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Transforming Development and Disaster Risk

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Abstract: This article focuses on the complex relationship between development and disaster risk. Development and disaster risk are closely linked as the people and assets exposed to risk, as well as their vulnerability and capacity, are largely determined by development processes. Transformation is key to moving from current development patterns that increase, create or unfairly distribute risks, to forms of development that are equitable, resilient and sustainable. Based on a review of existing literature, we present three opportunities that have the potential to lead to transformation in the development-disaster risk relationship: (i) exposing development-disaster risk trade-offs in development policy and decision-making; (ii) prioritizing equity and social justice in approaches to secure resilience; and (iii) enabling transformation through adaptive governance. This research aims to contribute to breaking down existing barriers in research, policy and practice between the disaster risk reduction, climate change adaptation, and development communities by providing cross-sectoral opportunities to operationalize theoretical knowledge on transformation. It also helps to clarify the connections between different global agendas by positioning transformation as a potential bridging concept to link disconnected policy processes. This paper argues for empirical research to test the opportunities presented here and further define transformative pathways at multiple scales.

Keywords: transformation; sustainable development; disaster risk; trade-offs; equitable resilience; adaptive governance

1. Introduction

Disaster risks and impacts are closely tied to development processes and initiatives; development can increase or decrease the exposure, vulnerability and resilience of societies, while disasters destroy assets and undo development gains [1]. Risk taking is a natural aspect of development, but there is a tipping point when tolerable and acceptable risk levels are exceeded, and major disasters can occur. A background paper to the 2002 World Summit on Sustainable Development [2] warned that disaster losses would continue to increase if actors and societies did not shift towards proactive

solutions, and that reducing disaster impacts should be part of sustainable development agendas. On a global scale, countries with higher income, higher educational attainment, greater openness, and more comprehensive financial systems are anticipated to experience fewer disaster losses [3]. Yet the economic and non-economic impacts of disasters are increasing, and the burden of losses, both human and economic, is being shouldered by the poorest nations already struggling to maintain development investments [1,4].

One explanation of the trend of increasing risks and impacts is that development and disaster risk reduction (DRR) decision-making processes occur in silos, conducted by different agencies, institutions and other actors with differing priorities, perspectives and outlook time horizons. Another is that development and DRR initiatives are often applied at different scales. The likelihood is that many intertwined factors are combining such that development is increasingly driving up levels of existential risk and creating new risks. While both unsustainable development [5] and disaster risk are recognized as 'messy' [6], wicked and complex problems [7], it is increasingly clear that disaster risk will continue to increase until development, and its relationship with risk, is transformed [1].

Development is most readily positioned as the focus for transformation as it lies at the heart of many risk determinants. Yet DRR policy and practice must also be addressed. During the Hyogo Framework for Action 2005–2015 [8] period, global progress was made in the key priority areas of risk assessment, disaster preparedness, early warning, and response. However, according to national reporting [1,9], little meaningful advancement occurred in addressing the root causes of risk. In spite of successful efforts in reducing the human loss from disasters, the DRR sector at large continues to be overly-focused on short-term preparedness and response efforts [10]. Research suggests that progress in DRR is restricted by a failure to acknowledge and address how development processes act as the root causes of disasters [11–13]. The Sendai Framework for DRR 2015–2030 (Sendai Framework) is attempting to catalyze a shift in priority from risk management to risk reduction [14]. However, this shift may not represent the necessary transformation in thinking and action that is required for sustained risk reduction. For example, DRR actors largely fail to consider the trade-offs that underpin development (and DRR) decision-making processes at all levels [15], and processes of 'building resilience' are often not equipped to tackle issues of social inequity and injustice. However, the specific DRR and development practices that are required to 'transform' need to be better understood [16].

Addressing the underlying drivers of risk inherent in the failures of development and DRR requires actions that challenge existing structures, power relations, vested interests, and dominant narratives that persist within systems and maintain and perpetuate poverty, inequality, and marginalization. Transformation may represent one opportunity, but there is a need to provide greater clarity of the scientific definition of transformation [17], as well as to generate empirical evidence on which to base our understanding of transformative policy [18]. This paper explores transformation as a pathway to achieving equitable, resilient and sustainable development outcomes in society. First, we present results of a literature review that conceptualizes transformation for linked development and DRR contexts. Second, we introduce three opportunities for transformation in this context: (i) exposing development-disaster risk trade-offs in development policy and decision-making; (ii) prioritizing equity and social justice in approaches to secure resilience; and (iii) enabling transformation through adaptive governance, each developed through subsequent literature reviews.

2. Conceptualizing Transformation

The discourse on transformation in the fields of development, DRR and climate change adaptation has been elevated by two recent flagship science-for-policy reports: A Special Report of the Intergovernmental Panel on Climate Change (IPCC) on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) [19], and the United Nations Office for DRR (UNISDR) 2015 Global Assessment Report on DRR (GAR) [1]. The SREX report considers transformational change essential to reducing climate and disaster risk, while the GAR report asserts that risks will continue to rise until development is transformed. The SREX report defines

transformation as the altering of fundamental attributes of a system, as does the Fifth Assessment Report of the IPCC [20]. However, the Sendai Framework [14] makes no mention of transformation, and a UNISDR report on terminology relating to DRR [21] does not define it, implying that the concept is not clearly articulated nor well-positioned in DRR policy and practice [22]. Yet, a focus on transformation can serve to highlight the need for systemic change to social systems that create and perpetuate risk and lead to socially unjust and ecologically unsustainable development outcomes [23–26].

Transformation has a close conceptual relative in resilience. Resilience approaches have advanced understanding of system dynamics, interconnections, thresholds and feedbacks [27]. The property of resilience is frequently positioned as innately desirable and the concept has proved malleable to a range of contexts; it is currently widely adopted in international development policy and strategy. As a result, many resilience definitions and interpretations have emerged, clouding its meaning, and limiting its practical use and value in operationalization. Further, a key critique of the resilience narrative is that it depoliticizes the creation of risk and vulnerability, and may be serving to maintain the status quo and/or system functionality [28–31]. In response to such resilience critiques, transformation is increasingly being considered a legitimate and necessary pathway to reducing risk, primarily through challenging existing systems, institutions and paradigms [24,25].

Building off the need for a recalibration of the development–disaster risk relationship [18], we consider that transformation has the potential to serve as an attractive proposition as there is general recognition that at the macro-level the 'status quo' is not sufficient to address the environment, development and risk challenges facing the planet [17], particularly in the context of climate change [23]. In seeking to better conceptualize transformation in linked development–disaster risk contexts, we review academic literature on transformation in three disciplines, identified through the Web of Science platform: (i) social-ecological systems (SES); (ii) adaptation to climate change; and (iii) DRR. Building on the IPCC [19,20] definition as a starting point for understanding transformation, we synthesize evidence of characteristics, attributes, conditions and outcomes of transformations organized by the three disciplinary framings. Table 1 summarizes the key findings.

From the SES perspective, transformation entails making new combinations of pre-existing components, functions or feedbacks of an SES in fundamentally novel ways [32–36]. In this context, a process of transformation may be enabled by innovation, diversity, governance networks, leadership, and learning, or triggered by crises or rapidly changing socio-ecological conditions. Key transformative outcomes include the establishment of SESs that ensure the sustained well-being of humans and ecosystem services.

Key attributes of transformational adaptation action include radical, non-linear step changes in the form, structure or functioning of key systems, typically triggered by extreme climate events [24,25,37–39]. Ref. [40] consider adaptations to be transformative when they occur at a larger scale or intensity, are new to a particular context or system, or transform or shift place-based systems to new locations. Long-term, innovative adaptive water management in the Netherlands is considered transformational [40]. A transformative outcome may occur as a result of incremental adaptations or following intentional or uncontrolled change when the limits of adaptation are exceeded [41]. Desirable outcomes are greater justice, equity, long-term resilience, and sustainable development.

Transformative DRR is characterized by changes in structures, goals, perspectives, and/or governance regimes that alter the pre-existing risk management status quo [12,13,18,42,43]. In this framing, transformative processes are triggered by major disasters, and positive outcomes are enabled by inclusive decision-making, self-organizing groups and networks beyond established institutions, and anticipatory risk planning that goes beyond coping. Desirable outcomes are significant and sustained risk reduction and sustainable development.

Table 1. Characteristics, attributes, conditions and outcomes of transformations in SES, adaptation and DRR contexts.

Transformation Framing	Attributes	Conditions	Outcomes	Key References
Social-ecological System (SES) Transformation	Recombining existing elements of an SES in fundamentally novel ways to create a new SES *Phases*: Prepare for SES change (window of opportunity); navigate the transition (selecting, learning and adoption); build resilience of the new regime; institutionalize the trajectory; and routinize new feedbacks	*Triggers*: Crises; untenable systems; changing environmental or socio-economic conditions *Enablers*: Novelty and innovation; resilience; all forms of capital; diversity of institutions; self-organizing groups and networks; leadership; learning platforms; strengthening cross-scale relationships in the governance structure	A development trajectory and SESs that ensure the sustained well-being of humans and ecosystem services	[32–36]
Transformational Adaptation	Physical and/or qualitative, non-linear radical or step changes in form, structure or meaning-making that include changes in regime management and functioning, behavior, values and perceptions *Indicators*: Adaptations at a larger scale or intensity; new to a context or system; or that transform places and shift locations	*Triggers*: Extreme climate events; multiple stresses *Enablers*: Transdisciplinary approaches; value- and place-based approaches; deep inquiry into structures of meaning-making, power relations and root causes of current failures; social networks across scales; local leadership and accountability; incentives; resources; communications technologies	Greater justice, equity, long-term resilience and sustainable development	[24,25,37–41]
Transformative DRR	A fundamental qualitative change, or a change in composition or structure that is often associated with changes in goals, perspectives, governance regimes or initial conditions, towards a different risk management status quo *Pathway characteristics*: competition; experimentation; scale effects; lock-in	*Triggers*: Major disasters *Enablers*: Critical reflexivity and inclusion in disaster risk decision-making; innovation; participatory learning; self-organizing groups and networks beyond established institutions; narrative analysis; adaptive co-management; anticipatory planning and behavior beyond coping	Reduced disaster risk; enhanced resilience; sustainability	[12,13,18,42,43]

Drawing on these insights on transformation from three relevant bodies of literature, in this paper, we consider the transformation of the relationship between development and disaster risk to represent a clear break and shift away from current trends of disaster risks being driven up by development processes that are inequitable, non-risk-informed and unsustainable. Further, transforming development and disaster risk needs radical changes in the form and function of critical governance and management systems. While transformations can be forced and unplanned, we are concerned with initiating and managing deliberate, desirable transformations [24] towards equitable, resilient and sustainable development. These transformative processes must involve the questioning of social values, institutions, and technical practices, and can be facilitated through increased adaptive governance, learning, innovation, and leadership. In an effort to understand how to move towards these grand, desirable outcomes, we consider three specific opportunities for transformation.

3. Opportunities for Transformation

While the body of research on transformation in complex systems has grown considerably in recent years, transformation remains somewhat abstract when considering the objective of transforming development and DRR policy and practice. The challenge is shaping and defining transformative pathways and action for development and DRR communities of practice. While additional research is needed to further develop the conceptual underpinnings of transformation, attention must also be paid to ensuring this knowledge is translated into action. There is currently a gap in identifying clear, practical entry points for transforming the relationship between development and disaster risk.

To help address this gap, we conducted three further literature reviews to identify three opportunities that have the potential to lead to transformation: (1) exposing development-disaster risk trade-offs in development policy and decision-making [15]; (2) prioritizing equity and social justice in approaches to secure resilience [44]; and (3) enabling transformation through adaptive governance [45]. Figure 1 presents a conceptual framework of these three opportunities and how they relate to one another.

This section aims to provide a brief summary of the three opportunities for transformation. It is important to note that these are exploratory opportunities, which need to be tested empirically and refined, and additional analysis of the development-disaster risk system is necessary as an insufficient understanding of the system dynamics might lead to interventions that are likely to fail. Additionally, this list is not exhaustive and other opportunities may exist that also have the potential to transform the development–disaster risk relationship.

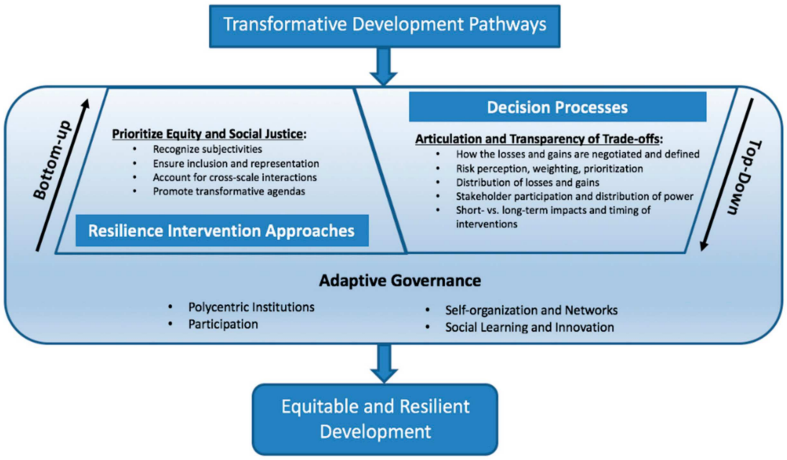

Figure 1. A conceptual framework of three opportunities for transforming the relationship between development and disaster risk.

3.1. Exposing Development-Disaster Risk Trade-Offs in Development Policy and Decision-Making

The disaster risk research community has largely concentrated efforts on understanding the reduction of existing risks, rather than on how risks are generated in the first place. Consequently, little attention has been paid to the critical decision-making processes, including in development, that create the underlying conditions for risk creation or reduction. Ref. [15] argue that the failure to critically consider development and DRR decision-making means that the inherent trade-offs of development activities, and their implications for disaster risk, are often overlooked.

A trade-off is defined as a situation in which a decision must be made between two desired aspects as they cannot both be achieved at the same time [46]. Ref. [15] propose a typology of five interlinked dimensions of trade-offs in development decision-making that help to highlight the potential cost, or risks, associated with development decisions. They consider both how risks are perceived, weighted and prioritized, and the processes through which development and risk trade-offs are conceptualized and negotiated. The typology was developed based on the insights of a non-systematic review of the scientific literature, grey literature, and government reports on DRR. The search was performed using Scopus and Google Scholar and applied various versions of the term "trade-off" with the aim to determine the extent to which this literature explicitly addresses DRR and development trade-offs. The typology represents dimensions (aggregation, risk, equity, time, participation) which the trade-offs identified through the literature review have in common.

The aggregation dimension of trade-offs centers on the prevailing tendency to focus on the aggregated gains of decisions, while inadequately considering the losses (economic, environmental, and social), as well as the impacts of those gains and losses at smaller scales. Although economic

growth is important for development, it can cause detriment to social and environmental well-being and can also increase the number of assets exposed to disaster risk, potentially worsening disaster losses [47].

The risk dimension of trade-offs focuses on multiple risks (hazard and non-hazard-related), including interacting risks, that must be considered within decision-making, the prioritization of those risks in the face of limited resources, and differential risk prioritization by policymakers and wider society. The tendency to prioritize more immediate risks or sudden onset hazards means that risks associated with slower onset hazards may be ignored, leading to unexpected and potentially catastrophic impacts in the future.

The equity dimension of trade-offs focuses on the uneven distribution of benefits, losses and risks from development-related decisions across different groups. There is currently a failure to balance the needs of different groups and a lack of equity which can be improved by strengthening knowledge on vulnerable groups, the high-risk areas they inhabit and the underlying drivers of their risk and vulnerability [1].

The time dimension of trade-offs relates to assessing the benefits and losses of a development decision in the short-term versus the long-term, as well as the short time frame in which decisions must often be made, especially in post-disaster processes. Intergenerational equity, in terms of social, environmental or economic well-being, has not been sufficiently considered in development decision-making processes. The uncertain conditions that will be created by development decisions in the long-term, and whether future generations will be able to cope with this uncertainty, are rarely considered.

The participation dimension of trade-offs deals with who is included or excluded and whose interests are prioritized in decision-making processes. Limited participation and low accountability in high-level decision-making can perpetuate risk-creating norms and practices by decision-makers who are usually less affected by disaster impacts. More participatory decision-making can lead to better development and DRR outcomes, however a trade-off exists as it can impact efficiency and increase the time required for policy change. For decision makers, there may also be political trade-offs related to sharing power and altering the status quo.

The typology by [15] is an initial organizing and diagnostic framework intended to enable further exploration of trade-offs, and to better understand the multidimensionality of decision-making processes in development and its interlinkages to the creation and reduction of disaster risks. Improving knowledge on decision-making processes can support the identification of 'intervention spaces' for transformative action that support the integration of risk into development decision-making.

3.2. Prioritizing Equity and Social Justice in Approaches to Secure Resilience

Resilience has gained popularity as a key principle within both the DRR and development communities, making it a potential entry point for transforming the relationship between the two. We understand resilience to be a system property and thus communities, individuals, or other actors or organizations can undertake actions that change the system and thereby alter resilience. However, actions in one part of the system may have unintended consequences at other temporal or spatial scales, enhancing the resilience of a particular group or community at a particular time, while eroding that of others. We refer to deliberate resilience interventions as attempting to 'secure' resilience when they involve actions that intend to build (increase) or maintain resilience, without suggesting that communities or other actor groups do not have resilience prior to the intervention. Importantly, resilience has been criticized for its failure to address social vulnerability and for disregarding issues of equity and power. The resilience discourse is frequently associated with incremental change, failing to tackle risk-creating development logics or leading to an unfair distribution of risk across a population. Therefore, understood, resilience can lead us to underestimate or overlook the nature and magnitude of the changes required within a system to ensure equitable outcomes.

Consideration of equity and social justice forces consideration of transformation as part of approaches that look to use resilience in practice. Resilience interventions generally do not thoroughly assess *whose* resilience should be secured and if and how such efforts actually tackle the root causes of disaster risk for the most vulnerable groups. The concept of equitable resilience requires us to consider overcoming or rejecting the dominant narratives that exist within a system when they fail to address the inequitable distribution of costs and benefits, including risk distribution. This requires understanding how power is held and exercised, and which actors or processes can create "winners" and "losers" [48]. By addressing the inequities in resilience interventions, possibilities can open up for whole-scale transformation within disaster risk and development.

Ref. [44] conducted a review of the literature connecting resilience to climate change adaptation, development and DRR to examine how equity and power are conceptualized in current research. The search terms resilience and equity, equality, power, agency, justice, ethics, or human rights were applied to peer-reviewed publications from the period 2005-2015 that appeared in the Social Sciences Citation Index of the Web of Science platform. The findings reveal four key elements that need to be considered if interventions are to work towards equity and social justice: (1) recognizing subjectivities; (2) ensuring inclusion and representation; (3) working across scales (geographical and temporal) and levels of governance; and (4) promoting system(s) transformation when existing arrangements degrade well-being or increase risks for sections of society.

Subjectivity draws attention to the ways in which groups become socially differentiated due to cultural, racial, ethnic, gender or other social attributes, and how this shapes disaster risk. Subjectivities can shape how people interpret experiences and information, including those related to disaster risk, and whether or not people take action to reduce their risk. They can drive the construction of inequitable socio-political entitlements, creating vulnerability for excluded groups. Similarly, subjectivities can lead to differential resilience. For example, individuals may use their subjectivities to harness opportunities to secure their resilience, while the subjectivities of others may repress their capacity to engage with such opportunities.

Inclusion highlights the notion of inclusion of diverse social groups based on different social groupings, including gender, age, ethnicity, disability and sexuality, that influence resource distribution and human-environment relationships (e.g., [49–51]). It confronts the power and inclusion imbalances that exist between different stakeholders in decision-making processes at multiple scales, which may lead to exclusion of certain groups and hinder transformation [52–54].

Scale acknowledges the importance of geographical and temporal scales in resilience and systems thinking. It is important to understand cross-scale interactions and the scales on which different actors operate, as implications for resilience may be scale-specific, e.g., securing resilience only at the local level, or in the short term. Scale can also contribute to exclusion, for example as those living far from the geographic, political or social core may be marginalized. Thus, to achieve equitable resilience, subjectivities, inclusion and scale must be jointly understood, with transformation, or the possibility for transformation, as the last stage of the four-step process.

3.3. Enabling Transformation through Adaptive Governance

While adaptive governance has been extensively theorized in relation to natural resource management [55], it has also been applied in resilience research to analyze the social, institutional, economic and ecological aspects of multilevel governance that contribute to building social-ecological resilience [56]. Using a qualitative content analysis approach [57], we conducted a comprehensive literature review of over 180 scientific articles and grey literature publications to identify and synthesize relevant studies and findings on adaptive governance and adaptive co-management, as they relate to DRR [58]. The literature review involved five steps, including question definition, study and search protocol, search and screen results, analysis, and presentation of results as suggested by [59].

Adaptive governance recognizes that interactions between people and ecosystems are inherently unpredictable and that governance needs to be adaptable to changing knowledge and circumstances

and to promote experimentation and innovation. Ref. [45] explored the potential for adaptive governance to transform the relationship between development and disaster risk, considering its ability to deal with uncertainty and complexity.

By adopting an adaptive governance framing, Ref. [45] identified key enabling components for transformation within development and DRR systems. These characteristics, adapted from [60], are: (1) polycentric and multi-layered institutions characterized by, for example, collaborative co-management that involves power-sharing, cross-sectoral institutional linkages, and institutional diversity; (2) participation and collaboration, including social capital, knowledge-pooling, and public participation processes; (3) self-organization and networks which can involve formal and informal, multi-level bridging organizations; and (4) social learning and system innovation, which can be characterized by, for example, shared learning, public learning, and triple-loop learning. While the presence of these components alone does not necessarily mean a transformation will occur, they can provide the conditions needed to enable transformation.

Some of the major strengths in adaptive governance exist in its ability to engage in retrospective- and forward-thinking, which jointly constitute important aspects for disaster resilience-building [61–64]. It is, therefore, an approach that facilitates holistic evaluations of multiple hazards, human vulnerabilities and exposure, options to reduce disaster risks, and capacity gaps based on past experience and plausible future scenarios. To explore opportunities for transformation in the DRR policy sphere, Ref. [45] used the conceptual underpinnings of adaptive governance to assess the potential of the Sendai Framework to integrate these transformative governance characteristics. The value placed on learning within adaptive governance makes it useful for dealing with (and reducing) uncertainties, in which novel approaches and experimentation are required [65]. The Sendai Framework recognizes the usefulness of such innovative approaches in dealing with complex disaster risks. For example, it recommends using disaster risk modelling to consider different scenarios and better address the complexity of the systems involved.

Another key strength of adaptive governance is its openness and adaptability; it does not favor a particular organizational or administrative structure. Instead, it promotes iterative, context-specific problem-solving processes that can respond to new insights and changing conditions [66]. An adaptive governance approach can help foster experimentation and innovation which may boost the potential to alleviate some of the long-standing tensions between development and DRR.

While there are numerous opportunities for synergies between adaptive governance and DRR, namely through the Sendai Framework, several challenges exist in terms of translating these synergies into concrete action plans. Some of the challenges highlighted by [45] include unequal power relations, including across different scales and communities of practice, and achieving flexibility and adaptability, particularly within rigid and hierarchical government structures that suppress interventions supporting transformation.

In summary, this section has introduced potential opportunities for transformation through the exploration of trade-offs in development decision-making and the prioritization of equity and social justice in resilience-building. Adaptive governance can enable the transformation of the development–disaster risk relationship. While further investigation is needed to define specific pathways for transformations to occur within development and DRR systems, these exploratory transformation opportunities provide initial entry points for future research. Each of these opportunities intends to unpack the 'locked-in' development and disaster-risk relationship from different, yet complementary, perspectives. Future research will need to enhance the theoretical understanding of where and how transformations can occur in the development–disaster risk system; which types of transformations have the potential to significantly reduce disaster risk and contribute to sustainable development; and how they may be achieved in practice, at different scales.

4. Conclusions

Development and disaster risk are closely interconnected. In this paper, we argue that transformations are needed to move towards equitable, resilient and sustainable development trajectories. As a boundary concept, transformation's utility is in challenging dominant values and goals in current development practice, examining the underlying failures of development and DRR, and calling for radical policy changes. We have outlined three opportunities for realizing such transformations via analysis of the trade-offs that are associated with development or DRR decision making; through an explicit focus on securing equitable resilience through development or DRR interventions; and through the application of adaptive governance to transform development and DRR systems.

Transformation cuts across the development, DRR, and climate change adaptation sectors. By breaking down an abstract concept into 'operational' opportunities for enabling transformation, our findings can contribute to overcoming the barriers in research, policy and practice that currently exist between these communities of practice. We propose that identifying multi-stakeholder and cross-sectoral opportunities for transformation can help clarify the connections between different global policies and frameworks associated with these respective communities of practice, including the Sustainable Development Goals, the Sendai Framework, and the Paris Agreement. Defining and operationalizing transformative pathways allows the potential contributions from different sectors and policy arenas to be identified and negotiated, positioning transformation as a binding concept that can link often disjointed development, DRR, and adaptation actors and policy processes.

By bringing together disparate fields we propose a multi-disciplinary research agenda that can help to ensure successful outcomes of the Sendai Framework and refocus development and risk reduction efforts towards support for those most vulnerable to disaster risks. Many observers are of the view that more radical, transformative changes in policy and decision-making are necessary to address the complex challenges that are changing our world. However, empirical evidence of transformation in action is urgently needed to create the basis for guidance on processes that would lead to a substantial reduction in disaster-related losses and damages. Further research that focuses on testing and refining the opportunities presented in this paper, among others, is urgently needed to enhance understanding of what types of transformations are possible and how they may be achieved in practice.

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