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Climate Action &
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Association

Insight: Critical Uncertainties and Transformational Adaptation: A Futuring Approach

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Abstract

This paper explores the role of futuring as a methodological framework for transformational adaptation in the face of profound uncertainty (adaptation in the broader, systemic sense). Rather than treating uncertainty as a limitation, futuring embraces it as a resource for creativity, inclusiveness, and systemic analysis. Through scenario development, participants construct multiple, divergent futures by crossing critical uncertainties, thereby enabling the design of interventions that remain resilient across diverse trajectories. The paper outlines the iterative process of futuring—from horizon scanning and clustering trends to constructing narratives—and demonstrates its application to climate change, where traditional forecasting often fails to capture complexity. By examining scenarios of cooperation versus fragmentation and innovation versus stagnation, the study highlights opportunities and threats that inform robust, equitable, and adaptive strategies. The group work diary illustrates the collaborative and pedagogical dimensions of futuring, showing how diverse perspectives enrich scenario development and cultivate the capacity to think critically about uncertainty. Ultimately, the paper argues that futuring transforms adaptation from reactive mitigation into proactive worldmaking, equipping societies to act purposefully in shaping multiple possible futures.

A. Contextualization and Overview of the Transformational Adaptation Futuring Approach

The practice of futuring has emerged as a vital tool for navigating the complexity and uncertainty of contemporary social and ecological systems. Rather than assuming that the future is a singular, predictable trajectory, futuring acknowledges that multiple, constructed worlds are possible, each shaped by diverse perspectives and values

(Goodman, 1978). This pluralistic orientation is particularly important for transformational adaptation, which requires not only reactive responses to crises but proactive, imaginative interventions that can seed desired futures in the present (Van Notten, 2005). Futuring thus becomes a means of designing flexible strategies that remain resilient across a range of hypothetical conditions, while simultaneously fostering inclusiveness and creativity in the exploration of what lies ahead (Vervoort et al., 2015).

The theoretical foundation of futuring rests on the recognition that uncertainty is not a limitation but a resource. By embracing uncertainty, scenario development allows participants to challenge assumptions, explore discontinuities, and imagine futures that depart radically from the consensual present (Vervoort et al., 2015). This approach is particularly relevant for complex systems, where interdependencies between social, economic, and biophysical factors make linear forecasting inadequate. Collaborative futuring processes encourage dialogue across disciplines and perspectives, ensuring that interventions are not narrowly reactive but instead account for overlapping drivers of change (Searce & Fulton, 2004; Kosow & Gaßner, 2008). In this way, futuring provides a framework for transformational adaptation that is both imaginative and grounded in systemic analysis.

Different approaches to scenario development highlight the diversity of futuring practices. **Exploratory scenarios** seek to map possible trajectories based on current trends and uncertainties, while **normative scenarios** articulate desired futures and pathways to achieve them (Van Notten et al., 2003; van Vliet & Kok, 2013). Each approach can be further *differentiated by its design* - whether intuitive or analytical, participatory or model-based—and by the complexity of its content. The typology of scenario characteristics proposed by Van Notten et al. (2003) underscores the flexibility of futuring as a methodology, allowing practitioners to adapt processes to specific contexts and objectives. *Ultimately, the value of futuring lies not in predicting outcomes but in cultivating the capacity to imagine, evaluate, and act upon multiple possible futures.*

B. The Process of Creating Futures

The process of creating futures is inherently iterative and collaborative, involving the gradual movement from past experiences to imagined possibilities. In practice, this begins with mapping the known and presumed elements of the present, often structured through frameworks such as **PESTLE (Political, Economic, Social, Technological, Legal, Environmental)**. By clustering ideas into thematic categories, participants can identify emerging trends and critical uncertainties that shape the trajectory of systems. This orientation toward both continuity and disruption ensures that scenario development does not simply extrapolate from the present but actively interrogates its limitations (Vervoort et al., 2015).

The methodology typically unfolds through a series of steps: orienting participants by defining the timeframe and guiding questions, exploring the past and present through horizon scanning, synthesizing critical trends and uncertainties, and finally constructing scenarios through a two-axis schema. Each axis represents a major uncertainty, and their intersection generates four contrasting futures. These quadrants are not predictions but heuristic devices, enabling participants to imagine how different combinations of drivers might unfold. By assigning nicknames and developing short narratives, the scenarios become communicable tools that capture complexity and stimulate dialogue (Searce & Fulton, 2004). Importantly, the narratives are not ends in themselves but vehicles for reflection, policy formulation, and intervention design.

In reframing the group's work, the scenarios can be understood as exercises in futuring rather than fixed depictions of 2050. For example, when technological dependency is contrasted with social cohesion, four distinct futures emerge: one where technology sustains society but erodes ecological systems, another where monopolies of

technology exacerbate inequality, a third where eco-centric values foster balance, and a fourth where ruptures destabilize social structures. Each scenario illustrates how the crossing of uncertainties generates divergent pathways, highlighting both opportunities and threats. The process of naming and narrating these futures demonstrates how imagination can be harnessed to make abstract uncertainties tangible, thereby enabling purposeful action in the present.

Table 1: Main Steps for Scenario Development

Process	Objective
Orient	<i>Give and gain</i>
Step 1: Define a timeframe and guiding question — e.g. <i>What will a sustainable morning look like in 2050?</i>	Summarize the skills and expertise each participant brings to the project and clarify what each hope to gain.
Explore	<i>Map the past and present</i>
Step 1: Map the past and present using PESTLE categories. Step 2: Research unknown or assumed points — can we find evidence to move them into the “known” column?	Consider and discuss the interconnected factors that have shaped today’s way of life.
Explore	<i>Horizon scanning (Emerging Trends)</i>
Step 1: Identify emerging trends, using PESTLE headings as prompts.	Recognize driving forces and trends that are currently unfolding or just beginning to emerge.
Synthesize	<i>Critical trends, uncertainties, and extremes</i>
Step 1: Rank factors by importance, from most critical to generally important.	Highlight the most significant and uncertain trends to serve as the foundation for scenario development.
Synthesize	<i>Naming the future (Scenario Grid)</i>
Step 1: Select the two most critical and uncertain trends. Define their extreme ends and label the axes. Step 2: Each quadrant becomes a scenario. Assign nicknames and add details.	Provide titles and concise descriptions for each scenario. Reflect on how the intersection of the two main factors, along with past, present, and emerging trends, shapes each future world.
Act	<i>Representations of the future</i>
Step 1: Develop interventions and assess how they apply across scenarios.	Ensure that solutions and infrastructure designed today are resilient, adaptable, and valuable across multiple possible futures.

C. Application of the Futuring Process: Climate Change

The application of futuring to climate change illustrates the potential of this approach to support transformational adaptation in the face of profound uncertainty. Climate change is not a single, linear phenomenon but a complex interplay of biophysical processes, socio-economic dynamics, and political decisions. Its drivers include greenhouse gas emissions, land-use change, and energy consumption patterns, while its impacts range from sea-level rise and biodiversity loss to food insecurity and forced migration. Because of this complexity, traditional forecasting methods often fall short, as they cannot adequately capture the multiplicity of plausible pathways. Futuring, by contrast,

embraces uncertainty and pluralism, allowing participants to construct scenarios that illuminate how different responses to climate change might unfold and what interventions could steer societies toward more desirable futures (Vervoort et al., 2015).

In practice, scenario development for climate change begins with the identification of critical uncertainties. For example, one axis might represent the degree of global cooperation versus fragmentation in climate governance, while another might capture the pace of technological innovation in renewable energy. Crossing these axes generates *four distinct scenarios: a world of strong cooperation and rapid innovation, a fragmented world with slow technological progress, a cooperative but technologically stagnant world, and a fragmented world where innovation occurs unevenly*. Each scenario provides a lens through which to explore how climate change mitigation and adaptation might evolve under different conditions. The narratives developed for these scenarios are not predictions but imaginative constructs that make abstract uncertainties tangible, enabling policymakers and communities to reflect on the consequences of their choices.

The opportunities and threats within each scenario highlight the importance of comprehensive interventions. In a cooperative and innovative world, opportunities include the rapid deployment of renewable energy, large-scale ecosystem restoration, and equitable climate finance mechanisms. Threats, however, might involve overreliance on technological solutions without sufficient attention to social justice. In a fragmented and stagnant world, opportunities may be limited to local resilience initiatives, while threats include escalating climate impacts, resource conflicts, and widening inequality. By systematically identifying these dynamics, futuring enables the design of interventions that are resilient across multiple scenarios. For instance, investing in decentralized renewable energy systems, strengthening community-based adaptation, and promoting inclusive governance are actions that remain valuable regardless of the broader trajectory.

The futuring process also underscores the need to move beyond isolated mitigation measures toward systemic interventions. Climate change is not only an environmental issue but a socio-political one, shaped by consumption patterns, economic structures, and cultural values. Effective interventions must therefore address overlapping drivers such as inequality, poverty, and polarization, which reinforce vulnerability to climate impacts. Contingency planning across scenarios ensures that interventions are adaptable, capable of guiding societies toward desirable futures even under uncertainty (Maack, 2001). For example, policies that integrate climate adaptation with social equity—such as ensuring access to clean energy for marginalized communities—can catalyze transformative change while remaining robust across different futures.

Ultimately, the application of futuring to climate change demonstrates its value as a tool for transformational adaptation. By constructing scenarios that explore divergent pathways, participants can identify interventions that not only mitigate risks but also create opportunities for more equitable and sustainable systems. The process does not aim to predict the future but to illuminate the range of possibilities and to empower societies to act purposefully in shaping them. In this way, futuring transforms climate change from a deterministic threat into a field of imaginative possibility, where multiple futures can be envisioned and constructed through collective action.

D. Conclusion

The transformational adaptation futuring approach represents a significant departure from traditional methods of dealing with uncertainty. Rather than seeking consensus or linear predictions, futuring embraces plurality, imagination, and inclusiveness. By constructing scenarios that cross critical uncertainties, participants can explore divergent futures and design interventions that remain resilient across them. This process acknowledges that the

future is mutable and heterogeneous, shaped by overlapping drivers that reinforce one another. In this way, futuring equips societies to navigate complexity and to act purposefully in the present.

The elaboration of contingency plans for each scenario underscores the importance of comprehensive interventions. By identifying opportunities and threats across different futures, participants can design strategies that catalyze transformative change while remaining adaptable. This differs from isolated mitigation actions, which often fail to account for systemic interdependencies. As the Intergovernmental Panel on Climate Change (IPCC) has emphasized, effective adaptation requires consideration of multiple development pathways, each shaped by economic, social, and environmental factors. Futuring provides a framework for such analysis, legitimizing policy processes and ensuring inclusiveness.

At a macro-regional level, scenario development could provide valuable guidance for policy formulation, particularly in contexts where institutional capacities are limited. Joint efforts among countries with similar socio-economic and environmental dynamics could enhance the legitimacy and effectiveness of interventions. While futuring is time-consuming and resource-intensive, its value lies in its ability to embrace uncertainty, foster creativity, and cultivate resilience. Ultimately, the practice of futuring is not about predicting the future but about constructing it—imagining multiple worlds and acting purposefully to shape them.

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