisis in the capital. So more of a solution-based jurisprudence is required for a sustainable democracy along with a sustainable developed society with all equipped measures to resolve the crisis.

Keywords: Air Pollution in Delhi, Environmental Crisis, Sustainable Democracy, Sustainable Developed Society.

“Sooner or later, we will have to recognise that the Earth has the right, too, to live without pollution. What mankind must know is that human beings cannot live without Mother Earth, but the planet can live without humans”

-Evo Morales Ayma

Introduction

Environmental crises are distinguished by abrupt and often unanticipated changes in the condition of the environment, presenting substantial problems due to their potential for irreversibility. Instances of notable occurrences that have had a considerable influence on ecosystems include extensive extinctions and major deterioration. The argument speculates that there are three essential conditions required for the emergence of a crisis. The aforementioned

criteria include inadequacies in governance, the existence of an ecological system that shows a critical threshold, and a correlation between the economy and the environment that displays reinforcing feedback mechanisms.¹

The notion of environmental democracy pertains to the incorporation of democratic concepts and practices into the processes of environmental decision-making. This statement underscores the significance of public involvement in fostering the creation of societies that value sustainable development. In the foreseeable future, it will be crucial to recognize that the Earth has an intrinsic right to live devoid of the presence of pollution. It is crucial for humanity to acknowledge that human survival is contingent upon the nourishment provided by the Earth, whilst the Earth has the ability to support its own life independently of human presence.²

New Delhi, designated as a Union Territory and functioning as the administrative center of India's capital, is one of the urban agglomerations worldwide that is characterized by significant levels of air pollution. The magnitude of air pollution is substantial, resulting in significant adverse effects on public health, as well as the environmental and economic vitality of urban areas. Despite the ample scientific evidence that underscores the severity of air pollution and its adverse consequences, it is unfortunate to note that India's policy interventions in this area still display inadequacies. In terms of pollution levels, the capital city achieved the second position in the rankings for the year 2022.³

The environmental issue in Delhi, India presents a substantial threat to the general well-being of the metropolitan region. An air pollutant is defined as a material that is found in the atmosphere and has the potential to have harmful effects on human health and the surrounding ecosystem. The research has successfully identified a number of key elements that are significantly contributing to the escalation of pollution levels in Delhi. The factors encompassed in this study consist of industrial emissions, climatic conditions (specifically average temperatures during summer and winter months), anthropogenic influences (such as motorization and vehicular traffic), policy-driven pricing of fossil fuels, burning of agricultural residue in neighbouring states, traffic congestion, population density, industrial activity, housing characteristics (including type and nature), as well as clustering and spatial

¹ M. Scott Taylor, *Environmental Crises: Past, Present and Future*, Innis Lecture, Canadian Journal of Economics, Nov. 2009, https://www.wto.org/english/res_e/reser_e/gtdw_e/wkshop09_e/taylor_e.pdf.

² Giulia Parola, *Environmental Democracy at the Global Level: Rights and Duties for a New Citizenship*, <https://www.degruyter.com/document/doi/pdf>.

³ 2022 World Air Quality Report, Region & City PM2.5 ranking, <https://www.iqair.com/in-en/world-most-polluted-cities>.

interdependence, among other relevant factors.⁴ An exemplary instance is Delhi, which demonstrates a noteworthy degree of substance pollution, specifically with regard to PM 2.5 and PM 10. Vehicular traffic and grinding activities are the principal sources of PM 2.5 emissions. In contrast, PM10 emissions are derived from a range of combustion activities, including but not limited to motor vehicles, power plants, domestic wood burning, forest fires, agricultural burning, and certain industrial operations. Moreover, the emission of sulfur dioxide (SO₂) is primarily linked to the burning of fossil fuels in power plants and other industrial establishments. In addition, the emission of Sulfur Dioxide (SO₂) is also attributed to the burning of fuel in mobile sources such as locomotives, ships, and other equipment.⁵

Traffic emissions are the main source of Nitrogen dioxide (NO₂), but incomplete combustion of carbon-based fuels, such as gasoline, natural gas, oil, coal, and wood, is the predominant contributor to the presence of CO (Carbon monoxide). Automobile emissions are identified as the main source of air pollution in urban areas. According to the World Health Organization's research in 2018, there is a correlation between extended exposure to particulate matter and the onset of respiratory and cardiovascular conditions such as asthma, bronchitis, lung cancer, and heart attack. Based on the 2015 Global Burden of Disease study carried out by the Institute for Health Metric and Evaluation (IHME), it was determined that outdoor air pollution ranked as the fifth most significant contributor to death in India. This rating positioned it at a lower position compared to other notable factors contributing to death, such as high blood pressure, indoor air pollution, tobacco smoking, and inadequate nutrition. The National Air Quality Monitoring Programme (NAMP) is a comprehensive project for monitoring ambient air quality throughout the nation, overseen by the Central Pollution Control Board (CPCB) as reported by WHO in 2018. The information on air quality at ITO is consistently updated on a weekly cadence. To successfully address pollution, it is crucial to possess a thorough understanding of the origins of emissions and their influence on air quality. While it is sometimes challenging to represent the many physical and chemical processes that contribute to pollution in a simplistic model, using such models may nevertheless provide valuable insights into fundamental relationships.⁶

⁴ Bhosale, J., Delhi air much cleaner and less polluted than last year: SAFAR, The Economic Times, 16 December 2015.

⁵ Richardson, A. J., (2015), Experience shows Delhi's 'even/odd' car plan won't cut massive pollution: US Expert, Reuters, <http://blogs.reuters.com/india/2015/12/10/experience-shows-delhis-evenodd-car-plan-wont-cut-massive-pollution-u-s-expert/>.

⁶ *Supra* note 5.

Significant causes of Air Quality Degradation in Delhi

In Delhi, as a major policy measure, the policy of odd and even numbers was implemented to control the environmental crisis. The first implementation of the odd-even transportation policy occurred over a span of five days during the month of November 2015. Following this, it was subsequently revived throughout the time frame of January 1st, 2016 to January 15, 2016. Additionally, the aforementioned regulation was once again implemented throughout the summer period, namely from April 16th to April 30th, 2016. The data shown in the plots indicates the potential existence of other variables, apart from the odd-even rule, that might have had a significant impact on pollution levels in Delhi.⁷ The transportation policy that was recently established mandated that vehicles with license plates bearing odd numbers would be authorized to run only on days with odd numbers, while vehicles with license plates bearing even numbers would be permitted to drive exclusively on days with even numbers. Trucks often operate throughout nocturnal hours and the early hours of the morning. This rule would not be applied on Sundays. The following entities were given exemption from the odd-even scheme-

1. Two-wheelers
2. Trucks
3. Women-driven cars
4. VIP and emergency vehicles
5. Student-driven vehicles
6. Public transport buses CNG operated passenger/private cars

The use of compressed natural gas (CNG) as a fuel source for public transport buses and privately owned passenger automobiles. The use of compressed natural gas (CNG) as a viable fuel alternative for both public transportation buses and privately owned passenger vehicles.

The primary goal was to reduce the levels of air pollution caused by vehicles inside the urban area of Delhi. In the urban area of Delhi, the aggregate number of motor vehicles consists of almost 3 million automobiles, 6 million scooters and motorcycles, and 0.2 million privately owned vehicles. The implementation of the odd-even transportation legislation would only apply to four-wheeled vehicles.⁸

⁷ Rizwan, S.A., Nongkynrih, B. and Gupta S.K. (2013) "Air pollution in Delhi: Its Magnitude and Effects on Health" *Indian J Community Med.*, Vol. 38(1), pp 4-8.

⁸ Top 10 most polluted cities in the world 2019, <https://whizzherald.com/top-10-most-polluted-cities-in-the-world-2019/>.

Stubble burning is a prevalent agricultural technique characterized by the intentional igniting of residual plant material remaining in fields after the completion of the harvest process. The national capital is situated in close proximity to the states of Haryana and Uttar Pradesh. The practice of crop burning, carried out by agriculturalists dwelling in the affected areas, is a significant contributing element to the increased levels of air pollution seen during the October-November period. The agricultural practice of burning rice stubbles is seen among farmers residing in the states of Punjab, Haryana, and Uttar Pradesh. Based on estimations, the aforementioned governments bear responsibility for the incineration of about 35 million tons of agricultural produce. The process of air movement facilitates the transportation of diverse pollutants and suspended particulate matter throughout the atmosphere.⁹

The issue of vehicular emissions in Delhi is of considerable importance, considering the city's substantial fleet of over 9 million registered vehicles. The identification of automobile emissions as a substantial contributor to the increasing air pollution levels in Delhi has been conducted by the Central Pollution Control Board (CPCB) and the National Environmental Engineering Research Institute (NEERI).¹⁰

The weather conditions in India also a contributor to the problem of pollution. During the winter season, there is a notable decrease in the mobility of dust particles and contaminants within the atmosphere. The existence of stagnant air flows contributes to the accumulation of these pollutants inside the atmosphere, hence resulting in the occurrence of atmospheric phenomena often referred to as smog.¹¹

Delhi, characterized by its high population density exceeding 11,000 inhabitants per square kilometer, is among the most densely populated metropolitan regions worldwide. The phenomenon of overcrowding is a significant factor in the widespread occurrence of many types of pollution. Insufficient investment in public transportation and infrastructure in India has been identified as a contributing cause of air pollution, leading to congestion on roads.¹²

The escalation of dust and pollution in the air, which may be linked to the vast construction activity and open rubbish burning, potentially has a significant influence on the environment

⁹ Aseem Prakash & Nives Dolšak, *Delhi's Air Pollution: A Failure of Democratic Governance*, Global Asia Journal, https://www.globalasia.org/v14no4/cover/delhis-air-pollution-a-failure-of-democratic-governance_aseem-prakashnives-dol%C5%A1ak.

¹⁰ *id*

¹¹ Rajveer Kaur & Puneeta Pandey, *Air Pollution, Climate Change, and Human Health in Indian Cities: A Brief Review*, 2021, <https://www.frontiersin.org/articles/10.3389/frsc.2021.705131/full>.

¹² Mark Roberts & Urvashi Narain, *More than dust in Delhi*, World Bank Blogs, 2015, <https://blogs.worldbank.org/endpovertyinsouthasia/more-dust-delhi>.

in the Delhi-NCR area. In addition to its landfill sites, Delhi has approved facilities for garbage disposal, whereby the combustion of waste contributes to the exacerbation of air pollution and the formation of haze in the atmosphere.¹³

Firecrackers have been identified as a significant contributor to pollution in the capital city of India, as well as in several other regions of the country. Despite the implementation of a ban on the sale of firecrackers in 2017, the prevalence of firecrackers during the Diwali holiday persisted. The key reason ascribed to the occurrence of haze in Delhi after the Diwali holiday is this.¹⁴

In situations when there is a disruption in the supply of electricity, many residential communities and businesses often use diesel generators as an alternative source of power. Diesel generators contribute to around 15 percent of the atmospheric pollution inside urban areas.¹⁵

Principle of Environmental Democracy and The Strategies

The assessment studies carried out by the Central Pollution Control Board (CPCB) pertaining to the odd-even policy have shown that this specific approach has not demonstrated efficacy in addressing the pollution levels in Delhi. Moreover, the evaluation indicates that the adoption of this strategy might potentially be linked to a rise in pollution levels inside the urban area. After employing the Regression Discontinuity Design (RDD) methodology and incorporating polynomials and interactive terms, the findings of the impact assessment on the transportation policy indicate that it effectively refutes the assertions put forth by the Central Pollution Control Board (CPCB) in light of their data analysis. The hypothesis suggests that including the odd-even policy inside the Resilient Distributed Dataset (RDD) model is anticipated to have an adverse impact on pollution levels in Delhi. Climatic factors, such as wind speed and precipitation, possess the capacity to alleviate pollution levels by enabling the dispersion and elimination of particulate matter linked to pollution. Temperature and humidity are other climatic factors that have a role in the mitigation of pollution levels.¹⁶

¹³ Sarath K. Guttikunda, Sai Krishna Dammalapati, et. al., *What Is Polluting Delhi's Air? A Review from 1990 to 2022*, February 2023, <https://www.mdpi.com/2071-1050/15/5/4209>.

¹⁴ Michael Safi, *India's supreme court bans Diwali fireworks in Delhi to tackle pollution*, The Guardian, 2017 <https://www.theguardian.com/world/2017/oct/09/indias-supreme-court-bans-diwali-fireworks-in-delhi-to-tackle-pollution>.

¹⁵ Diesel Generator Ban In Delhi-NCR: It's Impact On Daily Life & Infrastructure, https://timesofindia.indiatimes.com/city/delhi/delhi-noida-gurugram-housing-societies-diesel-generator-ban-2023-impact-reaction/amp_articleshow/104064611.cms.

¹⁶ Nandi, J., *Very high levels of toxic chemicals in Delhi air: Study*, The Times of India, 30 December 2015.

The effectiveness of the odd-even rule in controlling pollution seems to be limited. Nevertheless, as the ensuing round progressed, this phenomenon became harder to overlook, even for those who maintained strong ideological views in its favour. According to the research conducted by India Spends, a data journalism platform, it was seen that there was a 23% rise in pollution levels during the latter portion of April in comparison to the earlier portion. If this assumption is valid, it becomes apparent that pollution encompasses a wider range of factors beyond the sheer number of vehicles on the roads.¹⁷

One prospective strategy for addressing pollution is the adoption of a carbon pricing system, which necessitates people to bear the financial burden for their carbon emissions. Let us examine the assertion that a monthly carbon emission above one million tons is considered unacceptable. The government has the jurisdiction to levy fees on people and businesses in response to their emissions, so putting restrictions on emissions. Indeed, people possess the autonomy to make decisions about the allocation of their financial resources, including the choice to direct a greater proportion towards endeavours that contribute to heightened levels of pollution. Nevertheless, this decision suggests that in some situations, an increased level of pollution is considered more favourable. There exists a notable subset of persons who express a desire to live in a society where automobiles are absent, even in the absence of environmental degradation. The current technology used for emissions pricing is marked by exorbitant expenses, hence diminishing the prospects of its imminent adoption in India. Over the course of an extended period, a discernible decline in the emission of pollutants by motor vehicles has been seen, mostly attributable to technological developments. In contrast to their 1970s predecessors, contemporary cars exhibit decreased levels of pollution. This phenomenon partly explains why industrialized countries have cleaner urban environments, despite their far higher rates of car ownership. Many transportation planners maintain the perspective that the integration of electric engines in autos and other transportation modes might possibly provide a feasible resolution to the current problem. Nevertheless, should such a situation come to fruition, it is plausible to consider that the incorporation of a carbon pricing mechanism may play a significant role in effectively tackling several additional obstacles.¹⁸

An alternative course of action might include the implementation of tolls for those using road networks. The topic in discussion has relevance due to the classification of roadways, alongside

¹⁷ Nushaiba Iqbal, *Explained: What Does An Air Quality Index Of 450 Mean?* India Spend, 10 Nov 2022, <https://www.indiaspend.com/explainers/what-does-an-air-quality-index-of-450-mean-841923>.

¹⁸ Delhi State Action Plan on Climate Change, Department of Environment, Govt. of NCT of Delhi, <https://moef.gov.in/wp-content/uploads/2017/08/Delhi-State-Action-Plan-on-Cimate-Change.pdf>.

office buildings, restaurants, and retail outlets, as real estate. When businesses such as restaurants and merchants impose fees for their services, they include the costs related to property ownership as well. Rental costs comprise a significant proportion of the operational expenses incurred in the execution of corporate operations. Nevertheless, highways possess unique operating features. Individuals have the freedom to travel on roads, provided that they are ready to endure the emissions from vehicles and accept the delays imposed by traffic congestion. Providing citizens with the opportunity to use highways without incurring fees has similarities to the concept of allowing unlimited entry to urban center properties without any accompanying expenses. The provided scenario exhibits a deficiency in realism. Congestion pricing has been implemented in urban areas like Singapore and London, where citizens are subjected to charges for using highways. Consequently, the streets of Singapore have seen a significant reduction in traffic congestion. The city of London has seen a significant decrease in both vehicular congestion and pollution within a very short period. The absence of compelling arguments for the inability of Indian cities to achieve the same outcome is evident. The urban regions of India are characterized by a substantial cost of land, and Indian cities have a notable level of population density. In the specific setting of Delhi, where a significant proportion of citizens possess automobiles, the viability of using road networks for transportation purposes becomes a subject of uncertainty owing to the substantial levels of congestion that result. Undoubtedly, it is a valid proposition to contend that the expansion of road infrastructure and the encouragement of private enterprises in the realm of road development are feasible alternatives. Nevertheless, it is crucial to acknowledge that public highways will persist as a finite and precious resource. Moreover, the implementation of supplementary road infrastructure does not yield a decrease in pollution levels, since it engenders a rise in the use of these roadways by an augmented number of vehicles.¹⁹

The extension of public transportation networks in metropolitan places, such as Delhi, would provide significant advantages, irrespective of their ownership being governmental or otherwise. The development of the Delhi Metro system has resulted in a substantial yearly decrease in pollution in Delhi, estimated at 6,30,000 tons. This achievement has considerable significance. The prospective permission of private corporations to build metro lines and supply other types of public transportation has the potential to initiate a substantial disruption. During periods of high demand, particularly in important areas of Delhi, the Metro stations and

¹⁹ Pickett, B., *Crystal's smart technologies help to reduce air pollution*, (2014), *The New Economy*, <http://www.theneweconomy.com/business/crystals-smart-technologies-help-to-reduce-air-pollution>.

trains see substantial overcrowding. It is expected that an increase in private involvement in the Metro system would lead to a proportionate increase in supply, therefore addressing overcrowding concerns and aligning with demand patterns. The problem of transportation congestion has considerable importance. Nevertheless, it is crucial to take into account the issue of overcrowding inside Metro trains and buses.²⁰

Promoting the adoption of stubble-burning abstinence among Agricultural Practitioners will be a method of reducing air pollution in the capital. Numerous groups widely concur that the cessation of stubble burning is imperative. There is a prevailing belief that governments ought to abstain from employing coercive tactics to address the issue of crop burning. Instead, it is argued that the federal government should extend financial support in the form of subsidies to facilitate the procurement of agricultural machinery, such as the rotavator, the *Turbo Happy Seeder*, and the super straw management system. These technological devices provide several advantages to agricultural practitioners. One such strategy is facilitating the development of wheat crops by farmers while preserving the stubble. One notable benefit of this approach is the ability to consolidate the stubble, facilitating its transportation. Alternatively, it may be transformed into bio pellets, so offering a possible fuel source for diverse industries. Although individual farmers may face financial limitations when it comes to procuring this equipment, they may overcome this challenge by collectively acquiring them via efficient farmer cooperatives. The distribution of government subsidies should be prioritized as the key area of policy focus to facilitate the acquisition of these devices by cooperative organizations. The use of financial incentives has the potential to serve as a feasible approach to mitigating the problem of stubble burning.²¹

It is suggested that the inclusion of the business sector into the solution mechanism should be taken into consideration. As per the regulations outlined in India's corporate governance framework, it is obligatory for companies to contribute a certain proportion, namely 2 percent, of their earnings towards the fulfillment of their corporate social responsibility (CSR) commitments. Undoubtedly, the mitigation of air pollution is an issue of considerable social significance. Through the use of corporate social responsibility (CSR) funds, companies have

²⁰ Goel, R. & Guttikunda, S. K., *Evolution of on-road vehicle exhaust emissions in Delhi. Atmospheric Environment*, Vol. 105, March 2015, pp. 78-90.

²¹ H.S. Sidhu, Manpreet Singh, et al., *Development and evaluation of the Turbo Happy Seeder for sowing wheat into heavy rice residues in NW India*, 2015, <https://doi.org/10.1016/j.fcr.2015.07.025>.

the capacity to participate in the process of adopting villages or groups of villages, with the objective of assisting co-operatives in their acquisition of machinery.²²

The occurrence of haze in Delhi underscores the difficulties linked to tackling local or regional pollution problems, even within an affluent and well-governed democratic framework. Instances of governance failures might potentially arise due to the coexistence of democracy and competitive elections, together with the impact of identity politics. The court seems to exhibit deficiencies in its capacity to efficiently uphold legal regulations. Despite possessing the capacity for coercion, the current political climate shows a dearth of determination to use such tactics.²³

Delhi presents a significant subject of analysis for metropolitan regions, particularly with the complexities of air pollution issues. This encompasses both the internal sources of pollution originating inside the city's administrative boundaries, as well as the external sources that contribute to the overall pollution levels. There exists a significant need to allocate a considerable amount of money towards the improvement of public transportation infrastructure, in order to mitigate the reliance of urban residents on personal vehicles. It is essential for governments to give precedence to the avoidance of the occurrence of isolated enclaves of wealth inside urban areas since these differences have the potential to generate conflicts with economically disadvantaged rural regions. It has been noted that the inhalation of smoke arising from crop burning in the neighbouring states adversely impacted the respiratory health of its inhabitants for more than three weeks in the capital. Conversely, the emissions produced by vehicles in Delhi exert a continuous detrimental effect on the rural regions throughout the entirety of the year. The effectiveness of collaborative techniques in resolving regional challenges is hindered by the presence of income imbalance.²⁴

Conclusion

The government of Delhi is now facing substantial concerns due to the recent surge in air pollution levels in the region. Air pollution acts as a stimulant for several health disorders, including cardiovascular disease, mortality, cancer, and respiratory diseases, among others. Moreover, it serves as a precursor to the deterioration of economic prosperity. In addition to

²² Niloufar Fallah Shayan, Nasrin Mohabbati-Kalejahi, et al., *Sustainable Development Goals (SDGs) as a Framework for Corporate Social Responsibility (CSR)*, 2022, <https://www.mdpi.com/2071-1050/14/3/1222>.

²³ Asia Pacific Foundation of Canada, *Dire Delhi Pollution Underscores City's Political Dysfunction*, 17 November 2022, <https://www.asiapacific.ca/publication/dire-delhi-pollution-underscores-citys-political-dysfunction>.

²⁴ Arpan Chatterji, *Air Pollution in Delhi: Filling the Policy Gaps*, ORF Occasional Paper No. 291, December 2020, Observer Research Foundation.

transportation policy, a number of significant variables have been recognized as contributing to the exacerbation of pollution in Delhi. Several factors contribute to the current air pollution levels. These factors encompass climatic conditions, the economic implications of fossil fuel usage, the efficiency of the western and eastern peripheral highways, the release of pollutants from fireworks during the Diwali festival, the burning of agricultural residues (specifically paddy) in neighboring states during winter, the excessive consumption of fuel, and the registration of both public and private vehicles, among other variables. The levels of particulate matter (PM10 and PM2.5) and other gases, including Sulphur Dioxide (SO₂), nitrogen dioxide (NO₂), and carbon monoxide (CO), have shown an increasing pattern as a result of the variables described above. Hence, in order to tackle this concern, the government enacted many steps. One such policy that may be discussed is the odd-even rule.

The empirical evidence suggests that there is no clear causal relationship between the execution of the odd-even plan in Delhi and a sustained rise in pollution levels. This remark also presents a counterargument to the claim made by the Central Pollution Control Board (CPCB) in 2016, whereby the odd-even system was ascribed to the increase in pollution levels in various regions of Delhi. The impact of agricultural residue combustion, firecracker restriction, and the temporal aspect of Diwali on pollution levels in Delhi seems to be negligible. The ability to reduce pollution levels in Delhi may be attributed to the adoption of electric-powered automobiles, compressed natural gas (CNG) powered vehicles, and the registration of public and private vehicles in compliance with international pollution regulations.