



AI-Enabled Climate Governance and Resilience Through Human-Centered Decision Making in Pakistan: Policy Brief

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Highlights

Pakistan can use Artificial Intelligence to convert crude climate data to proactive, data-driven government that curbs the effects of severe floods, heat waves, and melting glaciers.

To successfully implement climate action, it is necessary to be ethical, transparent, and people-centered in order to make the implementation of technology-based interventions prioritize vulnerable groups and equal distribution of resources.

To fill in the existing gaps in governance, there is need to bridge the gap between the top-level climate regimes and the lower-level application using AI-enabled early warning systems and more inclusive decision-making.



Introduction

Pakistan is one of the most climate-sensitive nations that face global climate risks because of the exposure to short heavy monsoon floods, increased glacial meltdown, extended heatwave, droughts and water scarcity. These climate shocks repeatedly strengthen the impacts of destabilizing lives, livelihood, infrastructure and economic development. Nonetheless the articulation of climate policy frameworks and global partnerships, despite the involvement of the international partners, governance gaps persist especially relating to the fact that climate data are not straightforwardly converted into effective, equitable, and anticipatory decision-making. New technologies like Artificial Intelligence (AI) are held to enormous possibilities of enhancing climate governance, however, these possibilities will be possible only when implemented by offering human-centered, ethical, and transparent systems within the public institutions of the Pakistani state. This policy brief outlines the problem context, evidence regarding the effects of climate change, existing governance and data challenges, and proposed strategic policy endorsements that leverage for AI to build resilience while keeping people and institutions at the center of decisions.

1. Problem context: Climate Vulnerability in Pakistan

The climate crisis in Pakistan is not a hypothetical condition but it is a contemporary truth. extreme weather occurrences have increased in number and magnitude and have cost society and economies enormous amounts:

Floods: Tens of millions of people were impacted by the frequent floods, millions of houses and infrastructure harmed, and millions of people were brought to poverty as a result of the disastrous floods of 2022. The post-disaster needs assessment estimates the damage at over US\$14.9 billion and the economic losses at around US\$15.2 billion and is estimated to need at least a US 16.3 billion for resilient reconstruction.

Monsoon rains and glacial melt: Monsoon rains in the year 2025 were intensified by global warming which resulted in increased rainfall than the significant values and caused widespread floods causing hundreds of losses in lives and destruction. Heatwaves and droughts: Heatwave with unprecedented temperatures accelerate the melting of glaciers and the pressure on water resources, affecting food security and human health.

Although Pakistan's contribution in global greenhouse gas emission is less than 1% yet suffering disproportionate impact, continuously ranking high in global climate risk indexes consequentially a low embittering country experiencing massive climate distraction.

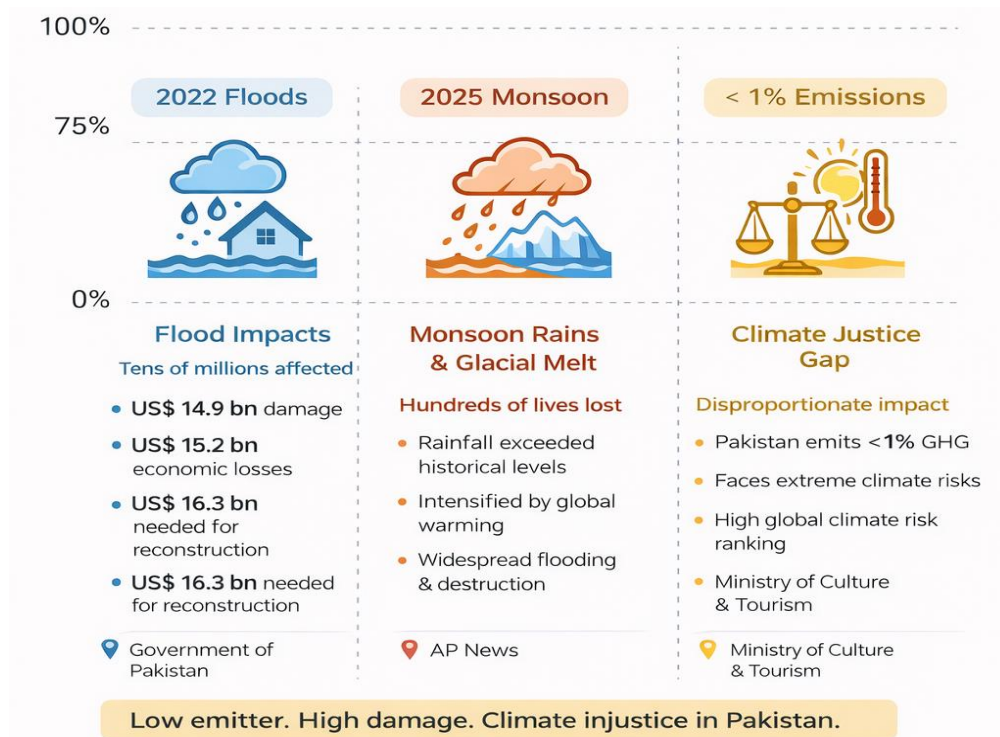


Figure 1: Climate Crisis in Pakistan

2. Does AI Matters for Climate Governance

Data predictions, forecasting and timely decision making are essential for climate governance. In Pakistan, traditional climate information, weather forecasting, early disaster warnings hydrological monitoring often faces limitation in spatial precision real time communication and integration across decision making.

AI technologies can enhance:

Predictive Climate Modeling: Past and real-time environments can be taken into account with the help of machine learning to make better predictions on extreme rainfall events, heatwaves, and flood risks (e.g., probabilistic forecasting, cloudburst detection and early warning). **Decision Support Systems:** AIs can turn raw data streams into meaningful action that can be taken by officials to aid in resource allocation initiate early response action and real-time involvement in risks in their dynamic situation. **Real-Time Monitoring:** Intelligent systems can take a combination of satellite, sensor and community data, and generate dynamic risk maps. **Community-Inclusive Insights:** The use of local community-generated data to AI might allow it to be more context-aware to the marginalized groups, particularly. However, AI cannot work solely. The AI is left as a so-called black box of responsibility or disaffection without the institutional framework, ethical fortifications, and human control. Instead, a human-centered system of governance should be introduced that would involve the use of AI, with the emphasis on transparency, accountability, equity, and local participation.

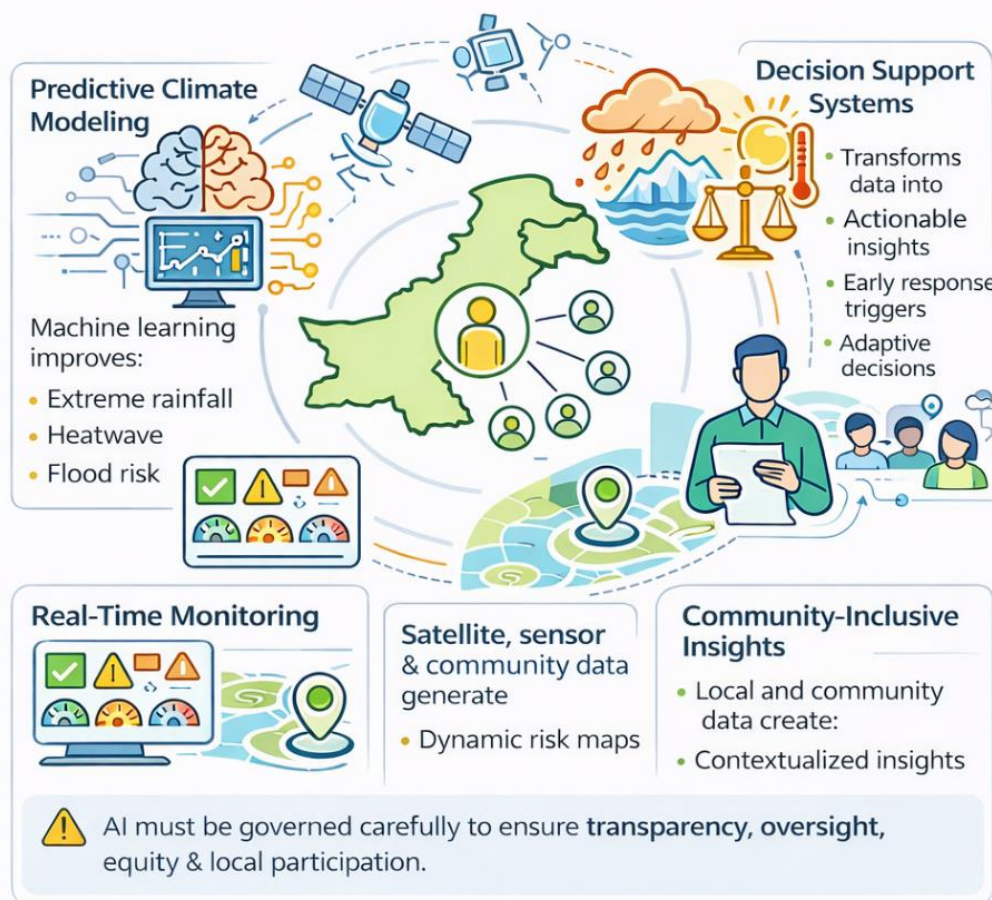


Figure 2: Why AI Matters for Climate Governance

3. Pakistan: Existing Climate Governance Gaps

There are several policy frameworks that constitute the policies and institutional requirements on climate change in Pakistan:

- The National Climate Change Policy offers adaptation and mitigation sectoral framework.
- The National Adaptation Plan (NAP) is concerned with addressing vulnerabilities in the sectors (natural capital, agriculture, urban resilience) with the help of specific projects and early warning systems
- Early warning and response coordination of the disaster response is headed by NDMA (National Disaster Management Authority) across the federal and provincial authorities. This schismatic disables early alerts and coordination.

3.1. Data and institutional Silos

The different agencies generated climate information by different differentiated agencies like the Pakistan Meteorological Department (PMD), SUPARCO (space and remote sensing), provincial agencies and they are not usually interoperable or in real-time across the authorities. This separation destroys early notification and co-ordinated actions.

3.2. Limited AI and Data Literacy

The analysis of complex data analytics, including outputs of AI, is not part of the training of federal, provincial and local public officials. Decision regimes in the absence of human ability to contextualize or attack algorithmic insight risk falling back to ad hoc or reactive responses.

3.3. poor Interpretation of local knowledge

Local and community information on local flood history, water resources, livelihood vulnerability, is not typically formalized into climatic policy or computer-aided decision-making, which leads to technocratic solutions that fail to be related to the everyday reality.

3.4. Problems of Transparency and Accountability

The effectiveness issue is reported by the civil society and oversight bodies on the matter of transparency and financing of climate action. The efforts to enforce the governance systems emphasize the need to have a proper accountability framework in the climate finance, planning and service delivery.

3.5. implementation and Financing Gaps

Although the policy objectives are stated and the funds are promised internationally, the application of the policies back home is often lagged behind by capacity issues, lack of funds, or by the complexity of the bureaucracies.

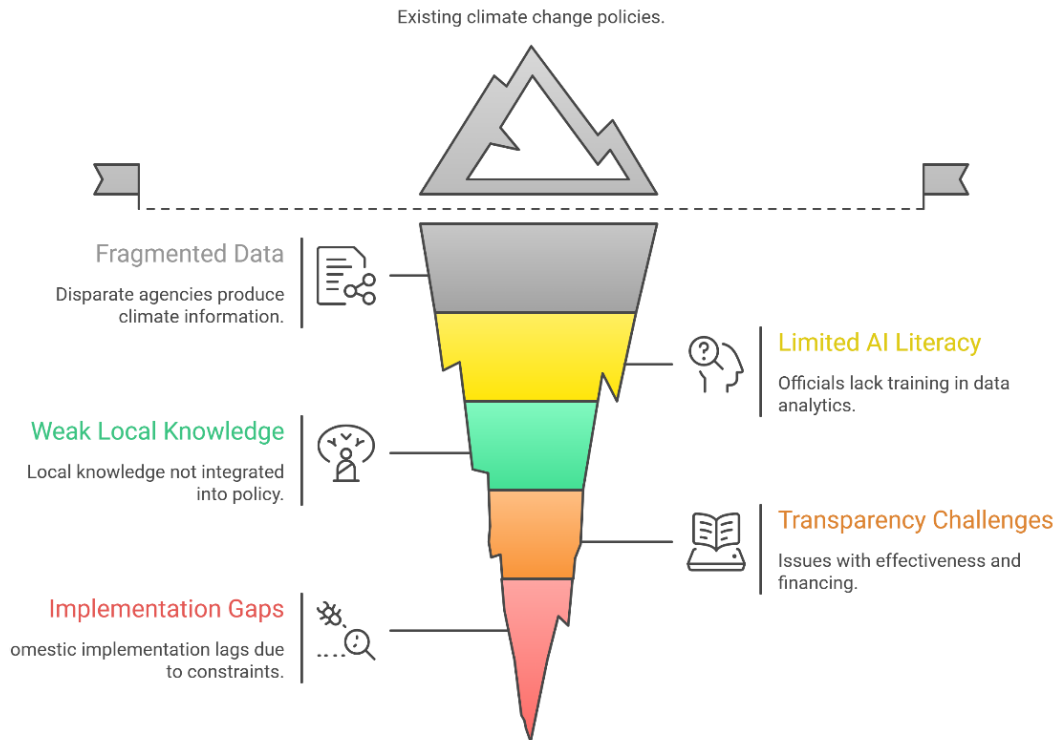


Figure 3: Climate Governance Gaps in Pakistan

4. Artificial Intelligence for Climate governance: Principles and Framework

To successfully incorporate AI in managing climate in Pakistan, one requires a humanistic framework based on the principles shared by accountable data structures:

Explainability: AI systems should deliver understandable and interpretable outputs that can be comprehended and acted by officials and communities.

Human Oversight: AI must not substitute human decisions - especially on large stake response.

Diversity: AI systems need to be designed in such a manner that local knowledge and other demographic data should be considered and that could guarantee that vulnerable groups are not marginalized.

Transparency: Algorithms, sources of data and decision rules should be open, when possible, to allow the trust of the people and civil controls.

Accountability: there should be clear institutional roles of who will take the decision informed by AI, including ethical protection.

Interoperability: data systems across agencies must be compatible and aligned with national climate priorities.

To apply these principles, it is necessary to construct the technical infrastructure as well as institutional processes that will establish AI accountability into the governance functions.

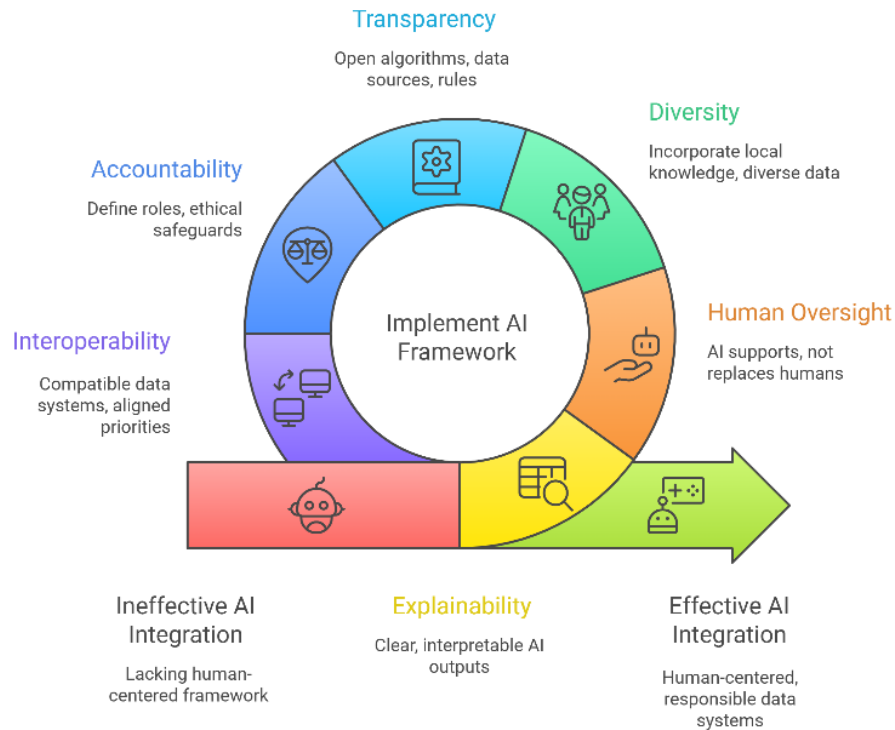


Figure 4: Integrating AI into Climate Governance

5. Strategy Policy Recommendation

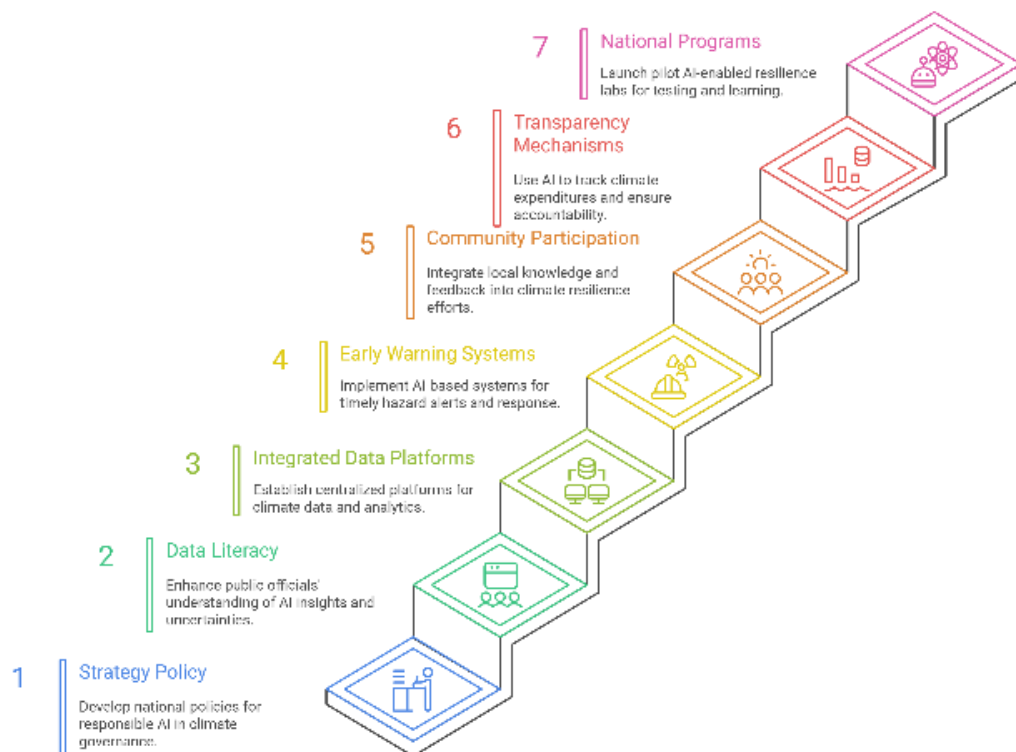


Figure 5 Achieving AI-Driven Climate Resilience

5.1. Developing national-level policies of Responsible AI in Climate Governance

Action: The Ministry of Climate Change and Environmental Coordination (MoCC&EC) ought to be in the frontline in designing a policy framework that stipulates ethical, explainable and accountable AI systems specific to climate governance.

Rationale: This framework would inform the agencies, including the NDMA, the PMD, the provincial disaster authorities and the planning commissions about how to procure AI, data governance, and model validation, documentation and human oversight mechanisms.

Key Elements:

Explainable AIM Standards in line with the public sector.

Data privacy, equity and discrimination ethical standards.

The review boards or independent auditors constitute oversight structures.

5.2. Develop institutional data literacy and AI capacity

Action: Develop specific public official, analyst, and planner government-wide training regarding the interpretation of AI insights, the nature of algorithmic uncertainties, and incorporating the outputs of artificial intelligence into routine working processes.

Rationale: Capacity building is critical to make sure that data-driven insights are translated into context-driven decisions in a meaningful way and not just offered but disregarded or misconceived.

Approach:

Collaboration with universities, research centers and other international organizations.

Boot camps, certification and continuous learning network.

5.3 Develop integrated climate data platforms with interagency coordination

Action: establish a centralized climate data and analytics platforms that unifies data streams from PMD, SUPARCO, NDMA, provincial agencies and community generated data supported by AI modules for forecasting, risk mapping and visualization

Rationale: interoperable data systems break silos and enable real time cross agency decision support, a critical factor for proactive disaster risk management

Features:

- Open data repositories
- Real-time dashboards for early warnings
- AI assisted risk analytics and scenario planning.

5.4 implementation of AI based early warning and emergency response system

Action: pilot and scale AI systems that enhances early warning lead times improve hazard forecasting accuracy, and expedite communication to first responders

Rationale: enhance predictive analytics can reduce loss of life and property by giving planners more time to prepare and respond.

Example use cases:

- AI models predicting cloudbursts and flash floods with high spatial resolution
- AI enabled evacuation route optimization during extreme events

5.5 combine local knowledge and community participation

Action: design climate resilience systems that systematically integrate community feedback, indigenous knowledge and participatory data into analytic models and governance processes

Rationale: local insights sharpen relevance and ensure that AI enabled decision reflect on ground realities of marginalized communities.

Mechanism:

- Mobile reporting tools for local hazards
- Community advisory committees
- Co design workshops with citizens and civil society partners

5.6 Transparency and Accountability Mechanisms

Action: use AI to support climate expenditure tracking, monitoring project implementation and evaluating outcomes, making climate financing more transparent and effective.

Rationale: transparency builds public trust and minimizes inefficiencies or corruption in climate related financing and project delivery.

Mechanism:

- AI powered tracking dashboards
- Public reporting portals with real time data

5.7 launching of national and regional level programs

Action: development of pilot AI enabled resilience labs to test human AI governance integration models.

Rationale: AI powered learning systems, enhanced context specific insights before national level implementation.

6. Expected Outcomes

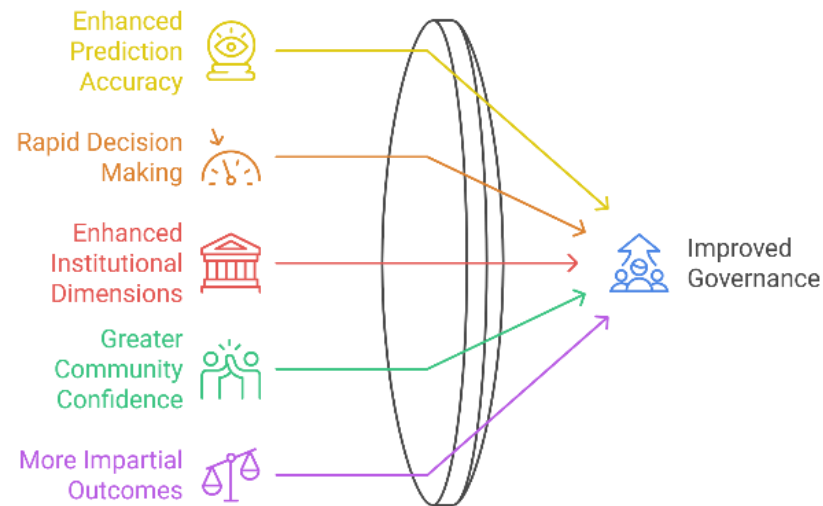


Figure 6: Pathways to effective Governance

7. Execution Roadmap Short, Medium, Long Term

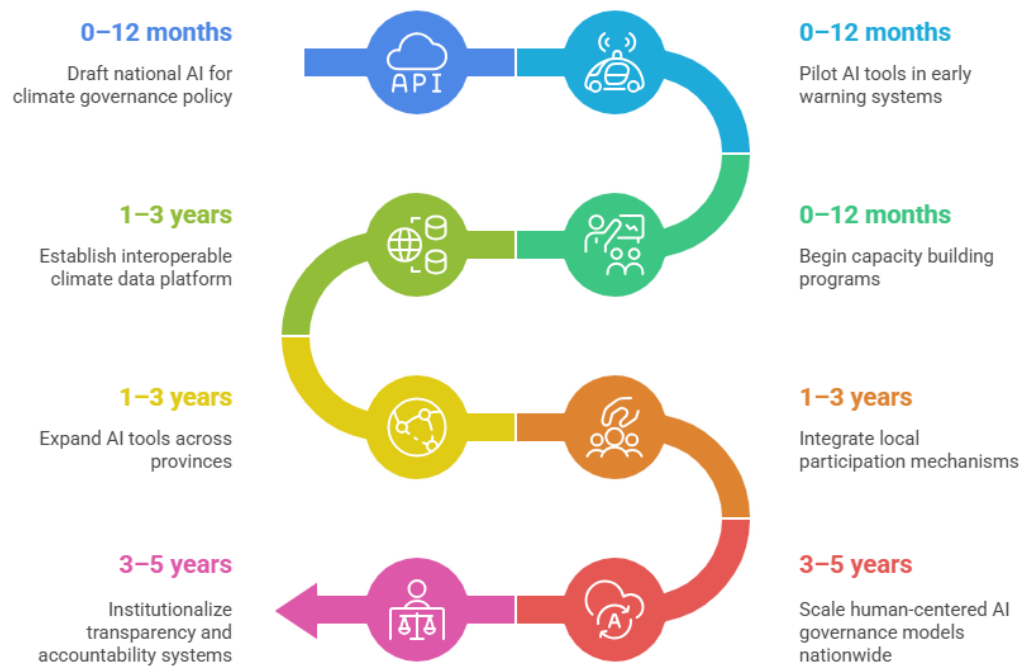


Figure 7: National AI Implementation Roadmap

8. Key Message for Policy Makers

AI can enhance climate resilience but only when human insight, ethical governance and institutional anchoring guide its design and development.

Pakistan stands at a critical junction in its climate governance journey and transformational potential of AI must be harnessed not as a standalone technological fix but as part of a human centered governance ecosystem the priorities equity transparency and institutional capacity.

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