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December 12th, 2025

How air pollution is holding back India's economy

Each year, smog descends on northern India. Schools close, work on construction sites halts and people change their routines in ways that undermine economic growth. India's air pollution problem is often framed as a side effect of rapid development. Here Shefali Khanna presents the emerging body of economic evidence which suggests instead that polluted air is itself a significant obstacle to growth.

This year's smog season was Delhi's **worst** for more than a decade. Each winter, as a thick haze settles over cities in northern India, the public debate rightly focuses on health. But the economic consequences of polluted air are equally severe. Poor-quality air is caused by vehicles, cooking fuel use, construction and road dust, industry and power plant emissions and agricultural residue burning and waste burning. It reduces how much people work, how much firms produce, how governments allocate scarce fiscal resources and how quickly the country can grow.

When these channels are taken into account, air pollution may reduce India's annual growth rate by **several tenths of a percentage point**. In a country that requires sustained high growth to create jobs and expand public services, this represents a very significant drag.

India's air pollution levels are extreme. Virtually the entire population is exposed to annual fine particulate (the yearly average concentration of airborne particles less than 2.5 micrometers, known as PM2.5) concentrations above the World Health Organisation's guideline. In 2019 an estimated **1.67 million deaths** in India were attributable to air pollution – around 18 per cent of all deaths. **Epidemiological work** estimates that premature mortality and illness from air pollution led to economic losses of about \$36.8 billion in 2019, equivalent to 1.36 per cent of India's gross domestic product (GDP).

Assessments that include other forms of environmental damage suggest even larger losses. A **diagnostic study** by the World Bank estimates that the total cost of environmental degradation is

about 6 per cent of GDP, with air pollution as a major contributor. Global studies reinforce this picture. Another **report** on the worldwide cost of air pollution estimates that the health damages from exposure to air pollution amount to about 5 to 6 percent of global GDP.

A newer strand of literature examines how changes in pollution levels influence economic activity over time. This World Bank **paper** shows that higher annual exposure to fine particulates reduces year-on-year growth in district-level GDP by about 0.56 percentage points. This implies that India's official national growth figures overstate the rate of growth once pollution damage is taken into account.

Productivity losses in workplaces and households

The effect of polluted air on worker productivity is well documented. This **widely cited study** shows that even variation in ozone concentrations at levels below regulatory standards can significantly reduce the daily productivity of agricultural workers in America. Evidence from India is consistent with this pattern. Research that combines company-level data with satellite-based measures of particulates finds that air pollution **reduces productivity** in manufacturing, particularly in labour intensive industries that cannot easily shield workers or automate tasks.

Productivity losses also occur outside workplaces. As air quality deteriorates, households change behaviour. People spend more time indoors, do less shopping and change their travel and recreation patterns. These new patterns reduce demand for services. Short-term effects on cognitive performance, such as concentration and decision making, are especially significant for India's economy, where a growing share of value added comes from services that depend on human capital.

These impacts rarely attract the same attention as **school closures** or **construction bans**. But they matter greatly for long term growth. Taken together, they represent a continuous but often invisible drag on economic activity.

An unequal burden on informal workers and small firms

Air pollution does not affect all groups equally. Poorer households, informal workers and small enterprises tend to bear a **larger share** of both health and income losses.

First, exposure is unequal. Street vendors, traffic police and delivery workers spend much time outdoors, in polluted environments, often without protective equipment. Wealthier households and

larger firms are better able to mitigate exposure through air purifiers, better building quality and the option to reduce time in the most polluted places.

Second, the ability to absorb shocks differs sharply. Informal workers typically lack paid sick leave, formal contracts or employer provided health insurance. When they fall ill, they lose income and face medical expenses which can lead to indebtedness. Small firms often operate with limited financial buffers and access to credit.

Third, adaptation options are constrained. Large firms may relocate production, invest in cleaner technologies or alter working hours. Small firms face higher relative costs of doing so and may have little flexibility regarding location or timing of production.

Recent surveys across the northern states in India during severe smog episodes **highlight** these inequalities. And **complementary work on the cost of air pollution** to business suggests that pollution-related absenteeism, reduced consumer demand and damage to assets together cost Indian firms several percentage points of gross domestic product each year. In effect, polluted air functions as a highly regressive tax on labour, reducing earnings precisely among those who are least able to bear the loss.

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How has India's government responded?

In the past two decades India has introduced a **range of policies** to address air pollution. These include more stringent vehicle emission standards, programmes to promote a shift from solid fuels to cleaner cooking fuels, restrictions on highly polluting industrial fuels and graded response plans in that trigger temporary measures during severe episodes.

In 2019 the government launched the **National Clean Air Programme** with the aim of improving air quality in 131 cities and large urban agglomerations across 24 states and union territories. The

programme sets percentage reduction and provides financial support for clean air action plans. Some assessments find modest improvements in some cities. But progress is uneven, and it is often difficult to attribute changes to specific interventions rather than to weather patterns or movement of pollutants.

Technological tools have complemented regulatory interventions. The Central Pollution Control Board is expanding the national network of monitoring stations under the National Air Quality Monitoring Programme. As of late 2024 this included nearly 1,000 stations across more than 400 towns and cities. City authorities and private firms are also using portals such as PRANA to track air quality in cities and monitor implementation of clean air plans. Low-cost sensor networks and mobile monitors provide more granular information, although their effectiveness depends on calibration and integration with official systems. Analyses of the monitoring network point to significant gaps in coverage, especially in smaller and poorer cities and in rural areas.

Agricultural residue burning in Punjab, Haryana and Uttar Pradesh illustrates both the promise and the limits of current policy. Although burning is formally prohibited, and state governments have experimented with subsidised machinery and financial incentives, enforcement remains difficult and the uptake of alternatives is still incomplete. Empirical work, including my own study of crop residue burning bans in north India, suggests that short term bans and fines alone deliver only limited and fragile improvements in air quality if they are not combined with sustained support that takes the constraints of farmers seriously.

International experience and implications for India

International evidence indicates that outdoor air pollution imposes substantial welfare losses on low- and middle-income countries. But it is possible to reconcile economic growth with cleaner air. China offers a striking example. Since 2013 clean air action plans, including enforceable standards, cleaner fuels, technological change and credible monitoring, have reduced average particulate concentrations by around 40 percent and increased life expectancy.

For South Asia, a report by the World Bank argues that co-ordinated action across airsheds and across countries would be significantly more cost effective than isolated national measures, estimating that joint policies to reduce pollution can be about 45 per cent less costly than uncoordinated approaches.

Three broad lessons emerge for India. First, clean air should be viewed as a core component of economic infrastructure. Investors and workers care about environmental quality as much as roads and electricity. Severe pollution can undermine the attractiveness of otherwise dynamic cities.

Second, distributional concerns should be central. Because informal workers and small firms bear a disproportionate share of the costs of polluted air, policies that ignore their constraints risk exacerbating inequality or generating political resistance. Designing interventions that explicitly consider the informal economy can improve both fairness and effectiveness.

Third, investment in data and evaluation is essential. Reliable monitoring, transparency and independent assessments of policy effectiveness are necessary to shift resources towards interventions that genuinely reduce exposure.

India's air pollution problem is often framed as the unfortunate side effect of rapid development and complex multi-level governance. The emerging body of economic evidence suggests instead that polluted air is itself a significant obstacle to sustained and inclusive growth. Framing clean air as part of the country's growth and jobs strategy, rather than solely as an environmental or public health concern, may help to build the coalitions needed for more ambitious action.

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