Environmental Risk Governance: National Responses To Global Challenges

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ABSTRACT

This article explores the evolving institutional frameworks of environmental risk governance in the context of growing transnational threats such as climate change, biodiversity loss, and environmental degradation. Drawing on risk society theory, environmental governance, and multi-level institutionalism, the study presents a comparative analysis of developed and developing countries. It demonstrates that while developed states such as Germany, Japan, and Canada have embedded environmental policy into legally grounded, technologically advanced, and multi-actor governance systems, many developing countries continue to face fragmented institutions, limited autonomy, and external dependency. The article emphasizes that the effectiveness of environmental risk management is determined not solely by economic capacity, but by the political system's ability to ensure long-term policy coherence, cross-sectoral coordination, and inclusive decision-making. The paper argues that institutional flexibility, digital infrastructure, and global integration are critical to transforming environmental risks into manageable governance challenges. By synthesizing theoretical and empirical perspectives, this research contributes to the discourse on ecological security and sustainable governance in the 21st century.

Keywords: environmental risk governance, sustainable development, institutions, developing countries, climate policy, political science, multi-level governance

Environmental risk governance has become one of the central directions in contemporary political science and institutional analysis, particularly in light of escalating transnational threats such as climate change, biodiversity loss, environmental degradation, and freshwater scarcity. Environmental risks are broadly understood as potential adverse impacts of natural or anthropogenic origin that threaten human well-being, the stability of ecosystems, and the functioning of socio-economic structures [1, p. 17; 2]. What characterizes contemporary environmental risks is their systemic nature, interdependence, and transboundary scope, all of which demand the development of institutionalized mechanisms for coordinated responses across multiple levels of governance.

One of the foundational theoretical approaches to interpreting environmental risks is the "risk society" concept introduced by Ulrich Beck [3]. According to this framework, industrial societies are increasingly preoccupied with managing the very risks they

themselves produce—technological, biological, and climate-related. Unlike traditional external threats, environmental risks in the era of "reflexive modernization" are latent, unpredictable, and often irreversible. In this context, the formation of reflexive institutions capable of anticipating uncertainty and enhancing systemic resilience becomes especially significant. Moreover, Beck emphasizes the social dimension of risk distribution: inequality in access to risk protection emerges as a new form of structural injustice in contemporary societies [3, p. 45].

The conceptual development of environmental risk governance has further evolved through the expansion of the theory of environmental governance, within which the state is no longer seen as the sole actor, but rather as a coordinator of horizontal and vertical networks comprising business actors, expert communities, and civil society institutions [4; 5; 6]. Elinor Ostrom emphasized the importance of polycentric governance of natural resources, allowing for local specificity and the participatory involvement of communities in decision-making [4]. Fritz Scharpf drew attention to institutional compatibility and the need for mechanisms to reconcile interests under conditions of limited centralized control [5]. Andrew Jordan proposed viewing environmental policy as a multi-layered system of decision-making, wherein coordination—rather than hierarchy—plays the central role [6].

A significant contribution to the development of risk governance theory was made by the concept of multi-level governance (MLG), formulated by Liesbet Hooghe and Gary Marks [7]. This framework reflects the necessity of interaction among various levels of authority—from the local to the global—under conditions of fragmented jurisdictions and distributed resources. The relevance of this approach becomes particularly evident in the context of environmental risk management, where threats rarely conform to the boundaries of a single administrative entity. A prime example is climate change: while its effects—such as droughts, floods, and the exacerbation of food insecurity—manifest locally, effective mitigation and adaptation require globally coordinated policy responses.

Within the aforementioned theoretical frameworks, environmental risks can be categorized into several key types:

- Climatic risks — including long-term shifts in temperature, extreme weather events, and rising sea levels. These risks are cumulative in nature and difficult to reverse.
- Technological risks — such as industrial accidents, chemical spills, and disasters at energy facilities. These events occur abruptly and are often associated with concentrated, high-impact damage.
- Biological risks — involving the spread of zoonotic diseases, epidemics, and ecosystem degradation. The COVID-19 pandemic clearly demonstrated the importance of incorporating ecological considerations into biomedical and public health policy.
- Hydrological risks — involving both scarcity and excess of water resources, particularly within transboundary river basins. Addressing these challenges necessitates multilateral cooperation and compliance with international water governance agreements.

Contemporary models of environmental governance emphasize a departure from sectoral isolation and promote integrative, adaptive, and preventive mechanisms. In an era of growing interdependence and globalized environmental threats, institutional flexibility, interdisciplinary policy-making, and a normative commitment to environmental justice and sustainable development have become increasingly central to governance strategies [1; 8].

In this context, environmental risk governance moves beyond traditional technocratic logic and requires a profound rethinking of political, institutional, and ethical foundations. The success of national strategies will depend not only on economic capacity but also on the ability of institutions to coordinate, engage stakeholders, and maintain long-term vision. In this sense, environmental policy must

be understood as an integral component of both national and global security in the 21st century.

The policy framework for environmental risk governance in developed countries demonstrates a high degree of institutional consolidation and a strategic orientation toward long-term sustainable development goals. Unlike the majority of developing nations, where risk management is often reactive and fragmented, advanced industrial states have adopted preventive, technologically supported, and normatively institutionalized models, in which environmental security is treated not as a peripheral concern, but as an integral component of both national and regional security—and as a key pillar of strategic development.

Environmental policymaking in countries such as Germany, Japan, Canada, and the Nordic states (including Sweden, Norway, and Denmark) is underpinned by deeply integrated institutional architectures. These systems are characterized by a high level of legal clarity, a clear functional distribution of administrative competences, and durable mechanisms for inter-agency coordination. In these countries, the environmental agenda is not confined to the jurisdiction of a single ministry or administrative body; instead, it is distributed across multiple levels of government—from the national to the municipal—while also engaging the corporate sector and civil society institutions.

First, in institutional terms, these governance models are distinguished by the presence of specialized ministries and agencies endowed not only with administrative authority, but also with regulatory, coordinating, and oversight responsibilities. In Germany, for example, the Federal Environment Agency (Umweltbundesamt) plays a central role as a scientific advisory body and coordinating authority in the field of environmental legislation, monitoring, and risk assessment, thereby providing essential evidence-based support for governmental decision-making [9].

Second, environmental policy in these countries is systematically embedded within national sustainable development strategies. These strategies encompass interlinked domains such as climate policy, the transition to renewable energy, nature conservation, sustainable urban planning, and environmental education. At the level of policy instruments and official documentation, specific targets are established for reducing emissions, improving energy efficiency, restoring biodiversity, and advancing the green economy [10].

Third, a critical element of environmental risk governance in developed countries is the technological foundation underpinning policy implementation. Advanced economies make active use of digital instruments, including satellite monitoring, geographic information systems (GIS), climate forecasting platforms, pollution databases, and machine learning algorithms to assess territorial vulnerability and support strategic response planning. These technologies are fully integrated into national early warning systems and serve as the basis for real-time decision-making under conditions of uncertainty and rapid environmental change [11].

Fourth, a defining political-institutional feature of developed states is their active participation in multilateral international environmental initiatives. Countries such as those in the European Union, as well as Japan and Canada, have not only ratified major agreements—including the Paris Agreement, the Aarhus Convention, and the Convention on Biological Diversity—but have also taken a proactive stance on matters of transboundary environmental regulation, climate finance for developing countries, and the transfer of green technologies [12].

An illustrative example is Germany's long-term environmental strategy, Klimaschutzplan 2050, which sets an official national course toward achieving climate neutrality by 2045. This strategy is based on interministerial coordination, the active participation of federal states (Länder), private sector engagement, and scientific consultation. Importantly, beyond the federal level, Germany also promotes the development of regional climate action plans (*Klimaschutzkonzepte*) at the level of municipalities and Länder,

illustrating a deeply decentralized and territorially differentiated approach to climate and environmental governance [13].

In Japan, the foundational legal document remains the Basic Environment Law (1993), which outlines both national-level objectives and mandates for the development of prefectural environmental plans. A notable characteristic of Japan's model is the institutionalization of public oversight and the legal right of citizens to participate in ecologically significant decision-making—a mechanism closely aligned with the principles of environmental democracy [14].

Canada exemplifies a polycentric model of environmental governance, in which provinces and territories—such as British Columbia and Quebec—possess broad authority over environmental and climate-related policy. These subnational jurisdictions are empowered to develop climate action roadmaps, establish emission standards, and implement clean energy support programs. At the same time, a federal policy framework ensures the coordination and integration of provincial efforts into a cohesive national climate strategy, most notably articulated in the Pan-Canadian Framework on Clean Growth and Climate Change [15].

Thus, among OECD countries, environmental policy is institutionally embedded, scientifically informed, and politically legitimate, forming an essential component of modern statehood. Its effectiveness derives from a hybrid governance structure that combines vertical administrative hierarchy with horizontal coordination. This system is further reinforced by a robust resource base, regulatory transparency, and a high level of environmental awareness within society.

In contrast to the institutionally resilient models of high-income countries, most developing states face a constellation of structural and political barriers that significantly constrain the implementation of effective environmental policy. These obstacles include institutional fragmentation, legal uncertainty, weak coordination across levels of government, shortages of qualified personnel, and limited access to environmental technologies and international sources of financing [16].

Striking examples can be found across South and Southeast Asia, Latin America, and Sub-Saharan Africa—in countries such as India, Indonesia, Bangladesh, the Philippines, Brazil, and Kenya. In these contexts, environmental risks—particularly those linked to climate change, resource degradation, and rapid urbanization—are acute and compounding. Yet the institutional mechanisms for political response often remain fragmented, resource-constrained, and externally driven [16].

First, many developing countries suffer from poor coordination between sectoral ministries and administrative levels. Environmental agencies often lack the political authority and institutional status necessary to initiate or implement strategic measures. Their functions are frequently limited to monitoring and reporting, while legal frameworks tend to be declarative, lacking enforcement capacity and administrative coherence [17].

Second, environmental policy in these countries is largely shaped by the logic of external financing. International donor institutions—including the World Bank, UNDP, the Global Environment Facility (GEF), and the Green Climate Fund (GCF)—often design the architecture of climate interventions and establish strategic priorities. While such support is critical, it creates a degree of policy dependency that may undermine national ownership and long-term institutional sustainability [18].

Nevertheless, a number of developing countries have undertaken efforts toward institutional modernization and the development of strategic frameworks for climate adaptation. In India, the National Action Plan on Climate Change (NAPCC) is currently being implemented. It comprises eight core missions targeting solar energy expansion, improvements in energy efficiency, sustainable water resource management, and climate-resilient agriculture. The strategy promotes an inter-ministerial governance approach and is

explicitly oriented toward vulnerable regions and populations, particularly those most exposed to climate impacts [19].

In Indonesia, the National Disaster Management Authority (BNPB) serves as the principal coordinating body for disaster response, including climate-related hazards such as floods, forest fires, and tsunamis. The agency's strategic plans incorporate digital monitoring technologies and community education programs, aiming to enhance national preparedness and resilience through a combination of technological infrastructure and local capacity-building [20].

On the African continent, promising cases can be found in Rwanda and Kenya, where, with the support of UNEP and FAO, governments are implementing initiatives focused on climate-smart agriculture, reforestation, and combating desertification. A defining feature of these programs is their emphasis on community-based participation, which increases the legitimacy, adaptability, and local ownership of environmental policy interventions [21].

Yet a persistent and overarching barrier remains the limited access to advanced technologies and data systems. Many developing countries lack the capacity to utilize satellite-based monitoring, geospatial analysis platforms, and risk forecasting tools for climate modeling. This technological deficit reduces their ability to plan and respond strategically in real time. Moreover, strong dependence on foreign consultants, NGOs, and donor agencies hampers the development of domestic research institutions and professional expertise, thereby reinforcing institutional vulnerability and external reliance [22].

As a result, the institutional trajectory of environmental governance in developing countries remains heavily influenced by external actors, constrained by fragmented internal coordination, and often lacks sufficient political weight within national development agendas.

A comparative analysis of institutional models reveals that the effectiveness of environmental risk governance depends less on a country's level of economic development per se and more on its political system's capacity to construct a stable, multi-level, and inclusive policy architecture—one that integrates environmental objectives into broader national priorities.

Developed countries exhibit several institutional advantages in this respect:

- Political stability and predictability, enabling the formulation and implementation of long-term environmental strategies spanning 20–30 years;
- Comprehensive regulatory systems, supported by monitoring, reporting, and enforcement mechanisms;
- Inter-agency coordination, facilitating cross-sectoral alignment across energy, transportation, agriculture, and urban development;
- Technological infrastructure, including Big Data platforms, modeling systems, Internet of Things (IoT) applications, and automated data environments;
- Institutional memory, reflected in policy continuity across electoral cycles and the retention of long-term climate objectives [23].

Conversely, developing countries face a set of persistent structural weaknesses:

- Financial dependency on international donors and multilateral funding mechanisms;
- Limited institutional autonomy of environmental ministries and agencies;
- Policy fragmentation, with environmental and climate concerns poorly integrated into economic or urban planning frameworks;
- Insufficient civic engagement, whereby consultative processes are often formalized but lack meaningful participation and transparency [24].

Analysis indicates that the success of climate and environmental strategies in both developed and developing countries depends on several key factors:

1. Political will at the highest levels of leadership and within national legislatures;
2. Institutional coherence, which ensures coordination and prevents inter-agency conflicts of competence;

3. Access to scientific data and technologies, including digital tools for forecasting, modeling, and scenario planning;

4. Global integration, reflected in active participation in international environmental coalitions, treaties, and technology transfer mechanisms [25].

In this context, what becomes critically important is not only the internal configuration of institutions, but also the adaptive capacity of political systems to respond to the imperatives of environmental transformation. This includes legal and regulatory reform, the realignment of national development priorities, and the construction of an inclusive, multi-level model of environmental governance that reflects both global responsibilities and local realities.

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