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Focus on governing risk and value: how institutions shape
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E-mail: Stefanos.Xenarios@csiro.au**Keywords:** uncertainty, adaptation, systemic risk, scenario analysis, distributional equity, institutional capacity**Abstract**

Investments in climate adaptation and resilience are increasingly shaped by complex, interacting risks spanning environmental change, geopolitical instability, and technological disruption. These dynamics create deep uncertainty and contested values, challenging conventional approaches to policy, planning, and finance. This editorial introduces a Focus Issue that examines how governance arrangements influence the definition, negotiation, and translation of risks and values into investment decisions. Drawing on 14 case studies from diverse global contexts, we show that the central barrier to climate resilient investment is not a lack of data or finance, but the absence of governance systems capable of structuring uncertainty, aligning actors across scales, and managing distributional consequences. The contributions are organised around three domains: institutional transitions and polycentric governance; financing and market innovations; and place-based system transformations, alongside cross-cutting insights on power, capability, and learning. Across the cases, a consistent pattern emerges: resilience becomes investable when uncertainty is transformed into decision-relevant choices, when institutional rules enable coordination and adaptation, and when the distribution of costs and benefits is made explicit. However, progress is frequently constrained by incumbent actors and entrenched regimes of truth, rule, and wealth accumulation. We conclude by outlining an agenda for ‘investable resilience’ centred on governance reform, mission-oriented finance, and capability development. This agenda emphasises the need to move beyond project-level solutions towards systemic approaches that enable sustained, scalable, and equitable climate-resilient transitions.

1. Introduction

Global risks to the reliable functioning of social, economic, and natural systems are intensifying as pressures from climate change, geopolitical instability, technological disruption, and demographic change interact. These dynamics are mutually reinforcing and characterised by deep uncertainty (Xenarios *et al* 2024).

At the same time, decision-makers must commit to long-lived investments in infrastructure and services—including energy systems, water, cities, transport, and digital infrastructure—under conditions of ambiguity, contestation, and high stakes. Making such strategic and operational decisions is inherently difficult. Investments entail large commitments, while the distribution of risks, costs, and benefits is often contested across sectors, regions,

and social groups. These challenges are compounded by the need to account for multiple plausible futures shaped by evolving climate hazards, socioeconomic conditions, technologies, and political dynamics (Cavoli *et al* 2023).

Effective decision-making in this context depends on governance arrangements that enable learning, adaptive planning, and coordination across scales and sectors. Such arrangements must support robust, multi-objective assessment and integrate diverse forms of knowledge and values. In particular, they must allow decision makers to evaluate how investments perform under deeply uncertain futures and to balance efficiency, equity, and resilience.

However, prevailing governance systems remain ill-equipped to address systemic and uncertain risks. This is reflected in delayed decision-making, persistent underinvestment in climate adaptation, and increasing exposure to maladaptation and disaster risks. These challenges are often reinforced by incumbency dynamics, where actors with economic and political power sustain existing regimes of value, rule, and accumulation (Box *et al* 2025).

Fit-for-purpose governance is therefore central to enabling climate-resilient and sustainable transitions. Effective governance arrangements translate climate risks into actionable standards, codes, and investment criteria, while aligning decision-making across national, regional, and local scales. It helps that infrastructure lifecycles are matched with appropriate institutional and financial horizons and that system-wide impacts—including indirect losses and co-benefits—are accounted for. Moreover, such arrangements can enable coordination across disciplines, mandates, and sectors, while managing the distributional and equity implications of investment decisions. Crucially, they also help articulate shared narratives that both legitimise and guide investment pathways.

2. Focus overview

This Focus Issue, *Governing Risk and Value in Climate-Resilient Investment*, examines how governance arrangements shape the consideration of risks and values in policy, planning, and investment decisions. Drawing on 14 case studies from diverse global contexts, it explores the opportunities and constraints arising from the interaction among governance systems, risk dynamics, and societal values. Across the contributions, four interrelated domains of challenge and opportunity emerge:

The following sections synthesise the key insights from the case studies within these themes of challenges and opportunities as presented in table 1. The first theme encompasses research in water governance, urban resilience, and energy transitions that utilise evolutionary models, institutional diagnostics, and participatory frameworks to demonstrate

Table 1. Challenges and opportunities for investments in climate-resilient transitions.

Challenge	Opportunity
Institutional fragmentation and transition needs	Polycentric and adaptive governance
Capital gaps and financial constraints	Financing innovation and market design
System lock-in and path dependency	Place-based transformation and adaptation pathways
Power complexities, uncertainty, and capability constraints	Cross-cutting insights of governance and economic initiatives

how fragmented, centralised systems are unable to coordinate across different scales. The second theme brings together studies that use scenario analysis, economic modelling, and policy design to show that systemic risks are often undervalued. It also highlights financing innovations such as PPPs, blended finance, circular-economy models, and utility-reform packages that align incentives, create new value streams, and enhance bankability amid uncertainty. The third theme concerns studies that employ system dynamics, catchment-scale planning, and post-disaster transformation frameworks to illustrate how development trajectories can be reshaped through integrated, place-based interventions. Across all themes, particularly in studies that incorporate scenario tools, coalition-building, and iterative learning, it is observed that the effectiveness of any method depends on how uncertainty is integrated into decision-making processes, the influence of power and representation on outcomes, and the development of institutional and organisational capabilities to sustain change.

3. Challenges and opportunities for climate-resilient transitions

3.1. Institutional transitions and polycentric governance (theme 1)

A central challenge across contexts is the fragmentation and misalignment of governance systems. Addressing systemic risks requires institutional arrangements that enable coordination, participation, and adaptation across scales. In Central Asia, an evolutionary game-theory analysis of water governance illustrates how shifts from communal norms to formalised property rights can improve efficiency and equity under climate stress (Amirova *et al* 2025). However, these transitions are constrained by institutional inertia and contested legitimacy, underscoring the need for credible, enforceable governance reforms.

In Kazakhstan's energy sector, early adoption of market instruments—such as emissions trading and renewable energy targets—has helped mobilise

private investment. Yet fossil-fuel subsidies, regulatory instability, and centralised governance continue to impede progress (Neafie *et al* 2025). Stable policy frameworks, phased subsidy reform, and managed decentralisation are identified as critical to aligning national ambition with local feasibility. This case is particularly instructive for resource-dependent economies where hydrocarbon revenues have historically suppressed energy diversification. The governance challenge is not only technical but involves managing the consequences of transition for regions and communities whose economic base is tied to extractive industries.

Other contributions emphasise the importance of participatory governance. For example, extensions to the hydro-social cycle incorporate dimensions of representation, recognition, and collaboration, offering more inclusive and effective governance frameworks (Ricart *et al* 2025). Similarly, urban resilience assessments reveal that fragmented governance and underfunded infrastructure constrain adaptive capacity, pointing to the need for decentralisation and improved financing (Sabyrbekov *et al* 2025).

Comparative analyses of hydrocarbon-dependent regions further demonstrate how institutional configurations—such as federal versus centralised systems—shape the capacity for just transitions (Xenarios *et al* 2026). Polycentric governance emerges as a key enabler of coordination, flexibility, and context-specific adaptation.

3.2. Financing mechanisms and investment systems (theme 2)

A second domain concerns the mobilisation and allocation of capital for resilience, particularly where public resources are insufficient. Several studies highlight the importance of aligning financial mechanisms with systemic risk. For example, analysis of indirect and economy-wide disaster losses shows that supply chain disruptions can exceed direct damages (Xue *et al* 2025). This finding strengthens the case for diversified financial instruments—including public-private partnerships (PPPs) and insurance—and for decision support tools that capture systemic risk.

In the water sector, redefining utility performance around ‘secure water for all’ enables the integration of demand management, supply diversification, and financial resilience measures (Whittington *et al* 2025). This reframing improves both service delivery and investment bankability under conditions of compound shocks.

Circular economy approaches also offer new investment opportunities. In India, projections of electric vehicle battery waste suggest that recycling could supply a significant share of critical minerals, creating investable value streams (Bhattacharya *et al* 2025). However, realising this potential depends

on governance mechanisms such as mandates, standards, and alignment with industrial policy. As global demand for critical raw materials intensifies amid clean energy transitions, resource-rich developing countries face a difficult task: moving beyond primary extraction towards value-added processing and circular resource management. This requires not only industrial policy but institutional frameworks capable of mediating between host-country development objectives, investor interests, and environmental obligations.

Public-private partnerships emerge as critical enablers of transformational adaptation, as illustrated by a national seafood initiative in Aotearoa, New Zealand. At the same time, the effectiveness of PPPs depends on adequate public sector capacity and sustained engagement (Butler *et al* 2026).

Mission-oriented innovation programmes, such as enabling resilience investment (ERI), demonstrate how programmatic approaches that combine scenario analysis, coalition building, and governance innovation can translate resilience concepts into investable pipelines (Wise *et al* 2026).

3.3. Place-based transformation and adaptation pathways (theme 3)

The third domain focuses on the need to move beyond business-as-usual trajectories through place-based, systemic interventions. Post-disaster contexts are identified as critical windows for transformation (Davidson *et al* 2025). Research emphasises the importance of preparedness through pre-established governance frameworks, shared visions, and adaptive capacities—to enable societies to ‘bounce forward’ rather than merely recover.

Catchment scale governance provides another example of system redesign. Integrating geoscientific baselines with regulatory reforms can reduce environmental degradation and improve social outcomes, particularly where informal or small-scale activities are formalised and supported (Domingo *et al* 2025).

Water reuse initiatives illustrate how governance—particularly standards, risk management, and public trust—determines the success of technological solutions. Experiences from multiple regions show that robust governance frameworks can enable scaling beyond traditionally water-scarce contexts (Tortajada *et al* 2025).

Similarly, system dynamics modelling of river basins demonstrates that integrated portfolios of interventions—such as land use change, sediment management, and floodplain redesign—can deliver more sustainable outcomes than conventional control approaches (Varma *et al* 2025).

3.4. Cross-cutting insights

Across the case studies, a consistent pattern emerges: progress in climate-resilient investment is achieved

not by ignoring uncertainty but by structuring it in ways that enable decision-making. Approaches such as scenario analysis, adaptation pathways, and system modelling translate deep uncertainty into bounded, actionable choices, allowing investments to proceed despite divergent futures. In this sense, the core constraint is not a lack of data, but the absence of institutional mechanisms capable of acting decisively under uncertainty.

At the heart of this challenge are institutions—understood as the rules, norms, and decision frameworks that shape behaviour and expectations. While the empirical cases are highly context-specific, their broader relevance lies in illustrating pathways for institutional change rather than in replicating discrete projects. Scaling resilience, therefore, depends less on copying interventions and more on embedding new performance metrics, governance arrangements, and investment rules that create enabling environments for locally appropriate solutions.

A related cross-cutting insight concerns the centrality of distributional clarity. The success of both governance reforms and investment strategies depends critically on how costs, benefits, and risks are allocated across actors, sectors, and social groups. Where these distributions are transparent and perceived as fair, legitimacy increases, political resistance declines, and financial viability improves. Equity, in this sense, is not an external constraint but a core determinant of system performance and investability.

Transformation itself is another cross-cutting insight, unfolding through dynamic pathways that combine incremental and disruptive change. Early interventions often focus on building legitimacy, trust, and institutional capacity, creating the conditions for more ambitious and systemic shifts over time. This sequencing underscores the need for governance systems that support iterative learning, adaptive planning, and the ability to escalate interventions as opportunities arise.

However, these processes are inherently political. Transitions are shaped—and frequently constrained—by incumbent actors who benefit from existing regimes of value, rule, and resource allocation. These actors can reinforce path dependencies and resist change, limiting the scope for transformative action. Overcoming such barriers requires deliberate strategies, including coalition-building, institutional reform, and, in some cases, the active displacement of entrenched interests.

Finally, the effectiveness of governance systems ultimately depends on capability and agency. Institutional reforms alone are insufficient without individuals and organisations equipped to design, implement, and sustain change. Technical expertise, leadership, and the capacity to coordinate across domains and scales are essential complements to formal governance structures, enabling resilience to move from concept to practice.

4. Outlook: an agenda for investable resilience

The findings point to a need for systemic approaches that link governance reform with investment practice. The centrepiece is to make resilience investable by aligning how risks are understood, how decisions are made, and how value is created and distributed.

A first priority is strengthening decision-making under uncertainty. This involves developing and institutionalising standards, tools, and appraisal frameworks that incorporate scenarios, adaptation pathways, and system-wide effects—including indirect losses and co-benefits—into investment processes. By embedding these practices, uncertainty becomes manageable rather than paralysing, enabling more robust and forward-looking decisions.

Equally important is the evolution of finance and policy frameworks. Expanding blended finance mechanisms and public–private partnerships can help mobilise capital at scale, but these must be coupled with policy reforms that align tariffs, subsidies, and incentives with long-term social and environmental objectives. At the same time, emerging opportunities—such as circular economy models and secondary resource markets—require supportive governance to translate potential value into viable investment streams.

These efforts depend fundamentally on governance systems that are both adaptive and coordinated. Polycentric arrangements that balance decentralised decision-making with clear accountability can respond more effectively to complex, context-specific risks. Strengthening institutional capacity—across public, private, and civic actors—is critical to enable adaptive planning, effective implementation, and sustained learning over time.

Scaling such approaches requires moving beyond isolated successes to programmatic, mission-oriented strategies. Initiatives that integrate scenario analysis, coalition-building, and iterative learning can generate pipelines of investable opportunities while embedding resilience metrics into planning and investment systems. In this way, scaling is achieved not through replication alone but through the codification and diffusion of governance innovations.

Ultimately, the evidence presented in this Focus Issue reinforces a central proposition: the primary barrier to climate-resilient investment is not technical or financial, but institutional. Governance systems determine how risks and values are framed, how trade-offs are negotiated, and how decisions are executed. When these systems enable coordination, transparency, and adaptive learning, they can transform resilience from an abstract imperative into a practical and investable reality.

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