

RESEARCH ARTICLE



# The evolution of transformational change in multilateral funds dedicated to financing adaptation to climate change

Marli Kasdan<sup>a</sup>, Laura Kuhl <sup>b</sup> and Pradeep Kurukulasuriya<sup>c</sup>

<sup>a</sup>Bureau for Policy and Programme Support, United Nations Development Programme, New York, NY, USA; <sup>b</sup>School of Public Policy and Urban Affairs and International Affairs Program, Northeastern University, Boston, MA, USA; <sup>c</sup>Nature, Climate and Energy and Environmental Finance, Bureau for Policy and Programme Support, United Nations Development Programme, New York, NY, USA

## ABSTRACT

Transformational adaptation is increasingly viewed as necessary to prevent the worst offsets in development gains due to severe climate impacts. However, clarity regarding how to produce transformational adaptation in practice is lacking, creating problems for project design and implementation. This paper examines (1) how transformational adaptation has been defined by major funders of adaptation; (2) how the concept has influenced funding priorities and the financing of projects. The study is based on a comparative analysis of the investment criteria, board meeting minutes, documents, and reports of the primary financial mechanisms under the United Nations Framework Convention on Climate Change: the Least Developed Country Fund, the Special Climate Change Fund, the Adaptation Fund and the Green Climate Fund. Our study demonstrates an increasing emphasis on transformational adaptation across funds over time, particularly in the Green Climate Fund. Transformative potential does guide funding decisions, but a clear understanding of whether transformational change is achievable, feasible, and desirable under all conditions has not yet emerged, an issue acknowledged by the funds and regularly discussed. Our analysis suggests that acknowledging tensions which arise with transformation in adaptation finance is critical because investment criteria and definitions of transformation impact the approaches to adaptation countries take.

## ARTICLE HISTORY

Received 13 March 2019  
Accepted 22 June 2020

## KEYWORDS

Climate change; climate finance; adaptation; transformational change; innovation; Green Climate Fund


## 1. Introduction


In recognition of the growing risk of climate impacts and the awareness that climate impacts threaten to offset, or even reverse, development gains, calls for large scale and impactful adaptive changes have taken on a greater urgency (IPCC, 2018; Pachauri et al., 2014; World Bank, Potsdam Institute for Climate Impact Research and Climate Analytics, 2013). Analysis of existing adaptation efforts suggests that the pace and scale of action is insufficient to address the problem (Olhoff et al., 2015; UNEP, 2018). This sense of urgency has translated into a push for transformational change<sup>1</sup> for adaptation to climate change (adaptation), in contrast to business as usual approaches to adaptation (Kates et al., 2012; O'Brien, 2012; O'Connell et al., 2016; Pelling et al., 2015).

While transformational adaptation is now broadly identified as a necessary component of adaptation strategies, clarity surrounding what constitutes transformational adaptation in practice is still lacking. There is no single agreed-upon definition, and scholars and practitioners acknowledge that existing definitions can be vague, creating problems when they become operationalized (Béné et al., 2018a; Blythe et al., 2018; Feola, 2015). This paper seeks to understand how transformational adaptation has been interpreted in practice. How has transformational

adaptation been defined by major funders of adaptation and how has the concept of transformational adaptation influenced funding priorities and the financing of projects? Through an analysis of definitions, investment criteria, board meeting minutes and guidance from major adaptation funds, we seek to better understand the opportunities as well as potential challenges of transformational adaptation as a concept and an investment criterion. Based on the analysis, as well as existing literature on transformational change and adaptation, this paper aims to provide clarity on the process of transformational adaptation, as well as the tensions and ambiguities that can arise with transformational adaptation in practice.

The remainder of the paper is organized as follows: the paper begins with a review of the literature on transformational adaptation, which focuses on conceptualizations of transformational adaptation and the transformation process. The following section introduces the methodology, which is followed by a comparative analysis of definitions, criteria, board meetings minutes, and guidance across funds. The paper concludes with a discussion of key themes and provides recommendations for the operationalization of transformational adaptation in practice, including ideas for how and when ideas of transformation can be effectively used in the context of adaptation.

**CONTACT** Laura Kuhl  l.kuhl@northeastern.edu

 Supplemental data for this article can be accessed <https://doi.org/10.1080/17565529.2020.1790333>

## 2. Conceptualizing transformational adaptation and the transformation process

Drawing upon social-ecological systems literature, resilience theory, and socio-technical transitions, we identify how transformational change for adaptation is currently defined, key characteristics of transformational adaptation, and ambiguities and tensions within the literature on the concept. Two critical questions addressed by the literature on transformational adaptation include: (1) how to identify, or distinguish, transformational adaptation from other types of adaptation, and (2) how to achieve or promote transformational adaptation.

### 2.1. Conceptualizing transformational adaptation

Due to the nature of adaptation as a social process driven by changes in socio-ecological systems, the literature on transformational adaptation draws heavily from both the literature on sustainability transitions and socio-technical systems and the socio-ecological systems resilience literature. With their respective roots in sociology and history or ecology, these two traditions provide different insights into the process of transformational adaptation and offer different perspectives.

While the concept of transformation has long been part of the scholarly tradition on social, ecological and technical change, its use in relation to adaptation is more recent. Within the climate policy field, the term has historically been used primarily to refer to mitigation efforts, and this conceptualization continues to dominate climate policy discourse to-date, with calls for a transformation to a green economy, for example (Markard et al., 2020; UNEP, 2018). Specifically related to adaptation, the IPCC first defined transformation in the context of adaptation in 2012 as a

fundamental qualitative change ... that often involves a change in paradigm and may include shifts in perception and meaning, changes in underlying norms and values, reconfiguration of social networks and patterns of interaction, changes in power structures, and the introduction of new institutional arrangements and regulatory frameworks. (Field et al., 2012)

In contrast to much of the literature on socio-ecological system transformation, the IPCC definition places greater emphasis on perceptions, norms, values and social systems, representing an explicit attempt to bring together the sustainability transitions and socio-ecological systems literatures. This framing of climate responses continues to grow in emphasis in the IPCC reports, with the Special Report on 1.5 degrees using transformational change as a framework for analysis throughout (IPCC, 2018).

Many conceptions of transformational adaptation highlight the temporal element as a distinguishing feature. From this perspective, strategies that address longer-term change, as opposed to immediate coping strategies, can be considered transformational (Béné et al., 2018a; Colloff et al., 2017; Wise et al., 2014). In a similar vein, Few et al. (2017) define transformational adaptation as a directional shift in practices and a significant deviation from business as usual in order to respond to climate effects (Few et al., 2017). Many scholars have focused on long-term biophysical changes associated with a changing climate, reflecting scholarly origins in ecology (Folke et al., 2010; Olsson

et al., 2006, 2014; Walker et al., 2004), but other scholars, particularly those working on ‘transitions’ are attentive to other sources of long-term change, including changing social structures, economies, and mobility patterns (Foxon et al., 2009; Gillard et al., 2016; Raven, 2007; Wilson & Grubler, 2011).

Scalability of an intervention, both in terms of size and speed, is also identified as a key criterion for transformation (Béné et al., 2018a; Kates et al., 2012). When considering the ability of social protection programmes to contribute to transformation, Béné et al. (2018a) identify the ability to scale a programme rapidly in response to a natural disaster, and the ability to ensure a swift response by operating through existing institutional structures as transformational (Béné et al., 2018a). Others suggest that responses that are truly new to a particular region or resource system are transformational (Kates et al., 2012). This conception is very much in line with the literature on technology transfer and innovation systems that emphasizes the importance of newness within that system, not necessarily novelty at a global scale (Brooks, 1995; Cohen & Levinthal, 1990; Edquist, 2005; Gallagher et al., 2012). While scalability and novelty may be compatible, literature on innovation and social change suggests that novel ideas and technologies are often met with resistance and need to be protected within niches before they are capable of being scaled up (Geels, 2002, 2004; Kemp et al., 1998; Rip & Kemp, 1998). Thus, sometimes those approaches that are most novel may be the most challenging to scale-up in the short term.

Another way that transformational adaptation is often conceptualized is in opposition to incremental adaptation (Few et al., 2017; Kates et al., 2012; Matyas & Pelling, 2015). Incremental adaptation actions are often defined as ‘extensions of actions and behaviors that already reduce the losses or enhance the benefits of natural variations in climate and extreme events’ (Kates et al., 2012). One of the largest critiques of incremental adaptation is that it does not represent a significant enough response to the urgency and severity of climate change, and that incremental changes reinforce the status quo (Barnett & O’Neill, 2010; Blythe et al., 2018; Brown, 2015; Kates et al., 2012). However, some scholars have questioned whether incremental adaptation always maintains the status quo, recognizing that seemingly small changes can shift path trajectories, often through a process known as niche accumulation (Colloff et al., 2017; Kemp et al., 1998; Schot & Geels, 2008). While there are clear conceptual differences between incremental changes *within* existing systems and changes that go *beyond* the system, a strict dichotomy between incremental and transformational adaptation does not allow for the possibility that incremental adaptations may eventually lead to transformation, as much of the innovation literature suggests.

A more fundamental question is the relationship between adaptation and transformation. Some scholars use the term transformative adaptation, whereas others view adaptation and transformation as being on a continuum of change, often linking this to conceptions of resilience. For example, Bene et al.’s frequently-cited resilience capacity framework distinguishes between *coping*, *adaptive* and *transformative capacities* as differing in the scope of the change and the degree of disturbance that the system is responding to, and claims that

each of these contribute to *resilience* (Béné et al., 2014, 2016). In contrast, Folke et al. (2010) define *resilience* as the capacity to change and adapt but remain within critical thresholds, *adaptability* as the ‘capacity to adjust responses to changing external drivers and internal processes and allow for development along the current trajectory’, and *transformability* as ‘the capacity to cross thresholds into new development trajectories’ (Folke et al., 2010). As this discussion highlights, the literature is not clear whether transformation supports resilience, or if in contrast, resilience represents one static end of the continuum, with transformation representing the other more dynamic end of the continuum. Given this lack of clarity, the normative goal of pursuing transformational adaptation in order to achieve climate resilience has to be questioned. The literature does not provide a consensus that transformation is always the pathway through which to achieve resilience, if indeed resilience is the goal.

## 2.2. The transformation process

While there is widespread acknowledgement of the need for transformational adaptation, *how* to get there is less clear. Scholars have also identified a number of risks that can emerge in the way that transformation discourses are implemented.

Literature on transformations suggests that we should be cautious in our expectations for transformational adaptation. It can be difficult to direct systemic change in ways that lead to desired transformation because of the non-linear, unpredictable nature of change in both human and natural systems (Blackburn, 2018; Blythe et al., 2018; Foxon et al., 2009; Olsson et al., 2006; Westley et al., 2013). It can be particularly challenging for outside actors to direct transformational change. Scholars point to the political nature of transformations (Béné et al., 2018b; Blackburn, 2018; Carr, 2019; Eriksen et al., 2015; O’Brien & Selboe, 2015), highlighting that change is inherently political and that certain actors have entrenched interests in the status quo, and thus may not be supportive of transformations. Blythe et al. (2018) argue that current interpretations of transformation have paid insufficient attention to the power and politics of transformation (Blythe et al., 2018). They point to the differential access that different people have to decision-making processes, as well as the differential access to take up opportunities offered by transformations (Blythe et al., 2018). Transformation scholars often espouse that transformation should be shaped by the values and priorities of citizens themselves, which Blackburn argues creates potential contradictions when transformation follows the visions of donors (Blackburn, 2018).

From the innovation systems literature, we know that historically, transformations have taken place over long periods of time, and that many transformations occur through the accumulation of incremental innovations (Bell, 2012; Edquist, 2005; Feder et al., 1985; Kemp, 1997; Raven, 2007; Rogers, 1995; Ruttan, 2001; Schot & Geels, 2008). This poses challenges for a transformational adaptation agenda that seeks to achieve transformational change in very short timeframes, particularly expectations that this can be achieved in project lifecycles of 3–5 years. While recent reports acknowledge that the pace and scale of transformational change required to achieve climate

resilience (both in terms of adaptation and mitigation) are unprecedented (IPCC, 2018), historical experience suggests that achieving this is neither a linear and predictable process, nor one that can be accomplished in a set timescale (ITAD, 2019).

## 3. Methodology

The study is based on a comparison of the three primary financial mechanisms under the UNFCCC: the Least Developed Countries Fund (LDCF) and Special Climate Change Fund (SCCF) managed by the Global Environment Facility (GEF); the Adaptation Fund (AF); and the Green Climate Fund (GCF).

To compare how each fund conceptualizes transformational adaptation, we first analyzed the investment criteria used by each fund. This included the criteria listed in the GEF’s *Project Identification Form*, the Adaptation Fund’s *Project/Programme Review Criteria* and the GCF’s *Initial Investment Framework*. Investment criteria related to aspects of transformation were identified, and similarities and differences in the conceptualization of transformation and the priorities of the funds were compared.

We next reviewed board meeting minutes, board decisions and reports from each of the funds to better understand how transformational adaptation has been conceptualized by each of the funds from their initiation through the summer of 2019. Minutes from each board meeting were downloaded from each of the funds’ websites, along with all associated board decisions. For the GEF this included the Highlights and Summary of Chairs documents for each LDCF/SCCF Council Meeting from Meeting 1, December 8, 2006 through Meeting 26, June 13, 2019. For the AF, this included Minutes from Meeting 1, March 26–28 2008 through Meeting 33b, June 28–29 2019 and for the GCF, Minutes from Meeting 1, August 23–25 2012 to Meeting 23, July 6–8 2019. A full list of Board meetings included in the analysis is included in the Appendix. We also identified all reports mentioned in the Board meeting or Board decisions and downloaded them for review. This included strategic plans, vision statements, technical guidelines, and performance reports. To ensure that we had comprehensive coverage of all reports, we also searched the knowledge products associated with each fund on the funds’ websites.

All documents were keyword searched for the term ‘transform’ and the total number of references to transform were counted. For Board meeting minutes and decisions, all text was extracted, and all uses of the term entered into a database for analysis. The full paragraph in which the keyword was used was included so that the keyword could be analyzed in context. The entire document was analyzed, with the exception of annexes, as documents varied in what was included in the annexes. For reports and other knowledge products, text was extracted and analyzed for all documents that included at least 10 instances of the term transform. Due to the large number of documents, and the infrequent usage of transform in many of them, the sample was restricted to documents with a significant use of the term in order to capture key documents that substantively discussed the topic. A full list of reports

and knowledge products along with the associated keyword counts can be found in the Appendix.

Based on the keyword counts, trends across funds and over time were analyzed. References were also analyzed thematically, using a grounded theory approach to coding. Analysis was organized around discussion of the definition of transformational change, board policies and initiatives, and projects. All documents were reviewed to develop the coding schema and then systematically coded according to the themes that emerged through the coding process. Key themes that emerged were: ambiguity of definitions, importance of scale, learning and mainstreaming as mechanisms for transformation, and the role of the private sector. These codes were used to qualitatively analyze the major themes found in board discussions, decisions and reports related to transformation.

Similarities and differences between definitions, investment criteria, narratives used by the funds, and discussions of projects were compared to the scholarly literature to elucidate differences in conceptualizing transformational adaptation between theory and practice, and to identify challenges that a transformational adaptation agenda may create for project design and implementation. Importantly, this analysis did not analyze project proposals or assess whether projects selected by the funds were actually transformational. Instead, the focus was on how the concept has been taken up by the funds. Whether project selection actually reflects the current focus on transformation is an open question and worthy of future investigation.

#### 4. How climate financing mechanisms view and influence transformational adaptation

This study analyzes the LDCF and SCCF under the GEF, the AF, and GCF because these entities have a formal mandate to provide adaptation finance under the UNFCCC. In many ways these funds are envisioned as catalysts for larger-scale finance, with an outsized agenda in comparison to the scale of funding. There is consensus amongst adaptation practitioners that the resources available in financing mechanisms are not sufficient for the scale and severity of the challenges they must face (UNEP, 2018). While constrained by limited resources, these funds share a goal of promoting transformational change for adaptation, although each conceptualizes and operationalizes transformational change somewhat differently.

In 2001, under the auspices of the GEF, the parties to the UNFCCC established the financial mechanisms of the LDCF and the SCCF. The LDCF is intended to meet the adaptation needs of the 51 least developed countries, while the SCCF funds adaptation, mitigation and technology transfer projects or programmes for any developing country party to the UNFCCC. Since their inception, the LDCF and the SCCF have approved more than \$1.2 billion of financing in conjunction with \$4.8 billion in co-financing and over \$348 million in financing and more than \$2.6 billion in co-financing, respectively (LDCF/SCCF Council, 2018). The AF became operational in 2007, with the explicit purpose of enabling and financing concrete adaptation projects specifically in developing countries that are signatories of the Kyoto Protocol, and its

role under the Paris Agreement was reaffirmed at the UNFCCC meeting in Katowice. The Fund's resources are sourced from donors, in addition to two percent of proceeds from the Kyoto Protocol's Clean Development Mechanism. The AF has committed \$720 million to 100 adaptation projects around the world (Adaptation Fund, 2019). The GCF was launched at COP16 in 2010 as an operating entity of the Financial Mechanism of the UNFCCC to provide equal funding to mitigation and adaptation initiatives. The GCF has an ambitious financing vision, with the goal of helping to mobilize \$100 billion a year before 2020. Thus far, \$10.3 billion in pledged support has been channelled through the GCF (Green Climate Fund, 2019).

##### 4.1. Investment criteria

To better understand how each of the funds conceptualizes transformational change, we first analyzed the investment criteria for each fund in relation to the concept of transformational adaptation.

*Global Environment Facility:* The GEF's investment criteria are listed in the GEF *Project Identification Form* (PIF) – a template that LDCF and SCCF financed-projects complete as the first stage of the approval process (Table 2). Among others, the criteria include stakeholder consultations, co-benefits, learning and knowledge management, private sector engagement, gender equality, additional cost reasoning, consistency with national priorities, and potential risks. While the GEF investment criteria do not explicitly reference transformation, as indicated in Table 1, two related criteria include: (1) scalability, measured by a project's potential for scaling up, and (2) the project's degree of innovation. As discussed in Section 2, the scalability of an adaptation activity, in terms of its size and its speed of implementation, is widely used as a criterion for transformation. Innovation, or newness within a system, is regularly deemed an integral aspect of transformational change. Both criteria are consistent with the literature on transformational adaptation.

*Adaptation Fund:* The AF's criteria for project approval are found in the AF's *Project/Programme Review Criteria* document and include co-benefits, learning and knowledge management, cost-effectiveness, funding justification, consistency with national priorities, potential duplication of funding, sustainability of outcomes, support for concrete adaptation actions, and increased resilience (Table 2). The AF's investment criteria do not explicitly focus on the need for projects to produce transformation, but rather place more emphasis on implementing concrete adaptation actions that meet urgent adaptation needs.

*Green Climate Fund:* The GCF's investment criteria are listed in its *Initial Investment Framework*. As shown in Table 2, many of the GCF's criteria are similar to those used by the GEF and AF. One notable difference is that the GCF uses paradigm shift as a metric of transformational change. 'Paradigm shift potential' is defined as the 'degree to which the proposed activity can catalyse impact beyond a one-off project or programme investment' (GCF Board, 2015a). To determine if proposal activities have the potential to produce a paradigm shift, they are evaluated upon two sub-criteria: (1)

**Table 1.** Attributes of transformational adaptation.

Attribute	Description
Temporality	<ul style="list-style-type: none"> <li>• Long-term change as opposed to immediate coping strategies</li> <li>• Long-term biophysical changes</li> <li>• Social structures, economies, mobility patterns, as sources of long-term change</li> <li>• Transformation does not happen in a set timescale</li> <li>• Transformations occur over time</li> </ul>
Scale	<ul style="list-style-type: none"> <li>• Scaling up/expanding rapidly</li> <li>• Projects that operate at a large scale (i.e. geographic scale; number of people reached; etc.)</li> </ul>
Non-incremental change	<ul style="list-style-type: none"> <li>• Significant, sweeping change that shifts path trajectories</li> <li>• Disruption of the status quo</li> <li>• Capacity to cross into new development trajectories</li> </ul>
Shifts in norms/perceptions	<ul style="list-style-type: none"> <li>• Change in paradigm</li> <li>• Shifts in perception and meaning</li> <li>• Changes in underlying norms, values</li> <li>• Reconfiguration of social networks and power structures</li> <li>• Introduction of new institutional arrangements/regulatory frameworks</li> </ul>
Innovation	<ul style="list-style-type: none"> <li>• Adaptation responses that are new to a particular region</li> </ul>
Non-linear	<ul style="list-style-type: none"> <li>• Unpredictable nature of change in human and natural systems</li> <li>• Difficulty in directing systemic change</li> </ul>

Table 1 shows a summary of the attributes identified in the literature as related to transformational change. The literature does not reach a consensus on what defines transformational change or the precise definition of each attribute.

Scalability and (2) Replicability. Scalability is defined as the potential to expand the proposal's impact without equally increasing its cost base, whereas replicability is defined as the potential to extend key structural elements of the proposal to other sectors, regions, or countries (GCF Board, 2015a). Similar to the AF, the GCF identifies sustainability of outcomes and the creation of knowledge and learning processes as linked to transformation, with both included as sub-criteria underneath paradigm shift potential (Table 2). Sustainability of outcomes encompasses whether an adaptation intervention can provide for the long-term and financially sustainable continuation of project outcomes, and the creation of knowledge and learning processes refers to the existence of a monitoring and evaluation plan and a plan for sharing lessons learned, so that learning can be incorporated into other projects. Similar to the GEF's emphasis on market transformations and private sector involvement, the GCF's sustainability criterion emphasizes market-based approaches, such as the extent to which the project creates new markets and business opportunities.

The GCF also considers impact potential for adaptation, co-benefits (i.e. sustainable development potential), vulnerability, consistency with national priorities (i.e. country ownership), and cost-effectiveness and efficiency as central components of its investment criteria, although not necessarily tied to

transformation. However, within cost-effectiveness and efficiency, the sub-criteria of 'application of best practices and degree of innovation' is particularly relevant. While innovation is integral for transformation, the GCF criteria appear to emphasize scalability and replicability as factors that have the potential to produce a paradigm shift over the degree of innovation.

#### 4.2. Board meetings, guidance and reports

In our analysis, we identified each time the term 'transform' and its variants were used in Board meeting minutes, reports and knowledge products. As seen in Table 3, the term has increased in usage dramatically over time. For the GCF, in the first year of the fund, the term was only used 28 times, but by 2019 there were over 700 uses of the term, with a steady increase year over year. While the trend is most dramatic for the GCF, both the GEF and the AF also use the term, although to a much smaller extent. In the early years of the LDCF/SCCF and AF mentions are rare, but in the early 2010s, the term begins to be used more regularly. For both funds, a few documents are responsible for the majority of the references (i.e. a 2013 and 2016 report for the GEF and a 2015 report for the AF). The content of these reports are discussed below, and the full details of the documents analyzed and the counts of 'transform' can be found in the Appendix.

After tabulating references to transform, we analyzed the narratives on transformational adaptation and their progression. Key themes for each fund are presented below.

*Global Environment Facility:* As the fund with the longest history, the LDCF/SCCF's conception of itself as a fund, and the way the LDCF/SCCF views transformational change, has changed substantially over time. Early documents (from 2006 to 2008) that reference transformation refer to mitigation and technology transfer, but by 2009, there were discussions about whether the funds had the potential to contribute to transformative adaptation. A 2009 report critically recognized that 'The modus operandi of the LDCF meant that, in common with other GEF supported programmes, it has been predominantly project and sector focused, rather than addressing the thematic and transformative approaches required for more effective adaptation planning and implementation' (GEF Independent Evaluation Office, 2009, p. 12). A 2011 meeting discussed how early LDCF investments for NAPAs aligned with existing GEF investments, and promoted transformation by implementing and catalyzing additional investments (LDCF/SCCF Council, 2011).

By 2013, transformation began to appear consistently in the language used to describe the adaptation programme, linked to the GEF's broader agenda: 'Consistent with the GEF's long-term vision of transformational change, the GEF Adaptation Program will promote: continuous innovation, scaling up, synergies and partnerships, knowledge management' (GEF, 2013, p. 32). Also in 2013, an early assessment of a community-based adaptation project discussed 'transformed resilience', evidence that the concept was being considered before there was consensus on the terminology (GEF, 2013). This assessment identified three features of scale to consider as criteria for transformation: geographic scale, arguing that

**Table 2.** Investment criteria for the GEF, AF, and GCF.

Criteria	GEF	AF	GCF
Impact on adaptation/ increased resilience	Adaptation benefits AND The proposed alternative scenario with a brief description of expected outcomes and components of the project AND The global environmental and/or adaptation problems, root causes and barriers that need to be addressed (systems description) AND The baseline scenario and any associated baseline projects	Does the project/programme support concrete adaptation actions to assist the country in addressing the adverse effects of climate change AND Does the project/programme build in climate change resilience	Contribution to increased climate-resilient sustainable development (impact potential)
Co-benefits		Describe how the project/programme provides economic, social, and environmental benefits, with particular reference to the most vulnerable communities.	Environmental, social, economic co-benefits and gender sensitive development impact (sustainable development potential)
Vulnerability of country/ beneficiary groups	Provide geo-referenced information and map where the project interventions will take place.	Is the country a developing country particularly vulnerable to the adverse effects of climate change?	Vulnerability of the country – Scale and intensity of exposure of people, and/or social or economic assets or capital, to risks derived from climate change; Vulnerable groups and gender aspects – Comparably high vulnerability of the beneficiary groups (needs of the recipient) AND Economic and social development level of the country and the affected/targeted population (needs of the recipient)
Gender equality and women's empowerment	Include gender dimensions relevant to the project, plans to address gender in project design, gender-responsible measures to address gender gaps or promote gender equality and women's empowerment.	Does the project/programme include gender considerations? AND Is a project results framework included? Are relevant targets and indicators disaggregated by sex?	Gender sensitive development impact (sustainable development potential)
Paradigm shift potential (including scalability and replicability)	Potential for scaling up		Degree to which the proposed activity can catalyze impact beyond a one-off project or programme investment including scalability: The potential to expand the proposal's impact without equally increasing its cost base, and replicability: The potential to extend key structural elements of the proposal to other sectors, regions, or countries AND Market development and transformation
Degree of innovation	Innovation AND Will there be private sector engagement?		Application of best practices (including industry best practices) and degree of innovation (efficiency and effectiveness)
Strengthened regulatory frameworks/ institutional capacity			Contribution to regulatory framework and policies – the potential for strengthened regulatory frameworks and policies to drive investment in low-emission technologies and activities, promote development of additional low-emission policies, and/or improve climate-responsive planning and development (paradigm shift potential) AND Opportunities to strengthen institutional and implementation capacity in relevant institutions in the context of the proposal (needs of the recipient)
Sustainability	Sustainability	Has the sustainability of the project/programme outcomes been taken into account when designing the project?	Contribution to the creation of an enabling environment in terms of the sustainability of outcomes and results beyond completion of the intervention (i.e. arrangements that provide for long-term and financially sustainable continuation of relevant outcomes and key relevant activities) (paradigm shift potential)
Financial sustainability			Arrangements that provide for long-term and financially sustainable continuation of relevant outcomes and key relevant activities (paradigm shift potential) AND Programme/project financial viability and other financial indicators in terms of expected economic and financial internal rate of return and financial viability in the long run (efficiency and effectiveness)
Cost reasoning/ cost effectiveness	Incremental/additional cost reasoning and expected contributions from the baseline, the LDCF, SCCF, and co-financing	Has the project/programme provided justification for the funding requested on the basis of the full cost of adaptation? AND Is the project/programme cost-effective	Cost-effectiveness and efficiency regarding financial and non-financial aspects
Financing		Is the requested project funding within the cap of the country? AND Is the implementing Entity management fee at or below	Financial adequacy and appropriateness of concessionality (efficiency and effectiveness) AND Absence of alternative

Consistency with national priorities	Is the project consistent with the National strategies and plans or reports and assessments under relevant conventions?	8.5% of the total project/programme budget before the fee? AND Are the project/programme execution costs at or below 9.5% of the total project/programme budget before the fee? Describe how the project/programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or subnational development plans, poverty reduction strategies, national communications, or national adaptation programmes of action, or other relevant instruments, where they exist AND Describe how the project/ programme meets relevant national technical standards, where applicable.	sources of financing – opportunities for the Fund to overcome specific barriers to financing (needs of the recipient)  Objectives are in line with priorities in the country's national climate strategy (country ownership)
Risks	Indicate risks, including climate change, potential social and environmental risks that might prevent project objectives from being achieved and, if possible, promote measures that address these risks	Are there measures for financial and project risk management?	
Stakeholder consultations	Identify stakeholders that have participated in consultations during the project identification phase		Stakeholder consultations and engagement (country ownership)
Learning and knowledge management	Outline the 'Knowledge Management Approach' for the project and how it will contribute to the project's overall impact AND Outline the institutional structure of the project, including monitoring and evaluation coordination at the project level.	Does the project/programme have a learning and knowledge management component to capture and feedback lessons? AND Are arrangements for monitoring and evaluation clearly defined, including a budgeted M&E plan?	Knowledge and learning: Contribution to the creation or strengthening of knowledge, collective learning processes, or institutions (paradigm shift potential)
Alignment with fund	Alignment with GEF focal area and/or Impact Program strategies	Does the project/programme align with the AF results framework?	
Coordination/ potential duplication of funding Eligibility	Describe possible coordination with other relevant GEF-financed projects	Is there duplication of project with other funding sources  Is the project submitted through an eligible National Implementing Entity or Multilateral Implementing Entity that has been accredited by the Board? AND Has the government endorsed the project through its Designated Authority? AND Is the country party to the Kyoto Protocol AND Is there adequate arrangement for project management?	Experience and track record of the Accredited Entity or executing entities in key elements of the proposed activity (country ownership)

Table 2 compares the investment criteria for the GEF, AF and GCF. Many of the criteria relate to transformational change.

**Table 3.** Use of the term ‘transform’ in Board meeting minutes, documents, and knowledge products over time.

Year	GEF	AF	GCF
2006	2	n/a	n/a
2007	0	n/a	n/a
2008	9	6	n/a
2009	4	1	n/a
2010	0	3	n/a
2011	2	21	n/a
2012	6	24	0
2013	108	3	28
2014	14	13	52
2015	17	129	103
2016	201	12	148
2017	18	19	194
2018	53	75	350
2019	82	21	702
<b>Total</b>	<b>516</b>	<b>327</b>	<b>1577</b>

Table 3 documents the increase in the use of the term ‘transform’ across Board meeting minutes, documents and knowledge products over time for the GEF, AF and GCF. There is a clear increase in usage over time, and although all funds use the term, it is used most frequently in the GCF.

community-based adaptation is transformational through mainstreaming and replication, time scale, focusing on resilience beyond the scope of the project, and approach, emphasizing more than development and disaster risk reduction approaches. These aspects continue to feature prominently in contemporary discussions of transformative adaptation.

In contrast to the 2013 reference to transformative resilience, in 2016, the Scientific and Technical Advisory Panel (STAP) provided guidance for project development in a report titled ‘Designing Projects in a Rapidly Changing World – Guidelines for embedding resilience, adaptation, and transformation into sustainable development projects’ (O’Connell et al., 2016). The report defines transformation as ‘a shift from the current system to a substantively new and different one’ and elaborates that

resilience, adaptation and transformation are ... a set of related concepts which are considered as a continuum that ranges from maintaining a healthy, resilient system in its present state, through to transforming it into a different system where necessary. (O’Connell et al., 2016)

This conception is consistent with the literature that views resilience and transformation on two ends of the spectrum, with adaptation viewed as an intermediate level of change, bringing into question the logic of ‘transformative adaptation’. However, the report also highlights scale, in both time and space, as an integral factor for transformation and states that transformation can occur at varying scales (i.e. small, medium, or large), and that any scale, a sequence of actions, or incremental adaptation, (i.e. adaptation in the short term), can be transformational over the longer term. As the GEF’s main scientific advisory panel, the STAP’s view on adaptation and transformation heavily influences how the GEF conceptualizes transformational change within project design.

A 2017 document that reviewed the GEF’s support for transformational change provides the first explicit definition of transformational adaptation: ‘transformational interventions are defined as engagements that help achieve deep, systemic, and sustainable change with large-scale impact in an area of global environmental concern’ (GEF, 2017). The report

suggests that transformative potential is part of the strategic process of selecting projects:

The underlying theory of change is that by strategically identifying and selecting projects that address environmental challenges of global concern and are purposely designed to support fundamental changes in --i.e. ‘flip’-- key economic markets or systems, GEF interventions will be more likely to cause a large-scale and sustainable impact ... (GEF, 2017)

‘Necessary and sufficient conditions for GEF interventions to achieve transformational change’ are identified, including: (1) the ‘level of ambition’ – having explicitly or implicitly ambitious objectives for the intervention; (2) ‘establishing an effective transformational mechanism’ for scaling up or expanding the intervention; (3) ‘the quality of implementation and execution’; (4) ‘harnessing market forces’ (catalyzing a private sector response); and (5) ‘size does not matter’ – interventions of all sizes can be deemed transformational (GEF, 2017).

The report also distinguished transformational interventions from other highly-successful GEF ‘engagements’. Four qualifiers were stated: (1) global relevance – ‘the intervention [is] addressing an environmental challenge like climate change, biodiversity loss, or land degradation’; (2) depth of change – ‘the intervention causes or supports a fundamental change in the system or market’; (3) scale of change ‘the intervention causes or supports a full-scale impact at the local, national, or regional level’; and (4) sustainability – ‘the impact is financially, economically, environmentally, socially and politically sustainable in the long term, after the intervention ends’ (GEF, 2017). The study concluded with a recommendation that the GEF should ‘consider developing and applying a framework for ex-ante assessments of projects or programs that are intended to be transformational to enhance impacts’ (GEF, 2017). While the projects in the review were not LDCF or SCCF projects, this document provides detailed insight into how the GEF views the concept of transformational change. It does raise the question of the extent to which this conception of transformational change applies to the LDCF and SCCF portfolio, as the LDCF and SCCF are explicitly not expected to demonstrate global environmental benefits, and this is a key feature of the transformational potential of the projects highlighted in this report.

By 2017, when the 2020 Vision Statement was published, transformation was solidly part of the GEF’s agenda, as the title was ‘Time for Transformational Change: The Role of the GEF’ (GEF, 2017). The Vision states, ‘incremental environmental strategies alone will not suffice’, and that the Vision shall ‘compel the GEF to equip itself to promote transformational change’ (GEF, 2017). This emphasis was extended from the GEF more generally specifically to the LDCF and SCCF in 2018 strategy documents that link transformative potential to the core missions of the funds: ‘The LDCF and SCCF are also facilitating the development of initiatives with transformative potential at the global and regional levels that may be too early or risky to be rolled out at the national level’ (LDCF/SCCF Council, 2018, p. 2) as well as national ‘initiatives with potential to make transformational contributions for adaptation’ (LDCF/SCCF



Council, 2018, p. 2). The SCCF's objectives are also identified as contributing to transformational adaptation by 'building on its history of successfully facilitating technology transfer and innovative approaches' (LDCF/SCCF Council, 2018, pp. 24–25).

An interesting emphasis that has emerged in the GEF's narratives of transformation is the important role of the private sector as integral to achieving market transformations. A 2019 report stated that 'Transformation, or systems change, is the centerpiece of the GEF's efforts to maximize impacts and scale-up integrated approaches with the private sector' (GEF Secretariat, 2019, p. 29). Speaking to the GEF's mission to transform economic systems and reverse unsustainable global trends,

The GEF is moving towards a more holistic approach that mainstreams private sector engagement across GEF programs and focal areas. In GEF-7, the GEF's work with the private sector is based on two pillars: (1) Expanding the use of blended finance; (2) Mobilizing the private sector as an agent for market transformation. (GEF Secretariat, 2019)

Although board guidance by this point clearly demonstrates the importance of transformation for the fund, the first reference to transformation in the LDCF/SCCF Board meeting minutes (with the exception of a report of a UNEP project in April 2009), was in December 2019, when the CEO of the GEF 'emphasized that transformational change requires consensus and political support', signalling an acknowledgement of the political and contested nature of transformation. In the June 2019 meeting, there were numerous references to transformation in the context of a review of the gender ratings of projects and whether projects were gender transformational, identifying an additional area of focus for transformational adaptation.

*Adaptation Fund:* Board meeting minutes from the AF included a limited number of references to the concept of transformation, with a total of only 8 references. Between the first meeting in March 2008 and the 14th meeting in June 2011, there was not a single reference to transformation. In September 2011, there was one reference, in the description of a project designed to transform the rice sector, which was rejected by the board. The next reference to transformation was in March 2014, and actually described the GEF's value proposition:

helping countries with transformational policies; promoting and demonstrating an innovative approach to technology; helping countries to acquire capacity, including governance; providing a form of financial risk-sharing with the private sector; and a convening role of facilitating interactions including with civil society and the private sector.

Although there are several references to transformation between 2014 and 2019, none of them are in reference to the AF or its activities.

While the AF's investment criteria do not overtly prioritize transformation and the topic is not addressed in Board meeting minutes, an analysis of the Fund's board meeting publications and wider strategy documents reveal an interest in transformational adaptation. As early as 2015, the AF began articulating its contributions to transformational adaptation. A report from 2015, which included 122 references to the term transformation, is the primary document that elucidates ways that AF projects contribute to transformational adaptation. It argued

that learning and knowledge management activities enable broader audiences to benefit from lessons learned and best practices of projects financed by the AF, thereby accelerating the understanding of what kinds of interventions work for adaptation. The report goes on to say that 'It is in this acceleration that the potential for scaling-up, replication, and transformational adaptation can be identified' and suggests that 'it may be useful to require project proposals, within the project sustainability component, to address how the project can contribute to transformational adaptation, at differing scales and in differing types of activities' (Adaptation Fund Board, 2015). Project outputs which produce transformation 'focus on introducing new technologies or practices, new systems or structures of governance, or shifting the location or nature of activities' (Adaptation Fund Board, 2015). Specific examples include: (1) the introduction of early warning systems as an example of new technologies and practices; (2) the integration of adaptation needs into risk assessments and national policies as an example of new structures or governance systems; and (3) the introduction of innovative agricultural methods as an example of shifting the nature of activities (Adaptation Fund Board, 2015). This guidance on transformation suggests an understanding of transformative change that is more specific, individualized, and relatively smaller-scale than the way the GEF views transformational change. Far from the GEF's view of 'flipping' key economic markets or systems, these examples suggest a view of transformation which is concrete, implementable in the short-term, and technical. Importantly, reflecting on the mission of the AF, the report also identified potential mechanisms for transformation that are *not* the way that the AF approaches transformational adaptation. Most noteworthy of these, is that the 'responses being undertaken at larger scales or magnitudes was not considered, given the nature of the Fund's projects/programmes as pilots or demonstrations and the intent for all projects to result in scaling up or replication'.

At the same time, the Secretariat identified the need for the AF to provide guidance to parties 'to strengthen the sustainability of project outcomes and their contributions to transformational adaptation', and acknowledged that transformational change 'is still an evolving concept and lacks clear operational definitions, which creates difficulties for the identification, evaluation, and practice of transformational adaptation' (Adaptation Fund Board, 2015). The Secretariat's analysis concluded that 'integrating a full consideration of transformational aspects of projects into proposals is difficult at this point in time, and may best be pursued once the concept matures'.

By 2018, transformation was central to the AF's vision of itself. The Medium-Term Strategy for 2018–2022 emphasizes innovation and learning as central components that create transformational impact. The Strategy references the AF's ability to create transformational impact through the generation of valuable and timely knowledge through effective and concrete adaptation activities (Adaptation Fund, 2018, pp. 15–16). In preparation for the design of the Medium-Term Strategy, the Board undertook a self-assessment of organizational weaknesses, strengths, challenges, and opportunities. During the assessment, stakeholders identified the AF's ability to 'generate uniquely valuable learning around vulnerability, effective

adaptation, access modalities, capacity strengthening, and climate finance. Innovation and learning ... offer the Fund real opportunities for transformational impact' (Adaptation Fund, 2018). As discussed in Section 2, innovation and novelty within a system are considered to be a marker of transformation.

An evaluation of the Fund in 2018 drew heavily on the IPCC 5th Assessment Report in defining transformational adaptation, and assessed the extent to which projects contribute to absorptive, adaptive, and transformative capacities, with transformative capacity defined as activities that promote 'enabling environments that support absorptive and adaptive capacities through good policies and regulations, infrastructure, formal and informal social protection mechanisms, and basic service delivery' (Adaptation Fund, Board, 2018, p. 28). A wide range of potential contributions were evaluated including

responses undertaken at larger scales or magnitudes; responses that introduce new technologies and practices to a region or system; responses that create new systems or structures of governance; responses that shift the location or nature of activities; responses involving normative elements that seek changes in desired values; objectives, and perceptions of problems. (Adaptation Fund Board, 2018, p. 187)

The report concluded that 58 projects (92% of the portfolio) contributed to transformative capacity, with the development of climate-resilient infrastructure systems, support for improved ecosystem management and policy-building interventions as the key contributions (Adaptation Fund, Board, 2018).

*Green Climate Fund:* While the GCF is the newest of the three major financing institutions, the GCF was the first climate fund to push for a transformational agenda (GCF Board, 2013). As early as the GCF's third Board meeting in March 2013, the need to solicit 'transformational proposals' was identified, and at the board's fourth meeting in June of 2013, the board determined that the GCF's objective was to 'bring about a "paradigm shift" towards low-emission and climate-resilient development pathways and that the Fund should be transformational' (GCF Board, 2013). During the development of the GCF's First Strategic Plan, transformational change was identified as a necessity for both mitigation and adaptation activities, and it remains a central element in GCF rhetoric and project implementation (GCF Board, 2015b, 2018b). The GCF emphasizes a primary focus on transformative adaptation because 'Incremental adaptation efforts may not be sufficient to protect assets, livelihoods and food security, and more transformational change or a paradigm shift will be required' (GCF, 2019a, p. 17). Strategy documents also stress that transformation spans across adaptation sectors, from integrated water resource management, to ecosystem management and restoration, to the water-energy-food security nexus (GCF, 2019a).

A key mechanism through which the GCF describes itself as supporting transformative projects is by engaging with the private sector. Reports regularly identified 'catalyzing private finance' and 'crowding in private capital by de-risking its delivery' as key ways the private sector can be drivers of transformation (GCF, 2019a, 2019b, 2019c). The GCF's Private Sector Facility was also discussed as having high transformational potential. The importance of market development, capital flows and private sector finance were repeatedly raised as

essential to the transformational agenda of the GCF (Board Meeting 4, June 2013; Board Meeting 11, November 2015; Board Meeting 17, July 2017). The latest strategy for the Readiness Programme also emphasizes the private sector, stating that 'Transforming private sector approaches to managing risk and investing in climate resilience and adaptation pose a crucial opportunity' (GCF Board, 2019b).

Given the importance of transformation for the mission of the GCF, unsurprisingly, the definition of transformational change has arisen regularly in Board meetings. The first time this was explicitly addressed was at the 11th Board meeting in November 2015, although as early as the 4th meeting in June 2013, a board member proposed that the 'concept of paradigm shift should comprise three areas: (a) contribute to long-term, sustained change, (b) scaling up – sector, regional or economy-wide; and (c) a learning experience'. At the 13th meeting in June 2016, several Board members requested that the Secretariat 'establish a more thorough definition of the term "transformational", to find ways in which the GCF could achieve maximum transformational impact, and to transmit relevant guidance to AEs [accredited entities] and NDAs [Nationally Designated Authorities]'. An observer commented on the 'need of guidance on the definition of terms such as "market transformation", "innovative" and "paradigm shift"'. Board members raised concerns that the lack of clarity on the definitions of criteria increased the workload significantly for AEs, as well as the Secretariat, as significant time has been spent on the development and review of proposals that are not fundable based on the GCF criteria. Greater engagement of the Secretariat at the concept note phase was proposed as a means to increase clarity on expectations, and a new concept note template specifically designed to ensure alignment with the GCF's transformational goals was proposed during the Sept-Oct 2017 Board meeting. Again in 2018, calls were made to 'Clarify what high quality, innovative, transformational / paradigm shifting potential means for GCF' (GCF Board, 2018c), and a 2019 report acknowledges that a '... key challenge GCF faces in managing and maximizing impact is the still-evolving state of global knowledge on how to define, articulate and evaluate paradigm shift and transformation, in particular for adaptation' (GCF, 2019b). At the 23rd meeting, in July 2019, in the context of discussions regarding the mandate of the GCF and the role of co-financing and shifting financial flows, there were again calls from the Board for clarity on paradigm shift and transformational impact, as well as discussions of the implications for SIDS. The 2019 revised strategic programming document sets out a theory of change intended to help clarify what constitutes transformational change (GCF Board, 2019c). The theory of change does this by including transformational change in Outcomes 1 and 4, with Outcome 1 focused on 'developing country capacity to identify, design and implement transformational climate investments and enabling frameworks', and Outcome 4 focused on 'dissemination and uptake of good practices, methodologies and standards for transformational climate investment enabling replication and systemic change' (GCF Board, 2019c).

Apart from defining transformational adaptation, a key concern has been how to ensure that the Fund meets its overall objective of being transformative. The tension between

ensuring that allocation decisions prioritized a paradigm shift and transformational potential and a fair and equitable distribution of resources across countries arose frequently. Concerns were raised that emphasizing transformation could inadvertently lead to a concentration of resources in a few countries, as occurred with the Clean Development Mechanism. Concerns were raised on the one hand, that if funds were not disbursed, the GCF as an institution would not have a transformational impact, and on the other, that if projects were not high quality, the Fund would fail to attract future funding. As articulated in the March 2016 Board meeting:

What is crucial, however, is that the Board's ambition to get the Fund off the ground and up to scale swiftly does not compromise on its ambition to promote cutting-edge innovation and real transformation towards the low-emission and climate-resilient future that the global community committed itself to in the Paris Agreement. Only by setting the highest standards in terms of ambition and country ownership, and by ensuring that the Fund's unique guiding principles are ingrained throughout its processes – including those within its accredited entities – from the very beginning, can the Fund make the strongest possible contribution.

Another discussion point was the need for the Fund to take on risk as a means of distinguishing itself from other sources of finance and ensuring that transformational ideas are implemented. As articulated by a Board member in Board meeting 14 in October 2016, 'In order to bring about the desired paradigm shift, ... the GCF should be more comfortable with taking risks, for example by applying innovative technologies, testing new financial strategies, addressing challenging environments and forming multi-stakeholder partnerships'. Although official documents purport the GCF's risk appetite, stating that the GCF 'has expressed a willingness to take greater risks, such as with very large or proof-of-concept projects that are transformative' (GCF Board, 2017), Board discussions elucidate that only certain conceptions of transformation were deemed compatible with the GCF's risk tolerance. Notably, as the quote illustrates, large projects are considered particularly worthy of GCF support. Relatedly, discussions during the April 2017 meeting suggest discrepancies in how the transformational concept is applied for adaptation versus mitigation. One observer noted that

large mitigation proposals with several components were usually welcomed by the Board and the TAP [Technical Advisory Panel] as transformative, programmatic approaches; therefore, in an adaptation context, the same courtesy should be given to attempts to address adaptation in a holistic manner.

The appropriateness of scalability and replicability as indicators of transformation has repeatedly been addressed. In March 2016, concerns were raised regarding the way that scaling up, as one of the ways that transformational change is operationalized, may disadvantage SIDS and LDCs, and Board members called for a broader conception of scaling up beyond financial value and replicability. This issue emerged again in October 2017, when an observer stated that

For the kind of activities which civil society wished to see, namely low risk, smaller ones, the quick replication made possible through the SAP [Simplified Approval Process] created the transformational impact. It was not necessarily the individual activity that was transformational, but the bundling and acceleration through the SAP. It

would therefore be more appropriate to use "ready for replication" rather than "ready for scaling up", and "having the potential to contribute to transformation" rather than "having the potential for transformation" as eligibility criteria.

In the Feb-March 2018 Board meeting, the Board argued that 'greater efforts should be made to promote transformative impact by ensuring complementarity and coordination among the range of GCF-funded projects over time', suggesting a growing recognition of the cumulative nature of transformation, rather than a project-based one. In the context of appropriate project fees, the Board discussed the possibility that the transformational nature of some projects may lead them to cost more (particularly in terms of administrative costs) than other types of projects and sought to ensure that fee incentives would not bias against these projects. Similar conclusions were reached in discussions of co-financing ratios (GCF Board, 2018b).

Recent evaluations suggest that the goal of transformational change may be in tension with other goals of the Fund, such as country ownership. An evaluation of the Country Ownership Approach (COA) found that:

Tension can also be observed when it comes to adaptation in priority countries, where projects may be closely linked to fundamental development needs and more geophysically or socioculturally context specific, making scalability or replicability challenging. Adaptation projects visited by the COA team during evaluation missions to Fiji and Uganda offer examples of projects that are seen as strongly linked to national climate change and development priorities, but that are not as particularly innovative or transformational. (Green Climate Fund Independent Evaluation Unit, 2019, p. 37)

The evaluation also found that 'paradigm shift was a subjective and context-specific concept, and one that has generally not been integrated into the way that countries are thinking about climate change and development'. Importantly for country ownership, stakeholders in multiple countries felt that there were differences in interpretation in terms of what actions might be seen as transformational by country stakeholders, and what might be perceived as transformational at the international level. Several interviewees pointed to feedback from the GCF Secretariat or iTAP [independent Technical Advisory Panel] that created a pressure point for country ownership (e.g. recommending a more innovative approach or technology that may be at odds with what national stakeholders were considering) (Green Climate Fund Independent Evaluation Unit, 2019, p. 38). Furthermore, the evaluation found that an overreliance on certain factors that the GCF finds produce transformation, such as innovation, may cause an undue delay in project development. Innovative technologies may take longer to develop, and they have the potential to exclude the local private sector (thereby working against country ownership), if the local private sector cannot operate new or innovative technology (Green Climate Fund Independent Evaluation Unit, 2019). In recognition of this challenge, Board members argued that countries need to drive the process if projects are going to result in transformational change.

In addition to broad discussions of the transformational role of the Fund, insights can be gained by examining the discussions of projects under consideration for approval. The first time that transformational adaptation in a project was

discussed was in November 2011, in reference to a project in Bangladesh. Two Board members commented on the ‘transformational potential of the centre of excellence in making Bangladesh more resilient’, citing its high-level political support, high visibility, and potential to serve as an international model.

In June 2016, there was an extended conversation regarding the quality of proposals, with multiple Board members raising concerns regarding the level of ambition, lack of scale and innovation, and insufficient transformational impact. Concerns raised included lack of attention to structural issues, whether projects were ‘business-as-usual’ projects being re-packaged for the GCF, and concerns about the replicability and scalability of projects. These concerns were again raised in the October 2016 meeting, in which the Board expressed particular concern for the quality of adaptation projects. One board member claimed ‘the need for more meaningful and transformational projects, especially in the field of adaptation, and warned of the risk of spending resources too quickly on suboptimal projects such as some of those currently in the pipeline’. In April 2017, the Board debated the transformational potential of several hydropower proposals, with proponents arguing that a particular project provided a model of infrastructure resilience and that the transboundary cooperation components were transformational, while others argued that hydropower projects in general should not be supported, as they are not transformational, and may be maladaptive. A board member requested the Secretariat to assess the transformational value of all water projects in the pipeline. Although by the October 2018 meeting, some Board members noted improvement in the quality of proposals, there were still concerns about the transformational potential in projects, and a Board member called for the Secretariat to identify model projects with transformational potential. Regularly throughout 2019, concerns were repeatedly raised regarding the quality of proposals, although the Board overall observed improvements in project quality.

Looking forward, it is clear that transformational adaptation is likely to play at least as large, if not a greater role, in the future as it has to-date. One of the GCF’s key 2020 work programme deliverables is to ‘Develop more transformative proposals that lean into the GCF risk appetite; and establish a wide range of instruments and partners to deliver higher leveraged impact’ (GCF Board, 2019a). As part of the discussions of replenishment, the Board discussed ways to better articulate the transformational agenda of the GCF to distinguish it as a unique funder and worthy of greater support. Discussions raised the tension between the importance of acting quickly to fulfil its mandate of facilitating transformational change, and the importance of ensuring that projects are high quality so that they can be transformational. New ideas for ways to implement the Fund’s transformational mandate were articulated in submissions to the Board, such as using ‘its transformational mandate assigned by the international community in order to promote and test new and innovative approaches to climate financing, such as debt for climate swaps, climate-related insurance mechanisms etc. to promote the paradigm shift’ (GCF Board, 2019d). In planning the adaptation agenda under replenishment, a recent document stated: ‘The adaptation portfolio under GCF’s first replenishment aims to support countries and entities to realise their projects and programmes and transform their systems, in

order to adapt to climate change and become truly climate resilient’ (GCF, 2019a, p. 3).

## 5. Discussion

As evidenced by the literature on transformational adaptation and the inclusion of transformational change within the major climate financing mechanisms’ discourse, there is a growing emphasis on transformational change for adaptation. Despite the lack of clarity in both academic and practitioner discourse on what constitutes transformational change and a clear understanding of whether transformational change is achievable, feasible, and the most effective approach for adaptation projects, transformational change for adaptation has become a funding priority. It is assumed by the major climate financing mechanisms that transformational change for adaptation is both necessary and positive. However, existing literature suggests the need to critically examine transformational agendas because the definition and understanding of transformational adaptation influences the approaches developing countries take when enacting policies and interventions for adaptation (Blythe et al., 2018; Lonsdale et al., 2015).

### 5.1. Conceptualizing transformational adaptation

While only the GCF requires that projects produce transformation (i.e. through a paradigm shift) to receive funding, the analysis suggests that a transformational agenda is rising across all the funds. Table 4 summarizes the various definitions of transformation and related concepts. As the comparison across funds indicates, there is a growing convergence around the use of transformation in the funds’ discourse, but insufficient clarity surrounding the meaning of transformation. This lack of clarity is widely acknowledged by all the funds, and has frequently been a topic of discussion in Board meetings. This leaves developing countries and project implementers with insufficient clarity to determine which adaptation activities produce transformative results or how to align their adaptation needs with investment opportunities. Reports and guidance, however, provide increasing insight on how each fund envisions itself as transformational, what constitutes transformational change, and the mechanisms through which transformation can be achieved.

While additional guidance from funds on the way that they define and operationalize transformation would be helpful, the analysis shows several important themes regarding transformational adaptation:

- (1) *Market transformations*: Clearly articulated by the GEF and the GCF, it is apparent that funds are thinking a lot about how markets can be transformed to support adaptation. Although the term market transformation is often used to discuss making markets more ‘green’ and is arguably more aligned with a mitigation agenda, there is also consideration of how markets can better engage the poorest and most vulnerable for adaptation. Engagement of the private sector appears to be considered an important element in transformation.
- (2) *Gender transformations*: One of the areas where transformation specifically focused on behaviour change and

**Table 4.** Definitions of transformation and related concepts.

Concept	Definition
GEF Transformation	<ul style="list-style-type: none"> <li>• ‘A system change to a new identity’ (O’Connell et al., 2016).</li> <li>• ‘A shift from the current system to a substantively new and different one’ (O’Connell et al., 2016).</li> </ul>
Transformability	<ul style="list-style-type: none"> <li>• ‘The capacity for a system to be transformed to a different system’ (O’Connell et al., 2016)</li> </ul>
Transition	<ul style="list-style-type: none"> <li>• ‘The course of the trajectory from one domain of a system to another, or from one kind of system to another (i.e. a transformational change)’ (O’Connell et al., 2016)</li> </ul>
Transformational Interventions	<ul style="list-style-type: none"> <li>• ‘Engagements that help achieve deep, systemic, and sustainable change with large-scale impact in an area of global environmental concern’ (GEF, 2017)</li> </ul>
AF Transformative Capacity	<ul style="list-style-type: none"> <li>• ‘Promotes enabling environments that support absorptive and adaptive capacities through good policies and regulations, infrastructure, formal and informal social protection mechanisms, and basic service delivery’ (Adaptation Fund, 2018)</li> </ul>
Transformational Interventions	<ul style="list-style-type: none"> <li>• ‘focus on introducing new technologies or practices, new systems or structures of governance, or changing the location or nature of activities’ (Adaptation Fund Board, 2015).</li> </ul>
Transformational Adaptation	<ul style="list-style-type: none"> <li>• ‘Responses undertaken at larger scales or magnitudes; responses that introduce new technologies and practices to a region or system; responses that create new systems or structures of governance; responses that shift the location or nature of activities; responses involving normative elements that seek changes in desired values; objectives, and perceptions of problems’ (Adaptation Fund, 2018)</li> </ul>
GCF Transformational Interventions	<ul style="list-style-type: none"> <li>• ‘Maximizing the scale and transformational impact of the mitigation and adaptation activities of the Fund’, investing the Fund’s resources in transformational climate actions that are country-driven, striving for ‘transformational ambition’, and funding proposals that will trigger transformational changes (GCF Board, 2018a)</li> </ul>
Paradigm Shift	<ul style="list-style-type: none"> <li>• ‘Comprise three areas: (a) contribute to long-term, sustained change, (b) scaling up – sector, regional or economy-wide; and (c) a learning experience’ (GCF, 2013)</li> </ul>

Table 4 summarizes key terms related to transformation and the definitions utilized by the different funds. Each fund emphasizes different elements of transformational adaptation, but key themes emerge across funds.

cultural norms was through the concept of transformation of gender norms and practices. The GEF in particular analyzed its gender impact using the concept of gender transformations, although this also arose in the other funds. Other aspects of behaviour change did not appear to feature as prominently.

- (3) *Mainstreaming*: Although less explicit than market or gender transformations, across funds a key feature of transformation appeared to be the integration of adaptation and resilience into sectoral or economic policies.
- (4) *Scalability, Replicability, Innovation and Learning*: Although contested, scalability and replicability remain central indicators of transformation across funds, as do innovation and learning. Each of these terms could benefit from clearer definitions, and the extent to which proposals can select one mechanism for transformation, rather than demonstrating all of the above, is not transparent.

## 5.2. Transformation process

While definitional challenges with transformational change across funds make it difficult for applicants to ensure that they meet the investment criteria, a larger question is whether project-based funding models can achieve transformation in a 3–5 year period, given the generational time, scale, and degree of change required to produce true transformation, particularly in light of the challenges for creating change in complex socio-technical systems.

Transformational change as a process is intrinsically connected to behavioural change. Social structures and entrenched practices, which may need to change through adaptation interventions if they increase climate risks, are not transformed in a short time period. Often, this takes demonstration projects and time for new practices to take root. Large-scale behavioural change is unlikely to occur in the limited time frame that adaptation interventions typically pursue. Surprisingly, behaviour change is not explicitly mentioned in any of the funds’ guidance or reports on transformational adaptation. Additionally, there is a danger that an over-emphasis on the need for rapid transformational adaptation may lead to investments in adaptation approaches that are less reliant on human change, such as changes in infrastructure or improvements in data, as it may be easier to demonstrate results in shorter timeframes with these approaches.

Scalability and replicability are important elements across the funds’ conception of the transformation process. However, measuring transformation through the criteria of scalability may be problematic because transformations can happen at any scale, as explicitly acknowledged by the GEF. A focus on scalability as part of transformation may privilege adaptation approaches that emphasize large-scale changes. As GCF Board discussions addressed, such approaches also disadvantage SIDS and other smaller nations that cannot inherently ‘scale up’ approaches within their national contexts. In addition, the importance of local context may be overlooked if scalability or replicability are used as a basis for project design at the expense of local

**Table 5.** Tensions in operationalizing transformational adaptation.

Issue Area	Key Tensions in project design/implementation
Scalability	A focus on scalability may privilege large-scale changes and more well-tested approaches, precluding more innovative strategies and experimentation.
Replicability	Replication has the potential to: <ul style="list-style-type: none"> <li>reinforce existing dynamics and power structures;</li> <li>be in contradiction to producing a paradigm shift or systematic change;</li> <li>promote the homogenization of adaptation interventions and discourage experimentation.</li> </ul>
Behaviour change	A push for results in short times spans may be in tension with the long-term nature of behavioural change.
Consideration of local context	Transformational change may not be appropriate in all contexts.
Degree of change	Incremental change can lead to transformations over time, so positioning these in opposition may be counterproductive.

Table 5 provides a summary of issues for the implementation of transformational adaptation identified through the analysis of the literature and experience of the GEF, AF and GCF.

appropriateness. Additionally, replication may mean that existing dynamics and power structures will either be maintained or reinforced through subsequent interventions. Reinforcing existing power dynamics is problematic if current dynamics are uneven or result in the marginalization of certain groups, and replication may be in contradiction to producing a paradigm shift or systematic change. Replicability as an investment criterion could have the unintended consequence of promoting homogenization of adaptation interventions.

As raised by the GCF evaluation of country ownership, an over-emphasis on the need for transformation may come at the expense of prioritizing urgent adaptation needs at the national, regional, and local levels if those needs do not align with a transformational agenda. To meet local adaptation needs, adaptation investments need to reduce the adaptation deficit – i.e. build capacity in ‘countries and communities [which] are underprepared for current climate conditions because people and decision makers are underinformed about climate uncertainty, and therefore do not rationally allocate resources to adapt to current climate events’ (UNDP Regional Technical Advisors, 2018). The approach to reducing the adaptation deficit is going to differ depending on the given local context, and transformational adaptation approaches are not necessarily the best entry point. (Table 5).

## 6. Conclusion: reframing transformational adaptation

Transformational change for adaptation is rising on the political agenda, and there are clear signs that transformational adaptation is likely to continue to be a significant part of the adaptation finance landscape in the future. Efforts by the funds to provide additional clarity on the meaning of transformational adaptation are welcome, and given the reality that adaptation financing is primarily project-based, although there are attempts to move to more programmatic

approaches, transformational adaptation may be better framed in terms of how projects can build upon each other over time, thereby creating synergies with existing adaptation efforts at the country level and producing change over the long term. The funds’ recognition of this through concepts such as ‘transformational potential’ is encouraging, and additional efforts in this direction would align well with the scholarship on the transformation process. True transformation – i.e. fundamental change in society – often takes generations; one short-term adaptation project is unlikely to produce societal change because norms, behaviours, institutions, and socio-technical systems have a great deal of inertia, entrenched interests and lock-in, which take time to shift. Although critical perspectives have been raised in some Board discussions, additional reflection on the challenges of transformation, particularly the power dynamics and the privileging of certain adaptation strategies that lend themselves well to the logic of scalability and replication deserve greater attention.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Notes on contributors

*Marli Kasdan* is an Environment and Climate Change Consultant at the United Nations Development Programme (UNDP) where she supports UNDP’s global programmes across the nature, climate, and energy portfolio. She graduated with her Master’s degree from the Fletcher School of Law and Diplomacy in 2018.

*Laura Kuhl* is an Assistant Professor in the School of Public Policy and Urban Affairs and the International Affairs Program at Northeastern University. Her research focuses on adaptation policy in developing countries, with a focus on climate finance. She holds a PhD from the Fletcher School of Law and Diplomacy.

*Dr Pradeep Kurukulasuriya* leads UNDP’s support to countries on addressing nature, climate and energy priorities in the context of their national priorities and aspirations on the sustainable development goals and UNDP’s support to countries on accessing climate finance from international funds including the family of funds under the Global Environment Facility, Green Climate Fund and Adaptation Fund. Dr Kurukulasuriya is an economist with a specialization on the economics of adaptation to climate change and natural resource management.

## ORCID

*Laura Kuhl*  <http://orcid.org/0000-0002-1379-9435>

## References

- Adaptation Fund. (2018). *Medium-term strategy of the adaptation fund for the years 2018-2022*. <https://www.adaptation-fund.org/wp-content/uploads/2018/03/Medium-Term-Strategy-2018-2022-final-03.01-1.pdf>
- Adaptation Fund. (2019). *Helping developing countries build resilience and adapt to climate change*. <https://www.adaptation-fund.org/about/>
- Adaptation Fund Board. (2015). *Analysis of Climate Change Adaptation Reasoning in Project and Programme proposals approved by the board*.
- Adaptation Fund Board. (2018). *Second phase of the overall evaluation of the fund*.
- Barnett, J., & O’Neill, S. (2010). Maladaptation. *Global Environmental Change*, 20(2), 211–213. <https://doi.org/10.1016/j.gloenvcha.2009.11.004>
- Bell, M. (2012). International technology transfer, innovation capabilities and sustainable directions of development. In D. G. Ockwell & A.

- Mallett (Eds.), *Low-carbon technology transfer: From rhetoric to reality* (pp. 45–72). Routledge.
- Béné, C., Cornelius, A., & Howland, F. (2018a). Bridging humanitarian responses and long-term development through transformative changes—Some initial reflections from the World Bank's Adaptive Social Protection Program in the Sahel. *Sustainability*, 10(6), 1697. <https://doi.org/10.3390/su10061697>
- Béné, C., Headey, D., Haddad, L., & von Grebmer, K. (2016). Is resilience a useful concept in the context of food security and nutrition programmes? Some conceptual and practical considerations. *Food Security*, 8(1), 123–138. <https://doi.org/10.1007/s12571-015-0526-x>
- Béné, C., Mehta, L., McGranahan, G., Cannon, T., Gupta, J., & Tanner, T. (2018b). Resilience as a policy narrative: Potentials and limits in the context of urban planning. *Climate and Development*, 10(2), 116–133. <https://doi.org/10.1080/17565529.2017.1301868>
- Béné, C., Newsham, A., Davies, M., Ulrichs, M., & Godfrey-Wood, R. (2014). Review article: Resilience, poverty and development. *Journal of International Development*, 26(5), 598–623. <https://doi.org/10.1002/jid.2992>
- Blackburn, S. (2018). What does transformation look like? Post-disaster politics and the case for progressive rehabilitation. *Sustainability*, 10(7), 2317. <https://doi.org/10.3390/su10072317>
- 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>
- Brooks, H. (1995). What we know and do not know about technology transfer: Linking knowledge to need. In *Marshalling technology for development* (pp. 83–96). National Academies Press.
- Brown, K. (2015). *Resilience, development and global change*. Routledge.
- Carr, E. R. (2019). Properties and projects: Reconciling resilience and transformation for adaptation and development. *World Development*, 122, 70–84. <https://doi.org/10.1016/j.worlddev.2019.05.011>
- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128–152. <https://doi.org/10.2307/2393553>
- Colloff, M. J., Martín-López, B., Lavorel, S., Locatelli, B., Gorddard, R., Longaretti, P.-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 & Policy*, 68, 87–96. <https://doi.org/10.1016/j.envsci.2016.11.007>
- Edquist, C. (2005). Systems of innovation: Perspectives and challenges. In A. Fagerberg et (Ed.), *Oxford handbook on innovation* (pp. 181–208). Oxford University Press.
- Eriksen, S. H., Nightingale, A. J., & Eakin, H. (2015). Reframing adaptation: The political nature of climate change adaptation. *Global Environmental Change*, 35, 523–533. <https://doi.org/10.1016/j.gloenvcha.2015.09.014>
- Feder, G., Just, R. E., & Zilberman, D. (1985). Adoption of agricultural innovations in developing countries: A survey. *Economic Development and Cultural Change*, 33(2), 255–298. <https://doi.org/10.1086/451461>
- 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>
- Few, R., Morchain, D., Spear, D., Mensah, A., & Bendapudi, R. (2017). Transformation, adaptation and development: Relating concepts to practice. *Palgrave Communications*, 3(1), 17092. <https://doi.org/10.1057/palcomms.2017.92>
- Field, C. B., Barros, V., Stocker, T., Qin, D., Dokken, D., Ebi, K., Mastrandrea, M., Mach, K., Plattner, G.K., Allen, S., & Tignor, M. (2012). *IPCC, 2012: Managing the risks of extreme events and disasters to advance climate change adaptation* (A special report of Working Groups I and II of the Intergovernmental Panel on Climate Change, pp. 7575-7613). Cambridge University Press.
- Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., & Rockström, J. (2010). Resilience thinking: Integrating resilience, adaptability and transformability. *Ecology and Society*, 15(4), 20. <https://doi.org/10.5751/ES-03610-150420>
- Foxon, T. J., Reed, M. S., & Stringer, L. C. (2009). Governing long-term social–ecological change: What can the adaptive management and transition management approaches learn from each other? *Environmental Policy and Governance*, 19(1), 3–20. <https://doi.org/10.1002/eet.496>
- Gallagher, K. S., Grübler, A., Kuhl, L., Nemet, G., & Wilson, C. (2012). The energy technology innovation system. *Annual Review of Environment and Resources*, 37(1), 137–162. <https://doi.org/10.1146/annurev-environ-060311-133915>
- GCF. (2019a). *Adaptation: Accelerating action towards a climate resilient future*.
- GCF. (2019b). *GCF: Driving the transformation to a climate resilient financial system*.
- GCF. (2019c). *Raising ambition. Empowering action. Report on the progress of the Green Climate Fund during its initial resource mobilization period (January 2015 to July 2019)*.
- GCF Board. (2013). *Business model framework: Objectives, results and performance indicators*. Songdo, Republic of Korea.
- GCF Board. (2015a). *Annex III: Initial Investment Framework: Activity-specific Sub-criteria and Indicative Assessment Factors*.
- GCF Board. (2015b). *Strategic plan for the Green Climate Fund (Progress report)*.
- GCF Board. (2017). *Structure and staffing of the Secretariat*.
- GCF Board. (2018a). *GCF handbook: Decisions, policies, and frameworks as agreed by the board of the Green Climate Fund B.01 to B.20 2012-2018*.
- GCF Board. (2018b). *Report of the nineteenth meeting of the board, 26 February – 1 March 2018*.
- GCF Board. (2018c). *Report on the activities of the Secretariat*.
- GCF Board. (2019a). *Forward-looking performance review of the GCF. Forward-looking performance review of the GCF*.
- GCF Board. (2019b). *Readiness and preparatory support programme: Strategy for 2019-2021 and Work Programme 2019*.
- GCF Board. (2019c). *Strategic programming for the green climate fund first replenishment*.
- GCF Board. (2019d). *Synthesis of Board submissions for the review of the Strategic Plan of the Green Climate Fund – Addendum I Compilation of Board Submissions*.
- Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. *Research Policy*, 31(8–9), 1257–1274. [https://doi.org/10.1016/S0048-7333\(02\)00062-8](https://doi.org/10.1016/S0048-7333(02)00062-8)
- Geels, F. W. (2004). From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. *Research Policy*, 33(6–7), 897–920. <https://doi.org/10.1016/j.respol.2004.01.015>
- GEF Independent Evaluation Office. (2009). *Joint external evaluation: Operation of the least developed countries Fund for adaptation to climate change*.
- GEF Secretariat. (2019). *Beyond the numbers actions by the GEF Partnership to Safeguard the Global Environment*.
- Gillard, R., Gouldson, A., Paavola, J., & Van Alstine, J. (2016). Transformational responses to climate change: Beyond a systems perspective of social change in mitigation and adaptation. *Wiley Interdisciplinary Reviews: Climate Change*, 7(2), 251–265. <https://doi.org/10.1002/wcc.384>
- Global Environment Facility (GEF). (2013). *Draft GEF programming strategy on adaptation to climate change for the Least Developed Countries Fund and the Special Climate Change Fund*.
- Global Environment Facility (GEF). (2017). *Review of GEF support for transformational change*.
- Green Climate Fund Independent Evaluation Unit. (2019). *Independent evaluation of the Green Climate Fund's country ownership Approach*.
- IPCC. (2018). *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* (P. Z. V. Masson-Delmotte, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R.

- Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, & T. Waterfield, Eds.).
- ITAD. (2019). *Final evaluation report - Evaluation of transformational change in the climate investment funds*.
- Kates, R. W., Travis, W. R., & Wilbanks, T. J. (2012). Transformational adaptation when incremental adaptations to climate change are insufficient. *Proceedings of the National Academy of Sciences*, 109(19), 7156–7161. <https://doi.org/10.1073/pnas.1115521109>
- Kemp, R. (1997). *Environmental policy and technical change. A comparison of the technological impact of policy instruments*. Edward Elgar Press.
- Kemp, R., Schot, J., & Hoogma, R. (1998). Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management. *Technology Analysis & Strategic Management*, 10(2), 175–198. <https://doi.org/10.1080/09537329808524310>
- LDCF/SCCF Council. (2011). *A joint work programme for the least developed countries fund and the Special Climate Change Fund Submitted for the LDCF/SCCF Approval*.
- LDCF/SCCF Council. (2018). *FY 17 annual monitoring review of the least developed countries fund and the special climate change fund*.
- Lonsdale, K., Pringle, P., & Turner, B. (2015). *Transformative adaptation: What it is, why it matters and what is needed*. UK Climate Impacts Programme, University of Oxford.
- Markard, J., Geels, F. W., & Raven, R. (2020). Challenges in the acceleration of sustainability transitions. *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/ab9468>
- Matyas, D., & Pelling, M. (2015). Positioning resilience for 2015: The role of resistance, incremental adjustment and transformation in disaster risk management policy. *Disasters*, 39(s1), s1–s18. <https://doi.org/10.1111/disa.12107>
- O'Brien, K., & Selboe, E. (2015). *The adaptive challenge of climate change*. Cambridge University Press.
- O'Brien, K. (2012). Global environmental change II from adaptation to deliberate transformation. *Progress in Human Geography*, 36(5), 667–676. <https://doi.org/10.1177/0309132511425767>
- O'Connell, D., Abel, N., Grigg, N., Maru, Y., Butler, J., Cowie, A., Stone-Jovicich, S., Walker, B., Wise, R., Ruhweza, A., & Pearson, L. (2016). *Designing projects in a rapidly changing world: Guidelines for embedding resilience, adaptation and transformation into sustainable development projects (Version 1.0)*. Global Environment Facility.
- Olhoff, A., Bee, S., & Puig, D. (2015). *The adaptation finance gap update with insights from the INDCs*. United Nations Environment Programme.
- Olsson, P., Galaz, V., & Boonstra, W. J. (2014). Sustainability transformations: A resilience perspective. *Ecology and Society*, 19(4), 1. <https://doi.org/10.5751/ES-06799-190401>
- Olsson, P., Gunderson, L. H., Carpenter, S. R., Ryan, P., Lebel, L., Folke, C., & Holling, C. S. (2006). Shooting the rapids: Navigating transitions to adaptive governance of social-ecological systems. *Ecology and Society*, 11(1), 18. <https://doi.org/10.5751/ES-01595-110118>
- Pachauri, R. K., Allen, M. R., Barros, V. R., Broome, J., Cramer, W., Christ, R., Church, J. A., Clarke, L., Dahe, Q., Dasgupta, P., & Dubash, N. K. (2014). *Climate change 2014: Synthesis report. Contribution of working groups I, II and III to the fifth assessment report of the intergovernmental panel on climate change*. IPCC.
- Pelling, M., O'Brien, K., & Matyas, D. (2015). Adaptation and transformation. *Climatic Change*, 133, 113–127. <https://doi.org/10.1007/s10584-014-1303-0>
- Raven, R. (2007). Niche accumulation and hybridisation strategies in transition processes towards a sustainable energy system: An assessment of differences and pitfalls. *Energy Policy*, 35(4), 2390–2400. <https://doi.org/10.1016/j.enpol.2006.09.003>
- Rip, A., & Kemp, R. (1998). Technological change. In S. Rayner & L. Malone (Eds.), *Human Choice and climate change* (pp. 327–399). Battelle Press.
- Rogers, E. M. (1995). *Diffusion of innovations*. Free Press.
- Ruttan, V. (2001). *Technology, growth, and development: An induced innovation perspective*. Oxford University Press.
- Schot, J., & Geels, F. W. (2008). Strategic niche management and sustainable innovation journeys: Theory, findings, research agenda, and policy. *Technology Analysis & Strategic Management*, 20(5), 537–554. <https://doi.org/10.1080/09537320802292651>
- UNDP Regional Technical Advisors. (2018). *GCF technical expert workshop on climate adaptation finance - Inputs from RTAs*.
- UNEP. (2018). *The Adaptation Gap Report 2018*.
- Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2004). Resilience, adaptability and transformability in social-ecological systems. *Ecology and Society*, 9(2), 5. <https://doi.org/10.5751/ES-00650-090205>
- Westley, F. R., Tjornbo, O., Schultz, L., Olsson, P., Folke, C., Crona, B., & Bodin, Ö. (2013). A theory of transformative agency in linked social-ecological systems. *Ecology and Society*, 18(3), 27. <https://doi.org/10.5751/ES-05072-180327>
- Wilson, C., & Grubler, A. (2011). Lessons from the history of technological change for clean energy scenarios and policies. *Natural Resources Forum*, 35(3), 165–184. <https://doi.org/10.1111/j.1477-8947.2011.01386.x>
- Wise, R. M., Fazey, I., Smith, M. S., Park, S. E., Eakin, H. C., Van Garderen, E. R. M. A., & Campbell, B. (2014). Reconceptualising adaptation to climate change as part of pathways of change and response. *Global Environmental Change*, 28, 325–336. <https://doi.org/10.1016/j.gloenvcha.2013.12.002>
- World Bank and Potsdam Institute for Climate Impact Research, & Climate Analytics. (2013). *Turn down the heat: Climate extremes, Regional impacts, and the case for resilience*.