

Environmental Federalism and Cross-Border Air Pollution Governance in India: A Comparative Analysis of Government Responses in Meghalaya and Assam in the Byrnihat Industrial Corridor

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Abstract

Air pollution has emerged as one of the most pressing environmental governance challenges in India, particularly in industrial regions that transcend administrative boundaries. The Byrnihat Industrial Corridor, located along the Assam–Meghalaya border, has recently attracted national attention due to its deteriorating air quality and the complex governance issues associated with regulating industrial emissions across two state jurisdictions. This paper examines the governmental responses of Meghalaya and Assam to the Byrnihat air pollution crisis through the theoretical perspectives of environmental federalism and multi-level governance. Employing a qualitative comparative case study design, the study analyses policy documents, legislation, reports of the Central Pollution Control Board (CPCB), Meghalaya State Pollution Control Board (MSPCB), Assam Pollution Control Board (APCB), National Green Tribunal (NGT) orders, government notifications, and secondary academic literature. The findings indicate that although both states recognize the severity of the pollution crisis, their approaches differ significantly in terms of regulatory enforcement, industrial policy, institutional coordination, and political commitment. Meghalaya has increasingly adopted precautionary regulatory measures, including restrictions on new industrial establishments in the Byrnihat area, while Assam has concentrated more on industrial regulation within its jurisdiction. Despite these efforts, inadequate inter-state coordination, fragmented institutional responsibilities, overlapping regulatory jurisdictions, and inconsistent enforcement continue to impede effective environmental governance. The paper argues that existing federal arrangements require stronger mechanisms for cooperative environmental governance and recommends the establishment of a permanent inter-state environmental authority, integrated air-quality monitoring systems, harmonized regulatory standards, and enhanced public participation to address cross-border pollution effectively.

Keywords: Environmental governance, environmental federalism, Byrnihat, Meghalaya, Assam, air pollution, cooperative federalism, public policy.

Introduction

Environmental degradation has become one of the defining governance challenges of the twenty-first century. While rapid industrialization has contributed significantly to economic development, it has

simultaneously intensified environmental pressures, particularly in developing countries where regulatory capacities often struggle to keep pace with industrial expansion (World Bank, 2023). Among these environmental challenges, air pollution represents a critical public policy issue because its impacts transcend administrative and political boundaries, affecting public health, ecological sustainability, and socio-economic development. India has consistently ranked among countries experiencing severe air pollution, with industrial emissions, vehicular pollution, construction activities, and biomass burning contributing substantially to deteriorating air quality (Health Effects Institute, 2024). Although considerable scholarly attention has focused on metropolitan centres such as Delhi, Mumbai, and Kolkata, relatively limited research has examined industrial border regions where pollution governance becomes particularly complex due to overlapping administrative jurisdictions and fragmented regulatory authority. The Byrnihat Industrial Corridor, situated along the Assam–Meghalaya border, exemplifies these governance complexities. The area has developed into one of northeastern India's largest industrial clusters, accommodating various wine and alcohol plants, ferro-alloy industries, distilleries, steel-processing units, chemical industries, and other manufacturing enterprises. While industrialization has generated employment opportunities and contributed to regional economic growth, it has also resulted in increasing concerns regarding air pollution, environmental degradation, and public health.

Unlike environmental issues confined within a single administrative jurisdiction, pollution in Byrnihat represents a classic cross-border governance challenge. Industrial activities located in one state frequently affect communities residing in another, thereby creating collective-action problems that cannot be effectively addressed through isolated state-level interventions. Consequently, environmental governance in Byrnihat requires not merely effective pollution control but also institutional cooperation between Meghalaya and Assam under India's federal framework. Recent actions by the Government of Meghalaya including restrictions on establishing new industrial units in parts of Byrnihat, enhanced monitoring by the Meghalaya State Pollution Control Board (MSPCB), and strengthened implementation of pollution-control measures demonstrate an increasing policy emphasis on environmental protection. Simultaneously, the Government of Assam has undertaken regulatory interventions through its Pollution Control Board and industrial regulatory framework. Nevertheless, despite these initiatives, persistent concerns remain regarding institutional coordination, regulatory enforcement, and policy effectiveness across state boundaries.

These developments raise important political science questions concerning environmental federalism, public policy implementation, cooperative governance, and institutional accountability. Existing environmental legislation in India including the Air (Prevention and Control of Pollution) Act, 1981, and the Environment (Protection) Act, 1986 provides statutory mechanisms for pollution control. However, implementation largely depends upon state institutions whose capacities, priorities, and political incentives may differ considerably. From a governance perspective, Byrnihat offers an important case for examining how federal systems manage environmental externalities that extend beyond state boundaries. It also illustrates broader challenges confronting multi-level governance in developing democracies, where environmental protection must be balanced against industrial development, employment generation, and regional economic aspirations.

Despite growing public concern, academic literature examining Byrnihat has predominantly emphasized environmental science, pollution measurement, and public health outcomes. Comparatively little attention has been devoted to analysing the governance dimensions of the crisis, particularly the comparative roles of Meghalaya and Assam in designing, implementing, and coordinating environmental policy responses.

This study seeks to address this gap by comparatively analysing governmental responses to the Byrnihat air pollution crisis through the conceptual lenses of environmental federalism and cooperative governance. By focusing on institutional arrangements, regulatory implementation, and inter-governmental coordination, the paper contributes to broader debates concerning environmental governance in federal political systems. The findings are expected to provide policy insights not only for Meghalaya and Assam but also for other regions confronting similar cross-border environmental challenges.

Literature Review

Environmental governance refers to the institutions, policies, legal frameworks, and processes through which governments, civil society, private actors, and citizens collectively manage environmental resources and address environmental challenges. Unlike traditional environmental management, which relied predominantly on state regulation, environmental governance emphasizes collaboration, accountability, transparency, public participation, and shared responsibility among multiple stakeholders (Lemos & Agrawal, 2006). The concept gained prominence following the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, where sustainable development became a guiding principle for balancing economic growth with environmental protection (United Nations, 1992). Since then, scholars have increasingly argued that environmental problems cannot be solved solely through command-and-control regulations; rather, they require participatory governance, adaptive institutions, and coordinated action across multiple levels of government (Jordan et al., 2005).

According to Lemos and Agrawal (2006), environmental governance encompasses three interconnected dimensions: state regulation, market-based instruments, and community participation. Effective governance therefore depends not only on legislation but also on institutional capacity, stakeholder engagement, and policy implementation. Environmental governance has become particularly significant in federal political systems where authority over environmental regulation is shared between national and sub-national governments. In such contexts, coordination among multiple jurisdictions becomes essential, especially when environmental impacts extend beyond administrative boundaries.

Environmental federalism examines how environmental responsibilities should be allocated among different levels of government. The theory argues that decentralization enables governments to design policies tailored to local environmental conditions while allowing central governments to establish national standards for environmental protection (Oates, 2001). In federal systems such as India, environmental governance involves concurrent responsibilities of the Union and State Governments. The Constitution of India, particularly after the Forty-second Constitutional Amendment (1976), placed forests and environmental protection within the Concurrent List, thereby encouraging shared governance between the Centre and States. Oates (2001) argues that decentralized environmental management often improves policy responsiveness because state governments possess better knowledge of local ecological conditions. However, decentralized governance also creates coordination problems when pollution crosses administrative boundaries. This issue is particularly evident in interstate industrial regions where emissions generated in one jurisdiction affect neighbouring states. Under such circumstances, independent state action may be insufficient because each government has incentives to prioritize local economic development while externalizing environmental costs onto neighbouring jurisdictions. Environmental federalism therefore highlights the importance of national coordination mechanisms, intergovernmental agreements, and harmonized regulatory standards. The Byrnihat Industrial Corridor exemplifies this

governance dilemma because industrial emissions generated within one state's jurisdiction directly influence environmental quality in adjacent areas governed by another state.

Cooperative federalism refers to institutional arrangements through which different levels of government jointly formulate and implement public policies (Elazar, 1987). Unlike dual federalism, which assumes clear separation of governmental powers, cooperative federalism recognizes overlapping responsibilities requiring continuous coordination among governments. Agarwal (2018) argues that India's environmental governance increasingly depends upon collaborative institutional mechanisms involving the Central Government, State Governments, Pollution Control Boards, municipal authorities, industries, and civil society organizations. Several scholars argue that India's environmental governance suffers less from inadequate legislation than from fragmented implementation (Rajamani, 2007). The Byrnihat pollution crisis illustrates this challenge because effective pollution reduction requires synchronized regulatory enforcement by both Meghalaya and Assam.

India experiences some of the world's highest levels of air pollution due to rapid industrialization, urbanization, fossil fuel consumption, and vehicular emissions. The World Health Organization (WHO, 2021) identifies air pollution as a major public health challenge associated with respiratory diseases, cardiovascular disorders, and premature mortality. In 2019, the Government of India launched the National Clean Air Programme (NCAP), aiming to reduce particulate pollution through city-specific action plans, strengthened monitoring networks, and improved inter-agency coordination (Ministry of Environment, Forest and Climate Change [MoEFCC], 2019). Although NCAP initially focused on metropolitan areas, industrial towns such as Byrnihat have increasingly received attention due to deteriorating air quality.

Industrial corridors contribute significantly to regional economic development but often generate substantial environmental externalities. Scholars studying industrial pollution emphasize that environmental impacts frequently extend beyond administrative jurisdictions, creating governance challenges requiring intergovernmental cooperation (Young, 2002). Cross-border pollution complicates accountability because environmental degradation cannot easily be attributed to a single authority. Industries may comply with regulations in one jurisdiction while exploiting regulatory weaknesses in another.

Existing research on Byrnihat has primarily emerged from environmental science, atmospheric studies, and public health disciplines.

Studies generally examine:

- Ambient air quality
- PM_{2.5} and PM₁₀ concentrations
- Industrial emissions
- Heavy metals
- Respiratory health impacts

Official reports by the Central Pollution Control Board and the Meghalaya State Pollution Control Board have highlighted deteriorating air quality in the Byrnihat region and identified industrial emissions, vehicular movement, road dust, and biomass burning as major contributors to pollution. Government action plans developed under the National Clean Air Programme recommend strengthening monitoring systems, regulating industrial emissions, improving road infrastructure, expanding green belts, and enhancing institutional coordination. Recent policy responses by the Government of Meghalaya—including restrictions on establishing new industries in sensitive areas, enhanced inspections, and stricter monitoring—indicate increasing political recognition of the environmental crisis. However, because

Byrnihat spans the Assam–Meghalaya border, pollution control depends substantially on coordinated action between both state governments. Despite growing policy attention, relatively little academic research has examined the political and institutional dimensions of environmental governance in Byrnihat from a comparative perspective.

Research Gap

A review of the literature reveals four major gaps.

First, existing studies predominantly adopt environmental science or public health perspectives, with limited attention to governance and public policy. Second, there is little comparative analysis of the environmental governance approaches adopted by Meghalaya and Assam despite their shared responsibility for managing the Byrnihat industrial region.

Third, the concepts of environmental federalism and cooperative federalism remain underexplored in studies of interstate pollution in Northeast India. Finally, insufficient attention has been devoted to institutional coordination, regulatory capacity, political commitment, and accountability in managing cross-border environmental challenges.

Thus, this study addresses these gaps by examining Byrnihat as a case of environmental federalism and comparing the policy responses of Meghalaya and Assam. By integrating theories of environmental governance, cooperative federalism, and policy implementation, the study seeks to contribute to the broader literature on environmental politics and governance in India.

Theoretical & Conceptual Framework

This study is anchored in four complementary theoretical perspectives: Environmental Federalism Theory, Cooperative Federalism, Multi-Level Governance Theory, and Policy Implementation Theory, to explain the factors influencing environmental governance in the Byrnihat industrial region. These theories collectively provide a comprehensive framework for understanding how political institutions, administrative systems, regulatory agencies, industries, and citizens interact in addressing interstate environmental pollution. Since air pollution in Byrnihat transcends state boundaries, no single theoretical perspective is sufficient to explain the complexity of environmental governance. Therefore, integrating these theories enables a more holistic analysis of governance processes and policy outcomes.

Environmental Federalism Theory provides the primary theoretical foundation for the study. Oates (2001) argues that decentralization allows state governments to formulate environmental policies that are responsive to local ecological conditions and public preferences. However, environmental problems such as air pollution often generate interstate externalities that cannot be effectively managed by individual states acting independently. The Byrnihat industrial region exemplifies this challenge, as industrial emissions originating in one state significantly affect environmental quality in neighbouring areas. Consequently, the effectiveness of environmental governance depends upon the extent to which governments demonstrate political commitment to environmental protection by formulating sound environmental policies while simultaneously recognising their shared responsibilities in managing interstate environmental resources.

Building upon this perspective, Cooperative Federalism emphasizes that environmental governance requires continuous collaboration among multiple governmental institutions. Rather than operating independently, the Government of India, the Governments of Meghalaya and Assam, the Central Pollution Control Board (CPCB), the Meghalaya State Pollution Control Board (MSPCB), the Assam Pollution

Control Board (APCB), district administrations, and other stakeholders must coordinate their policies, resources, technical expertise, and enforcement strategies. Such institutional coordination strengthens regulatory enforcement by promoting information sharing, harmonising environmental standards, and facilitating joint monitoring of industrial activities. In interstate pollution management, effective cooperation therefore becomes essential for translating environmental policies into meaningful regulatory action.

The study further incorporates Multi-Level Governance (MLG) Theory to explain the networked nature of environmental decision-making. According to Marks (1993) and Hooghe and Marks (2003), governance has evolved beyond hierarchical governmental structures towards systems involving multiple public and private actors operating across different territorial levels. In Byrnihat, environmental governance involves not only central and state governments but also pollution control boards, district administrations, industries, the judiciary, local communities, and environmental non-governmental organisations. Within this governance network, effective regulatory enforcement encourages greater industrial compliance, while the active involvement of citizens, community organisations, and civil society enhances transparency, accountability, environmental awareness, and public participation in pollution management. Multi-Level Governance therefore explains how collaborative interactions among diverse actors contribute to more effective environmental governance.

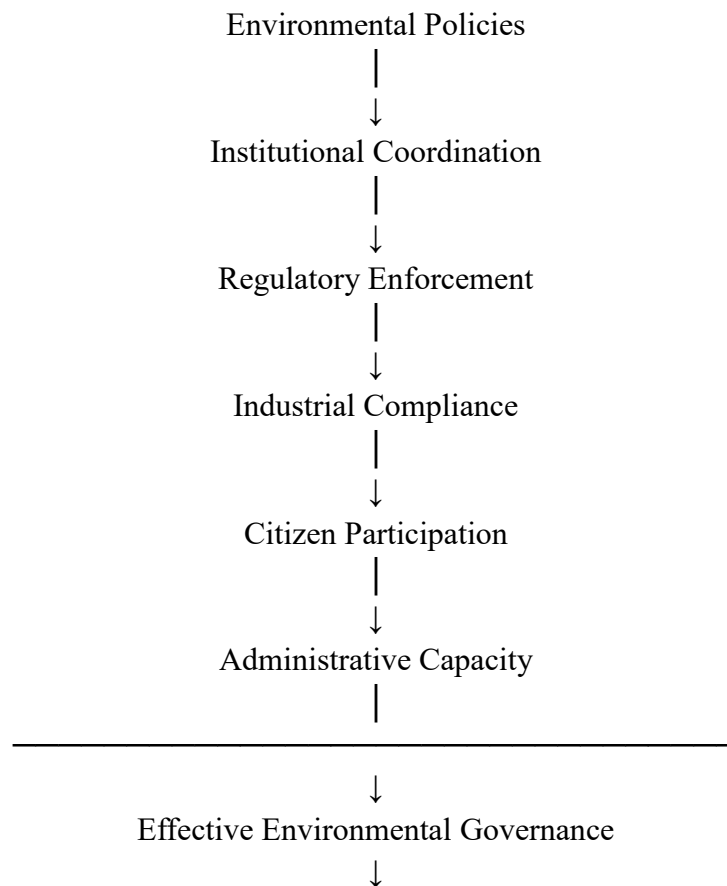
Policy Implementation Theory complements the preceding theories by explaining why environmental policies often fail to achieve their intended outcomes despite the existence of appropriate legislation. Pressman and Wildavsky (1973) argue that successful policy implementation depends upon administrative capacity, political commitment, institutional coordination, adequate resources, and stakeholder cooperation. In the context of Byrnihat, environmental laws and regulatory institutions already exist; however, persistent pollution indicates weaknesses in implementation. This theory highlights the importance of administrative capacity, including technical expertise, financial resources, institutional infrastructure, monitoring mechanisms, and human resources, in ensuring that environmental policies are effectively enforced. Without adequate administrative capacity, even strong political commitment and comprehensive environmental policies may fail to produce desired environmental outcomes.

Drawing upon these four theoretical perspectives, the conceptual framework proposes that political commitment serves as the foundation for environmental governance by influencing the formulation and implementation of effective environmental policies. These policies require strong institutional coordination among governmental agencies and regulatory institutions, which subsequently strengthens regulatory enforcement. Effective enforcement promotes greater industrial compliance with environmental standards, while active citizen participation enhances transparency, accountability, and environmental stewardship. The effectiveness of these governance processes is further reinforced by adequate administrative capacity, which supports policy implementation and institutional performance. Collectively, these interrelated governance dimensions contribute to effective environmental governance, ultimately leading to improved air quality, reduced industrial pollution, sustainable development, and public health protection in the Byrnihat industrial region.

Conceptual Framework

Political Commitment





- Improved Air Quality
- Reduced Industrial Pollution
- Sustainable Development
- Public Health Protection

Research Questions

1. What environmental governance mechanisms and policy implementation strategies have been adopted by the Governments of Meghalaya and Assam to address air pollution in the Byrnihat industrial region, and how do they differ?
2. How do institutional coordination, regulatory enforcement, political commitment, and citizen participation influence the effectiveness of environmental governance and pollution control in Byrnihat?
3. What governance challenges hinder effective interstate environmental management, and what policy measures can strengthen cooperative environmental governance between Meghalaya and Assam?

Research Objectives

1. To examine and compare the environmental governance mechanisms and policy implementation strategies adopted by the Governments of Meghalaya and Assam for controlling industrial air pollution in the Byrnihat region.
2. To analyse the influence of political commitment, institutional coordination, regulatory enforcement, industrial compliance, and citizen participation on the effectiveness of environmental governance.

3. To identify the major governance challenges affecting interstate environmental management and recommend policy measures for strengthening cooperative environmental governance between Meghalaya and Assam.

Research Hypotheses

H1: Political commitment and effective environmental policies have a significant positive influence on environmental governance in the Byrnihat industrial region.

H2: Institutional coordination, regulatory enforcement, industrial compliance, and citizen participation significantly improve the effectiveness of environmental governance and pollution control.

H3: Stronger cooperative federalism and interstate coordination significantly enhance environmental governance and contribute to improved air quality and sustainable environmental management in Byrnihat.

Research Methodology

This study adopts a qualitative comparative case study design to examine environmental governance in the Byrnihat Industrial Corridor, supported by documentary analysis and limited quantitative evidence where available. A qualitative approach is considered appropriate because the research seeks to understand governmental behaviour, institutional arrangements, policy implementation, interstate coordination, and governance processes rather than merely measuring pollution levels. The study focuses on the Byrnihat Industrial Corridor located along the interstate boundary between Meghalaya and Assam, specifically covering Byrnihat (Meghalaya), Byrnihat (Assam), Ri Bhoi District, and Kamrup Metropolitan District, which together constitute a single integrated industrial and environmental region. Data are collected from both primary and secondary sources. Primary data are obtained through semi-structured interviews with purposively selected respondents, including government officials, officials from the Central and State Pollution Control Boards, environmental experts, industry representatives, local residents, non-governmental organizations, and community leaders, based on their direct involvement in environmental governance. An illustrative sample of approximately 110 respondents is proposed, comprising 15 government officials, 10 pollution control officials, 15 industry representatives, 50 local residents, 10 environmental NGO representatives, and 10 academicians. Secondary data are drawn from official government documents such as reports of the Central Pollution Control Board (CPCB), Meghalaya State Pollution Control Board (MSPCB), Assam Pollution Control Board (APCB), National Clean Air Programme (NCAP) documents, Environmental Impact Assessment (EIA) reports, government notifications, legislative assembly proceedings, legal instruments including the Air (Prevention and Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, National Green Tribunal (NGT) judgments, and relevant peer-reviewed journal articles, books, research reports, and policy briefs. Data collection methods include semi-structured interviews, document analysis, field observations, policy analysis, and review of official government reports. The collected qualitative data are analysed using Thematic Analysis following Braun and Clarke (2006), with themes focusing on environmental governance, policy implementation, institutional coordination, regulatory enforcement, interstate cooperation, political commitment, and governance challenges. Government documents are further examined through qualitative content analysis, while comparative institutional analysis is employed to evaluate differences and similarities in environmental governance and policy implementation between Meghalaya and Assam.

Comparative Analysis of Environmental Governance in the Byrnihat Industrial

Environmental governance in industrial regions requires balancing economic development, environmental sustainability, and public health, a challenge that becomes significantly more complex when industrial activities extend across administrative boundaries. The Byrnihat Industrial Corridor, located along the Assam–Meghalaya border, represents one of the largest industrial clusters in Northeast India and exemplifies the governance challenges associated with managing shared environmental resources within India's federal system. Although both Meghalaya and Assam are governed by the same constitutional and legal framework, including Article 21, Article 48A, and Article 51A(g) of the Constitution of India, as well as the Air (Prevention and Control of Pollution) Act, 1981, the Water (Prevention and Control of Pollution) Act, 1974, the Environment (Protection) Act, 1986, and the National Green Tribunal Act, 2010, differences arise in policy implementation, regulatory enforcement, institutional coordination, and political commitment. Environmental governance in Byrnihat operates through a multi-level institutional framework involving the Ministry of Environment, Forest and Climate Change (MoEFCC), the Central Pollution Control Board (CPCB), the Meghalaya State Pollution Control Board (MSPCB), the Pollution Control Board, Assam (PCBA), state environment departments, district administrations, and local authorities. While the institutional architecture in both states is broadly similar, governance effectiveness depends largely on administrative capacity, technical expertise, financial resources, and the ability of these institutions to coordinate across state boundaries.

The Government of Meghalaya has increasingly prioritised environmental governance in Byrnihat through a series of policy and regulatory initiatives aimed at strengthening pollution control and sustainable industrial management. The Meghalaya State Pollution Control Board has expanded ambient air quality monitoring, intensified industrial inspections, and strengthened environmental surveillance to identify major sources of pollution and recommend corrective measures. Under the National Clean Air Programme (NCAP), the state has prepared a City Action Plan focusing on improving monitoring infrastructure, regulating industrial emissions, upgrading road infrastructure, controlling construction dust, expanding green belts, and promoting public awareness regarding environmental protection. Recognising the ecological vulnerability of the region, the Government has also imposed restrictions on the establishment of new industries in environmentally sensitive areas, reflecting the application of the precautionary principle to prevent further environmental degradation while existing pollution-control mechanisms are strengthened. Furthermore, Meghalaya has consistently emphasised the importance of interstate collaboration with Assam, acknowledging that effective pollution control cannot be achieved through unilateral action because the sources and impacts of industrial pollution extend across administrative boundaries.

The Government of Assam has similarly undertaken several regulatory measures to control industrial pollution within its jurisdiction, primarily focusing on ensuring industrial compliance with existing environmental laws and standards. These measures include regular industrial inspections, monitoring of industrial emissions, enforcement of environmental clearance conditions, implementation of pollution-control standards, and coordination with the Central Pollution Control Board. However, because a substantial proportion of industries within the Byrnihat industrial economy are located on the Assam side of the border, regulatory enforcement faces significant challenges arising from high industrial concentration, competing economic development priorities, and administrative constraints. Consequently, despite operating under a common legal framework, the environmental governance approaches of Meghalaya and Assam differ in their policy emphasis and implementation strategies. Meghalaya has

adopted a relatively precautionary and collaborative approach by combining regulatory measures with restrictions on industrial expansion and promoting interstate cooperation, whereas Assam has largely relied on strengthening compliance through existing regulatory mechanisms. The comparative analysis therefore demonstrates that the effectiveness of environmental governance in the Byrnihat Industrial Corridor depends not only on the existence of comprehensive environmental legislation but also on sustained political commitment, robust institutional coordination, effective regulatory enforcement, and cooperative federalism between the two states.

Comparative Policy Analysis

Fig 1.1

Governance Dimension	Meghalaya	Assam
Air Quality Monitoring	Strengthened ambient air quality monitoring network and expanded environmental surveillance.	Existing air quality monitoring mechanisms with periodic monitoring of industrial emissions.
Industrial Development Policy	Restrictions on establishing new industries in environmentally sensitive areas based on the precautionary principle.	Continued regulation through existing environmental clearance and approval processes.
National Clean Air Programme (NCAP)	Active City Action Plan focusing on monitoring infrastructure, emission control, dust management, green belts, and public awareness.	Pollution control initiatives implemented through the State Pollution Control Board under the NCAP framework.
Public Awareness and Community Participation	Greater emphasis on public awareness campaigns and community engagement.	Moderate emphasis through government initiatives and regulatory programmes.
Green Belt Development	Green belt expansion incorporated into environmental planning.	Green belt development implemented in selected industrial areas.
Institutional Coordination	Greater emphasis on interstate cooperation and inter-agency coordination.	Coordination primarily through existing administrative and regulatory mechanisms.
Regulatory Enforcement	Strengthened inspections, environmental monitoring, and compliance mechanisms.	Industrial inspections, emission monitoring, and enforcement of environmental clearance conditions.

Source: Compiled by the Author Dr. T. E. Lamare based on CPCB Reports, MSPCB Reports, PCBA Reports, NCAP Documents, Government Notifications, and Secondary Literature (2023–2026).

The comparison suggests that both governments acknowledge the seriousness of air pollution. However, their strategies differ in emphasis rather than objective. Meghalaya has recently highlighted precautionary

measures and interstate cooperation, while Assam has focused more on regulatory oversight within its jurisdiction.

Challenges in Environmental Governance

Despite numerous policy initiatives, several governance challenges continue to hinder effective pollution control in the Byrnihat industrial region. One of the most significant issues is the fragmented jurisdiction arising from the area's location across the interstate boundary of Meghalaya and Assam. Although Byrnihat functions as a single ecological and industrial zone, it is administered by two separate state governments with distinct regulatory frameworks and administrative procedures. This institutional fragmentation often results in overlapping responsibilities, inconsistent enforcement of environmental regulations, administrative delays, and duplication of policy efforts. Furthermore, while existing environmental legislation encourages interstate cooperation, there is no permanent joint environmental authority responsible for integrated governance of the region. Consequently, coordination between the two states is largely dependent on ad hoc meetings and temporary arrangements rather than well-established institutional mechanisms capable of ensuring sustained and coordinated environmental management.

Another major challenge relates to regulatory capacity, industrial compliance, and public participation. Effective environmental governance requires adequate technical expertise, modern monitoring equipment, laboratory infrastructure, trained personnel, and sufficient financial resources. However, State Pollution Control Boards frequently operate under resource constraints, limiting the frequency of inspections, environmental monitoring, and enforcement activities. Although many industries have installed pollution-control technologies in compliance with regulatory requirements, persistent concerns regarding air pollutant emissions suggest that technological interventions alone are insufficient without continuous monitoring, strict enforcement, and transparent compliance mechanisms. Additionally, public participation remains an area requiring considerable strengthening. Environmental governance literature consistently identifies citizen engagement as a critical pillar of accountability and sustainable policy implementation. Expanding opportunities for public consultations, community-based environmental monitoring, environmental awareness programmes, and accessible grievance-redress mechanisms would not only improve transparency and public trust but also enhance policy legitimacy, regulatory compliance, and long-term environmental sustainability in the Byrnihat industrial region.

Discussion

One of the most significant governance challenges affecting pollution control in the Byrnihat industrial region is its fragmented jurisdiction. Although Byrnihat functions as a single ecological and industrial system, it is divided administratively between the states of Meghalaya and Assam. This dual governance structure creates overlapping responsibilities among regulatory agencies, resulting in inconsistent implementation of environmental laws, administrative delays, and duplication of policy efforts. Since each state follows its own institutional procedures and regulatory priorities, achieving a coordinated response to environmental problems becomes difficult. Consequently, pollution management often lacks the integrated approach necessary to address transboundary environmental challenges effectively. Institutional coordination remains another critical challenge in the governance of the Byrnihat industrial corridor. While India's environmental legislation encourages cooperation among different levels of government, there is currently no permanent interstate environmental authority responsible for the integrated management of the region. Instead, coordination between Meghalaya and Assam generally occurs through periodic

administrative meetings, directives from the Central Pollution Control Board (CPCB), or judicial interventions whenever serious environmental concerns arise. The absence of an institutionalized coordination mechanism often leads to fragmented decision-making, delayed information sharing, and inconsistent regulatory enforcement, thereby reducing the overall effectiveness of pollution control measures. The effectiveness of environmental governance largely depends on the capacity of regulatory institutions to implement and enforce environmental laws. This requires adequate technical expertise, modern monitoring equipment, laboratory infrastructure, trained personnel, and sufficient financial resources. However, State Pollution Control Boards frequently operate under resource and manpower constraints, limiting their ability to conduct regular inspections, monitor industrial emissions continuously, and ensure strict compliance with environmental standards. These institutional limitations weaken regulatory oversight and reduce the effectiveness of pollution-control initiatives despite the existence of comprehensive environmental legislation. Industrial compliance remains uneven across the Byrnihat industrial region despite increasing regulatory efforts. Although many industries have installed pollution-control technologies and adopted cleaner production practices to comply with environmental regulations, concerns regarding continued emissions and deteriorating air quality persist. This suggests that technological interventions alone are insufficient unless accompanied by rigorous monitoring, regular inspections, transparent reporting, and strict enforcement of environmental standards. Strengthening compliance mechanisms through continuous oversight and effective regulatory action is therefore essential for achieving meaningful reductions in industrial pollution. Public participation constitutes an essential pillar of effective environmental governance and democratic accountability. Environmental governance literature consistently emphasizes that citizens play a crucial role in monitoring environmental performance, promoting transparency, and holding regulatory institutions accountable. In the Byrnihat industrial region, opportunities exist to strengthen public consultations, community-based environmental monitoring, environmental awareness programmes, and accessible grievance-redress mechanisms. Encouraging greater participation by local communities, civil society organizations, and academic institutions would enhance public trust in environmental governance while improving policy legitimacy, industrial compliance, and the long-term sustainability of pollution-control initiatives.

Conclusion

The Byrnihat Industrial Corridor presents one of the most compelling examples of the challenges associated with environmental governance in India's federal system. Situated along the Assam–Meghalaya border, the region demonstrates how environmental problems transcend administrative boundaries and therefore require collaborative governance rather than isolated policy responses. Although India possesses a comprehensive legal framework for environmental protection, the effectiveness of environmental governance ultimately depends on the capacity of institutions to coordinate, implement, monitor, and enforce environmental policies across multiple jurisdictions.

This study examined the environmental governance approaches adopted by the Governments of Meghalaya and Assam through the analytical lenses of Environmental Federalism, Cooperative Federalism, Multi-Level Governance, and Policy Implementation Theory. The analysis indicates that while both state governments acknowledge the seriousness of air pollution in the Byrnihat region, their policy responses differ in emphasis. Meghalaya has increasingly focused on precautionary measures, strengthened monitoring, and restrictions on further industrial expansion in environmentally sensitive areas. Assam, meanwhile, has continued to regulate industrial activity through existing administrative and

legal mechanisms while addressing the challenges associated with a large concentration of industrial establishments within its jurisdiction.

The comparative analysis does not suggest that one government has been entirely successful or unsuccessful. Instead, it demonstrates that environmental governance in Byrnihat cannot be evaluated solely on the basis of individual state initiatives. Air pollution in the region is a shared environmental problem that requires integrated planning, harmonized regulatory standards, coordinated enforcement, and sustained intergovernmental cooperation. Fragmented governance arrangements limit the effectiveness of even well-designed policies because environmental impacts extend beyond political boundaries.

The study also reveals that institutional coordination remains one of the most significant challenges in addressing interstate environmental problems. Although the Central Pollution Control Board, the Meghalaya State Pollution Control Board, the Pollution Control Board, Assam, district administrations, and other agencies possess defined statutory responsibilities, coordination among these institutions remains largely administrative rather than institutionalized. The absence of a permanent interstate governance mechanism restricts information sharing, joint planning, and coordinated regulatory action.

From a theoretical perspective, the findings reinforce the relevance of Environmental Federalism in explaining the limitations of decentralized environmental governance where environmental externalities cross state boundaries. The study further demonstrates that Cooperative Federalism is not merely a constitutional principle but a practical necessity for effective environmental management. Multi-Level Governance theory also provides an important framework for understanding how governments, regulatory agencies, industries, local communities, and civil society interact in addressing complex environmental challenges.

A major contribution of this study is the proposed **Interstate Environmental Governance Framework (IEGF)**. The framework emphasizes institutionalized cooperation between Meghalaya and Assam through a permanent joint coordination mechanism, integrated environmental monitoring systems, harmonized regulatory standards, strengthened public participation, and regular policy evaluation. Although developed in the context of Byrnihat, the framework may also be applicable to other interstate industrial regions in India facing similar environmental governance challenges.

The study contributes to Political Science by extending the application of environmental governance theories to the context of Northeast India. While previous research on Byrnihat has largely focused on environmental science and public health, this research highlights the political and institutional dimensions of pollution control. By integrating environmental federalism with governance and public policy analysis, the study broadens scholarly understanding of how federal institutions respond to shared environmental problems.

Nevertheless, the study has certain limitations. It primarily relies on documentary analysis and comparative policy evaluation. Future research may incorporate large-scale surveys of affected communities, interviews with policymakers and regulatory officials, longitudinal analysis of air-quality data, and comparative studies of other interstate industrial corridors. Such research would further strengthen empirical understanding of environmental governance in federal systems.

In conclusion, the Byrnihat case illustrates that sustainable environmental governance cannot be achieved through isolated administrative actions. Effective pollution control requires cooperative federalism, strong institutions, transparent governance, scientific monitoring, and meaningful public participation. Strengthening these dimensions will not only improve environmental quality in Byrnihat but also provide important lessons for environmental governance across India.

Limitations of the Study

The present study is subject to several limitations:

1. It relies primarily on policy documents, legal frameworks, government reports, and secondary literature rather than extensive primary field data.
2. Air quality measurements and environmental indicators are discussed from a governance perspective and are not independently verified within the scope of this study.
3. The comparative analysis focuses on the Byrnihat Industrial Corridor and may not be directly generalizable to all interstate industrial regions in India.
4. Government policies and regulatory actions continue to evolve, and future developments may influence the effectiveness of environmental governance.

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