

Working paper

Transforming resilience-building today for sustainable futures tomorrow

Insights from the forthcoming book “Transformation and Disaster Resilience” (Springer)

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Abstract

Addressing increasingly profound vulnerabilities and risks requires a step change away from piecemeal fixes often focused around preparedness and post-disaster recovery towards transformational interventions and measures that focus on creating systemic shifts that challenge underlying vulnerabilities and governance gaps from the design phase itself.

IIASA and ISET in the project “Transformation and Resilience” conducted with the Zurich Flood Resilience Alliance and other initiatives respond to the evident need to reform climate and disaster risk management towards transformational approaches. In this working paper, we reviewed efforts to respond to this evident need, drawing on key findings from the forthcoming book “Transformation and Disaster Resilience” (Springer, forthcoming) to provide a practical stock-take of what transformational risk management (adaptation) is, deep dive into examples of transformational interventions and uncover barriers and enablers for getting transformational resilience-building underway in diverse contexts.

We found that while there are diverse entry points for transformational resilience-building, they share a combination of (some of) the following interlinked pathways: i) Operationalizing innovative approaches and solutions; ii) Delivering integrated intervention packages; iii) Establishing participatory governance models; and iv) Scaling successful pilots, along with a strong commitment to delivering on achieving transformation by setting it as their goal from the start, consequently designing their resilience-building measures and interventions with transformation as their guiding star.

We also found that whether interventions and measures designed for transformational change will deliver on their objective strongly hinges on creating appropriate enabling environments, which include i) learning and knowledge platforms and experiential niche learning and continuous feedback loops; ii) aligning transformational change objectives with strategic government priorities to harness and foster political will and momentum; as well as iii) unlocking the transformational potential of bottom-up governance grounded in local contexts; together with iv) establishing the necessary framework conditions for phased, long-term programs; and v) committing sufficient financial outlays to initiatives designed with transformational change in mind.

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1 Transformational resilience-building: Why do we need it?

In the context of strong evidence on mounting disaster and climate-related risks and early evidence of adaptation limits, conventional approaches will soon no longer suffice to manage disaster and climate-related risk as well as deliver on the Paris ambitions (Colloff et al., 2017; Kates et al., 2012; Klein et al., 2017; Mechler et al., 2020). Addressing increasingly profound vulnerabilities and risks requires a step change away from piecemeal fixes often focused around preparedness and post-disaster recovery towards transformational disaster risk management and climate change adaptation that challenges underlying vulnerabilities in a systemic and development-centered manner (Ajibade & Egge, 2019; Bosomworth, 2018; Deubelli & Mechler, 2021; Keating et al., 2017; Pal et al., 2019; Pelling et al., 2015; E. Roberts & Pelling, 2019). Yet, we find that a clear ‘operationalization gap’ in terms of delivering on transformative change ambitions, including in ways that can be replicated and scaled (Deubelli & Mechler, 2021). Although some promising avenues exist, such as examples focusing on transformational adaptation in agriculture (Panda, 2018; Vermeulen et al., 2018), empirical studies continue to remain limited and practical evidence and guidance regarding transformational approaches is largely missing. As a result, practitioners and decision-makers are increasingly looking for practical insights on translating transformative change ambitions into transformational processes and, ultimately, outcomes.

IIASA and ISET through their project on “Transformation and Resilience” conducted with the Zurich Flood Resilience Alliance and other initiatives respond to the evident need to reform climate and disaster risk management towards transformational approaches. In this working paper, we review salient efforts to respond to this need, summarizing key findings from the forthcoming, multi-authored book “Transformation and Disaster Resilience” (Springer). We provide a broad stock-take and practical overview of what transformational risk management (adaptation) is, how it has been applied, and showcasing barriers, enablers, and policy implications for supporting transformation. With these insights at hand, practitioners, and decision-makers from across the climate resilience realm will be able to better ensure the sustainability of resilience efforts by fundamentally reducing vulnerabilities and building more inclusive decision-making processes.

2 Transformational resilience-building: What is it?

Transformational resilience-building offers pathways for responding to the evident need to reform how we address mounting climate and disaster risk in a more sustainable and effective manner. Nevertheless, the terms 'transformational' and 'transformation' often remain ambiguous within the global discourse on climate change and disasters, with multiple interpretations circulating (Deubelli & Mechler, 2021; E. Roberts & Pelling, 2019). At its core, transformation is about change.

Often juxtaposed with incremental change (see Figure 1), transformational change entails profound changes of the system, challenging its status quo (Armitage, Charles, and Berkes 2017; Park et al. 2012). Incremental adaptation, on the other hand, entails more moderate changes that do not challenge the system itself. Examples would be ex-post spending for short-term response and recovery needs or piecemeal grey infrastructure solutions such as sea walls and embankments with hard design limits. Such incremental approaches are often not a part of comprehensive risk management strategy that addresses the multitude of risks that people and places are prone to alongside the social, economic, political, and physical factors that perpetuate and exacerbate vulnerability (Dowd et al., 2014; Rickards & Howden, 2012).

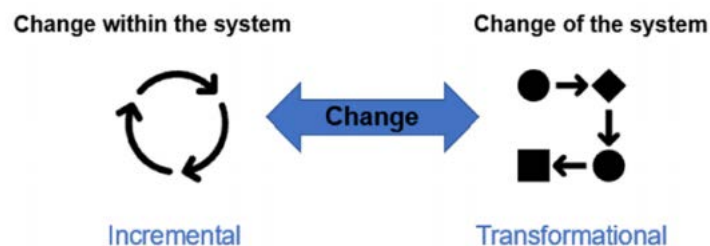


Figure 1 Incremental-transformational change dichotomy (Deubelli & Mechler, 2021)

Thus, when it comes to its application in the context of the resilience-building, transformation is not congruent with change alone but rather describes **a shift towards systemic, long-term oriented and development-centered action** that follows a multiple dividend logic and thus away from single-issue focused measures and interventions, often centered around ex post short-term fixes after disasters strike (Deubelli & Mechler, 2021; Keating et al., 2017; Rickards & Howden, 2012).

Inherently, transformational resilience-building **entails qualitative shifts towards a more resilient state** - a state where disaster and climate-related risks will no longer have any substantial negative impact on people's and business' ability to thrive (ZFRA, 2021). Thus, our premise is that the ambition to transform our systems and way of life needs to be an integral part of the resilience spectrum, which includes actions across all phases of the disaster risk management and climate change adaptation cycles (Mechler et al., 2018). We do however recognize that engaging in transformational resilience-building efforts carries a risk of going the other way, too, potentially triggering potentially non-desirable outcomes or even maladaptation (Blythe et al., 2018; Marshall et al., 2012; Tröger, 2016) and caution to brace for the inherent uncertainties of change (Manuel-Navarrete & Pelling, 2015). Ultimately, operationalizing transformation is a learning process, that requires constant critical reflection and adjustment to support desirable and equitable outcomes.

Transformational change in the context of resilience-building can thus be attained when measures and interventions move from a linear understanding of risk to one that **embraces the complex, multifaceted and dynamic nature of disaster and climate-related risk** (Deubelli & Mechler, 2021; Feola, 2015; Hochrainer-Stigler, 2020). This means that transformational resilience-building measures take the bigger picture into account by **shifting the focus of interventions to the structural, socio-economic root causes** of vulnerabilities and risks (Bosomworth, 2018; Pelling, 2014; Pelling & Manuel-Navarrete, 2011).

Transformational resilience-building thus **deliberately** (Fedele et al., 2019) **addresses** the underlying social, cultural and economic **root causes of risks** (Bosomworth, 2018; Pelling, 2011) in a **development-centered** (Keating et al., 2017), **systemic** (Pelling et al., 2015) and **inclusive** (Ajibade & Egge, 2019) manner (Figure 2) with a view to **enabling scaling** (Pal et al., 2019) – before disaster strikes, led by a long-term and anticipatory vision (Campos et al., 2016; Thomalla et al., 2018). Delivering on such ambitious objectives into practical action benefits from translating them into tangible action areas, as was done with the ACT and BRACED frameworks and the transformational process framework. These frameworks divide transformation to resilience into the capacities needed to operationalize resilience along transformation pathways.

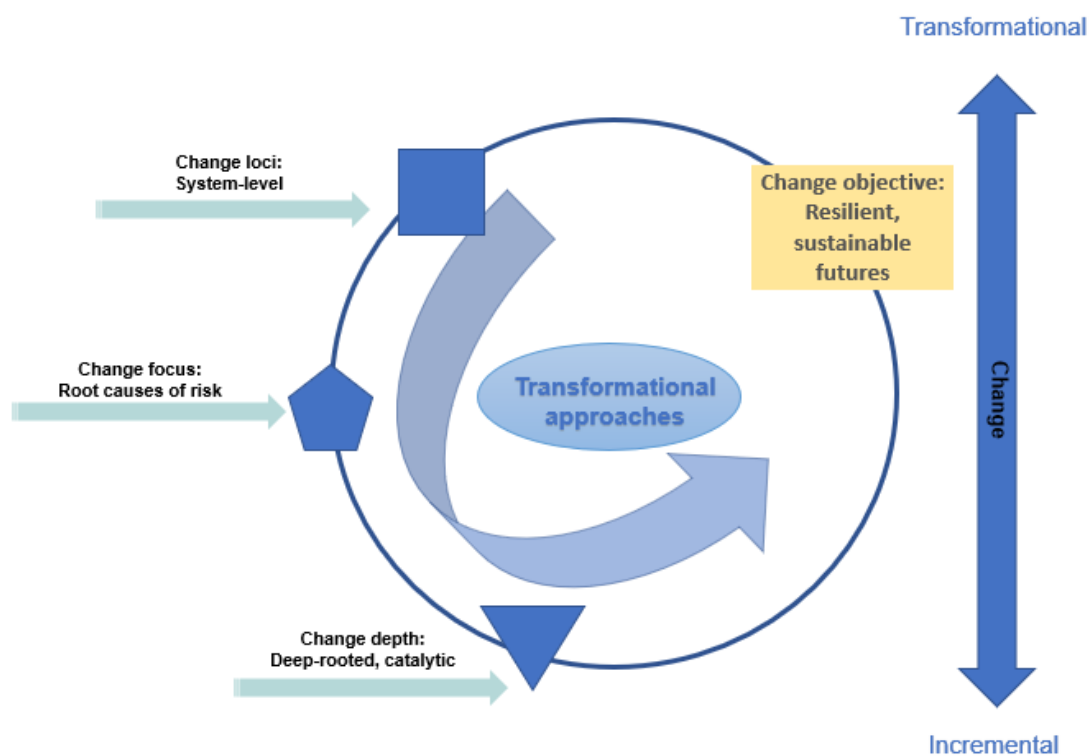


Figure 2 Transformation in the context of resilience-building: Delivering deep-rooted, systematic change towards sustainable futures (adapted from Deubelli & Mechler, 2021)

Box 1 The Transformational Process Framework (TPF)

The Transformational Process Framework (TPF) (Schamberger et al. forthcoming) distinguishes six capacities – participation, learning, networks/collaboration, empowerment, leadership, and vision/communication, which all display one facet of a transformational change process relevant for climate risk management. To add nuance, each is divided into three levels – static, incremental, and transformational. The key difference between static, incremental or transformational change is the extent of change inherent to each process. By incorporating different levels of change, transformation is displayed as a potentially reversible and stepwise process.



Figure 3 Transformational Process Framework (TPF) (Schamberger et al. forthcoming)

Box 2 The BRACED & ACT frameworks for transformation

The Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED) program and the Action on Climate Today (ACT) program funded by the UK government, define transformation as the “the likelihood of human systems to fundamentally and sustainably improve the resilience of vulnerable citizens to the impacts of climate extremes and change” (Bahadur et al., 2015; Pal et al., 2019; Tanner et al., 2017). In this framework, resilience is broken down into the capacity to anticipate, absorb and adapt to climate extremes and disasters – “the 3As”. Transformation refers to the “holistic and fundamental ways in which people’s capacity to adapt to, anticipate and absorb shocks can be built, reshaped and enhanced” (Bahadur & Tanner, 2015), and can be operationalized via the following pathways: taking a systemic approach, catalysing broader change, operating at scale, and implementing initiatives that are inclusive of marginalized populations and sustainable. Benefitting from several enabling environments, the transformation can take place through several domains, including policies and governance and social and behavioral change (see Figure 3). Across the BRACED and ACT programs, these themes are coupled with a strong emphasis on strengthening empowerment of marginalized groups in decision-making processes to shift power dynamics.

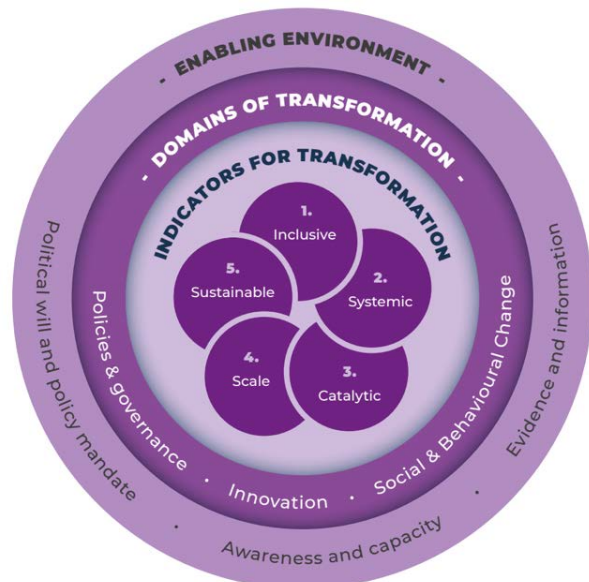


Figure 4 Transformation pathways to resilience (Pal et al., 2019)

3 Transformational resilience-building: Examples from across the globe

Researchers and practitioners from across the resilience and development realm work in diverse contexts and face a variety of challenges; consequently, the measures and interventions they take to deliver deep-rooted transformations towards resilient futures are often tailored to the respective operational settings, needs and objectives.

Methodological approach

This working paper draws on a first stocktake of evidence on the practice at the frontlines of transformational disasters and climate risk management, as presented in the forthcoming book “Transformation and Disaster Resilience” (Springer). For this, we reviewed concrete examples of the range of transformational options that have been implemented across diverse geographies against the set of aspects of transformational change in the context of resilience-building that were introduced in the previous section.

Overview

Table 1 provides an overview of measures and interventions by the Zurich Flood Resilience Alliance and other partners and initiatives that, in one way or another, deliver on transformational change objectives. The measures and interventions highlighted here represent a diverse risk portfolio within a range of socio-economic contexts and enabling environments (Figure 5).

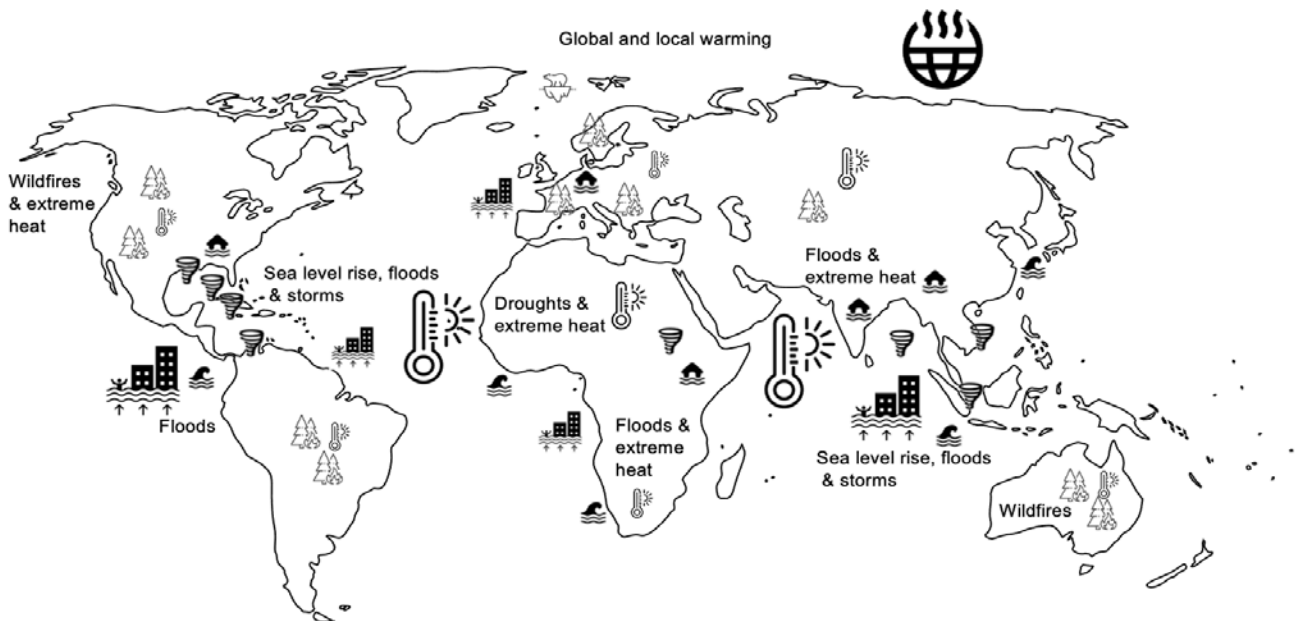


Figure 5 Evidence cases across the globe as featured in the forthcoming book “Transformation and Disaster Resilience” (Springer, forthcoming)

While these examples show diverse pathways towards transformation, collectively, they provide useful insights as to what is required to move to transformational resilience. Moving away from incremental, piecemeal approaches to transformational disaster risk management and resilience building that takes the bigger picture into account has required a concerted focus on ‘doing things differently’. To this end, the examples introduced

in this section all embraced transformation as a process, which has required **defining the ambition to deliver deep-rooted, transformational change in how risk is addressed as the goal** from the outset.

The majority of examples listed in Table 1 are from recent years, and it would be difficult to claim with certainty that the pathways and processes instituted will result in transformational outcomes. Nevertheless, these pathways and processes comprehensively focus on creating systemic shifts that challenge underlying vulnerabilities and governance gaps from the design phase itself.

Country	Measure/intervention	What makes it transformational?
South Asia	'Action on Climate Today' (ACT): targeted interventions across agriculture, water, governance, and finance	adopted a systems perspective to engage with risk holistically from the national to sub-national levels
Indonesia	Transboundary flood risk governance scheme	inclusive cross-sector and cross-scalar coordination around climate change adaptation
Vietnam	storm-resistant housing and the City Climate Change Coordination Office projects	Systems-oriented focus to address underlying drivers of vulnerability and risk, cross-scalar capacity and coordination, integration into development planning
UK, India and New Zealand	Planned relocation and managed retreat	Planned retreat pilots serving as examples of approaches that can be scaled up
African Sahel	Community Resilience to Acute Malnutrition (CRAM) program in Chad, Building Resilience in Chad and Sudan (BRICS) program and Community-Based Management of Acute Malnutrition (CMAM) Surge approach in Niger	Adopted an integrated resilience program with combined FIM and WASH interventions with subsequent scale up
India and South Africa	Urban nature-based Solutions (NbS)	Agenda of empowerment and focus on structural changes to address underlying drivers of risks
India	Climate Risk Assessment (CRA) framework	Creating the enabling environments for intensification leading to transformation
Peru	Community Early Warning System (EWS)	strong and diverse networks and inclusive participation learning-oriented
Nepal and Myanmar	Community Based Adaptation (CBA)	systemic focus on issues influencing climate vulnerability long-term incentivizes stakeholders to continue adaptation efforts beyond program funding cycles
USA	Urban flood and heat management	Creating the enabling environments for intensification leading to transformation

Table 1 Practical insights of what transformational resilience-building may look like

Pathways to transformation: Shared elements and processes

Many of the examples in Table 1 implemented a combination of the following interlinked pathways:

- **Operationalizing innovative approaches and solutions** – Innovative approaches and solutions to risk management have helped to shift paradigms for what constitutes risk management and what its social value should be (Jakku et al., 2016; Kates et al., 2012). For example, Madurai and Pune in India (OPM-India, 2019), and Durban and Cape Town in South Africa (Roberts et al., 2012) have all piloted nature-based solutions that address compound risk (and thus avoid maladaptation) and/or have strong social, economic, and environmental co-benefits. In Durban, South Africa, the Municipal Climate Protection Programme (MCP), in partnership with the University of KwaZuluNatal and the Indigenous Trees for Life Programme, established a major reforestation project in 2008 in the buffer zone of the Buffelsdraai Regional Landfill site as a part of a wider, long-term multi-sectoral effort to respond to specific climate change impacts (Roberts et al., 2012). Reforestation led to the creation of a carbon sink, critical climate change mitigation, while also providing socio-economic benefits to indigenous communities via new income-generating opportunities, food security, and greater access to education. Another example comes from Action on Climate Today's (ACT) work in Bihar where they identified sediment deposits as a key driver of flood risk on the banks of the Kosi River (OPM-India, 2019). Thus, their intervention sought to add value to silt; they developed a model for a supply chain for silt to build livelihood and market opportunities while also supporting silt management to reduce flood risk. While these types of solutions are largely pilots, they are concrete examples of using innovative approaches to create system shifts while also addressing underlying vulnerabilities.
- **Delivering integrated intervention packages** – Integrated and systemic intervention packages that provide the range of services, inputs, capacity-building, technical support, and advocacy help to create end-to-end system shifts that target the root causes of risk (Kates et al., 2012; Pal et al., 2019). Mercy Corps' Managing Risks through Economic Development (M-RED) program in Nepal is a phased 10-year program that has worked to improve socio-economic conditions while also intensifying adaptation and risk management (Mercy Corps, 2020). The first and second phases of the program focused on developing sustainable models for integrating market systems with disaster risk reduction and resilience. The third phase of the program, intentionally focused on transformational resilience building. The M-RED program sequenced multi-sectoral interventions to strengthen watersheds and market linkages to simultaneously reduce disaster risk and enable communities to secure their assets and livelihoods during shocks and stress. They also aligned with government priorities and engaged with sub-national government from the inception to secure their buy-in and program gains. Delivering an integrated intervention package over a 10-year period enabled M-RED to create systemic change to tackle underlying vulnerabilities (Mercy Corps, 2020).
- **Establishing participatory governance models** – Several of the examples in Table 1 established participatory governance structures, involving communities, governments, and/or different sectors (e.g., private, utilities, academia) to co-produce transformational outcomes for localities (Ajibade & Egge, 2019; Wamsler, 2017). Depending on the context, these innovative governance models have been embedded within formal governance structures or have been created at the grassroots level to support local disaster and climate risk management. An example of a formal governance initiative comes

from Vietnam, where ISET-International supported the cities of Da Nang, Quy-Nhon, and Can Tho to establish inclusive and integrated decision-making channels to build climate resilience (ISET-International, 2015). In each city, a City Climate Change Coordination Office was set up with the mandate to conduct climate responsive decision-making and planning at the provincial and city levels in coordination and consultation with governments, NGOs, research institutions, donors, and civil society (Tyler, 2017). To enable these offices to operate under the leadership of local authorities over the long-term, they were trained in a variety of skills ranging from assessing climate risk to integrating climate resilience into development policies and plans to monitoring of resilience. As a result of this initiative, the three cities were the first in Vietnam to integrate resilience into climate planning (Tyler, 2017). An example of a grassroots, community-based governance initiative comes from Peru where emergency brigades that intentionally included women were created in the Rimac and Piura watersheds to support community-based disaster risk management (Szoenyi et al., 2016). They were heavily involved in prioritizing, designing, and implementing, and maintaining an early warning system supported by Practical Action. Involved community members, and particularly women, reported that the access to data and knowledge from the early warning system made them feel more empowered to engage in political processes and demand that local governments address their needs. Though targeted at different levels, both governance models show that going beyond mainstreaming and focusing on empowerment can move the dial on shifting power structures and enhancing marginalized voices in decision-making processes.

- **Scaling successful pilots** – Scaling successful pilots is a key avenue for creating wider systemic shifts and thus achieving transformational change (Pal et al., 2019). Concern Worldwide’s Community-Based Management of Acute Malnutrition (CMAM) Surge program sought to address underlying vulnerabilities in health systems that are exacerbated by shocks and stresses and overall reduce the coping capacities of vulnerable communities; peaks in acute malnutrition rates, for example, tend to occur during seasonal and predictable shocks (Ali et al., 2018). The CMAM Surge program therefore provided health practitioners with the tools to assess local risks, trends, and capacities and developed a thresholds system to define at what point and what type of government and non-government support needed to be mobilized to rapidly enhance local health support. Meanwhile, Concern also provided timely and needed technical assistance to a wide variety of stakeholders (including government ministries, partner NGOs, UN agencies, and other agencies), which enabled the creation of informal and formal local to national partnerships to support implementation and learning across different contexts (Ali et al., 2018). In 2017, CMAM Surge was highlighted as a model approach in Echo’s Humanitarian Implementation Plan. Subsequently, the approach was also implemented in Niger and the wider Sahel Region, supported by the creation of national CMAM Surge task forces and the Global Technical Working Group in 2019 (Whitney, 2021). The combination of embedding the pilots in localized information and health systems and building the technical capacity of key stakeholders across scales helped to lay the groundwork for significantly scaling up a pilot to create sustainable and transformative shifts in how malnutrition, a key health vulnerability, is addressed at a regional level.

4 Bottlenecks and enablers of transformational resilience-building: Practical insights & lessons learned

The previous section established that achieving transformational outcomes often requires starting with committing to transformation as a goal and instituting transformational pathways from the outset. However, the ability to achieve transformational change also highly depends on having an appropriate enabling environment. Initiatives highlighted in Table 1 and Figure 5 that had inappropriate enabling environments, though they were able to achieve promising gains along the resilience spectrum, fell short of creating long-term, sustainable systemic change. This section provides an overview of the bottlenecks and enablers that the initiatives in Table 1 faced and how those impacted their ability to achieve transformational change.

Learning and more broadly, fostering knowledge, are critical for achieving transformational change (Jakku et al., 2016; Kates et al., 2012; Moser & Ekstrom, 2010). Knowledge factors into transformational change in several ways. Firstly, stakeholders require knowledge of climate risks and their presentations across different land use areas and risk zones. Further, stakeholders also require a comprehensive framework for guiding and enacting transformational change to gain their buy-in and participation in instituting transformational pathways. Indeed, several of our examples cited weak institutional knowledge and capacities as key barriers to achieving transformational change. As a result, initiatives, particularly those led by NGOs or multi-sectoral coalitions have spent significant time and resources building risk awareness, developing risk assessment tools, and providing technical capacity-building and assistance to stakeholders whose buy-in and effort is required for sustaining those initiatives and systems change over the long-term. Some initiatives have also brought research institutions on as core partners to enable evidence-informed practice and decision-making. In the Greater Pekalongan Area, Indonesia, for example, Mercy Corps conducted a Climate Risk and Impact Assessment (CRIA) in partnership with Diponegoro University and Bogor Agricultural Institute (Syam & Okura, 2020). CRIA provided scientific evidence on flood risk, drivers of flooding and flood impacts, and the current and potential economic impacts of losses and damages in an area where climate risk has been difficult to understand, and address given the complex nature of transboundary risk and governance. The evidence was used to bring stakeholders across sectors and geographies together and facilitate policy discourse that went beyond short term needs and interests. Mercy Corps' knowledge building efforts go beyond just providing evidence on climate risk and include working with government stakeholders to understand how to analyze the assessment results through a conceptual framework for risk informed planning to support evidence-informed policies and plans on integrated water resource management.

Secondly, initiatives need to be able to **conduct experiential niche learning**. In effect, this means that initiatives need 'pause points' to stop and evaluate what is and is not working in their interventions and adapt their approach(es) based on that learning (Metelerkamp et al., 2020). As a phased 10-year program, M-RED included reflection points to strategically adapt and expand the program based on evolving learning; in particular, learning from the first phase was used to refine the second phase, and learning through both phases led to a third phase that was explicitly focused on leveraging the relationships and structures they already had in place to implement transformative resilience building (Mercy Corps, 2020). A key entry point for doing this type of phased learning is via monitoring and evaluation customized for assessing systemic and transformational change. Monitoring is often conducted at regular intervals within program cycles and expanding monitoring

systems to have a learning role beyond tracking change achieved against program targets will help programs to assess and internalize what is and is not going well and why. The additional advantage of harnessing learning-oriented monitoring and evaluation is that it can contribute towards an otherwise small evidence base on what transformational adaptation is and how it can be achieved. Post-end line evaluations, in particular, can help to generate concrete examples that have resulted in actual versus potential transformation, thus enabling catalytic learning that helps to minimize the risk and uncertainties in pursuing transformative resilience pathways.

The examples in Table 1 also pointed to the importance of **political will and momentum** for embarking on fruitful transformational change processes. Successful initiatives such as M-RED, CMAM Surge, and those of ACT have succeeded as they have been able to **align their transformational change objectives with government priorities**, bound the ambition of their efforts based on what governments, NGOs, and civil society will be able to manage over the long-term, and engage government as core program partners. They have also been successful by acting as third-party facilitators or boundary organizations that translate knowledge into concrete policy and practice options and work to overcome vested and sometimes conflicting interests of multi-sector stakeholders.

However, government opportunities often align more with incremental shifts; government priorities and political will do not often align with the scale of transformational shifts needed to manage climate risk and adapt to climate change in equitable and inclusive ways. Most examples in Table 1 show that the perception of and reliance on piecemeal grey infrastructure solutions as a core adaptation strategy has been a major constraint for shifting risk management paradigms. Furthermore, radical but necessary solutions such as managed retreat and relocation in light of sea level rise are controversial and lack government and public support due to their vast economic and social implications. In New Zealand, there was one instance of managed retreat where the central government, with the Bay of Plenty Regional Council and the Whatkatāne District Council, co-financed the buy-out of 16 houses and 18 vacant sections located in a zone in Matatā particularly at risk from sea level rise. Though a successful and innovative, if small-scale, cost-sharing initiative, government ministers have been clear that their support in this case does not set a precedent for future managed retreat. Without adequate political will, creating and scaling out transformational pathways and shifts will continue to be a challenge.

Deeper analysis of the examples in Table 1 also indicates that **locally grounded, bottom-up governance** can better support transformational processes (Wamsler, 2017). Systems with a strong role for local and subnational authorities to manage local risks and needs enable innovative, locally contextualized initiatives with noteworthy transformational potential. In the United States, for example, Chicago, Philadelphia and Washington D.C. in the United States (Chicago, 2021; Department of Energy & Environment, 2021; PennFuture, 2019) have all been able to implement nature-based solutions (e.g., the Riversmart Rooftops; Green Alleys Program; and Green City, Clean Waters Program, respectively) to manage compound risk while also providing socio-economic benefits. While these solutions have not been scaled nationally, these examples (along with the examples we have from South Africa and India) indicate that transformational changes that are situated in local needs, conditions, and resources are underway in cities in nations where cities and its constituents have the power to implement their own innovations and mobilize and coordinate different sectors. In Vietnam, on the other hand, where governance is highly centralized and top-down, innovative initiatives proved riskier. The City Climate Change Coordination Offices (CCCCO) program that aimed to address gaps in cross-sectoral coordination around climate resilience in the cities of Da Nang, Quy Nhon, and Can Tho, although an innovative governance effort with transformational potential, has faced significant challenges in the long-

term. All three CCCO offices still exist, but they are unable to operate as initially designed as the CCCO model has not been institutionalized at the national level, leaving them with limited financial, administrative, and legal resources, and because there are no nationally defined requirements or mechanisms for cross-sector coordination (Tyler, 2017). Overcoming such constraints in top-down systems is difficult and will likely require, once again, strong political will, buy-in and champions across scales of government.

Ultimately, and critically, transformational processes are best supported by **phased, long-term programs** combined with long-term monitoring and evaluation (Campos et al., 2016; Lonsdale et al., 2015), as transformation is a long-term process. The pathways highlighted in the previous section take time to sequence and implement strategically, particularly as programs work in parallel to generate political buy-in, build knowledge and capacity, and overcome institutional and social constraints. To this end, transformational programming requires a **higher financial outlay**. The lack of funds has been a key constraint for both non-government and government initiatives, and in many cases, initiatives have had to figure out financing mechanisms for implementation and long-term sustainability. Of course, there is a need to work within existing resources, but for transformational resilience-building efforts to deliver on their ambitions, it is key to foster momentum around the need for transformation and reallocate funds from incremental to transformational resilience and reinforce the resource base.

5 Conclusions

As the impacts of climate change are increasingly felt around the globe, practitioners from across the resilience and development realm look for more effective and sustainable ways to respond to mounting disaster and climate-risk. Deliberately shifting resilience-building efforts into the transformation space today offers pathways for moving away from piece-meal fixes to mounting climate-related hazards, exposure, and vulnerability toward initiatives that enable sustainable futures tomorrow.

We find that transformational change entails profound changes at the system-level (Armitage, Charles, and Berkes 2017; Park et al. 2012) that aim to deliver multiple benefits in a long-term oriented and development-centered manner (Deubelli & Mechler, 2021; Keating et al., 2017). Such efforts and interventions embrace the complex, multifaceted and dynamic nature of disaster and climate-related risk (Deubelli & Mechler, 2021; Feola, 2015) and aim at targeting the root causes of risks (Bosomworth, 2018; Pelling, 2014; Pelling & Manuel-Navarrete, 2011), led by a long-term and anticipatory vision (Campos et al., 2016; Thomalla et al., 2018).

Drawing on examples of transformational resilience-building measures and interventions researched and implemented by academia and organizations collaborating through the Zurich Flood Resilience Alliance and other initiatives and synthesized as a part of the forthcoming book, "Transformation and Disaster Resilience" (Springer, forthcoming), we showcased diverse pathways towards transformation and uncovered useful insights as to what is required to move to transformational resilience. While there are diverse entry points, they all have in common that they implemented a combination of (some of) the following interlinked pathways for creating the needed shifts for realizing transformational change: i) Operationalizing innovative approaches and solutions; ii) Delivering integrated intervention packages; iii) Establishing participatory governance models; and iv) Scaling successful pilots. In addition, they all share a strong commitment to delivering on achieving transformation by setting it as their goal from the start, consequently designing their resilience-building measures and interventions with transformation as their guiding star.

We also found that whether interventions and measures designed for transformational change will deliver on their objective strongly hinges on creating appropriate enabling environments. Reviewing the successful transformational resilience-building initiatives highlighted in the earlier section, we identified several enablers that policymakers may draw on as useful inspiration for creating the enabling environments for fostering the development and uptake of initiatives in support of a transformational change agenda. These include i) Setting up learning and knowledge platforms and creating the conditions for experiential niche learning and continuous feedback loops; ii) aligning transformational change objectives with strategic government priorities to harness and foster political will and momentum; as well as iii) unlocking the transformational potential of bottom-up governance that is grounded in local contexts and engages local stakeholders. On the other hand, we found that many initiatives faced timelines that were too short to deliver the long-term processes underpinning transformational change or constrained by tight funding envelopes. We thus conclude that for initiatives to successfully deliver on their transformational change ambitions, it is key that decision-makers iv) establish the necessary framework conditions for phased, long-term programs that foster learning through monitoring and evaluation throughout the project cycle but also include provisions for long-term evaluations; and v) commit sufficient financial outlays to initiatives designed with transformational change in mind.

6 References

- Ajibade, I., & Egge, M. (2019). SDGs and climate change adaptation in Asian megacities: Synergies and opportunities for transformation. *Achieving the Sustainable Development Goals: Global Governance Challenges, October*, 100–116. <https://doi.org/10.4324/9780429029622>
- Ali, M., Hutton, K., & Lewis, J. (2018). *Final Evaluation of Building Resilience in Chad and Sudan About the evaluation team*. www.aidworks.org.uk
- Armitage, D., Charles, A., & Berkes, F. (2017). Governing the Coastal Commons. In *Governing the Coastal Commons*. <https://doi.org/10.4324/9781315688480>
- Bahadur, A., & Tanner, T. (2015). *The 3As: Tracking Resilience Across BRACED Action on Climate Today View project Realising the Resilience Dividend: A new business case for disaster risk management View project*. <https://doi.org/10.13140/RG.2.1.3813.2965>
- Bahadur, A. V, Peters, K., Wilkinson, E., Pichon, F., Gray, K., & Tanner, T. (2015). The 3As: Tracking Resilience Across Braced. *BRACED Knowledge Manager*, 57.
- Blythe, J., Silver, J., Evans, L., Armitage, D., Bennett, N. J., Moore, M. L., Morrison, T. H., & Brown, K. (2018). The Dark Side of Transformation: Latent Risks in Contemporary Sustainability Discourse. *Antipode*, 50(5), 1206–1223. <https://doi.org/10.1111/anti.12405>
- Bosomworth, K. (2018). A discursive–institutional perspective on transformative governance: A case from a fire management policy sector. *Environmental Policy and Governance*, 28(6), 415–425. <https://doi.org/10.1002/eet.1806>
- Campos, I. S., Alves, F. M., Dinis, J., Truninger, M., Vizinho, A., & Penha-Lopes, G. (2016). Climate adaptation, transitions, and socially innovative action-research approaches. *Ecology and Society*, 21(1). <https://doi.org/10.5751/ES-08059-210113>
- Chicago, C. of. (2021). *Green Alleys*. https://www.chicago.gov/city/en/depts/cdot/provdrs/street/svcs/green_alleys.html
- Colloff, M. J., Martín-López, B., Lavorel, S., Locatelli, B., Gorddard, R., Longaretti, P.-Y. Y., Walters, G., van Kerkhoff, L., Wyborn, C., Coreau, A., Wise, R. M., Dunlop, M., Degeorges, P., Grantham, H., Overton, I. C., Williams, R. D., Doherty, M. D., Capon, T., Sanderson, T., & Murphy, H. T. (2017). An integrative research framework for enabling transformative adaptation. *Environmental Science and Policy*, 68, 87–96. <https://doi.org/10.1016/j.envsci.2016.11.007>
- Department of Energy & Environment. (2021). *Green Roofs in the District of Columbia | ddoe*. <https://doee.dc.gov/greenroofs>
- Deubelli, T. M., & Mechler, R. (2021). Perspectives on transformational change in climate risk management and adaptation. *Environmental Research Letters*, 16(5). <https://doi.org/10.1088/1748-9326/abd42d>
- Dowd, A. M., Marshall, N., Fleming, A., Jakku, E., Gaillard, E., & Howden, M. (2014). The role of networks in transforming Australian agriculture. *Nature Climate Change*, 4(7), 558–563. <https://doi.org/10.1038/nclimate2275>
- Fedele, G., Donatti, C. I., Harvey, C. A., Hannah, L., & Hole, D. G. (2019). Transformative adaptation to climate change for sustainable social-ecological systems. *Environmental Science and Policy*, 101(July), 116–125. <https://doi.org/10.1016/j.envsci.2019.07.001>
- Feola, G. (2015). Societal transformation in response to global environmental change: A review of emerging concepts. *Ambio*, 44(5), 376–390. <https://doi.org/10.1007/s13280-014-0582-z>
- Hochrainer-Stigler, S. (2020). *Systemic Risk and Dependencies* (pp. 65–105). https://doi.org/10.1007/978-981-15-2689-3_3
- ISET-International. (2015). *Vietnam City Climate Change Offices | iset*. <https://www.i-s-e-t.org/resource-city-climate-change-offic>
- Jakku, E., Thorburn, P. J., Marshall, N. A., Dowd, A. M., Howden, S. M., Mendham, E., Moon, K., & Brandon, C. (2016). Learning the hard way: a case study of an attempt at agricultural transformation in response to climate change. *Climatic Change*, 137(3–4), 557–574. <https://doi.org/10.1007/s10584-016-1698-x>
- Kates, R. W., Travis, W. R., & Wilbanks, T. J. (2012). Transformational adaptation when incremental adaptations to climate change are insufficient. In *Proceedings of the National Academy of Sciences of the United States of America* (Vol. 109, Issue 19, pp. 7156–7161). National Academy of Sciences. <https://doi.org/10.1073/pnas.1115521109>
- Keating, A., Campbell, K., Magnuszewski, P., Liu, W., Szoenyi, M., C 4, Mechler, R., Magnuszewski, P., Mochizuki, J., Liu, W., Szoenyi, M., & McQuistan, C. (2017). Disaster resilience: what it is and how it can

- engender a meaningful change in development policy. *Development Policy Review*, 35(1), 65–91. <https://doi.org/10.1111/dpr.12201>
- Klein, R., Adams, K. M., Dzebo, A., Davis, M., & Siebert, C. K. (2017). Advancing climate adaptation practices and solutions: Emerging research priorities. *SEI Working Paper 2017-07, May*, 28. <https://www.sei.org/wp-content/uploads/2017/05/klein-et-al-2017-adaptation-research-priorities.pdf>
- Lonsdale, K., Pringle, P., & Turner, B. (2015). Transformational adaptation: what it is, why it matters and what is needed. In *UK Climate Impacts Programme*. https://www.researchgate.net/publication/293823090_Transformational_Adaptation_what_it_is_why_it_matters_and_what_is_needed
- Manuel-Navarrete, D., & Pelling, M. (2015). Subjectivity and the politics of transformation in response to development and environmental change. *Global Environmental Change*, 35, 558–569. <https://doi.org/10.1016/j.gloenvcha.2015.08.012>
- Marshall, N., Park, S. E., Adger, W. N., Brown, K., & Howden, S. M. (2012). Transformational capacity and the influence of place and identity. *Environmental Research Letters*, 7(3), 34022. <https://doi.org/10.1088/1748-9326/7/3/034022>
- Mechler, R., Singh, ·Chadni C, Ebi, · K, Djalante, · R, Thomas, · A, James, · R, Tschakert, · P, Wewerinke-Singh, · M, Schinko, · T, Ley, · D, Nalau, · J, Bouwer, · L M, Huggel, · C, Huq, · S, Linnerooth-Bayer, · J, Surminski, · S, Pinho, · P, Jones, · R, Boyd, · E, & Revi, · A. (2020). Loss and Damage and limits to adaptation: recent IPCC insights and implications for climate science and policy. *Sustainability Science*, 1, 3. <https://doi.org/10.1007/s11625-020-00807-9>
- Mercy Corps. (2020). *Managing Risk Through Economic Development (MRED) NEPAL RESULTS BRIEF*.
- Metelerkamp, L., Biggs, R., & Drimie, S. (2020). Learning for transitions: a niche perspective. *Ecology and Society, Published Online: Feb 24, 2020* | *Doi:10.5751/ES-11326-250114*, 25(1). <https://doi.org/10.5751/ES-11326-250114>
- Moser, S. C., & Ekstrom, J. A. (2010). A framework to diagnose barriers to climate change adaptation. *Proceedings of the National Academy of Sciences of the United States of America*, 107(51), 22026–22031. <https://doi.org/10.1073/pnas.1007887107>
- OPM-India. (2019). *The hungry river: Looking through floods and silt in North Bihar* | *Oxford Policy Management*. <https://www.opml.co.uk/blog/the-hungry-river-looking-through-floods-and-silt-in-north-bihar>
- Pal, U., Bahadur, A. V., Mcconnell, J., & Vaze, P. (2019). *Unpacking transformation: A framework and insights from adaptation mainstreaming*. *March*, 1. <https://doi.org/10.13140/RG.2.2.20256.40962>
- Panda, A. (2018). Transformational adaptation of agricultural systems to climate change. *Wiley Interdisciplinary Reviews: Climate Change*, 9(4), e520. <https://doi.org/10.1002/wcc.520>
- Park, S. E., Marshall, N. A. A., Jakku, E., Dowd, A. M. M., Howden, S. M. M., Mendham, E., & Fleming, A. (2012). Informing adaptation responses to climate change through theories of transformation. *Global Environmental Change*, 22(1), 115–126. <https://doi.org/10.1016/j.gloenvcha.2011.10.003>
- Pelling, M. (2011). Adaptation to climate change: From resilience to transformation. In *Adaptation to Climate Change: From Resilience to Transformation*. <https://doi.org/10.4324/9780203889046>
- Pelling, M. (2014). Transformation: A Renewed Window on Development Responsibility for Risk Management. *Journal of Extreme Events*, 01(01), 1402003. <https://doi.org/10.1142/s2345737614020035>
- Pelling, M., & Manuel-Navarrete, D. (2011). From Resilience to Transformation: the Adaptive Cycle in Two Mexican Urban Centers. *Ecology and Society*, 16(2), art11. <https://doi.org/10.5751/ES-04038-160211>
- Pelling, M., O'Brien, K., & Matyas, D. (2015). Adaptation and transformation. *Climatic Change*, 133(1), 113–127. <https://doi.org/10.1007/s10584-014-1303-0>
- PennFuture. (2019). *About Philadelphia Water Department's Green City, Clean Waters*. <https://www.pennfuture.org/about-philadelphia-water-dept-green-city>
- Rickards, L., & Howden, S. M. (2012). Transformational adaptation: agriculture and climate change. *Crop and Pasture Science*, 63(3), 240–250. <https://doi.org/10.1071/CP11172>
- Roberts, D., Boon, R., Diederichs, N., Douwes, E., Govender, N., Mcinnes, A., Mclean, C., O'Donoghue, S., & Spires, M. (2012). Exploring ecosystem-based adaptation in Durban, South Africa: “learning-by-doing” at the local government coal face. *Environment and Urbanization*, 24(1), 167–195. <https://doi.org/10.1177/0956247811431412>
- Roberts, E., & Pelling, M. (2019). Loss and damage: an opportunity for transformation? *Climate Policy*. <https://doi.org/10.1080/14693062.2019.1680336>
- Schinko, T., Mechler, R., & Hochrainer-Stigler, S. (2018). *The Risk and Policy Space for Loss and Damage: Integrating Notions of Distributive and Compensatory Justice with Comprehensive Climate Risk*

- Management* (pp. 83–110). Springer, Cham. https://doi.org/10.1007/978-3-319-72026-5_4
- Syam, D., & Okura, Y. (2020). *Pekalongan Flood Risk and Impact Assessment predicts 90% of the City will be inundated by 2035: how is climate change impacting Indonesia? – Flood Resilience Portal*. <https://floodresilience.net/blogs/pekalongan-flood-risk-and-impact-assessment-predicts-90-of-the-city-will-be-inundated-by-2035-how-is-climate-change-impacting-indonesia/>
- Szoenyi, M., Nathaz, M., & Freiner², L. (2016). *The Zurich flood resilience alliance: A new approach to partnership for effective disaster risk reduction*.
- Tanner, T., Bahadur, A., & Moench, M. (2017). *Shaping policy for development odi.org Challenges for resilience policy and practice*. August, 1–24. www.odi.org/resilience-scan.
- Thomalla, F., Boyland, M., Johnson, K., Ensor, J., Tuhkanen, H., Swartling, Å. G., Han, G., Forrester, J., & Wahl, D. (2018). Transforming development and disaster risk. *Sustainability (Switzerland)*, 10(5), 1–12. <https://doi.org/10.3390/su10051458>
- Tröger, S. (2016). Societal transformation, buzzy perspectives towards successful climate change adaptation: An appeal to caution. In *Climate Change Management* (pp. 353–365). Springer. https://doi.org/10.1007/978-3-319-28591-7_19
- Tyler, S. (2017). *The Role of Climate Change Coordination Offices in Building Resilience*. <http://www.i-s-e-t.org/>
- Vermeulen, S. J., Dinesh, D., Howden, S. M., Cramer, L., & Thornton, P. K. (2018). Transformation in Practice: A Review of Empirical Cases of Transformational Adaptation in Agriculture Under Climate Change. *Frontiers in Sustainable Food Systems*, 2, 65. <https://doi.org/10.3389/fsufs.2018.00065>
- Wamsler, C. (2017). Stakeholder involvement in strategic adaptation planning: Transdisciplinarity and co-production at stake? *Environmental Science and Policy*, 75(March), 148–157. <https://doi.org/10.1016/j.envsci.2017.03.016>
- Whitney, K. G. and S. (2021). CMAM Surge: the way forward Field Exchange 64, -. *Field Exchange* 64, 47. www.ennonline.net/fex/64/cmamsurgewayforward
- ZFRA. (2021). *Zurich Flood Resilience Alliance – Flood Resilience Portal*. <https://floodresilience.net/zurich-flood-resilience-alliance/>