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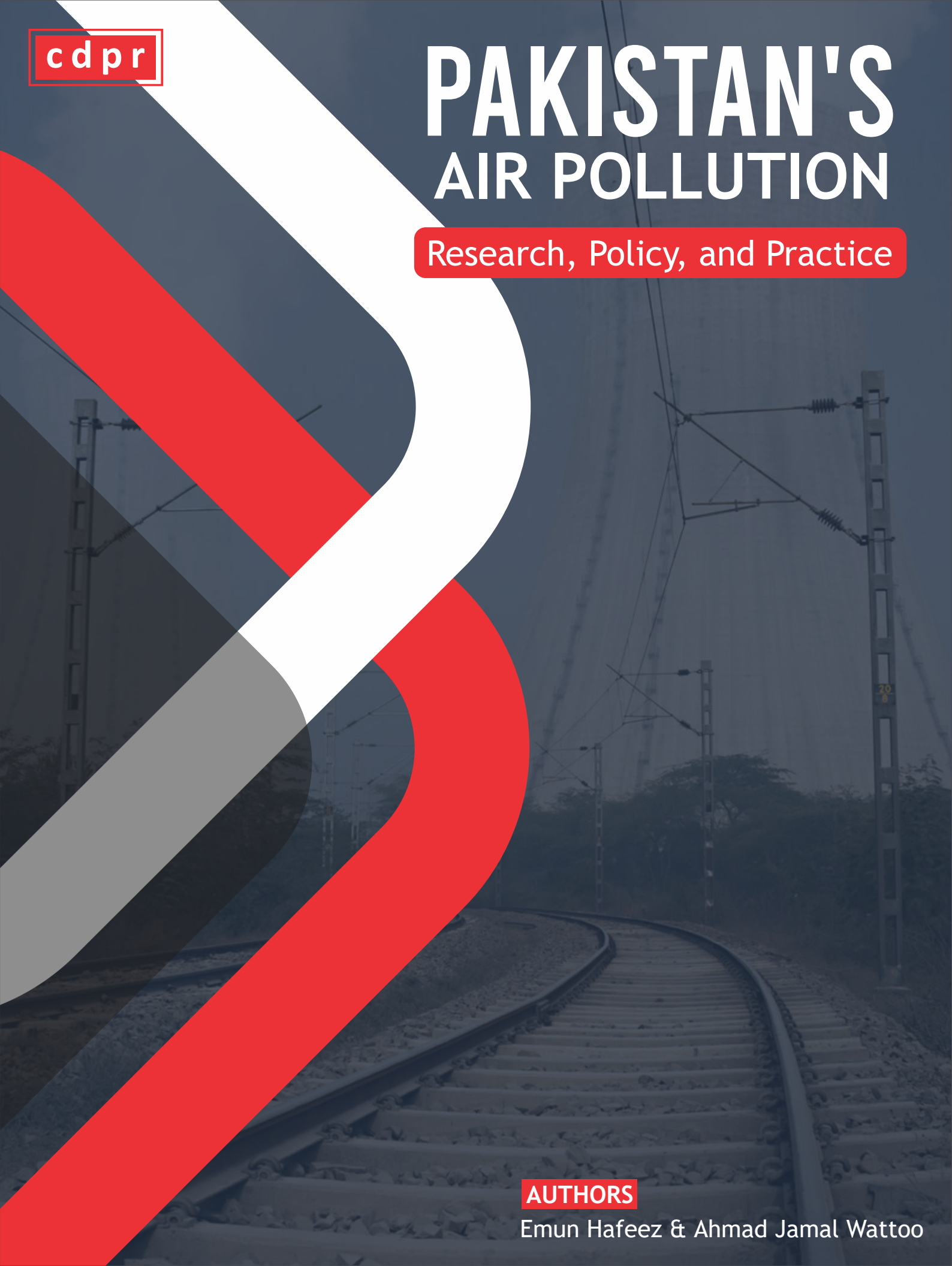
PAKISTAN'S AIR POLLUTION

Research, Policy, and Practice



AUTHORS

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The Consortium for Development Policy Research (CDPR), International Growth Centre (IGC) and Mahbub-ul-Haq Research Centre (MHRC) hosted a workshop to assess the causes and impact of air pollution in Pakistan. The two sub themes discussed included data issues and regulatory challenges in tackling air pollution. Participants included government representatives, international development agencies, representatives from civil society, the legal community, and academic researchers. The workshop identified 'low-hanging fruits' i.e., some immediate and actionable measures which could easily be taken to tackle air pollution. While air pollution on its own is an immediate concern for Pakistani citizens, especially in urban areas, it is also critical to the issue of climate change since it affects the sustainability and liveability of cities.

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The workshop tied in well with the work IGC and CDPR are undertaking this year on setting an agenda on climate change in Pakistan. The aim of this activity is to: i) bring the climate change onto the decision-making agenda of the government and relevant stakeholders; ii) create an understanding of the current climate policy landscape and state of knowledge; iii) identify concrete policy initiatives/ interventions for mitigation/ adaptation to impacts of climate change; iv) engage with global community and discourse for climate research and action.

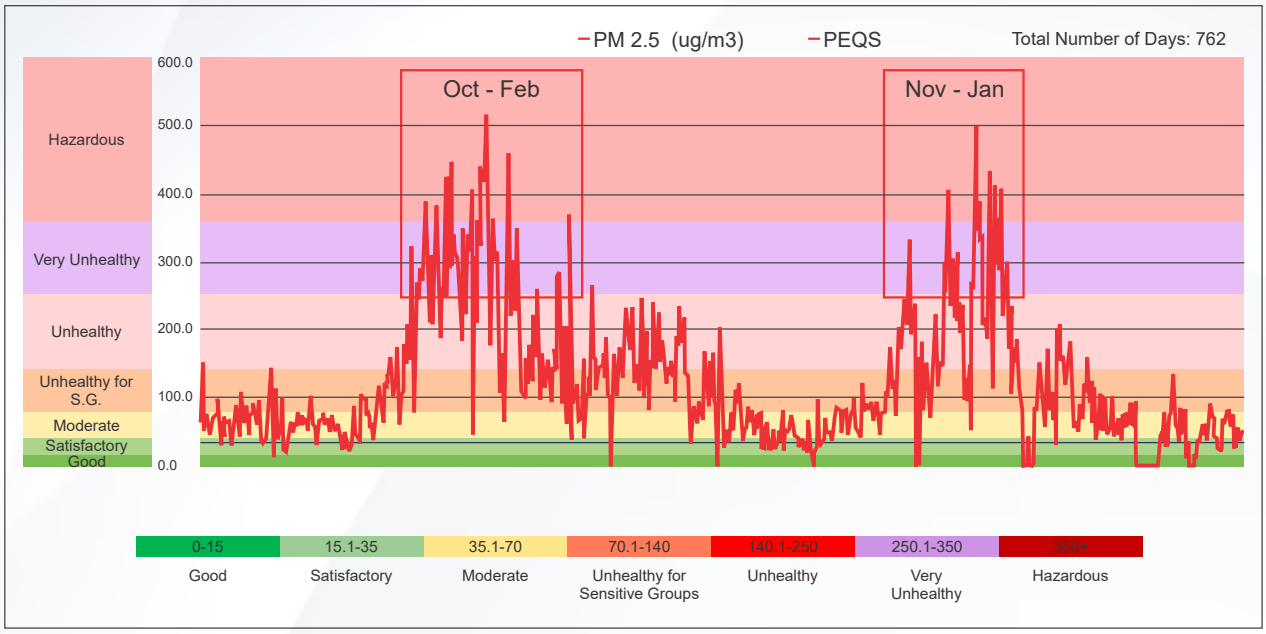
Air quality is a key focus area under the sustainable and resilient city's sub-theme within this agenda setting activity.

INTRODUCTION

Pakistan's cities are growing fast. The country now has the highest rate of urbanisation across South Asia. Almost 40% (around 90 million) of its population is urban with at least 12 cities having over a million residents. These cities face excessive environmental pollution along with high population densities and poor service delivery. Karachi and Lahore are now ranked amongst the world's most polluted cities. Pakistan is also amongst the top 10 most vulnerable countries to climate change. The climate crisis is likely to further exacerbate urban challenges, deteriorate the quality of life in Pakistan's cities and pose a serious threat to its urban sustainability. High levels of pollution in and around cities also amplify the impact of climate change.

Why should we be concerned about air pollution? Bad air can cost Pakistan up to 6.5% of its annual GDP and citizens of Lahore 4.2 years of their life[1]. Of particular concern is Particulate Matter (PM) 2.5[2] which can easily enter the body to cause health complications. Even though the level of toxicity in Lahore's air is above acceptable thresholds most year-round, during winters pollutants reach particularly hazardous levels resulting in a blanket of haze across Punjab. Figure 1 below shows PM2.5 concentration peaking during winter months.

FIGURE 1: Continuous Air Quality Monitoring using BAM-1020 in Township, Lahore[3]



Hence, Pakistan faces seasonal spikes of pollution for various reasons ranging from stubble burning, traffic congestion, industrial emissions and weather conditions that trap the pollutants near the ground. Hospital admissions for lung-related ailments spike during this time. Lahore can experience average daily PM2.5 concentrations up to 13 times Punjab Environment Protection Department (EPD)'s own permissible standard (35 µg/m³).[4]

In order to effectively respond to this challenge, policymakers need to understand the extent of the challenge, be able to measure air quality, and know where pollution comes from. Finally, they also need to know the policy mix that would work best to tackle it.

CLIMATE CHANGE AND AIR POLLUTION: TWO SIDES OF THE SAME COIN

Air pollution and climate change are often treated as separate issues despite being heavily interconnected. Many of the sources of air pollution also cause high CO2 emissions. Use of fossil fuels to generate energy and in industries and transport contributes both to particulate matter and CO2. On the other hand, pollutants also impact the earth's climate and ecosystems globally, forming a destructive feedback loop. Air pollutants such as carbon monoxide and methane trap heat from the sun and raise the earth's temperature. In turn higher temperatures worsen air quality by increasing the production of allergenic air pollutants including mould and pollen. Additionally, smog is worsened by increased heat, forming when the weather is warmer and there's more ultraviolet radiation.

Hence, it is imperative that climate change and air pollution are addressed simultaneously and not looked at in isolation. Moreover, most policies that reduce air pollution, also offer a "win-win" strategy for not just climate but also public health. An energy transition is a common solution to both. Hence, an energy model that relies on more energy-efficient and renewable sources will lower both pollution and GHG emissions.

PAKISTAN BEARS BOTH DIRECT AND INDIRECT COSTS OF AIR POLLUTION

Pakistanis bear considerable costs of poor air quality. Exposure to PM2.5 increases the incidence of cancer along with cardiovascular and respiratory diseases such as ischemia, myocardial infarction, asthma, and bronchitis[5]. Studies from India reveal that a 10 μg/m^3 increase in PM2.5 can significantly raise chances of childhood asthma, lung cancer and heart attacks[6]. Other pollution related morbidities include obesity, mental illness, and cognitive dysfunction, that significantly raise an economy's health expenditure.[7]

Since humans exposed to PM2.5 have a higher likelihood of suffering morbidities, they also live shorter lives on average. The Air Quality Life Index (AQLI) developed by the Energy Policy Institute at the University of Chicago (EPIC) causally related PM2.5 to life expectancy. It shows that exposure to an additional 10 μg/m3 of PM2.5 decreases life expectancy by roughly one year.

The figure below shows a snapshot of Pakistan's Air Quality Life Index (AQLI) which reveals that at current PM2.5 levels, an average Pakistani loses 2.7 years of their life while an average Lahori loses 5.3 years of their life[8]. These emissions lead to over 20,000 premature adult deaths in Pakistan and a loss of 160,000+ disability-adjusted life years (lost due to sickness, disability, or early deaths)[9]. In 2010, premature deaths due to pollution resulted in welfare losses worth $3 trillion globally.[10]

Poor air quality poses significant economic costs for a country; as a consequence of poor health cognitive performance drops, labour productivity is compromised and the number of missed days of labour work rise exponentially. Premature deaths and morbidities due to air pollution cost Pakistan up to 6.5% percent of its GDP annually[11]. This will have adverse impacts on household income, economic outputs, and the GDP, which further stunt the economic growth in developing countries like Pakistan. By 2060, an annual global loss of 3.8 billion is predicted.[12]. Moreover, outdoor air pollution disproportionately impacts the health and productivity of the poor, particularly for more than 35% of Pakistanis living in urban areas[13]. This adversely affects the labour supply, as changing migration patterns discourage workers from moving to polluted urban centres like Lahore, where they may have otherwise found more gainful employment.[14&15]

Key Message 1: The way air pollution is framed as a sustainability challenge has implications on how policy responds. Air pollution is an environmental crisis as much as it is a health crisis. Oftentimes measures are needed to treat poor air quality as a public health emergency to encourage swift and decisive actions, similar to the kind of response delivered to the Covid-19 pandemic, Dengue or Malaria.

MEASURING AND MONITORING AIR QUALITY IS ESSENTIAL TO EFFECTIVELY ADDRESS IT

Lack of Credible Data to Monitor Air Quality Impedes Efforts to Curb Air Pollution

Data is a critical first step in the fight against air pollution. In many cases, across the world including Pakistan, citizens and policymakers are unaware of the severity of the risks of air pollution or lack the information needed to address the problem. These problems are often exacerbated by the absence of reliable measurement data, limited access to data, and ineffective communication strategies. Citizens may not know how dirty air can impact their health or actions they can take to protect themselves. Any attempt to alter behaviour will require sustained regulation to address air pollution. In Pakistan, weak or absent monitoring programs and scientifically backed policies make addressing air pollution more challenging.

Measuring air quality is essential to be able to appropriately manage it. Firstly, the government has an insufficient number of quality air monitors. Currently the Punjab government has only 30 monitors installed by the EPD across the province of which 17 are located in Lahore. Bad air quality is not a Lahore-specific phenomenon, and during episodes of smog, the entire province is engulfed by the toxic air. Not only is there a paucity of government installed air quality monitors, but they are also not regularly maintained, and are unable to capture robust information. Moreover, whatever limited information that is captured is not utilised in an organised, strategic, and meaningful manner. This makes it exceedingly difficult to monitor the situation and enable an evidence-informed response.

Resultantly, Punjab's EPD struggles to report air quality data, with large chunks of daily readings missing. This deepens citizens' mistrust in the government and reinforces the belief that it may be incapable of managing air quality.

Key Message 2: There is a need to install more good quality air monitors to collect valuable air quality data which will serve as the backbone of any policy intervention. Moreover, the data collected through the monitors will not only be essential for regulatory purposes but can also inform citizens about how to conduct their outdoor activities and make decisions regarding their health.

Demand for Quality Data Exists

With NGOs and external agencies now starting to provide air quality readings, citizens now have multiple information sources to choose from. Air quality data plays a critical role in identifying 'silent killers' in urban spaces and helping cities measure and manage air quality.[16]

In Pakistan's context it is also particularly imperative to translate, simplify and disseminate the data and information to make it more accessible to the general public. Recent research funded by the International Growth Center (IGC) aimed to assess the demand for air quality information in Pakistan and attempted to determine whether citizens had preferences for sources of air quality information. After providing SMS-based air quality forecasts, the study found that surveyed citizens were willing to pay PKR 238 for two months of air quality forecasts. They also adapted their

behaviours according to the forecasts. Citizens belonging to working class neighbourhoods of Lahore particularly valued the air quality SMS forecasts. Interestingly, it was found that while citizens did not exhibit any strong preferences for sources prior to the intervention, after exposure to both private and government sources of information they believed that government forecasts were slightly less accurate.[17]

However, the majority of the population does not have access to the internet and many of those who do, are not aware of the sources of information available online. There is also a language barrier when it comes to explaining air quality and its intricacies; it is difficult to translate technical jargon to urdu or other local languages as there are no exact substitutes which capture its exact meaning. Experience from the study mentioned above also highlighted locals' perception and understanding of air quality. Many considered air pollution as an isolated problem affecting only certain segments of society and that there were certain, more expensive, and better maintained localities, where the air was generally cleaner. Some also felt that knowledge on the quality of air pollution is immaterial as it is not possible to escape toxic air.

Key Message 3: There is a need to review the manner in which air quality information is disseminated to the masses to make it readily accessible for all so that they can make informed decisions. This is pivotal for prompting adequate behaviour changes in locals; individuals will only take corrective and preventive action when they understand the gravity of the situation. Adaptive and avoidance behaviours will only ensue once there is a firm understanding of what the problem really is.

POLICY ACTION MUST BE GUIDED BY INCREASING THE EVIDENCE BASE OF WHERE POLLUTION COMES FROM

Knowing What Causes Air Pollution is an Essential First Step

Lack of credible data and research in Pakistan makes it difficult to accurately determine how much air pollution sources contribute to overall emissions. Source apportionment studies in Pakistan are too few and not robust.

Five years ago, in 2018, the Food and Agriculture Organization (FAO) conducted one of the first comprehensive source apportionment studies in Punjab with disaggregated data on several pollutants including PM2.5. However, this study is now five years old and did not cover all districts across the province. As per the study, the main polluting sectors include transport (43% percent share in total emissions), industry (25% percent), agriculture (20% percent), and power (12% percent). Environmental experts generally consider steel, cement, fertiliser, sugar, power, and brick industries egregious polluters.

A recent source apportionment study for Peshawar places transport (58.46%) and dust (17.67%) as the primary contributors to bad air[18]. More recently the Urban Unit, Government of Punjab also conducted a similar study for Lahore. According to their research, the biggest contributor to Lahore's air pollution is the transport sector accounting for 83.15% of the emissions, followed by industry (9.07%), agriculture (3.9%), waste burning (3.6%), commercial practices (0.14%) and domestic emissions (0.11%).[19]

Key Message 4: The availability of such information is instrumental in determining what course of policy action needs to be undertaken. There is a need to conduct more source apportionment studies that are essential for the development of effective targeted policies, and which will reduce costs associated with blind policymaking.

FIGURE 2: Sectoral Emissions Inventory of Lahore, Urban Unit[20]

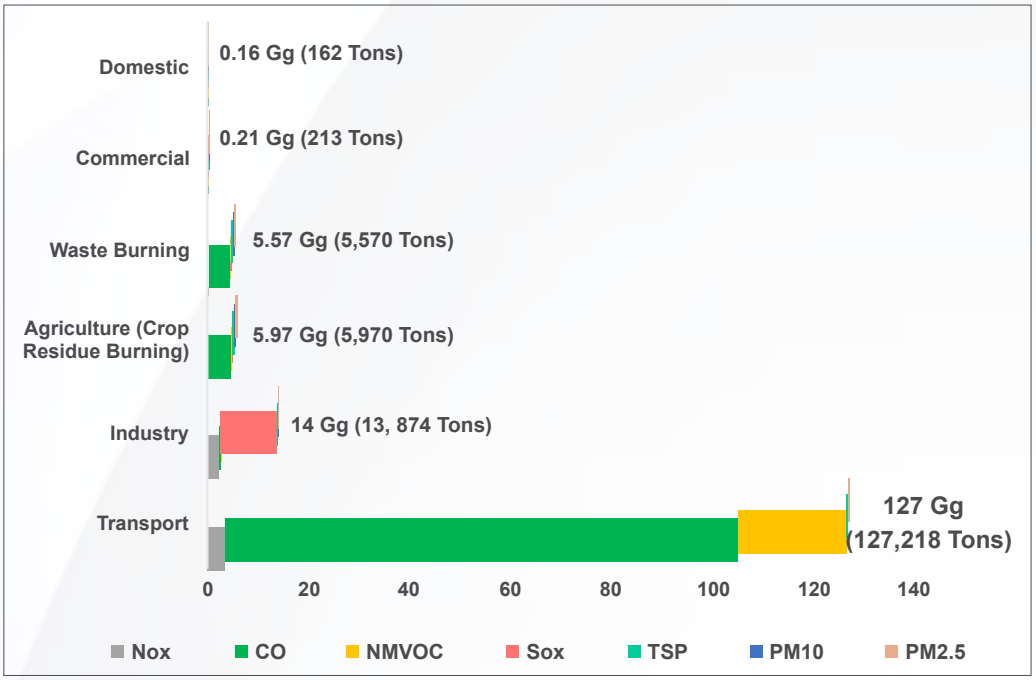


FIGURE 3: Potential PM2.5 reduction and its impact on life expectancy (EPIC 2020, as cited in Nasim and Kashif 2021)[21]

Province	District	Population (Millions)[1]	$PM_{2.5}$ Concentration (µg/m^3)		Life Expectancy Gain (Years) from Reducing $PM_{2.5}$ from 2016 Concentration		
			2016	After 32% Reduction	To WHO Guidline of 10µg/m^3	To National Standard of 15 µg/m^3	By 32%[2]
All Pakistan		203.2	37	25	2.7	2.2	1.2
Sindh	Karachi City	22.4	16	11	0.5	0.1	0.5
Punjab	Lahore	9.4	64	43	5.3	4.8	2.0
Punjab	Faisalabad	8.1	59	40	4.8	4.3	1.8
Punjab	Gujranwala	5.1	58	40	4.7	4.3	1.8
Punjab	Rawalpindi	4.9	41	28	3.0	2.5	1.3

REGULATION OF AIR QUALITY IS COMPLEX BUT ESSENTIAL

Regulation of air quality is complex for a number of reasons: As data is not available to monitor progress, environmental protection departments have been unable to effectively tackle the air quality crisis. Moreover, command and control methods have largely been unsuccessful as there is lack of incentives to account for externalities produced by emitters. Additionally, the policy landscape is complex as provincial policies often do not align with federal policies vis-a-vis emissions reduction.

Overlapping Jurisdictions hinder Effective Response

Prior to the 18th Amendment to Pakistan's Constitution, the federal Environmental Protection Agency (EPA) set air quality and emission standards and defined the framework for their monitoring and enforcement while the provincial EPAs took on the responsibility to implement. Following the Amendment, the provinces gained greater autonomy in environmental decision-making. Provinces can now define and legislate their own standards and develop their own system to monitor and enforce their rules and regulations—though the Federal Government still retains power to regulate environmental concerns in the areas of oil and gas, electricity, airports, shipping, and marine resources.

Implementation of environmental policies becomes challenging as it requires coordination between multiple departments. While all provincial EPAs are responsible for setting and enforcing the provincial environmental quality standards, to effectively do so they need support from other official departments. The Industry Departments lend support to inspect facilities and monitor emissions. The Transport Departments possess the authority to inspect and certify vehicles while the Agriculture Departments, Parks and Horticulture Authorities, and Municipal Authorities monitor stubble, biomass, and waste burning. Unfortunately, however, the turnover rate for secretaries of the above-mentioned departments remains high; this makes execution of initiatives exceedingly difficult as departments are forced to start from scratch in order to build an actionable policy following a change in leadership.

Another big cause for inertia within both the federal and provincial EPAs is their lack of accountability. Federal and provincial Environment Protection Councils were set up to serve as independent oversight bodies, tasked with monitoring and enforcing the EPDs' rules and regulations. However, these councils have either held far fewer meetings than mandated or not met at all in the last few years — a fundamental failure of Pakistan's air quality management.[22]

Key Message 5: There is a need to reach cross-departmental consensus and build cooperative understanding to facilitate environmental management. Placing permanent members within each department who are responsible for/are involved in policy decision making processes can make interventions impervious to frequent leadership changes.

Judicial Activism has played a Key Role in Regulation of Air Quality in Pakistan

The Shehla Zia v. WAPDA case is a landmark case for protection of the right to a healthy environment. This public interest litigation came before the Supreme Court of Pakistan when petitioners challenged the construction of a nearby electricity grid station due to potential health risks and hazards. The case addresses a range of issues including, environmental protection, and an expansive interpretation of the right to life.

The residents argued that the high-voltage grid station would pose a health risk and potential hazard to residents. Ultimately, the court determined the scientific evidence inconclusive, while observing the general trend supports that electromagnetic fields have negative effects on human health. The Court accepted the petitioner's argument that it should adopt the precautionary principle set out in the 1992 Rio Declaration on the Environment and Development, the first international instrument that linked environment protection with human rights, whereby the lack of full scientific certainty should not be used as a reason to prevent environmental degradation. Thus, it was held that the right to a healthy environment was part of the fundamental right to life and right to dignity, under Article 9 and 14 of the Pakistan Constitution, respectively.

However, in an effort to strike a balance between the rights of citizens and the plans that are executed by the authorities for the welfare, economic progress and prosperity of the country, the Court did not make a definitive ruling on the pending construction of the grid station, but, with the consent of both parties, ordered a review and report of grid project by the National Engineering Services of Pakistan (NESPAK) to suggest alterations and location alternatives. The decision further directed the government of Pakistan to establish a commission of internationally known and recognized scientists to review and rule on future grid station projects. In addition, the Court ordered WAPDA to immediately introduce public consultation and objection procedures for all projects concerning grid stations and power lines.

This landmark case expanded the fundamental rights to life and dignity by interpreting these rights to encompass the right to a healthy environment. This decision is particularly significant as there are no specific provisions in the Pakistani Constitution regarding environmental protection.

Failed Regulatory Models impede Effective Actions

Use of excessive regulatory measures is a flawed policy, and a more holistic and flexible approach is needed. Enforcement and compliance remain major challenges in the government's overall command and control approach. This approach to air quality entails mandating various standards through law and then harnessing state machinery—inspectors, police, courts, fines, and threats of shutdown—to enforce the standards. Though the provinces have prescribed rules to measure and levy pollution charges on sources, they have desisted from enforcing these rules since their inception. Broadly, regulators mandate three types of standards: ambient (hourly, daily, monthly,

and annual average air quality in a particular region), emission or performance (hourly, daily, monthly, and average annual emissions from sources), and technology (technologies, practices, and procedures that sources must adopt).

The Punjab EPD's 'Policy on Controlling Smog 2017' attempted to find solutions for the province's smog problem in 2017; fog, mist, and smog shroud the province between November and February, resulting in periods of low visibility. Various studies have linked it to the burning of rice stubble in the province. EPD ordered the imposition of a complete ban on open burning of rice stubble, solid waste and other hazardous materials. Moreover, it was ordered that in the case of a smog event, immediate advisories be issued. In addition to this, the 'Punjab Clean Air Policy' includes administrative measures that have attempted to precipitate efforts towards reduced air pollution; the Chief Minister constituted a Ministerial Committee on Smog, and the operation of conventional brick kilns was banned. These are examples of command-and-control policies which, since their inception, have failed to reduce smog due to lack of proper implementation.[23]

It has proven exceedingly difficult to implement similar policies because regulators with limited resources are unable to keep tabs on millions of polluters. Moreover, polluters have incentive to withhold information from the regulator in order to avoid being penalised for non-conformance with stringent standards[24]. The effect of withholding this information is two-fold: i) it compromises the accuracy of air quality data and ii) makes regulation difficult.

Key Message 6: There is a need to move away from command-and-control strategies towards incentive-based models. Incorporating a healthy mix of instrument types (economic, regulatory and information) that link different aspects of innovation can lead to more effective and sustainable solutions for reducing air pollution that also help address its multiple drivers.

Cross Boundary Learning Experiences Can Inform Policy

Pakistan can explore incentive-based abatement strategies such as emission charges and tradable permits. Such strategies incentivise polluters to abate cost-effectively and provide them greater flexibility in determining the best abatement measures.

Incentive-based mechanisms have yielded good results in two of Pakistan's neighbouring countries, India and China. For instance, in India, Continuous Emissions Monitoring Systems have allowed regulators to track firm emissions in real time, allowing the Indian state of Gujarat to implement the world's first PM2.5 emissions trading system, which can control pollution more cost-effectively than the existing command-and-control approach.

India's and China's push to publicly disclose air quality information and make emissions reporting more transparent forms the backbone of their pollution management. In China, after its air quality management came under intense public scrutiny, authorities vastly expanded their air quality monitoring network and regularly reported air quality statistics to the public. They also aggressively pushed power plants and firms to move from coal to natural gas. Similarly, they encouraged residents to replace coal boilers with electric or gas heaters. In large urban centres, authorities restricted the number of vehicles on the road. These assertive measures led to an average increase of 2.3 years life expectancy of 70 percent of the population relative to 2013.[25]

Key Message 7: There is a need to publicly disclose air quality data and leverage regional experience to inform local policy. IGC is currently funding research that will help set up a dashboard that discloses information on how much firms are polluting to test whether it changes their behaviour.

The Informal Regulator May be an Unlikely Hero

Non-governmental stakeholders offer a complementary channel to pressure polluters to comply with standards and the government to improve monitoring and enforcement. The federal and provincial laws already require the Environmental Protection Councils to include several non-official members, enabling society to play an important role in implementing laws and overseeing regulators. Leveraging informal regulators such as civil society organisations, academic and research institutions, and industrial associations can create more transparency in air quality data sharing and motivate voluntary initiatives.[26]

It might prove useful to look at the provision of air quality in the public good domain. This will encourage collective action from various stakeholders to overcome the larger issue rather than minimising the issue to the interests of each individual stakeholder.

While it is primarily the government's responsibility to control air pollution, various segments of the public at large can assist the government in several capacities. Non-governmental organisations can assist courts in a legal capacity, support public interest litigation, implement projects, and establish voluntary monitoring and oversight committees. Academic and research institutes can harness research to develop and pilot abatement technologies, generate data, and evidence, and produce policy frameworks. Industry associations can monitor whether their members legally comply with regulations and assist them in identifying and adopting cleaner technologies. Chambers of commerce can facilitate its members to engage with organisations that provide technical assistance, and conduct seminars and training exercises. Furthermore, civil society and private organisations can collect and disseminate air quality data and create information-sharing platforms[27]. However, this approach will only be effective if the stakeholders are not working in silos and there is no repetition of work being undertaken by them.

Key Message 8: There is a need to leverage the civil society actors, academics and non-governmental stakeholders to aid in the regulatory processes.

POLICY RECOMMENDATIONS

1. Reframe the problem for effective policy response. The way air pollution is framed as a sustainability challenge has implications on how policy responds. Air pollution is an environmental crisis as much as it is a health crisis. Oftentimes measures are needed to treat poor air quality as a public health emergency to encourage swift and decisive actions, similar to the kind of response delivered to the Covid-19 pandemic, Dengue or Malaria.

2. Data collection is essential for informed policymaking. There is a need to install more good quality air monitors in order to collect valuable air quality data which will serve as the backbone of any policy intervention. Moreover, the data collected through the monitors will not only be essential for regulatory purposes but can also inform citizens about how to conduct their outdoor activities and make decisions regarding their health. The availability of detailed information on air quality is instrumental in determining what course of policy action needs to be undertaken. There is a need to conduct more source apportionment studies that are essential for the development of effective targeted policies, and which will reduce costs associated with blind policy-making.

3. Proper dissemination of air quality issues is essential for prompting behavioural responses. There is a need to review the manner in which air quality information is disseminated to the masses to make it readily accessible for all so that they can make informed decisions. This is pivotal for prompting adequate behaviour changes in locals; individuals will only take corrective and preventive action when they understand the gravity of the situation. Adaptive and avoidance behaviours will only ensue once there is a firm understanding of what the problem really is. There is a need to publicly disclose air quality data and leverage regional experience to inform local policy. IGC is currently funding research that will help set up a dashboard that discloses information on how much firms are polluting to test whether it changes their behaviour.

4. Cross-departmental cooperation is instrumental for tackling the air quality crisis. There is a need to reach cross-departmental consensus and build cooperative understanding to facilitate environmental management. Placing permanent members within each department who are responsible for/are involved in policy decision making processes can make interventions impervious to frequent leadership changes.

5. Forego previously failed policy measures in favour of newer approaches and strategies. There is a need to move away from command-and-control strategies towards incentive-based models. Incorporating a healthy mix of instrument types (economic, regulatory and information) that link different aspects of innovation can lead to more effective and sustainable solutions for reducing air pollution that also help address its multiple drivers.

6. Maximise all resources to reach cross-sectoral consensus on the way forward. There is a need to leverage the civil society actors, academics, and non-governmental stakeholders to aid in the regulatory processes. Ensure that various stakeholders are not working in silos and there is no repetition of work being undertaken by them. Leverage each stakeholder's strengths and delegate tasks. Look at the provision of air quality in the public good domain. This will encourage collective action from various stakeholders to overcome the larger issue rather than minimising the issue to the interests of each individual stakeholder.

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