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ASSESSING THE EFFECTIVENESS OF ENVIRONMENTAL PROTECTION POLICIES IN PAKISTAN: EVIDENCE FROM POLICY ANALYSIS AND ENVIRONMENTAL INDICATORS



Mir Abdul Qadir¹, Saif ur Rehman², Muhammad Ibrahim Ansari², Syed Ghous Ali Shah², Yasir Saud Sadiq¹, Shahzad Wahid¹

¹Post Graduate Medical Institute, Quetta, Pakistan

²National Institute of Public Administration (NIPA), Karachi, Pakistan

*Corresponding Author: Mir Abdul Qadir. E. mail: drmirqadir@gmail.com

Abstract

Pakistan has a comprehensive environmental policy framework in place to effectively address the issues related to environment such as air pollution, water scarcity, deforestation, and climate change. Key regulatory and policy frameworks include: Pakistan Environmental Protection Act 1997, National Environmental Policy 2005, National Climate Change Policy 2012, and Pakistan Climate Change Act 2017. However, despite the existence of these policies, Pakistan has witnessed a continuous environmental degradation which raises serious concerns about the effectiveness of environmental governance and effectiveness of these policies. The research evaluates effectiveness of environmental policies by assessing the link between policy, institutional capacity and environmental outcomes. A mixed-method research approach was adopted for this study by combining qualitative policy analysis with quantitative environmental indicators and trends. This study identifies several governance challenges which affect policy effectiveness such as institutional fragmentation between federal and provincial authorities, weak regulatory enforcement, limited environmental monitoring and data infrastructure, rapid urbanization and industrial expansion, climate change vulnerability, limited public participation and environmental awareness. These factors create a significant gap between environmental policy commitments and environmental outcomes. The findings suggest that Pakistan has a strong legislative framework but weak implementation capacity which require strengthening environmental governance by improved regulatory enforcement, enhanced environmental monitoring systems, greater intergovernmental coordination and increased public engagement in environmental decision-making. Effective integration of environmental considerations into national development planning is essential for achieving sustainable environmental management in Pakistan.

Keywords: Environmental policies, Environmental indicators, Pakistan, Policy analysis

INTRODUCTION

Environmental Issues have emerged as one of the most pressing global and national problem during the past two decades. The degradation of environment is closely linked with the development of global and national economy. Population growth, urbanization, development in energy sector, industrial growth, are some of the factors that have been the contributor to give rise to the environmental degradation. Pakistan is a developing country and during the past decades it has witnessed one of the highest population growth rates in the region, a trend of unplanned urbanization, depleting forest cover, degrading quality of crops and climate related disasters to name a few. These factors have been the major contributors to the environmental stressors and have direct impact on the quality of public health, food security, economic activity and day to day life of the masses.

In the backdrop of these issues Pakistan has always shows readiness on the legal front and have timely developed environmental protection laws and policies as a preventive measure to mitigate the impact of environmental degradation. Pakistan Environmental Protection Act (PEPA) 1997(1) was the first law that was passed in 1997 to acknowledge this pressing issue and adopt the preventive and corrective measures in this regard. Subsequently, Pakistan Environmental Protection Council, Pakistan Environmental Protection Agency were established later on to continue the approach towards protection of environment (2). Later,



after the devolution of powers to the provinces through 18th Amendment in the Constitution of Pakistan, the subject was delegated to the provinces. However, besides establishment of local policies and acts as provincial subject, it remained a concern of importance and several other initiatives such as National Environmental Policy, National Biodiversity Strategy, National Forest Policy and the latest National Climate Change Policy (2012, Updated 2021) had been introduced (3, 4).

These laws and policies have been comprehensive to provide framework for the environmental protection and mitigation strategies, theoretically, but in reality collectively these laws and policies could not prove fruitful in terms of bringing about any real preventive and corrective measures on local, provincial or national level since water pollution still remains an issue to be addressed, air quality in major urban centers of Pakistan is compromised, deforestation have been ever growing, food security is becoming a question of existence, biodiversity is on a decline, economic productivity is inconsistent and most significantly public health is under the dark clouds of environmental and climate related issues (5).

These issues pose a significant question to the effectiveness of the laws and policies that have been brought into existence to tackle the environmental degradation. All the indicators have been pointing downwards consistently. This also raises another question whether this problem stems from the ineffective implementation mechanism and enforcement bottlenecks (2, 5). Therefore, this study explores the factors that have collectively contributed to the environmental degradation and weak implementation of relevant policies.

Pakistan's environmental governance began with the National Conservation Strategy (1992), but the first comprehensive law was the Pakistan Environmental Protection Act (PEPA) 1997. PEPA established the Pakistan Environmental Protection Council and Pak EPA and introduced Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) to identify development-project risks, with EIA assessing environmental, social and economic impacts. It also enabled National Environmental Quality Standards (2001), setting limits for municipal, industrial and vehicular effluents and emissions, backed by penalties. The Self Monitoring and Reporting by Industry Rules (2001) sought greater industrial accountability through routine emissions and waste reporting. Pakistan has further joined international commitments, including the Paris Agreement and REDD+ to cut emissions and support sustainable forest management. National policies and sectoral rules have followed on climate change, adaptation, disaster risk reduction, forests, biodiversity, water and hospital waste. After the 18th Constitutional Amendment, environmental powers shifted to provinces, which enacted their own EP acts and related standards and sectoral laws across Punjab, Sindh, KP, Balochistan and ICT. Despite this extensive framework, enforcement remains weak because of limited institutional capacity and resource constraints, contributing to worsening urban pollution in Karachi and Lahore. The study examines gaps between rules and environmental performance and suggests practical reforms.

METHODOLOGY

RESEARCH DESIGN

This study adopted a mixed method research design. Qualitative and quantitative approaches were utilized in this study for comprehensive assessment of effectiveness of policy through measurable indicators.

DATA COLLECTION

QUALITATIVE DATA COLLECTION

Qualitative data was collected through sources such as policy documents, legislation, regulations, strategies, and engagements with International Organizations on national level. The policy documents were extracted from official websites of ministries and departments. All documents that had been available publicly were included in this study.

QUANTITATIVE DATA

The Quantitative Data was obtained from available sources such as environmental indicators namely air quality indicators, water quality indicators, deforestation rates, and waste management statistics from regulators. The data from newspaper reports and publications was also be used in this study.

Both qualitative and quantitative were collected regardless of any specific time-frame and all documents (earliest to latest) that have been available publicly were in the scope of this study.

DATA ANALYSIS

The data analysis of qualitative data was conducted using thematic analysis to identify the trends and patterns that highlight the effectiveness of regulatory frameworks, policies and bottlenecks. The quantitative data was analysed using descriptive statistics using MS Excel.

ETHICAL CONSIDERATIONS

The study adhered to ethical research standards.

RESULTS

As per the scope of each policy and law, they have been focused on various outcomes. Such as National Conservation Strategy focused on Sustainable resource management and environmental awareness; Pakistan Environmental Protection Act (PEPA) focused on Pollution control regulation, environmental licensing, compliance enforcement; IEE/EIA Regulations focused on Environmental assessment for development projects; Hazardous Substances Rules focused on Regulation of hazardous materials handling; National Environmental Policy focused on Policy guidance for air, water, biodiversity, waste management; National Environmental Policy focused on Policy guidance for air, water, biodiversity, waste management; Hospital Waste Management Rules focused on Safe disposal of medical waste; National Sustainable Development Strategy focused on Integration of environmental sustainability with economic growth; Provincial Environmental Protection Acts focused on Environmental monitoring and regulatory oversight, Pollution control and environmental monitoring, Pollution regulation and environmental governance, Industrial monitoring and pollution control; National Disaster Risk Reduction Policy focused on Disaster risk reduction and climate resilience; National Forest Policy focused on Sustainable forest management, afforestation programs; REDD+ Strategy focused on Carbon sequestration through forest conservation; Pakistan Climate Change Act focused on Climate adaptation and mitigation governance; National Biodiversity Strategy & Action Plan focused on Ecosystem conservation, protected area expansion; National Water Policy for Sustainable water use and integrated water resource management; National Adaptation Plan on Risk-based climate adaptation planning; National Climate Change Policy on Climate adaptation, mitigation, climate-resilient infrastructure; and National Environmental Quality Standards on pollution emission limits for industries and municipalities (6).

Table I. Environmental protection policy in Pakistan: Core policy mechanisms (7)

Policy / Law	Year	Policy instrument type	Institutional authority	Core policy mechanisms
National Conservation Strategy	1992	Strategic environmental planning	Ministry of Environment (now Ministry of Climate Change)	Sustainable resource management, environmental awareness
Pakistan Environmental Protection Act (PEPA)	1997	Command-and-control regulation	Pakistan EPA, Provincial EPAs, Environmental Tribunals	Pollution control regulation, environmental licensing, compliance enforcement
Punjab Environmental Protection Act	1997	Provincial environmental regulation	Punjab EPA	Industrial monitoring and pollution control
IEE/EIA Regulations	2000	Preventive environmental governance	Federal and provincial EPAs	Environmental assessment for development projects



Hazardous Substances Rules	2003	Environmental safety regulation	Environmental Protection Agencies	Regulation of hazardous materials handling
National Environmental Policy	2005	Integrated environmental policy framework	Federal and provincial environmental authorities	Policy guidance for air, water, biodiversity, waste management
Hospital Waste Management Rules	2005	Sectoral environmental regulation	Health departments and environmental authorities	Safe disposal of medical waste
National Sustainable Development Strategy	2012	Development planning policy	Planning Commission & Ministry of Climate Change	Integration of environmental sustainability with economic growth
Balochistan Environmental Protection Act	2012	Provincial environmental governance framework	Balochistan EPA	Environmental monitoring and regulatory oversight
National Disaster Risk Reduction Policy	2013	Disaster governance framework	NDMA and Provincial Disaster Management Authorities	Disaster risk reduction and climate resilience
Sindh Environmental Protection Act	2014	Provincial environmental legislation	Sindh EPA	Pollution control and environmental monitoring
KP Environmental Protection Act	2014	Provincial environmental regulation	KP EPA	Pollution regulation and environmental governance
National Forest Policy	2015	Resource management policy	Provincial forestry departments	Sustainable forest management, afforestation programs
REDD+ Strategy	2016	Market-based climate instrument	Ministry of Climate Change, Forestry Departments	Carbon sequestration through forest conservation
Pakistan Climate Change Act	2017	Institutional governance framework	Climate Change Council, Climate Change Authority	Climate adaptation and mitigation governance
National Biodiversity Strategy & Action Plan	2017	Biodiversity conservation strategy	Ministry of Climate Change, Wildlife departments	Ecosystem conservation, protected area expansion
National Water Policy	2018	Integrated resource management policy	Federal and provincial water authorities	Sustainable water use and integrated water resource management
National Adaptation Plan	2023	Climate adaptation strategy	Ministry of Climate Change, NDMA	Risk-based climate adaptation planning
National Climate Change Policy	2012 / 2021	Sectoral climate policy	Ministry of Climate Change, Provincial governments	Climate adaptation, mitigation, climate-resilient infrastructure
NEQS (Environmental Quality Standards)	Various updates	Environmental regulatory standards	Pakistan EPA and Provincial EPAs	Pollution emission limits for industries and municipalities

Table II provides a snapshot of implementation tools/methods, evaluation indicators, outcomes and constraints. The legal framework for environmental protection policies have employed different implementation approaches such as regulatory requirements, licensing, inter-sectoral coordination, cross-sector planning frameworks, donor supported projects for policy coordination and implementation, community engagement approaches and several others. Based on these implementation approaches, there are following evaluation indicators such as compliance rates, pollution rates, the number of environment impact assessment conducted, SDG indicators, economic indicators, forest cover changes and deforestation rates, green house gases emission rates, water stress index, water depletion rates, air quality index etc (8).

Evaluation of environmental protection policies through this lens helps us identify the constraints that hinder the effective implementation of these policies (9). They have also been populated in the Table II. Three of the most significant constraints that could be identified in this research are lack of monitoring mechanism, weak enforcement of laws and policies, institutional coordination challenges. Collectively these

challenges add to the broader issue of policy failure due to the ineffective implementation mechanism, lack of departmental coordination, interprovincial disputes etc.

Table II. Environmental protection policy in Pakistan: Implementation tools, evaluation indicators, outcomes and constraints (10)

Policy / Law	Year	Implementation tools	Evaluation indicators	Observed outcomes	Constraints
National Conservation Strategy	1992	Policy coordination, donor-supported projects	Resource conservation indicators, environmental awareness measures	Introduced sustainability discourse in national planning	Lack of binding authority and monitoring mechanisms
Pakistan Environmental Protection Act (PEPA)	1997	NEQS enforcement, Environmental Impact Assessment (EIA), inspections, penalties	Industrial compliance rate, pollution levels, number of EIAs approved	Established national regulatory framework for environmental governance	Weak enforcement capacity, institutional fragmentation after 18th Amendment
Punjab Environmental Protection Act	1997	SMART self-monitoring system, inspections	Industrial emissions, smog index	Enhanced monitoring mechanisms	Persistent urban air pollution
IEE/EIA Regulations	2000	Impact assessments, public consultations	Number of EIAs conducted mitigation compliance	Institutionalized environmental impact assessment	Often treated as procedural requirement
Hazardous Substances Rules	2003	Licensing and inspection	Hazardous waste handling compliance	Improved regulatory framework for chemical safety	Weak enforcement in industrial zones
National Environmental Policy	2005	Inter-sectoral coordination, environmental mainstreaming	Environmental quality indicators, policy implementation milestones	Strengthened policy coherence	Limited implementation oversight
Hospital Waste Management Rules	2005	Waste segregation, treatment facilities	Healthcare waste management compliance	Increased awareness in healthcare facilities	Infrastructure gaps in smaller hospitals
National Sustainable Development Strategy	2012	Cross-sector planning frameworks	Sustainable development indicators, SDG alignment metrics	Improved alignment with global sustainability agenda	Weak operational mechanisms
Balochistan Environmental Protection Act	2012	Environmental inspections, licensing	Environmental compliance statistics	Established regulatory framework	Limited financial and technical resources
National Disaster Risk Reduction Policy	2013	Early warning systems, risk mapping	Disaster mortality and economic loss indicators	Improved disaster preparedness structures	Institutional coordination challenges
Sindh Environmental Protection Act	2014	Industrial inspection and licensing	Urban pollution indicators (air, water)	Strengthened provincial environmental governance	Urban environmental management challenges
KP Environmental Protection Act	2014	Environmental compliance monitoring	Industrial compliance indicators	Improved policy integration with climate initiatives	Institutional resource constraints
National Forest Policy	2015	Community forestry, reforestation initiatives	Forest cover change, deforestation rate	Large-scale afforestation programs launched	Illegal logging and land-use conversion
REDD+ Strategy	2016	Forest carbon accounting, climate	Forest carbon stock estimates,	Integration of forest policy with climate	Governance and carbon accounting

		finance mechanisms	deforestation rates	finance	challenges
Pakistan Climate Change Act	2017	National climate action planning, sectoral adaptation strategies	GHG emission trends, climate resilience indicators	Strengthened climate governance architecture	Delays in operationalization and funding constraints
National Biodiversity Strategy & Action Plan	2017	Biodiversity monitoring systems	Species population trends, protected area coverage	Strengthened biodiversity governance framework	Weak monitoring infrastructure
National Water Policy	2018	Groundwater regulation, water conservation programs	Water stress index, groundwater depletion rates	Recognition of water scarcity crisis	Weak enforcement and inter-provincial disputes
National Adaptation Plan	2023	Climate risk assessment, sector-specific adaptation programs	Climate risk reduction metrics, disaster loss data	Strengthened resilience planning	Resource limitations and coordination challenges
National Climate Change Policy	2012/2021	Sectoral adaptation plans (water, agriculture, energy)	Climate vulnerability index, emission reduction targets	Climate change integrated into national development planning	Implementation dependent on provincial capacity
NEQS (Environmental Quality Standards)	Various updates	Environmental monitoring and reporting	Air quality index, effluent compliance rates	Standardized pollution benchmarks established	Limited monitoring infrastructure

The Table III presents the Policy Implementation Gap Analysis of the issue. It can be broadly identified and attributed to weak enforcement mechanism and limited regulatory monitoring, gaps in policy integration, implementation and financing gap and multiple levels, institutional capacity gap in terms of budgetary and human resource constraints, policy enforcement gap due to regulatory bottlenecks, and conservation effectiveness gap in terms of climate and forest protection. The existence of these gaps can be attributed to governance fragmentation gap and under the umbrella of this governance gap, all these gaps act as contributory factors for ineffective implementation of the environmental protection policies.

Table III. Policy implementation gap analysis

Policy / Law	Intended policy objective	Implementation mechanism	Observed policy outcome	Implementation gap	Underlying causes
Pakistan Environmental Protection Act (1997)	Control environmental pollution and regulate industrial emissions	Environmental tribunals, NEQS standards, environmental licensing	Pollution levels continue rising	Weak enforcement and limited regulatory monitoring	Institutional capacity constraints and political interference
National Environmental Policy (2005)	Integrate environmental protection into development planning	Policy coordination across sectors	Environmental considerations rarely prioritized in development projects	Policy integration gap	Weak inter-ministerial coordination
National Climate Change Policy (2012/2021)	Build climate resilience and reduce emissions	Sectoral adaptation and mitigation strategies	Climate vulnerability remains high	Implementation and financing gap	Dependence on international climate finance
Pakistan Climate Change Act (2017)	Establish climate governance institutions	Climate Change Council and Authority	Institutional framework exists but limited operationalization	Institutional capacity gap	Budget constraints and administrative delays
National Water Policy (2018)	Achieve sustainable water resource management	Water conservation programs and groundwater regulation	Water scarcity continues worsening	Policy enforcement gap	Weak provincial coordination and groundwater regulation



National Forest Policy (2015)	Increase forest cover and reduce deforestation	Community forestry and afforestation programs	Forest cover remains below global average	Conservation effectiveness gap	Illegal logging and land-use pressure
NEQS (Environmental Standards)	Set national limits for pollution emissions	Industrial compliance monitoring	Many industries operate without compliance	Monitoring gap	Limited environmental monitoring infrastructure
IEE/EIA Regulations (2000)	Ensure environmental impact assessment before development projects	Environmental impact assessments and public consultation	EIAs often treated as formalities	Regulatory integrity gap	Political pressure and weak oversight
Provincial Environmental Protection Acts	Decentralize environmental governance	Provincial EPAs and environmental tribunals	Policy implementation varies across provinces	Governance fragmentation gap	Uneven administrative capacity
Disaster Risk Reduction Policy (2013)	Improve disaster preparedness and resilience	Early warning systems and disaster planning	Disaster losses remain high	Risk management gap	Limited disaster mitigation infrastructure

Table IV. Thematic analysis of environmental protection laws/policies at federal and provincial levels in Pakistan (11)

Major theme	Sub-theme	Policy / Legal source	Observed evidence from policy documents	Research interpretation
Institutional Fragmentation and Governance Complexity	Federal-Provincial Authority Division	Pakistan Environmental Protection Act 1997; Climate Change Act 2017	Environmental regulation responsibilities divided between federal and provincial governments following the 18th Constitutional Amendment	Governance decentralization has increased policy complexity and coordination challenges
	Inter-Agency Coordination Weakness	National Environmental Policy 2005	Multiple ministries and departments involved in environmental governance with overlapping mandates	Institutional overlap leads to policy inefficiency
	Regulatory Enforcement Disparities	Provincial Environmental Protection Agencies	Enforcement capacity varies significantly across provinces	Uneven environmental protection across regions
Policy Implementation Gap	Weak Enforcement Mechanisms	Pakistan Environmental Protection Act 1997; National Environmental Quality Standards	Industries frequently exceed emission and waste discharge limits	Legal frameworks exist but enforcement remains weak
	Institutional Capacity Constraints	Environmental Protection Agencies	Limited staffing, technical expertise, and financial resources	Regulatory institutions lack operational capacity
	Limited Accountability Systems	Environmental regulatory bodies	Monitoring and penalty systems are not consistently applied	Weak accountability reduces compliance incentives
Environmental Monitoring and Data Limitations	Limited Environmental Data Infrastructure	National Environmental Policy 2005	Environmental indicators and monitoring systems remain underdeveloped	Evidence-based environmental policymaking remains constrained

	Air Quality Monitoring Gaps	National Clean Air initiatives	Few operational air quality monitoring stations in major cities	Air pollution policy responses rely on incomplete data
	Environmental Impact Assessment Limitations	Environmental Impact Assessment regulations	EIAs often conducted without strong independent verification	Environmental assessments may lack reliability
Urbanization and Industrialization Pressure	Rapid Urban Population Growth	National Environmental Policy 2005	Increasing urban population placing pressure on environmental resources	Urban environmental management systems remain insufficient
	Industrial Pollution	Industrial Environmental Regulations	Industrial waste and emissions remain significant sources of pollution	Industrial compliance mechanisms require strengthening
	Waste Management Challenges	Municipal environmental regulations	Solid waste management systems underdeveloped in major cities	Urban environmental services lag behind urban growth
Climate Change Vulnerability and Adaptation	Climate Risk Exposure	National Climate Change Policy 2012	Pakistan identified as highly vulnerable to floods, droughts, and heatwaves	Climate risks intensify environmental governance challenges
	Adaptation Strategy Development	Climate Change Act 2017	Establishment of climate governance institutions and adaptation planning frameworks	Climate adaptation emerging as central policy priority
	Disaster Risk Management Integration	Climate adaptation programs	Integration of environmental and disaster management policies	Climate governance increasingly linked with disaster resilience
Limited Public Participation and Environmental Awareness	Public Consultation in Environmental Assessments	Pakistan Environmental Protection Act 1997	Public hearings required during Environmental Impact Assessments	Legal mechanisms for participation exist
	Civil Society Engagement	Environmental policy frameworks	Environmental NGOs and community groups participate in advocacy and monitoring	Civil society plays an emerging but limited role
	Environmental Education and Awareness	National Environmental Policy 2005	Environmental awareness initiatives remain limited in scale	Public understanding of environmental issues remains low

Table V shows the available data related to environmental indicators and their impact on different sectors such as increasing health burden, elevated levels of hazardous pollution levels, economic loss, increasing burden of water scarcity, low forest coverage, increase in industrial pollution source and urban environmental stress.

The table presents the recent trends which show that approximately 256,000 deaths are annually accounted due to air pollution due to elevated levels of air pollutants above approximately 13% than permitted ranges. It is also important to note that there is approximately 4years of average decline in life expectancy due to air pollution.

Similarly, the smog levels have seen the sharp spike in previous decade especially in urban centers and it is one of the most significant environmental hazardous pollutants that directly impacts the day-to-day life activities. The air pollution not only cause a significant health burden but it also adds to the loss of economic activity and an estimated loss of \$22 billions in incurred due to it (12).

Another aspect of environmental degradation in the form of water scarcity is growing. As per a careful estimate currently 1700m³ of water is available per capita which is classified as the water stressed condition and if the trend continues it will lead to <1000m³ of water per capita and thus water scarcity. The decreasing trend of green cover has Pakistan at currently 5% of forests which is an environmental risk factor and major contributor to floods and landslides. During the past two decades, Pakistan has witnessed heavy floods which have incurred not only economic loss but also responsible for loss of precious human lives. It is a preventable phenomenon if the forest cover is increased.

Another important trend is of urban heat island phenomenon. This occurs at mostly urban centers which results in higher temperatures and heat waves during the summer. It stems from the urban emissions of greenhouse gases through industries and vehicles and leads to an elevated temperature at these centers.

Table V. Environmental outcome indicators for Pakistan (12)

Environmental indicator	Baseline data	Latest available data	Change / Trend	Policy framework linked	Source type
Air pollution deaths	~128,000 deaths annually	Up to 256,000 deaths annually	Increasing health burden	Environmental Protection Act, National Environmental Policy, Smog Policies	Government & news reports (The News Pakistan)
Average PM2.5 concentration	~63–66 µg/m ³ annual exposure	WHO guideline = 5 µg/m ³	~12–13× above safe limit	NEQS, PEPA, Clean Air initiatives	Research studies & global air reports (PMC)
Life expectancy reduction due to air pollution	—	~3.9 years national average	Significant health impact	National Environmental Policy, Climate Policy	Environmental health research (Human Rights Watch)
Extreme smog levels (PM2.5)	—	300–400 µg/m ³ during winter episodes	Hazardous pollution levels	Provincial environmental acts, smog action plans	Research and environmental monitoring reports (Pakistan Today)
Economic cost of air pollution	—	~\$22 billion per year (~6.5% of GDP)	Major economic loss	Environmental protection laws and pollution control regulations	Government statements & economic analyses (The News Pakistan)
Population affected by smog episodes	—	~1.8 million people treated for respiratory illness in one month	Increasing health burden	Provincial environmental regulation and smog policy	Health department reports (AP News)
Per capita water availability	5,260 m ³ (1951)	~899 m ³ (2025)	Severe decline → water scarcity	National Water Policy	Government water resource reports (Dunya News)
Water scarcity threshold	1,700 m ³ = water stress	<1,000 m ³ = water scarcity	Pakistan now below threshold	National Water Policy	Government planning reports (Dunya News)
Forest cover	historically low	<5% of national land area	Persistently low forest coverage	National Forest Policy, REDD+	Environmental research reports
Air pollution share of total deaths	—	~17% of deaths in Pakistan	Major public health issue	Environmental protection policies	Environmental research campaigns (Press Network of Pakistan)
Brick kiln pollution sources	—	~11,000 verified kilns identified as major pollution sources	Significant industrial pollution source	Industrial pollution regulation	Environmental research datasets (arXiv)
Urban heat island temperature increase	—	Up to ~7°C higher temperatures in cities	Urban environmental stress	Climate Change Policy, Urban planning policies	Environmental studies

Table VI presents a thorough snapshot of environmental indicators and their performance over the course of decades. The data shows a dismal picture of environmental degradation where it can be seen that the trajectory of environmental indicators is on a steep decline and if it remains unaddressed, Pakistan may have to bear the brunt of not only environmental degradation but also of economic losses, growing health burden, increasing mortality rates and reduced quality of life.

Table VI. Pakistan environmental indicators dataset (1990–2025) (13)

Indicator	1990	2000	2010	2020	2025 (approx.)	Policy relevance	Linked policy framework
Population (millions)	108	138	179	220	~241	Population pressure on environment	National Environmental Policy
CO ₂ emissions (million tons)	~66	~103	~161	~223	~240	Climate change contribution	Climate Change Policy, Paris Agreement
Per capita CO ₂ emissions (tons)	0.6	0.8	0.9	1	~1.1	Carbon intensity of economy	Climate Change Act
Average PM _{2.5} concentration (µg/m ³)	~40	~50	~60	~65	~63	Air pollution trend	NEQS, PEPA
Air pollution deaths per year	~60,000	~90,000	~120,000	~200,000	~250,000	Public health impact	Environmental Protection Laws
Life expectancy loss due to pollution (years)	~1.5	~2.0	~3.0	~3.5	~3.9	Environmental health risk	National Environmental Policy
Forest cover (% of land area)	~4.8%	~4.5%	~4.2%	~4.7%	~5%	Forest conservation performance	National Forest Policy
Deforestation rate (% annual loss)	~0.5%	~0.4%	~0.3%	~0.2%	~0.2%	Effectiveness of forest conservation	REDD+, forestry policies
Per capita water availability (m ³ /year)	~2600	~1800	~1300	~1000	~899	Water scarcity trend	National Water Policy
Population with safe drinking water (%)	~40%	~55%	~65%	~70%	~72%	Water quality governance	Environmental Protection Policy
Urban population (%)	31%	34%	36%	38%	~40%	Urban environmental pressure	Urban environmental regulation
Solid waste generation (million tons/year)	~20	~28	~35	~48	~55	Waste management performance	Waste management policies
Waste recycling rate (%)	~5%	~8%	~10%	~13%	~15%	Circular economy progress	Environmental management strategies
Climate disaster losses (USD billions/year avg.)	~0.3	~0.6	~1.5	~3	~4+	Climate vulnerability	Disaster Risk Reduction Policy
Agricultural land degradation (%)	~20%	~23%	~25%	~28%	~30%	Soil sustainability	Sustainable development policies
Renewable energy share (%)	~30% (hydro dominated)	~33%	~31%	~34%	~36%	Energy transition progress	Climate Change Policy
GDP loss from environmental degradation (% GDP)	~5%	~6%	~6.5%	~7%	~7–8%	Economic impact of environmental issues	Environmental governance framework

DISCUSSION

Pakistan is a developing country and on a high risk of environmental degradation due to economic as well as industrial development and climate related nature calamities. Although, there exists comprehensive environmental policies and regulatory frameworks for its implementation, the effective implementation and enforcement remain inconsistent. This study examined that the air pollution, water

contamination, climate change and public health issues related to environment through the lens of strengths and weaknesses of the laws, policy, regulatory frameworks, their implementation and bottlenecks in their enforcement. It is imperative through comprehensive review of the existing policy frameworks to address this issue and enumerate the measures that could be taken to address this problem.

This study is a significant step towards examining the overall regulatory and governance structure that is responsible for the enforcement of environmental protection policies. This study is focused on addressing this issue with a holistic approach through step by step dissecting the subject at hand and identify the underlying problems that are hampering the delivery of desired goals. This study addressed the critical gap in literature and offered the evidence-based insight for policy makers, regulators and development partners seeking to improve environmental governance. This study also provided basis for informed decision-making and offer a road map for designing future legislative and implementation roadmap for sustainable development, climate resilience and improvement public sector performance.

These results indicate that despite existence of regulatory frameworks, the implementation, enforcement and environmental governance has remained weak owing to limited institutional capacity, financial and human resource constraints. That have resulted in rise in levels of pollution especially in urban centres such as Karachi and Lahore.

This study has been an attempt to bridge the gap between policy guidelines and environmental performance indicators by adopting a holistic approach of analysing the regulatory framework and policy outcomes in terms of environmental indicators.

CONCLUSION

Environmental Protection policy is of pivotal importance in development and growth. The growing risks of environmental degradation and climate change require immediate attention to address this growing problem. Hence, it is imperative that an effective and evidence-based environmental protection policy may be adopted with extensive engagement from community and stakeholders. This proposed study will lay out the framework for evaluation, identification, rectification and implementation of effective environmental protection policies.

Future Recommendation:

The study identifies the key areas of improvement and offers with following recommendations

1. Strengthening of institutional capacity of environment protection agencies
2. Enhancing vertical and horizontal coordination between agencies
3. Recommendation on enforcement mechanisms
4. Community engagement for better outcomes
5. Data availability for transparency and accountability
6. Environmental policies and economic/development planning.

Limitations:

This study acknowledges following limitations that could be addressed in future studies on this topic:

1. This study utilized the secondary sources that were publicly available.
2. This study did not carry out structured/unstructured interviews directly with stakeholder and policy makers.
3. Although the study carefully included the data from publicly available sources but the element of any bias could not be completely ruled out in case of data from news reports and such publications.

Conflict of interests:

The authors don't share any competing interests in this manuscript

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Authors' contribution:

MAQ Conception, study design, data collection and drafting; SUR Drafting, literature review; MIA Data collection and drafting; SGAS Drafting and proofreading; YSS Study design and data collection; SW Literature review and proofreading.

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