From environmental management to risk governance: air pollution case of Delhi, India

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Abstract: Air pollution is one of the critical issues for environmental management as well as public health. Increasing pollution risk decreases the quality of life and reduces life expectancy. This paper focuses on increasing air pollution risks in the capital of India. New Delhi is a major hotspot due to the high probability of risk and impact arising from air pollution. Administrative, legal, and non-state agencies have put all possible institutional interventions to alert the citizens and reduce the risks. However, even after decades of intervention, the battle continues. This paper attempts to understand the air pollution phenomenon from the lens of the concept of risk governance. In Delhi, the political process to govern the risk of air pollution is a primary subject of investigation in this research. The paper analyses interventions taken since the 1970s. It presents a concise picture of how risk governance machinery has managed the evolving risk.

Keywords: risk; air pollution; risk governance; risk communication; public health emergency; environment management; India.

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1   Introduction

Most of the contemporary environmental management issues are an outcome of human actions over the decades. The developmental processes of industrialisation and rapid urbanisation have brought various risks and led to issues that are a direct threat to our immediate environment and its management, the most critical issue being air pollution. It not only negatively affects our environment, but it also lowers our standard of health and lowers our lifespan. Hence, due to its uninterrupted effect on human lives, it is classified as a critical public health issue.

Governments around the world are exploring and experimenting with strategies to deal with the risks of air pollution arising in their sovereign territories, and India has been one of the worst-hit by the adverse effects of air pollution, especially in recent years.

This paper focuses on increasing air pollution risks in the capital of India, i.e., New Delhi. The air pollution governance process spans over three decades. Delhi is of great strategic importance being the capital of India, headquartering the parliament, apex court, ministries, embassies, and other places of national importance. The legislative government of Delhi, judiciary, and non-governmental agencies have intervened in the risk governance of air pollution at various points in time. They have played a key role in contributing to the intervention and shaping it in the form it takes today.

However, air pollution has been a mounting risk to governments as an inevitable outcome of development. Legal and non-state agencies have organised institutional campaigns to warn states and reduce the risks by informing the citizens. However, it is important to note the scale of risk has been incrementally increasing since the 2000s.

This paper tries to understand the air pollution phenomenon from the lenses of the risk governance concept, a significant concept in disaster studies. Risk governance is a policy process involving institutions, structures, state, and non-state actors which regulate (reduce, control, and manage) the risk in question.

One of the reasons why the risk governance study is a steady reference in this paper is because the Sendai framework for disaster risk reduction 2015–2030 also focuses on the significance of risk governance. It has been considered a crucial process indicator in determining the capacity for disaster risk reduction (UNDRR, 2015). The increasing levels of air pollution are hazardous and have been declared a public health emergency. Hence, the need to analyse the risk of air pollution from the conceptual perspective of risk governance.

There are manifold reasons for the occurrence and persistence of air pollution in Delhi. The sources of air pollution in the city are many and tackling each one is a complex task. Attempting to seek a solution to the rising pollution risk in Delhi is beyond the scope of this paper. Instead, this paper attempts to see how governance machinery has managed the emerging risk of urban air pollution and tries to comprehend how it has responded to the public demand for government interventions to reduce this risk.

2   Conceptual framework and method

2.1   Contextualising risk governance

Risk as a concept denotes, 'the probability of harmful consequences, or expected loss (of lives, people injured, property, livelihoods, economic activity disrupted or environment

damaged) resulting from interactions between natural or human-induced hazards and vulnerable/capable conditions (UNISDR). Risk governance is an elaborate approach to dealing with emerging risks. It involves risk assessment, risk evaluation, and risk management. Risk governance is about demonstrating the application or combining science with that democratic participation (De Marchi, 2003).

As Renn (2008) argues, risk governance is a 'multifaceted and multi-actor risk process'. It engages with the institutional arrangement and political culture including the perception of risk. In simple terms, it pertains to risk-related decision-making. Risk governance is a multi-level process integrating the top-down and bottom-up approaches (Hammer et al., 2011). Gunningham et al. (1998) explain risk governance as a comprehensive process and it is about the 'translation of the substance and core principles of governance to the context of risk and risk-related decision-making'.

Risk governance is often recognised in terms of the risk analysis process which involves risk assessment, risk management, risk communication, and policy outcome. Risk governance requires consideration of legal, institutional, social, and economic contexts in which risk is evaluated along with people's representation and participation. The Sendai Framework for Disaster Risk Reduction 2015–2030 prioritises risk governance as a key factor for improving the capacity for disaster risk reduction.

Mathur (2009) argues that sustainable development to address environmental problems is global collective responsibility. George et al. (2013) assessed that urban air pollution is a mixture of atmospheric pollutants in atmospheric air. It consists of fine particles (particulate matter) and ozone (O_3) which often seems like yellowish fog. Hardin (2005), observe that the pollution problem is a result of population. Vēron (2005) further adds that urban space today is highly polluted primarily due to urban growth and industrialisation. Cropper et al. (1997) also observed that air pollution is a statistically significant determinant of daily deaths for all categories of deaths (except those among the very young, i.e., 0 to 4 years and the very old, i.e., 65 and above). Beck (1992) propounds that the social production of wealth is systematically accompanied by the social production of risk. Further, he argues that risk tolerance ultimately leads to risk acceptability.

2.2   Risk possessed by air pollution

Air is the most essential and basic commodity that is needed by all. Polluted air is a universal life-threatening risk. According to the World Health Organisation (WHO), the air we breathe is growing hazardous, as throughout the world 9 out of 10 people are breathing in polluted air. Its health effects are dangerous for our respiratory health and can drastically reduce life expectancy.

Air pollution is a phenomenon that occurs when toxic gases from human-induced sources mix in the air. Some of these gases are ozone, carbon oxides, sulphur, and more importantly particulate matter. Out of all the toxic gases, it is a particulate matter which is the most hazardous element in the air causing respiratory problems in human beings. Particulate matter 2.5 and particulate matter 10 are the most toxic elements. These are minuscule particles of matter which cannot be seen by human eyes and enter the respiratory tract and lungs. In the long run, particulate matter is also capable of mixing into the blood and breaching the blood-brain barrier.

HEI & IHME (2019) claims that India and China have the highest health burden from air pollution. It states that the entire Indian population lives in areas with a concentration of $PM_{2.5}$ which is higher than the WHO air quality guidelines, and only 15% live in areas below WHO's the least stringent target of $PM_{2.5}$ concentration. As per the same report, exposure to particulate matter is putting the health of people at risk. It also states that air pollution in India is the third most prevalent reason for mortality among all causes.

The ICMR, PHFI, and HEI & IHME (2017) found that pollution is the second major risk factor that causes diseases and injuries, leading to premature death and disability in India. The World Bank terms air pollution as a threat to sustainable prosperity. In its report it reveals that more than 5.5 million people die prematurely around the world annually due to respiratory illnesses, arising as an impact of rising levels of pollution in the air (World Bank, 2016). The economic cost arising due to air pollution is also a lag, since not only does it cost human lives, but it also reduces people's ability to work, and damages historical monuments. Governing risk, including pollution risk, needs a combination of science and a democratic process, however, often democratic processes become instrumental in building risk tolerance.

2.3   Methodology

This study followed a qualitative method of research – the case study, involving an in-depth and well-defined analysis of Delhi's case of air pollution using multiple data sources, has been employed to conduct this research.

This study comprehensively analyses the case of risk governance of air pollution in the study region of Delhi. Both primary and secondary data have been used to conduct this research. Interviews with 15 key informants from administrators in the environment ministry, scientists from the pollution control board, public health and medical experts, civil society activists, and research fellows from Indian think tanks were part of this study. Their insights on pollution sources, management strategy, and governance were used to form the arguments in this paper. Their opinions guided the findings which are stated at the end of this paper.

Extensive secondary literature including the legislative acts, policy papers, legal documents, research studies, and research papers have been used to investigate the risk governance of air pollution in Delhi.

## 3   Overview of Delhi's situation of air pollution

The increasing trajectory of air pollution has been a matter of great concern. The alarming rise of pollutants in Delhi's air has been documented through the AQI data captured by various agencies.

Tracing from the past experiences it has been found that from the late 1980s and to date the situation has not come under control but has rather increased manifold over the years. This is evident from the fact that in Delhi, between the years 1991–1994, the average total suspended particulate matter level in Delhi was 375 micrograms per cubic metre ($\mu g/m^3$) which was approx. five times high than the air quality guidelines by WHO (Cropper et al., 1997).

In the present times, levels of particulate matter have been observed to have overshot the WHO standards too. As per the WHO (2005) air quality guidelines, it is mandated the

levels of $PM_{2.5}$ should be 10 μg/m³ annually. However, it has reached up to 999 μg/m³ during winter in recent years and has been captured by monitoring stations in Delhi. On the other hand, the PM_{10} levels as per WHO standards should be 20 μg/m³ annually. In Delhi, it reaches up to +500 μg/m³ as per DPCB and CPCB monitoring data. It should also be noted here that the statistical levels of pollutants presented as a general picture of recent years. The present-day pollution measurements are also overshooting the national parameters set as AQI by CPCB. According to the State of Global Air 2020, India recorded the highest air pollution exposure globally in 2019. The scenario in 2021 is no different.

Figure 1   Delhi's air pollution annual trends for Delhi (see online version for colours)
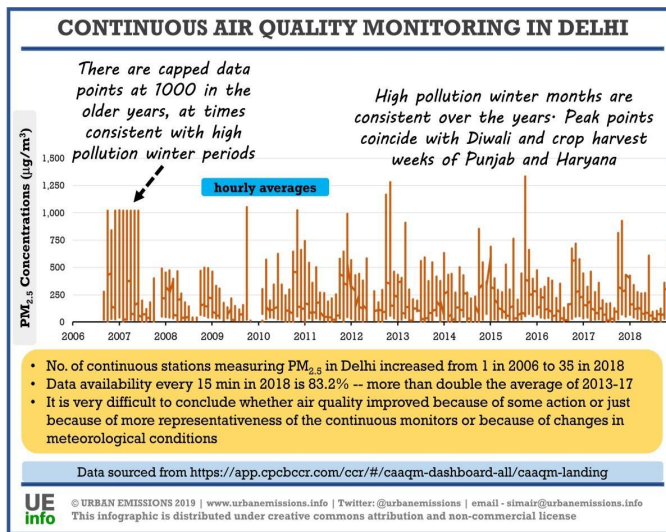
Source: Urban emissions

The graph shows the variations in the air quality of the city during different months over the years. The days of good air have been reflected to be very limited, while during winter months the pollution levels can be seen to be high. Air pollution thus has been a matter of great concern as it has become a perennial phenomenon.

4   Governing the air pollution risk in Delhi

4.1   Risk governance regime of air pollution in Delhi

Risk governance of air pollution in Delhi has been a multifarious and exceptional case. The risk governance here involved extremely complex policy choices which required a combination of scientific orientation, and economic and political considerations. It stands for dealing with the present risk as a curative approach, rather than a preventive approach. This research has traced the evolution and process of governing the risk, i.e., air pollution in the following sections of the paper.
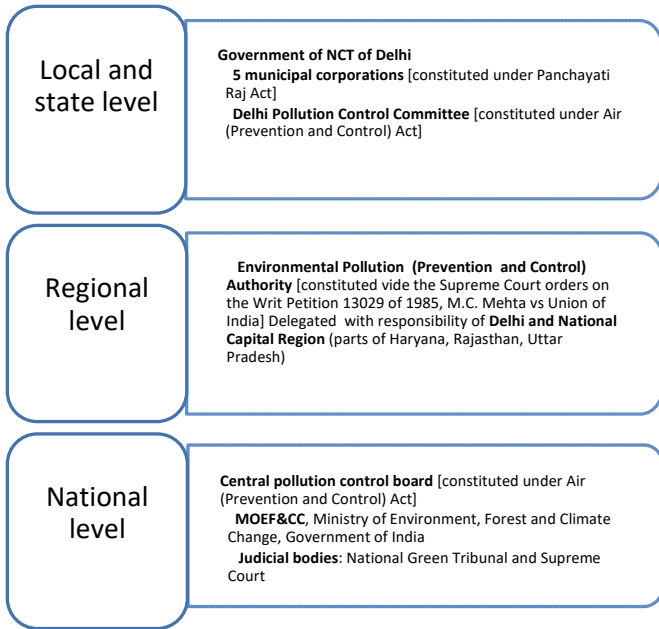
The following flowchart is the representation of the dynamic nature of risk governance of air pollution in Delhi.

Figure 2   Risk governance regime of air pollution in Delhi (see online version for colours)
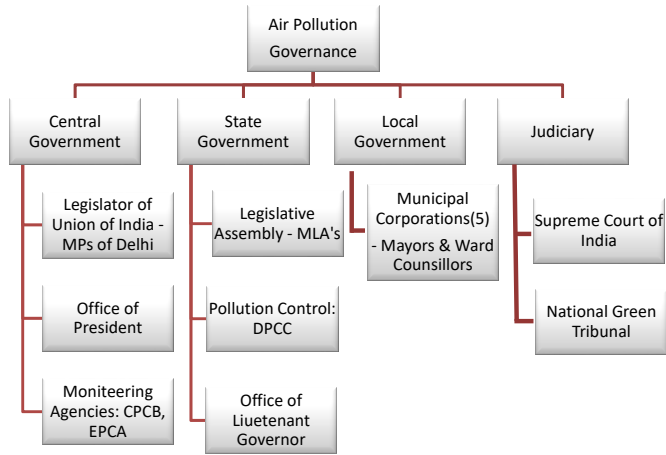
Source: Authors

Figure 3   Risk governance framework (see online version for colours)

Source: Authors

4.2   *Risk governance models and frameworks*

There are many risk governance frameworks and models outlined by various scholars over time. A conventional risk governance model would primarily deal with: risk assessment, risk communication, and risk management. Many of the risk governance frameworks have been referred to while conducting this research such as the technocratic

model, decisionistic model, transparent risk governance model, International Risk Governance Council (IRGC)'s risk governance framework, etc.

4.2.1 Transparent (inclusive) model of risk governance

The transparent (inclusive) governance' model is fitting to depict the process of risk governance of air pollution in Delhi. This model has been inspired by the 1996 NRC report on risk characterisation and has been conceptualised by Ortwin Renn in the book *Risk Governance: Coping with Uncertainty in a Complex World*.

This model brings the interface between assessment and management in which science, politics, economic actors, and representatives of civil society are invited to play a vital role in both assessments as well as management of risk. This model is exceptional as it includes pre-assessment, socio-politico considerations as well as categorisation and elements of risk evaluation and management resulting in policy outcomes.

Figure 4   Transparent risk governance model

Figure 1.5 *The 'transparent' model*
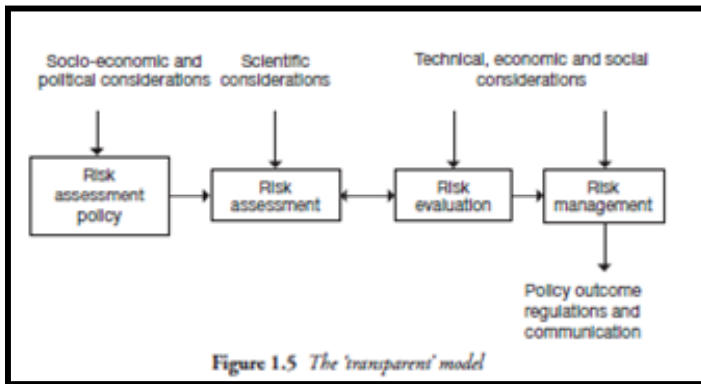
Source: Adapted from Milestone et al. (2004), as cited in Renn (2008)

This model is elaborated in the following sections as per the stages it presents in Delhi's context:

- *Stage one: the risk assessment policy* has been the initiation point of the risk governance process in Delhi. The driving forces initially were socio-economic and political considerations. Herein Delhi's case the PIL of M.C. Mehta in 1985, citizens' concerns, political attention and visibility of smog have been the real driving forces. Due to these driving forces, committees were set to investigate the air pollution subject. Risk assessment policy was not only a legislatives initiative, but the judiciary was also highly involved.

- *Stage two: risk assessment* has been carried out in Delhi by the pollution control boards initially. Under the National Air Ambient Quality Standards (NAAQS) and air quality index (AQI) records of the levels of pollutants have been maintained. With time the network of air pollution monitoring stations increased. These monitoring stations, both manual and automatic have been owned by agencies such as DPCC, Indian Meteorological Department (IMD), and CPCB. This data is uploaded on the CPCB's portal which is presently also available on their Sameer

mobile application. Indeed, the driving forces for risk assessment have been only: the scientific considerations.

The issue of increasing pollution has also consequently highlighted the environmental and health risk. Several independent studies have been conducted for investigating emission sources, effects of pollution on health, and environmental consequences.

- *Stage three: risk evaluation* is a major stage in the risk governance process. The pollution control board has played a key role in this stage. Additionally, the committees established by the judiciary, high power taskforces, and ministries such as MOEF&CC, and GOI have been instrumental.

  The driving forces such as technical, economic, and social considerations have been critically examined by these risk-evaluating bodies. The risk evaluation would also count the contribution of research which have highlighted the increased levels of emissions and its economic implications (such as man-hour loss and increased health expenditure). Environmental pollution (prevention and control) authority (EPCA) is a key body that has been working towards risk evaluation and risk management.

- *Stage four: risk management* as per this model has been leading to policy outcomes, regulations, and communication. In Delhi, risk management has been translated into policies and programs to tackle air pollution. Judiciary, as well as the legislative government, has over time come up with many policies addressing different dimensions of the risk. These policies range from the schemes such as relocation of industries from the residential and central part of the city to the outskirts, conversion of the whole fleet of public transport into CNG and Clean air campaign, odd-even policy, and ban on stubble burning, fireworks, among many others.

Figure 5   Transparent model of risk governance adapted into Delhi's case of risk governance of air pollution (the boxes in grey are added by authors citing Delhi's example)
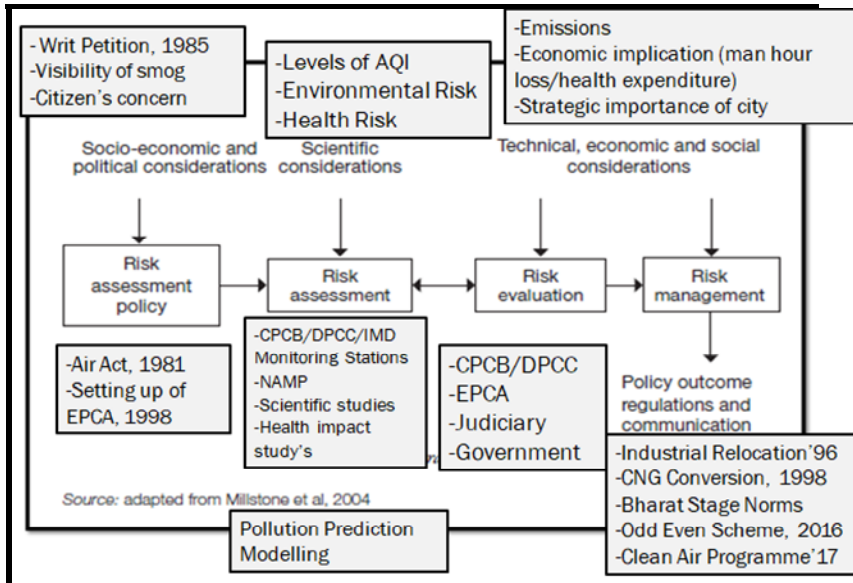
4.2.2 Three stages of risk governance in Delhi: the journey of air pollution control and governance in Delhi

After careful review and analysis, the authors of this research have carefully devised three stages of risk governance for Delhi's case of air pollution governance. The risk governance process has been documented into three different stages based on the timeline and its unique characteristic, which is discussed briefly:

- Stage one: deepening of India's environmental values (1970–1985)

  The first stage was a period where initial actions were policy formulation by the state to safeguard the environment. Herein the policy measures were adopted for pan-national environmental management such as the introduction of the Environment Protection Act and Air (Prevention and Control) Act.

- Stage two: era of environmental jurisprudence (1985–2005)

  The second stage involved the steps wherein the citizenry was engaged in appealing to the judiciary seeking actions for claiming environmental justice. Advocate M.C. Mehta has been the key person, putting in petitions and vouching for environmental justice. Various steps taken in Delhi during this time owe their origin to petition hearings of M.C. Mehta v/s Government of India. Other steps driven by the state Government of Delhi and national-level authorities for pollution control were crucial too.

- Stage three: period of exposure-response policy actions (2005 – till date)

  Stage three is the contemporary period wherein the policy actions were taken in response to the increased exposure to hazardous air. The measures ranged from short-term actions (e.g., comprehensive action plans and odd-even schemes) to long-term measures (e.g., closure of Badarpur thermal power plant, ban on pet coke and furnace oil) and even experimentations (employing anti-smog guns, plans of cloud seeding and smog towers).

Table 1 depicts the evolution of Delhi's risk governance process and the three stages. It attempts to bring a brief picture of the various policy measures taken across various periods in Delhi by the risk governing regime-

It is important to note here that these three stages are not mutually aligned. The researchers have found that each stage has its characterisation and is idiosyncratic. It has been formulated to present a holistic picture of the governance process.

It has been a long journey against air pollution in Delhi, yet the unmatched risk mounts over the city. Evidently, over the years multi-fold policies, initiatives and actions have been introduced to tackle air pollution. An institution like EPCA was setup to exclusively deal with the risk of pollution at the inter-state level. The legislation and judiciary were engaged in the risk governance process. Regardless of the consequences of these policies, the initiatives have certainly not matched the progressive increase in the level of pollution. The situation has persisted in the city's air for years now.

Some of the recent developments are remarkable in the country. The government of India in the union budget of 2021 has made an allocation of Rs 2,217 crores to tackle air pollution in 42 urban centres with a million-plus population. The emphasis on clean air in

the union budget is a significant development. While in Delhi, the state government is encouraging clean fuels and is also giving subsidies for the purchase of Electric vehicles.

Table 1   Stages of pollution risk governance in Delhi

Stage one 1970–1985 Deepening of India's environmental values	Stage two 1985–2004 The era of environmental jurisprudence	Stage three 2005–till date Period of exposure-response policy actions
• Air (Prevention and Control) Act, 1981	• M.C. Mehta v/s Union of India	• An epoch of action plans
• 42nd Amendment, 1976	• Bharat Stage Norms	• Green taxes
• Notification for National Ambient Air Quality	• Conversion of catalytic convertors	• Car-free days
	• Setting up of EPCA[1]	• Odd-even scheme
	• Relocation of industries	• Ban on pet coke and furnace oil
	• Conversion into CNG	• Clean air campaign
	• Pollution under control certification	• Green crackers
		• Cloud seeding planning
		• Public air purifiers
		• Union budget allocation
		• E-vehicles incentives

Note: [1]EPCA stands for Environment Pollution Control and Prevention Authority, https://www.epca.org.in.
   *Source:*   Devised by authors

Many other projects and initiatives are started in the state. In April 2021, the Union Environment Ministry issued an amended notification permitting thermal power plants within 10 kilometres of the National Capital Region (NCR) and in cities with populations above 10 lakhs to comply with revised emission criteria by the end of 2022. Again, in June 2021, the Delhi Government has also moved to the Supreme Court to seek the closure of ten polluting thermal power plants in the city's vicinity. A massive smog tower was installed in the city centre, Connaught Place area by Delhi's Chief Ministers for attracting the pollutants out of the air.

5   Analysing multi-dimensional risk governance of Delhi's air pollution

The case of toxic air in Delhi is a very complex subject to address. Many studies have been conducted to study the sources of pollution and even come up with policy-relevant solutions. This study analysing the risk governance process in Delhi brings out how air pollution governance has multiple dimensions and associated complexities. Herein an uneven balance between governance initiatives, increase in pollution levels and interplay of various other factors has been studied. Figure 6 is a simplified depiction of the same.

Figure 6 Multi-dimensions of risk governance of air pollution in Delhi (see online version
for colours)
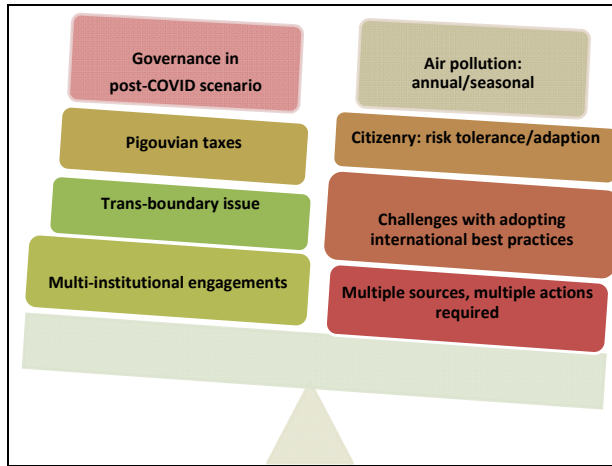
There is a complex interplay of multiple factors in Delhi for governing the risk of air
pollution. These factors are related to the layers of governance, pollution control and
mitigation challenges, politics, and citizenry. Each of these factors has a huge role to play
in addressing the high levels of air pollution.

5.1 Governance-related aspects

Governance has been dealt with in the earlier sections of this paper where it was shown
how *different layers are present in the federal system*. From central government to
regional authorities and local government, each has its jurisdiction, and this has made it
difficult to lead in mitigating the risk.

The issue of air pollution is not limited to Delhi, but it is *transboundary*. The
Indo-Gangetic plains and the states of Uttar Pradesh, Haryana, Punjab, etc. are also
victims of air pollution. During this research and interview conducted it has been found
that national-level bodies provide guidelines and support to the affected states. State
governments are supposed to be the acting bodies supported by local authorities. In the
National Capital Territory and Region, limited actions are visible to curb pollution. In the
state of Delhi, it is the bans, conversions, action plans, and other enforcement options
which have been executed so far.

The risk governance initiatives taken to date have not resolved the risk. These actions
were responses to exposure and are correctly termed as 'band aids' in a report
(Guthikunda, 2017). The overall reduction or complete change in air quality levels has
not been evident to date. For instance: smog towers have been installed in the city by
Central Pollution Control Board (Vayu at ITO in 2018), member of Parliament from
Delhi: Mr. Gautam Gambhir (Lajpat Nagar in 2019 and Krishna Nagar, 2020), and giant
smog tower by Chief Minister of Delhi Arvind Kejriwal (at Connaught Place in 2021).
However, many reports and studies have shown the minimal impact of smog towers.
Firstly, a smog tower only purifies a limited area and hence would have a limited impact
on the city's air quality. Secondly, it is a very cost-effective solution and has added
maintenance costs such as the filters, their cleaning, replacement, etc.

Green tax: in Delhi, pollution is the negative external factor, and to minimise the losses and correct inefficiencies, green taxes have been designed and collected. Since these taxes were implicitly or explicitly meant to be returned to the economy, the government is utilising them in some of the other schemes to curb air pollution. These funds have been used in the deployment of civil defence volunteers during the odd-even scheme, and electric buses were planned to be purchased. Even electric rickshaws were subsidised by a fund called Delhi Electric Vehicle Policy (Govt. of NCT of Delhi, Transport Department, 2018). Thus, these taxes have been returned to society in one or another way. This also sets an example for the 'accountability government'.

Air pollution as seasonal or annual: many are of the view that air pollution is seasonal. Since the smog is visible to human eyes in the winter months only. Hence even the policy interventions for mitigation are activated in the same season. It is also a matter of fact that the air quality is not very satisfactory in summer or spring season too. Only during the rainy season, do pollution particles settle down creating healthy air quality levels. This notion implicates that the risk governance in the winter months is more predominant than in other seasons. The following graph depicts the pollution levels and AQI for the years 2017–2018.

Figure 7   Monthly average AQI values of Delhi-NCR from January 2017 to 2018 depicting monthly data and fluctuating patterns of air pollution level on the AQI (see online version for colours)
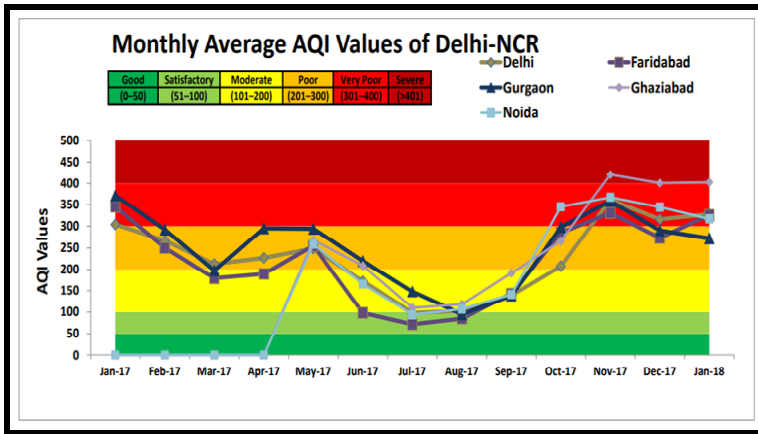
Source: CPCB (2018)

5.2   *Air pollution sources*

There are multiple sources of air pollution which are found in the report of IIT Kanpur (2016). Some of these sources are dust, fly ash, coal, garbage burning, vehicular pollution, stubble burning, etc. Each source requires attention and solution separately. Hence, *for addressing multiple sources an intervention with multiple solutions* is to be made which can be complex to manage and keep a check on.

Stubble burning inter-state issue: in Delhi's neighbouring states of Haryana and Punjab farmers are found practicing stubble burning in masses. This generates smoke in large amounts and travels in and around regions. This is often considered to be the main

reason for high levels of pollution in Delhi. The farmers usually burn their crop waste in the month of August-October. The month of October-November is the peak pollution time of the year. Additionally, during this time there's low wind speed, and hence mixing height is low too. This issue is often politicised. States blame each other for increasing the levels of pollution. There are many sources of pollution within the city apart from stubble burning. Delhi being land-locked becomes a hot spot of pollution. Moreover, cracker-bursting currently is prevalent around the traditional festival of Diwali.

The farmers are compelled to burn the crop residue to clear their farms post-harvest as a cheap alternative. Several reports and research show how this intensive work of crop residue removal is not incentivised enough that farmers move from burning. Several schemes were launched in recent years to promote eco-friendly measures such as incentivising the use of machines such as Happy Seeder. Institutes like IIT Ropar explored the use of crop residue for electricity generation. These measures are often overlooked, and farmers are not incentivised enough to opt for these options.

5.3 Challenges with adopting international best practices

Often the developing world looks to the West for the best practices to govern their crisis. Air pollution is prominent in the whole world, is locally determined, and possesses its characteristics. The case of London Smog cannot be compared with that of Beijing or Delhi.

For instance, schemes like odd-even which are practiced internationally have witnessed huge participation and support from the citizens. However, in Delhi, the ways and means to get away from the policy implications were well identified by the citizens. While in Paris during odd-even all the public transport is free which encourages citizens to follow the rule (*The Wire*, 2020). Nevertheless, we are yet to conclude if the same methods can be pragmatic and successful in Delhi. The car-free day's initiative is sincerely followed in many countries. In Delhi, the state government tried to implement it in certain stretches of the city. However, it was for limited areas and time, which was not reported to bring any major change in overall air quality.

In 2018 during the festival of Diwali, fireworks were banned from sale by the Supreme Court, yet many violations were reported (TNN, 2018). However, many people were caught burning fireworks with masks and many were fined too. The country should take inspiration from Singapore where the Dangerous Fireworks Act (1972) prohibits the ownership, trade, transportation, deliverance, or discharge of hazardous firecrackers.

Thus, the adaptation of policy mechanisms used in other countries can be translated into the context of India. However, this acceleration toward cleaner air comes with its technicalities, legalities, cost, and other complexities

5.4 Citizen's engagement in the larger context of risk society

Citizens' engagement and concern for increasing pollution levels have not been visible, except in recent times. The voluntary contribution of citizens in adopting eco-friendly practices can undoubtedly be significant. Pollution is not gaining a large amount of attention from the common citizens in Delhi who have accepted the conditions and co-exist with them. However, the petitions by M.C. Mehta and later by other informed citizens in NGT and Supreme Court are a few examples of citizen vigil. Also,

non-governmental organisations have been immensely engaged in the dialogue, apart from the other activists, environmentalists, researchers, and other institutions which are immersed in this subject of inquiry. Also, e-vehicles are popular in the present times, especially after special schemes launched by Delhi's state government.

The tendency of people in Delhi can be assumed as transitioning from risk tolerance to risk adaptation. Though, no claim is made here. This assumption is made for the reason that people have their views which may vary. Despite that fact, it is important to highlight that no major civil protest or popular demand has been raised by common citizens to contain the air pollution and reduce it. This can be possible because people have started to adapt to the risk rather than massively demanding their right to clean air. Pollution is seen as new normal for the people of Delhi and NCR. Pollution never became a popular topic or a popular demand for resolution. People disobeyed rules such as bans on crackers, buying new cars during the odd-even scheme, etc. Air pollution was also not part of political debates during elections. Therefore, it can be stated that people became partially 'tolerant' of the risk rather than focussing their thoughts on it. Anti-pollution masks and air-purifiers are an apt example of how society is adapting itself to air pollution risk rather than claiming its Right to Clean Air.

Delhi can be compared to a *risk society* that is on the path of adaptation and risk tolerance. Risk society is a notion propounded by Ulrich Beck. He put forward the perspective that the social production of wealth is systematically accompanied by the social production of risk. As he writes about Reflective modernity, he explains that as a society modernises, it increasingly moves toward becoming a risk society (Beck, 1992). Adaptation by people, in Beck's conceptualisation of risk tolerance ultimately leads to risk acceptability.

5.5   Post-COVID scenario and air pollution control

The COVID-19 pandemic has shown a different picture altogether. The change in air pollution menace and its perception was visible and is discussed in the following sections.

Firstly, air pollution and COVID-19 have emerged as dual risks and significant public health concerns. According to Harvard's research titled, 'Fine particulate matter and COVID-19 mortality in the USA, it has been observed that a single microgram per cubic meter rise in $PM_{2.5}$ – dangerously small particles in the air – is linked to an 8% increase in the COVID-19 fatality rate. Additionally, a study conducted by experts at the University of Cambridge in the UK discovered a link between the severity of COVID-19 infection and long-term exposure to air pollutants such as nitrogen oxides and ground-level ozone produced by car exhaust fumes or fossil fuel combustion (Travaglio et al., 2020).

Secondly, during the lockdown, the clean air days in the year 2020 increased as compared to previous years. From April 2020 to June 2020, pollution levels were satisfactory, and the sky was clear. This was possible because of the closure of industries, less use of vehicles (personal and commercial), and closure of markets, restaurants, all other industries, and sectors. The Hindu's news report explained, "at an average AQI of 63.8, August was the cleanest month of the year in terms of air quality. There were four 'good' air days in August, the highest in any month since 2015 when the CPCB began monitoring AQI."

With the re-opening of various sectors, the pollution level has started to rise again. From September-October 2020, air quality went to the same old severe levels raising alarm bells. The Government of Delhi led a massive campaign on, 'Yuddh Pradushan ke viruddh' (War against pollution) for awareness. This was followed by a ban on fireworks and other restrictions. However, the pollution levels have reached the utmost levels and smoggy days were also observed (The Hindu/PTI, 2020).

The Centre abolished the Environment Pollution (Prevention and Control) Authority and established a new commission to manage air quality in Delhi-NCR while the Delhi NCR was battling with 'severe' air quality at end of 2020. The Delhi government, on the other hand, has launched the PUSA bio-decomposer, which will disintegrate crop residue in 20 days and prevent stubble burning in the city.

The year 2022 ushers forth fresh opportunities as well as new challenges. In 2022, it will be interesting to observe if the prior government initiatives yield any dividends and how air pollution governance unfolds.

6 Road to clean air: risk reduction, air pollution control, and governance

The risk governance of air pollution is not an easy process. It has evolved through multiple layers of administrative channels and many practical challenges. However, the road to clean air is not going to be an easy process. The scope of this paper is not to recommend any actions. An extensive study has been done while conducting this research and the following has been identified as the key recommendations. Figure 8 depicts some indicative steps that can be the key areas for action. These are indicative steps and not limited steps or compulsory pathways to resolve the air pollution menace. There can be many interventions that can aid in reducing the risk and cleaning the air.

Figure 8 Descriptive display of multiple solutions that is required to achieve better air quality (see online version for colours)
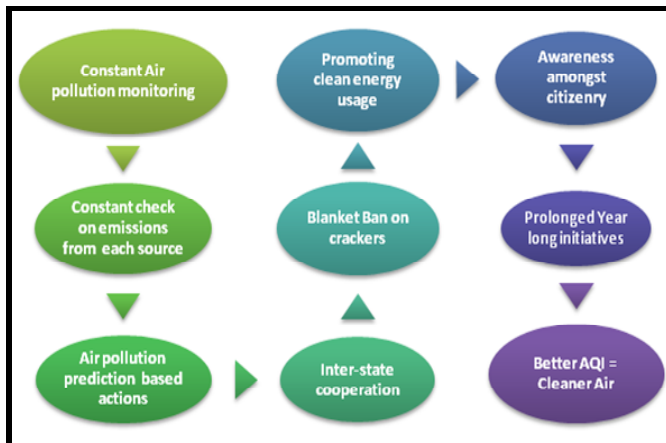
7   Concluding remarks

National Human Rights Commission, India in its Press Release (NHRC Press Release, 2017) on air pollution in Delhi has rightly published: 'the state cannot leave its citizens to die due to the toxic haze'.

This study has explored the domain of risk governance and attempted at widening the horizons of this subject through its application to Delhi's air pollution case. Risk governance has been a matter of constant debate and research in the context of Delhi as it is an ongoing phenomenon. Air pollution as a risk has been inevitable and thus must be addressed. The role of governance in addressing the risk is principal to overcoming the risks.

Delhi's case demands improved air quality levels for enhancing the quality of life. The right to a safe and healthy environment is declared to be an expansion of the 'Right of Life' enshrined in the Indian constitution under Article 21 as a fundamental right. Even the National Health Policy 2017 chalks out for reducing air pollution and calls for preventive and curative health measures.

The administration of the risk and its impact has been a challenging task for Delhi with its geographical location, environmental conditions, and jurisdictional limitations. It has been observed that the common citizens have shown risk tolerance regardless of the threat that air pollution possesses to their life. However, risk governance steps were crucial for risk mitigation, if fully implemented and followed. There's a need for sustained commitment to enhancing air quality to achieve a healthy environment and quality of life.

The political process to govern the risk has been investigated in this research. Since governance processes facilitate the risk reduction policies as governments are entrusted to work towards making a 'risk-free' society. This is a subject of detailed analysis and in a short period of this research, researchers have traced the evolution and dynamics of risk governance of Delhi's case of air pollution. Many inferences have been drawn and findings of which have been mentioned in this paper. Air pollution has been a matter of great debate; risk governance has been institutionalised over the years after a great struggle. Risk mitigation interventions had been crucial, though more reactive than proactive. Yet, the battle is ongoing, there's more to come and more to do in near future.

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