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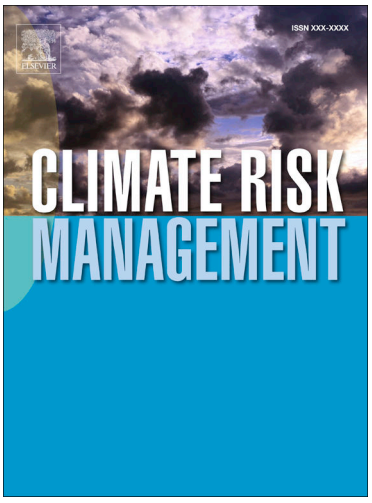


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# Assessing the Likelihood for Transformational Change at the Green Climate Fund: An Analysis Using Self-Reported Project Data.

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**Abstract**

Climate finance institutions have been tasked with effectively and efficiently allocating funds to spur the transition to low-carbon, climate-resilient economies. The GCF is a climate fund expected to assist the most vulnerable adapt to and mitigate climate change because of its mandate to contribute to a paradigm shift. To understand if the GCF's portfolio is on track to achieve this aim, we review the project documents of GCF investments through March 2020 (N=125 projects). We examine attributes of these investments by applying a framework for potential transformational change, comprised of eight components. We use bivariate statistics and multivariate cluster analysis to examine the GCF's project portfolio of mitigation, cross-cutting and adaptation projects. Bivariate tests find that adaptation projects show the greater intention to integrate policy change into national planning processes and that both adaptation and cross-cutting projects require a greater need for and expectation of behaviour change. Results from cluster analysis shows how adaptation projects dominate clusters with high and medium potential for transformational change (with 47% and 78% of projects, respectively). However, even the high potential cluster only displays the highest average scores for four of the eight components in our framework of transformational change. These findings present learning opportunities for the GCF's future project selection. The GCF should leverage its current resources carefully to attain transformational impacts especially within adaptation where the Fund has a greater market share compared to mitigation projects.

Key words: transformational change, paradigm shift, climate change, climate finance, international development, climate fund

## Introduction

The current and projected effects of climate change emphasise the need for immediate action as ecological, social, and economic facets of societies may become untenable if global average temperature increases go above 2°C (UNFCCC, 2015; IPCC, 2018). The Paris Agreement has underscored the need for adequate levels of finance to fund the requisite climate goals (UNFCCC, 2015) but it is widely recognised that finance flows are still insufficient to meet the climate needs of many countries (UNFCCC, 2018). With limited resources to deploy, climate finance must carefully allocate funds to leverage maximum impact (World Bank, 2020).

Such delays in effective climate action have spurred calls for systematic shifts away from business-as-usual approaches towards low-carbon, climate-resilient societies (IPCC, 2012; Kates et al., 2012). At their core, these demands underscore the need for a paradigm shift or transformational change, understood as the fundamental restructuring of systems (IPCC, 2012; Blythe et al., 2018).[2] The Green Climate Fund (the GCF) is one notable institution equipped to mobilise action in developing countries and was established to "promote the paradigm shift towards low-emission and climate-resilient development pathways" (GCF, 2011).

[2] The terms 'transformational change' and 'paradigm shift' are not used within the Paris Agreement, whilst the GCF's Governing Instrument only refers to 'paradigm shift'. Policy and academic literatures as well as IPCC reports use either one or other of these terms to convey the systemic or broad changes necessary for low-carbon, climate-resilient societies. We use both terms interchangeably and sections 2 and 3 discusses the relationship between these two terms in some depth.

The GCF's portfolio should mirror this ambition. As the largest climate finance institution, the GCF has the means to catalyse measurable and meaningful change. To accomplish this, it is paramount that the GCF allocates its investments effectively and strategically. However, the degree to which its portfolio of projects is likely to contribute to a paradigm shift is presently unclear. This uncertainty provides the impetus for the present paper.

As the GCF is still a young organization, many of its funded projects have not been implemented. This precludes an *ex-post* assessment of transformational change. Instead we develop a framework of transformational change and present an *ex-ante* assessment of the GCF's project portfolio based on the funding proposals that have been approved by the Board. It is important to highlight that information provided in GCF funding proposals is self-reported data that has not been independently verified and it has not been possible to cross check the information presented. With this caveat in mind, we aim to respond to the following questions: 1) To what extent is the GCF portfolio consistent with the Fund's objective of funding paradigm-shifting projects?; 2) How is the framework for potential transformational change reflected within the portfolio across mitigation, adaptation, and cross-cutting projects?; 3) What are the implications of these characteristics in terms of GCF project design and selection going forward?

The paper consists of seven sections. Section 2 offers a literature review of transformational change concerning climate and development interventions. It also describes the continuum of transformational change and compares its use across donor

agencies. Section 3 describes how the terms transformational change and paradigm shift are understood and applied by the GCF and by the Independent Evaluation Unit (IEU) of the GCF. Section 4 discusses data extraction and variable construction. Section 5 describes the data preparation and analytical methods used in this article, namely a data classification technique in the form of cluster analysis. Section 6 offers the findings from these models and presents basic descriptive statistics. Section 7 discusses these findings and reflects on the GCF's current approach in dealing with the complexity of transformational change. We compare the GCF's position vis-à-vis other multilateral agencies, highlighting an opportunity for the GCF to distinguish itself within the climate finance space.

## Section 2- An overview of current mitigation and adaptation actions: Why do we need transformation?

Ideally, climate finance should promote systemic and long-term change in regions to which funds are deployed to have maximum effect. In this respect, many countries should phase-out conventional fossil fuel and energy-intensive technologies and undertake sustainable management and agricultural practices to achieve a low-carbon economy (Vieweg and Noble, 2013). However, conventional mitigation and adaptation actions have realised limited success. Current investments and projects[3] often focus on incremental adjustments which are unlikely to manage climate change (Termeer et al., 2017). Current levels of climate finance, as well as pledges and actions, currently fall short of the requisite commitment to reach the Paris Agreement's goals (Lebling et al., 2020), as shown in the

[3] We use the word 'investments' and 'projects' in the paper interchangeably. This is because the GCF makes its investments on climate, through projects.

Glasgow Climate Pact from November 2021. Specifically, progress towards emissions reductions targets across sectors are largely not apace with the goal of a low-carbon economy (Lebling et al., 2020). These shortcomings are reflected in the increase in atmospheric $CO_2$ concentration of 2.3 parts per million between 2017 and 2018 (WMO, 2020).[4]

Similar trends are prevalent within climate adaptation (Global Commission on Adaptation, 2019). Current adaptation projects frequently focus on incremental solutions at the expense of structural and social processes producing vulnerability (Bassett & Fogelman, 2013; Watts, 2015). These approaches can be either top-down, such as large-scale infrastructural investments, or bottom-up, such as community-based adaptation initiatives. Both approaches seldom address the root causes of vulnerability (Bassett & Fogelman, 2013; Godfrey-Wood & Naess, 2016). In this respect, current adaptation interventions are not supporting countries for the scale of forthcoming climatic changes (Barnett & O'Neill, 2010). For instance, ecosystem-based adaptation strategies that only deal with current changes but fail to anticipate future impacts may prove ineffective and unsustainable (Wise et al., 2014). The shortcomings of both climate mitigation and adaptation interventions have prompted researchers to question the efficacy of the current paradigm for dealing with climate change (for example, see Klein, 2014). These failings have also whetted an appetite for broader *transformational* change. This is illustrated through the work of multilateral climate institutions that now aim for their mitigation and

[4] These figures do not include emissions for methane, nitrous oxide or fluorocarbons which have also increased in the past decade and which have a greater level of radiative forcing.

adaption programmes to be 'transformational' (see, for example, GEF IEO, 2018, Grimm et al., 2018, and Puri, 2018).

**An overview of transformational change as a concept**

Transformational change is often considered a multi-dimensional and multi-attribute process (reviewed in Feola, 2015; Mapfumo et al., 2017; Puri, 2018) with implications across personal, political, and practical spheres (O'Brien et al., 2015). More specifically, we understand this term as:

> "*A structural change that alters the interplay of institutional, cultural, technological, economic, and ecological dimensions of a given system. It will unlock new development paths, including social practices and worldviews*" (Mersmann et al., 2014 p. 6)

Whilst there is a clear consensus around the need for transformational change (Pelling, 2011; O'Brien et al., 2012), there is less agreement on the concept's characteristics and constituent parts (Feola, 2015; Boodoo et al., 2018). In the context of climate change, clear definitions or agreement on what constitutes either a paradigm shift or transformational change are similarly absent (Mersmann et al., 2014). There is also significant discord within development agencies regarding the nature of transformation and its preconditions (Puri, 2018). In many cases, organisations use the concept as a

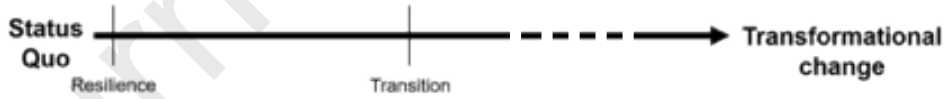
metaphor for systemic change (Feola, 2015). Such a broad definition provides a common ground among diverse disciplines (Godfrey-Wood & Naess, 2016). However, it also subjects the term to misappropriation if it is attributed to approaches that are not fundamentally different (Feola, 2015). In the context of climate change, the term transformational change has a close relationship with a sibling, paradigm shift. Both terms are often used interchangeably (Puri, 2018), including within climate finance institutions (e.g. Harmeling et al., 2013). Within the GCF, the notion of transformational change featured heavily during discussions surrounding the Fund's creation (Winkler & Dubash, 2016). For example, the transitional committee of the UNFCCC which designed the GCF originally underlined the type of change needed to make the transition to low-carbon, climate-resilient societies as 'transformational' as opposed to using the term 'paradigm shift' which was preferred later. Furthermore, the GCF has also used the notion of transformation in relation to the ambition to achieve a 'paradigm shift' (GCF, 2019a; GCF, 2020) and relevant board documents also suggest that the GCF should be transformational (GCF, 2013). Given the fluidity with which these terms are used within the GCF and elsewhere, we refer to both terms interchangeably, whilst recognising one important difference: that paradigm shjft is typically used at a conceptual level whilst transformation change is more concrete, and is usually used in relation to changes at the level of implementation and action.[5]

**Review of transformational change in adaptation and mitigation interventions**

[5] We thank a referee for this manuscript who alerted us to this distinction. In this respect, it may have been more appropriate to use the term 'transformational change' within the GCF's Governing Instrument when referring to the Fund promoting a "paradigm shift towards low- emission and climate-resilient development pathways by providing support to developing countries.

Overall, transformational approaches should necessarily challenge as opposed to reinforce the status quo (Roberts & Pelling, 2019) and seek to change the fundamental attributes of a system (IPCC, 2014). In this respect, a useful and tractable way of approaching transformational change is to see it as a continuum that stretches from incremental at one end to transformational at the other (Waddell, 2016; Ajibade & Adams, 2019) (Figure 1). Incremental approaches often make small adjustments to existing systems, seeking to maintain their integrity (Ajibade & Adams, 2019). These approaches dominate the literature, whereas examples of transformational measures are rare (Thornton & Comberti, 2017; Heikkinen et al., 2018). The journey from transition to transformation is, though, subject to discontinuities: it is rarely smooth but instead should be seen as staccato, uncertain and subject to failure.

**Figure 1.** Continuum of transformational change within adaptation




Source: Pelling (2011)

The dearth of transformational approaches is particularly salient in adaptation interventions (Godfrey-Wood & Naess, 2016; Brooks et al., 2017), despite its recent surge

in popularity in the climate change literature (Bassett & Fogelman, 2013). One approach to describe adaptation to global climate change is through a continuum of resilience, transition, and transformation (Pelling, 2011) (see Figure 1). Incremental solutions are often employed to increase resilience, whereas fundamental changes and innovations in adaptation are adopted if agents want to be transformative (reviewed in Fook, 2017). Adaptation is often depicted in reactionary terms and frequently framed as a process of adjustment (Bassett & Fogelman, 2013). This narrow interpretation of such a broad concept may have stymied the application of transformational interventions (Bassett & Fogelman, 2013; Godfrey-Wood & Naess, 2016) and precipitated a reliance on proximate, incremental approaches that we witness globally. There also appears to be a lack of clarity about the potential for incremental adaptation actions to be transformative (Vieweg & Noble, 2013). Kates et al. (2012) specify that transformational approaches in adaptation should include interventions adopted at a larger scale or intensity, that are new to a particular system, and that transform places.

Within mitigation, transformational interventions support the transition to low-carbon economies by disrupting existing path dependencies within – for example – socio-technical systems (Markard et al., 2012). Here, transformational actions often reflect the scale, sustainability, and innovation of interventions (Wienges et al., 2017). More broadly, transformational projects should reduce implementation barriers for subsequent projects, thereby catalysing more substantial impacts (World Bank, 2020). Akin to adaptation interventions, there are few readily apparent examples of transformational mitigation actions (reviewed in Winkler & Dubash, 2016). To take one example, Nationally

Appropriate Mitigation Actions (NAMAs) are a mitigation mechanism which attempts to foster carbon-centric transformational approaches through emissions reductions in developing countries (Green Climate Fund, 2014; UNFCCC, n.d). However, in tying a project's success to its emission reductions, projects may fail to articulate clear roadmaps to transformational change (ICF, 2014). Furthermore, there may be some tension between the current emphasis on demonstrable emission reductions with the need for country ownership, itself a necessary precondition for transformational change (Winkler & Dubash, 2016). That is, top-down mandates for transformation may inadvertently eschew bottom-up dynamics that characterise country ownership (Winkler & Dubash, 2016).[6]

**A proposed framework for transformational change**

Few frameworks exist to guide practitioners who wish to promote transformational change (Mapfumo et al., 2017), highlighting the need for more manageable and actionable strategies. The development and application of these frameworks is contingent on breaking down the (abstract) concept down into smaller components – akin to other forms of systems change (Muehlenbein, 2018). We operationalise transformational change by deconstructing it into eight proxy variables (hereafter referred to as components) based on Puri (2018) and the wider literature, especially GEF IEO (2018) and Grimm et al. (2018) (see Table 1). Although individual entities often use bespoke definitions of transformational change (Puri, 2018), there is some consensus on the concept's necessary

[6] The interplay between transformational change and the need for country ownership is understandably complex. In part, this dynamic rests on the lack of a cogent understanding of what transformational change entails.

elements. We postulate that combinations of these components together may create an enabling environment to support transformational change (Figure 1). We recognise that transformation is a protracted process and may not occur within the confines of a given project or programme. However, it is essential to identify the factors of projects and investments that may promote the type of systemic change necessary for transformational change to occur and endure.

In our view, these eight components are central to precipitating transformational change. Following Puri (2018) and the IEU (2019), projects must have sufficient scale and depth of change, permanence of change[7], support policy change, and behaviour change. Interventions should also be innovative, moving away from traditional forms of technical assistance. Complementarity and coherence, on the one hand, and demonstration ability on the other feed into and support the elements above. Specifically, complementarity and coherence between climate funds can increase the scale of impacts and the depth of impact per beneficiary. Demonstration ability (replication and scale) may increase the permanence of impact. Collectively, these eight components are likely to provide the *necessary* environment for transformations to emerge. In this sense, this is a framework for 'potential transformation'. It is also important to note that until there is more evidence, we do not make assertions about what are *sufficient* conditions for transformations to occur. We now review the lessons that can be learnt on achieving scale within the international development literature.

[7] Some researchers use the term 'durability' in place of 'permanence' to refer to impacts that endure after an intervention ends (e.g. GEF STAP, 2019)

**Figure 2.** Operational dimensions of potential transformational change – a new framework.


Source: Authors

**Table 1.** Relevant components of a framework for potential transformational change, as defined by both the literature and by select climate funds.

| **Components of and contributors to transformational change** | **Use in other climate funds** | **Literature reference** |
|---|---|---|
| Scale | CIF<br>GEF | Kates et al. 2012; Few et al. 2017; Mapfumo et al. 2017; Termeer et al. 2017; Wienges et al. 2017 |
| Behaviour change (including stakeholder engagement; social learning; social change) | | O'Brien et al. 2012; Few et al. 2017; Mapfumo et al. 2017; Thornton and Comberti 2017; van den Berg & Cando-Noordhuizen 2017; Ajibade et al. 2019 |
| Replicability | | Mapfumo et al. 2017 |
| Sustainability | CIF<br>GEF | Mapfumo et al. 2017; Thomalla et al., 2018; Wienges et al. 2017 |

| | | |
|---|---|---|
| Innovation (including risk-taking) | | Kates et al. 2012; Few et al. 2017; Thornton and Comberti 2017; Thomalla et al., 2018; Fedele et al., 2019 |
| Policy change (including governance) | AF | Rippke et al. 2016; Few et al. 2017; Thornton and Comberti 2017; van den Berg & Cando-Noordhuizen 2017; Thomalla et al., 2018; Ajibade et al. 2019; Feinstein, 2019; |
| Depth of change | CIF and AF (systemic change), GEF | Termeer et al. 2017 |
| Relevance | GEF, CIF | |

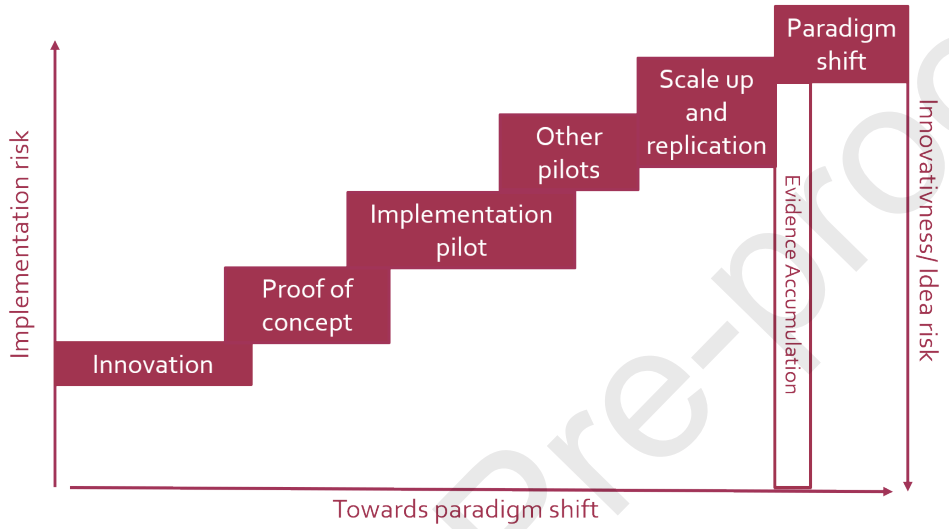
Source: Authors

***Achieving scale within international development***

International development organisations are increasingly concerned with achieving impacts at scale (Hartmann et al., 2013). Specifically, interventions that scale out, up, and deep (Olsson et al., 2017). Both scale and depth of impact are often used within development agencies and the broader literature to indicate a project's potential for transformational change (see Table 1). We operationally define 'scale' as increasing the number of beneficiaries reached by expanding projects across contexts and over time (Hartmann & Linn, 2008). Organisations achieve this goal through an iterative three-part process that involves innovation, learning, and scaling up (Linn et al., 2010) (Figure 3). Unfortunately, many organisations have grappled with this schema's effective execution. Before turning to the literature on scaling innovations and how their effective implementation can contribute to transformational change, we introduce a simple illustration that describes the foundations of our conceptual framework. Figure 3 illustrates

the steps to support the realisation of transformational change which intersect with *effective scaling pathways* are vital to long-lasting change.

**Figure 3 An illustration of the different components leading to transformational change.**




Source: Authors

Notes: The diagram introduces the steps by which an innovation leads to a paradigm shift. We hypothesize that the 'innovativeness' of an idea (on the x-axis) is inversely correlated with the risk of implementation (plotted on the right hand y-axis), so that the risk of an idea reduces as one moves from initial innovation to proof of concept, implementation pilots, replication pilots, and scaling up. During this time, the risk of implementation (plotted on the left-hand side x-axis, increases. As evidence on the efficacy and implementation effectiveness of an innovation[8] accumulates, it leads to a tipping point for a new paradigm.

Several frameworks have been developed to respond to the need for such pathways (Cooley & Ved, 2012; Cooley & Linn, 2014). At their core, these frameworks rest on an *enabling environment*, which is similarly a precondition for transformational change (Folke et al., 2010; De Haan & Rotmans, 2011; O'Brien et al., 2012; Termeer et al., 2017).

[8] Also called 'anomalies' in Thomas Kuhn's 1962 book, 'The Structure of Scientific Revolutions'

Addressing the underlying conditions that give rise to sustainable solutions may allow for subsequent shifts in *behaviour, social structure*, and the pursuit of *new norms* (reviewed in Ajibade et al., 2019). Such changes must precede and complement the implementation and scaling of an *innovation*. We now briefly review six aspects of effective scaling pathways and how they interact with our understanding of transformational change.

First, innovation. We suggest that a concept's potential for transformation is predicated on an innovation's ability to be successfully disseminated and scaled. We also recognise that innovations can vary substantially across relevant dimensions (see Table 2 and Figure 3). In the presence of an enabling environment, an innovation is likely to be developed, implemented and scaled up. Hence Hartmann & Linn (2008) argue that innovations that are scaled up should be carefully selected. Furthermore, these innovations should address the root causes of unsustainable pathways and break the path-dependence set by the current paradigm (Olsson et al., 2017; Hall & Dijkman, 2019). They must also support synergies that are likely to contribute to transformational change. Innovations need to be tested for both efficacy and effectiveness, evidence of which is critical before which we can witness a transformation (see Puri et al, 2020).

**Table 2.** An overview of innovation as a function of its type, intensity, scale, and context.

| **Dimensions of innovation** | **Typology by type of effect** |
|---|---|
| Type | Technology, product, service |
| | Process, social, policy |
| | Business model or financial instrument |
| Intensity | Incremental |
| | Radical |
| | Disruptive |
| Scale | Central to project design |

| | |
|---|---|
| | Peripheral to project design |
| Context | Macro: New to the world or region |
| | Micro: New to the country or institution |

Source: Chase et al. (2020)

Second, scaling up implementation. As is clear, scaling up is essential to ensure widespread access to interventions (see GEF IEO, 2019 for a recent review). Numerous factors may permit or impede the development of an innovation at scale, which may be both endogenous and exogenous (Do, 2019). These enabling conditions are varied and may include facilitating the adoption of the intervention, ensuring sustained support for the initiative, and allowing for learning to improve adaptability of the scaled intervention (GEF IEO, 2019). Innovation must also occur across multiple dimensions (IIRR, 2000; Cooley & Linn, 2014; Do, 2019). At each stage of scaling, barriers must be tackled to allow for change.

Third, a supporting environment. Several complementary facets of the environment promote the adoption of innovations. These include the innovation itself, the context and policy environment in which the innovation is piloted, relevant market conditions (especially when markets themselves are transformed) as well as engagement with local stakeholders (GEF IEO, 2018; Woltering et al., 2019; Low & Thiele, 2020). Across these dimensions, implementation must be sensitive and adapt to local conditions (Chambers et al., 2013).

Fourth, time periods and sustained impacts. Sustained impacts are often the hallmark of effectively scaled interventions (GEF STAP, 2019). This in turn is dependent on multiple dimensions. Notably, program beneficiaries are critical to the adoption and use of interventions. Communities in which interventions take place must be active participants to promote scaling and innovation adoption (Westley & Antadze, 2010). For this reason, the literature predominantly identifies the idea that scaled-up programs are bottom-up, driven by local engagement and government ownership (Hartmann & Linn, 2008; Linn, 2012; Brooks et al., 2017; Low & Thiele, 2020). In this way, communities are likely to be more inclined to change norms and values, and demonstrate behaviour change, a requirement of long-lastiung interventions (O'Brien et al., 2012). Indeed, to bolster their chances of success, the process of behaviour change in interventions must be explicitly articulated as opposed to implicitly assumed (Metternicht et al., 2020).

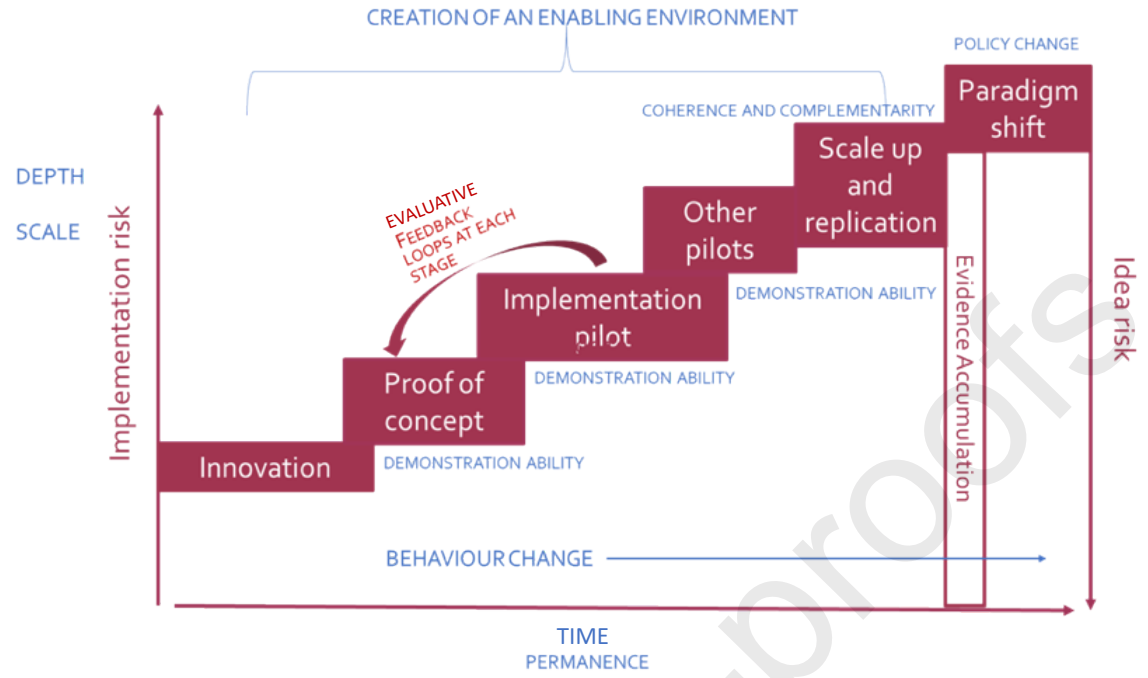
Fifth, replication. Once evidence of impact is accrued from multiple settings, an innovation needs to be replicated within and outside a target region (Cooley & Ved, 2012) (Figure 3). In this context, collaborations between organisations can help bring piloted innovations to scale (Hartmann & Linn, 2008; Cooley & Ved, 2012; Do, 2019), extending both a project's scale and depth of impact. Indeed, in this sense, coherence and complementarity between organizations can contribute to such collaboration.

Sixth, adoption. As articulated above, facilitating the use of innovations at scale involves many interlocking components: the innovation itself, an enabling environment, testing and evidence, behaviour change, replication, and work with complementary

institutions and participation by beneficiaries/adopters. The success of an innovation is also tied to its permanence, scale, and depth of change. Many of these requirements are outlined in discussions of transformational change (see Table 1). Lastly, all stages – from a pilot through replication – require evidence, produced via monitoring and evaluation (Cooley & Linn, 2014). This can promote feedback loops that may channel into subsequent program planning and execution (Boodoo et al., 2018).

Figure 4 below applies the eight components of transformational change to the steps of scaling outlined in Figure 3. As noted above, each scaling stage is a necessary building block for transformational change (but not sufficient). Figure 4 illustrates how, in our view, transformational change relies on a sequence of steps across policy, technological, financial, and social spheres.

**Figure 4**. Innovation and transformational change




Source: Authors

**Section 3 - How do climate funds and the GCF apply transformational change?**

Transformational change is contingent on comprehensive and cross-sectoral interventions (Wienges et al., 2017) which may involve reconfiguring social, political, technical, and policy elements of society (Murray et al., 2010; Olsson et al., 2017; Hall & Dijkman, 2019). It has recently gained attention within the climate finance community (Mersmann et al., 2014; Uitto et al., 2019). For example, the Global Environment Facility (GEF), the Climate Investment Funds (CIF), and the Adaptation Fund (AF) have all articulated their organisational ambitions in this space (GEF, 2012; GEF IEO, 2018; Grimm et al., 2018; Itad, 2019; Table 1). But despite a nascent focus on transformation,

clear pathways towards achieving this aim are scarce (van den Berg & Cando-Noordhuizen, 2017).

Akin to other climate funds, the GCF has grappled with how transformational change should frame its identity and project portfolio (Bertilsson & Thörn, 2020). The GCF was created in 2010 as a designated operating entity of the financial mechanism of the UNFCCC and provides funding for climate change mitigation and adaptation projects and programmes (Althor et al., 2016). The notion of paradigm shift is central to the GCF: It is both a principle within its Governing Instrument and one of six investment criteria used to assess funding proposals. However, the GCF has yet to provide a concrete definition or framework for either a paradigm shift or transformational change (Green Climate Fund 2016, para.129; IEU, 2019; Bertilsson & Thörn, 2020). These inconsistencies occur despite such terms featuring prominently in internal documents (Green Climate Fund, 2018). The GCF loosely implies that specific components are needed to contribute to a paradigm shift; however, the extent to which these criteria differ from business-as-usual development interventions is unclear (Persson & Atteridge, 2019). Furthermore, we find that results management frameworks within funding proposals mostly fail to relate to how project outcomes contribute to a paradigm shift (Fiala et al., 2019; IEU, 2019).[9]

[9] Based on the premise that the term paradigm shjft is typically used at a conceptual level whilst transformation change is more concrete, the GCF could take a stepwise approach and explicitly support projects which contribute to a (conceptual) paradigm shift which in turn would lead to outcomes that could generate forms of transformative change.

We now use the framework developed in Section 2 and apply it to the GCF's project portfolio to understand the extent to which there is potential for a paradigm shift.

To understand the extent to which investments at the GCF include the components for transformational change, we reviewed the GCF's project portfolio. We assessed board-approved FPs across the eight components of transformational change described in Figure 2. To translate these components into measurable variables that we used for our analyses, we map the components to (proxy) variables as described in Table 3.

**Table 3**. A mapping of components of potential transformational change to their proxy variables.

| Component | Definition and proxy variables |
|---|---|
| 1. Scale | Definition: Breadth of impact<br>Proxy variable: This is measured by the number of beneficiaries or geographic area |
| 2. Depth | Definition: Impact per unit beneficiary<br>Proxy variables: This is measured by hectares and/or $CO_2$ emissions reductions). Specifically:<br>• For adaptation and cross-cutting portfolios, impact was measured in terms of adaptation improvement in relation to the nature of the intervention (for example, in terms of number of hectares improved for a nature-based solution).<br>• Within the cross-cutting and mitigation portfolios, impact is measured in the context of lifetime $CO_2$ emissions reductions |
| 3. Complementarity and coherence | Definition: Are GCF investments complementary to and coherent with projects funded by other climate funds (e.g. GEF, CIF, AF). This variable assesses the degree to which the GCF interacts with other climate funds will increase both the scale and depth of impact to targeted beneficiaries.<br>Proxy variables: It is measured by the extent to which project proposals mention that the investment is complementary to previous or existing investments made by GEF, CIF and AF. |
| 4. Permanence | Definition: To what extent will the impact be sustained over time?<br>Proxy variables: This is measured by the period of time that the investment proposal indicates its impacts will last. |
| 5. Demonstration ability | Definition: Does the project have a plan to affect others (e.g. through replicating project attributes)?<br>Proxy variable: This is measured by examining the plans for replication in the project proposal. |
| 6. Behaviour change | Definition: Does the project aim to change behaviour? What means will it use? |

| | |
|---|---|
| | Proxy variable: This is measured by the plans for behaviour change mentioned in the project proposal. |
| 7. Policy change | Definition: Does the project aim to catalyse change in policy, strengthened policies, or increased spending on policy initiatives?<br>Proxy variable: This is measured by the plans for policy change/support mentioned in the project proposal. |
| 8. Innovation | Definition: Does the project contain a self-reported innovation or disruption? The innovation may be geographical, sectoral, or institutional.<br>Proxy variable: This is measured by the description of innovation described in the project proposal. |

Source: Authors

We extracted data from the GCF's complement of funding proposals (N= 125), including projects invested through the Simplified Approval Process (N=13). Projects following a results-based payment scheme [REDD+ projects (N= 4)] were excluded from consideration as FPs followed a different format. We included FPs approved through March 2020 from the GCF's three research foci: adaptation (N=59), mitigation (N=32), and cross-cutting (N=34) projects. As we extracted data from funding proposals, all information refers only to planned activities that are self-reported by accredited entities.

Extraction took place in three phases. To identify discrepancies in variable interpretation and coding, we piloted the process with a subset of FPs (N=8). Here, two evaluators extracted data from the same FPs. Variable definitions and extraction guidelines were subsequently revised before the full extraction. In the second phase, two independent evaluators pulled relevant information from the FPs in parallel over six weeks. We extracted data for each variable from pre-identified sections of FPs. For subjective Likert scale variables, we also extracted passages from the text to validate scoring. We maintained a change-log to record alterations to the dataset. In the third phase, after extraction, we selected 10% of the FPs at random to screen for discrepancies in coding *post-hoc*. These

FPs were then cross-checked by an alternate reviewer to highlight differences in data coding and verify the accuracy of the data. We re-coded variables for which we found apparent discrepancies.

**Section 4 – Data preparation and analytical methods**

We undertook data cleaning and analysis in both R (R Core Team, 2020) and SPSS 25 (IBM, 2017). To analyse emergent trends for each of the adaptation, mitigation, and cross-cutting foci, we derived basic descriptive statistics for variables within each of the eight components of transformational change. To assess the portfolio's likelihood for transformational change, we conducted cluster analysis. Cluster analysis identifies patterns and sub-structures within the dataset by grouping observations based on measures of similarity. We used theory-based feature selection to determine a subset of variables to include (Table 5)[10]. We cleaned and standardised data before conducting the cluster analysis. Firstly, we imputed variables containing missing values. Missing values were imputed using predicted values from a normal distribution (R Core Team, 2020). Secondly, we $\log_{10}$-transformed other positively skewed scale variables to ensure a normal distribution. Third, we aggregated binary variables with other relevant binary variables within each component to create an ordinal variable. We then converted these and other ordinal variables to scale variables via a logit transformation. We standardised all scale variables. Lastly, we removed outliers i.e. those observations whose values exceeded three

[10] Before conducting the cluster analysis, we checked to see if we could reduce the number of variables within the transformational change components using principal components analysis. However, principal component analysis was not necessary as the correlation coefficients for all components fell below 0.30.

standard deviations from the mean. We replaced these values with one which was fractionally lower/higher than the adjacent case. We performed cluster analysis using K-means clustering so we could select the number of clusters we required. We partitioned the data into three groups. Initial cluster centre points were randomly selected cases, and each case was assigned and re-assigned to clusters to maximise intra-cluster homogeneity. The final cluster centre points reflected the mean value for all cases in each cluster. We stipulated a maximum of 10 iterations before the most optimal solution was presented (the cluster analysis never required this number of iterations).

**Table 5**. Variables included in multivariate cluster analysis

| Component | Variable and sections of the FP from where information was extracted | Direction | Original Form | Transformation | Final Form | Standardised | Notes |
|---|---|---|---|---|---|---|---|
| 1. Scale | Proportion of direct beneficiaries (national level: per capita) | Higher value increases likelihood of transformative change | Scale, Positively skewed | Log10 | Scale Normal distribution | Yes | Before standardisation, zeros converted to one unit below minimum value |
| 2. Depth | | | | | | | |
| 3. Permanence | Expected lifespan of the proposed project/programme (in years). | Higher value increases likelihood of transformative change | Scale, Positively skewed | Log10 | Scale Normal distribution | Yes | |
| | Internal rate of return (either FIRR or EIRR) to estimate the profitability of the project (proportions) | Higher value increases likelihood of transformative change | Scale, Positively skewed | Log10 Imputed values | Scale Normal distribution | Yes | |
| | Inclusion of stakeholder engagement with eight different groups (created from binary variables) | Higher value increases likelihood of transformative change | Scale, Normal distribution | - | Scale Normal distribution | Yes | |
| | Government co-financing proportion of total financing | Higher value increases likelihood of transformative change | Scale, Positively skewed | Log10 | Scale Normal distribution | Yes | Before standardisation, zeros converted to one unit below minimum value |
| 4. Behaviour change | Whether social norms are included in project (created from binary variables) | Higher value increases likelihood of | Ordinal | Logit transformation | Scale Normal distribution | Yes | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | transformative change | | | | | |
| 5. Policy change | Degree to which FP will lead to policy change | Higher value increases likelihood of transformative change | Ordinal | Logit transformation | Scale Normal distribution | Yes | |
| 6. Demonstration ability | Number of jobs created divided by country population at national level (proportion). | Higher value increases likelihood of transformative change | Scale, positively skewed | Log10 Imputed values | Scale Normal distribution | Yes | |
| | Combined potential for replication and scale (both intra-country and inter-country | Higher value increases likelihood of transformative change | Scale | - | Scale Normal distribution | Yes | |
| 7. Innovation | An overall metric for innovation potential, based on the interaction between project risk (implementation risk) and project innovation. | Higher value increases likelihood of transformative change | Scale | Imputed value | Scale Normal distribution | Yes | |
| 8. Complementarity and coherence | Number of existing plans/ strategies/ policies aligned | Higher value increases likelihood of transformative change | Scale, positively skewed | Log10 | Scale Normal distribution | Yes | |
| | Total amount of co-financing divided by the Fund's investment in the project | Higher value increases likelihood of transformative change | Scale, positively skewed | Log10 | Scale Normal distribution | Yes | Before standardisation, zeros converted to one unit below minimum value |

## Section 5 – Findings

### *Descriptive statistics*

Table 6 shows a summary of descriptive statistics for all eight components and their constituent variables. We conducted comparisons between the GCF's thematic areas: namely, mitigation, adaptation and cross-cutting.

Scale and depth: The three thematic areas had similar scale[11] and depth of impact (unit impact per beneficiary).[12]

Permanence: Potential for sustained impact or permanence in the context of stakeholder engagement was similar between thematic areas, both during project design and implementation.[13] However, both mitigation (P=0.057) and cross-cutting (P=0.01) projects were more likely to report measures of economic feasibility than adaptation projects.[14] Furthermore, government co-financing varied significantly among the portfolios.[15] Adaptation portfolio boasted the highest rate of government co-financing relative to either mitigation (P<0.0001) or cross-cutting portfolios (P=0.0008).

[11] *Per-capita* direct beneficiaries affected: Kruskal-Wallis: $\chi^2 = 2.89$, $df = 2$, $P > 0.10$; *per-capita* $CO_2$ emissions reductions: Wilcoxon: W=546, P>0.10
[12] *Mitigation:* Wilcoxon: W=210, P>0.10; *adaptation:* Wilcoxon: W=255, P>0.55
[13] Permanence in project design: Fisher's exact test: P>0.10; Permanence in project implementation: Fisher's exact test: P>0.10).
[14] Fisher's exact test: P=0.006.
[15] Fisher's exact test: P<0.0001).

Behavior change: The sub-portfolios differed significantly in their *need* for behaviour change[16] as well as their *expectation of behaviour change* (Fisher's exact test: P<0.0001). Both adaptation and cross-cutting projects showed a greater need for and expectation of behaviour change[17] relative to mitigation projects (*adaptation:* P<0.0001*; cross-cutting:* P=0.02).

Policy change: In the context of policy change, adaptation projects showed greater intention to integrate policy change into national planning processes than the other two portfolios[18] but a similar likelihood of catalyzing policy change.[19]

Innovation and demonstration ability: The presence of innovation was sporadic throughout the portfolio. Just over 50% of FPs self-reported an innovative aspect of their project. Mitigation projects reported the greatest prevalence of innovation, though this was not significant.[20] Demonstration ability was similarly mixed among portfolios. Job creation was most prevalent in mitigation projects,[21] though employment impacts were similar across the three portfolios.[22]

Complementary and coherence: Finally, the portfolios differed markedly in the context of complementarity and coherence. There was a significant difference in co-finance ratios

[16] I*n general:* Fisher's exact test: P=0.02; *individual-level:* Fisher's exact test: P<0.0001.
[17] *Individual-level:* P<0.0001*; general:* P=0.04.
[18] Fisher's exact test: P=0.02.
[19] Kruskal-Wallis: $\chi^2 = 3.51$, $df = 2$, $P = 0.17$.
[20] Fisher's exact test: P>0.10.
[21] Fisher's exact test: P=0.001.
[22] Kruskal-Wallis: $\chi^2 = 0.31$, $df = 2$, $P > 0.10$.

between portfolios.[23] The adaptation portfolio shows smaller climate fund co-finance ratios funds compared to mitigation (P<0.0001) and cross-cutting (P=0.0006) portfolios.[24]



[23] Kruskal-Wallis: $\chi^2$ =28.62, $df$ = 2, $P$ < 0.0001.
[24] Kruskal-Wallis: $\chi^2$ =28.62, $df$ = 2, $P$ < .0001

Table 6 – Bivariate analysis of full set of variables. Significant relationships ($P \leq 0.05$) are denoted by an asterisk (*).

| Component | Variable | Descriptive statistic |
|---|---|---|
| 1. Scale | *Per-capita* direct beneficiaries affected | Kruskal-Wallis: $\chi^2 = 2.89$, $df = 2$, $P > 0.10$ |
| | Number of total beneficiaries affected | Kruskal-Wallis: $\chi^2 = 18.36$, $df = 2$, $P = 0.0001$* |
| | *Per-capita* $CO_2$ emissions reductions | Wilcoxon: W=546, P>0.10 |
| | CO2 emissions reductions as a function of baseline emissions | Kruskal-Wallis: $\chi^2 = 0.49$, $df = 2$, $P > 0.10$ |
| 2. Depth | Mitigation benefit (lifetime CO2 emissions reduction) per individual | Wilcoxon: W=210, P>0.10 |
| | Adaptation benefit per unit individual (number of hectares improved per beneficiary) | Wilcoxon: W=255, P>0.55 |
| 3. Permanence | Implementation length | Kruskal-Wallis: $\chi^2 = 9.47$, $df = 2$, $P = 0.01$* |
| | Project lifespan | Kruskal-Wallis: $\chi^2 = 8.68$, $df = 2$, $P = 0.01$* |
| | Economic feasibility | Fisher's exact test: P=0.006* |
| | EIRR | Kruskal-Wallis: $\chi^2 = 1.09$, $df = 2$, $P > 0.10$ |
| | FIRR | Kruskal-Wallis: $\chi^2 = 1.26$, $df = 2$, $P > 0.10$ |
| | Self-sustaining impact | Kruskal-Wallis: $\chi^2 = 22.31$, $df = 2$, $P < 0.0001$* |
| | Government co-financing | Fisher's exact test: P<0.0001* |
| | Government co-financing proportion of total financing | Kruskal-Wallis: $\chi^2 = 18.02$, $df = 2$, $P < 0.0001$* |
| | Number of relevant stakeholder groups which are consulted | Kruskal-Wallis: $\chi^2 = 4.10$, $df = 2$, $P > 0.10$ |
| | Stakeholder engagement (project design) | Fisher's exact test: P>0.10 |
| | Stakeholder engagement (project implementation) | Fisher's exact test: P>0.10 |
| 4. Behaviour change | Need for change (general) | Fisher's exact test: P=0.02* |
| | Need for change (individual) | Fisher's exact test: P<0.0001* |
| | Behaviour change expectation | Fisher's exact test: P<0.0001* |
| 5. Policy change | Potential to catalyse policy change | Kruskal-Wallis: $\chi^2 = 3.51$, $df = 2$, $P = 0.17$ |
| 6. Demonstration ability | Employment impact | Kruskal-Wallis: $\chi^2 = 0.31$, $df = 2$, $P > 0.10$ |
| 7. Innovation | An overall metric for innovation potential, based on the interaction between project risk (implementation risk) and project innovation. | Fisher's exact test: P>0.10 |
| 8. Complementarity and coherence | Co-finance ratios | Kruskal-Wallis: $\chi^2 = 28.62$, $df = 2$, $P < .0001$ |

Overall, the three thematic areas had similar scale (*per-capita* direct beneficiaries affected; *per-capita* $CO_2$ emissions reductions) and depth of impact (unit impact per beneficiary) (Table 6). Both adaptation and cross-cutting projects showed a greater need for (*individual-level:* P<0.0001*; general:* P=0.04) and expectation of (*adaptation:* P<0.0001*; cross-cutting:* P=0.02) behaviour change relative to mitigation projects. Adaptation projects showed greater intention to integrate policy change into national planning processes than the other two portfolios (Fisher's exact test: P=0.02), but a *similar likelihood of catalysing policy change*. We now turn to the multivariate statistics in the form of cluster analysis.

***Cluster analysis***

The cluster analysis formed three groups after seven iterations: one with 36 projects, one with 49 projects and one with 40 projects (Table 7). Eleven variables showed statistically significant differences between the three groups which is not too surprising as we selected clusters that maximised intra-cluster homogeneity and differences between the clusters. The only variable that did not show statistical significance was one of the two variables for demonstration ability (that combined intra-country and inter-country potential for replication and scale). Cluster 1 demonstrated the least potential for contributing to a paradigm shift, Cluster 3 showed some potential to contribute to a paradigm shift, and Cluster 2 showed the most potential to contribute to a paradigm shift.

**Cluster 1 displayed the lowest average score for 8 of the 12 components.** Cluster 1 included projects which had the lowest *per-capita* direct beneficiaries affected (scale),

the lowest internal rates of return (permanence), the lowest degree of stakeholder inclusion (permanence), the lowest government co-financing (permanence), lowest social learning (behaviour change), the lowest influence on policy (policy change), the lowest combined potential for replication and scale (demonstration ability), and the lowest alignment with existing plans and strategies (complementarity and coherence). On the other hand, it shows the highest expected lifespan of the proposed project (permanence), the highest score of innovation potential (innovation), and the highest co-financing ratios (complementarity and coherence).

**Table 7**. ANOVA results for clusters created using K-means (P-values correct to 3 decimal places)

| Component | Variable | Cluster | N | Mean | SD | SE | F-statistic | P-value |
|---|---|---|---|---|---|---|---|---|
| 1. Scale | Proportion of direct beneficiaries (national level: per capita) | 1 | 36 | -1.00 | 0.84 | 0.14 | 43.49 | 0.000 |
| | | 2 | 49 | 0.34 | 0.83 | 0.12 | | |
| | | 3 | 40 | 0.49 | 0.63 | 0.10 | | |
| | | Total | 125 | 0.00 | 1.00000 | 0.09 | | |
| 2. Permanence | Expected lifespan of the proposed project/ programme (in years) | 1 | 36 | 0.39 | 0.83 | 0.14 | 6.37 | 0.002 |
| | | 2 | 49 | 0.03 | 1.02 | 0.15 | | |
| | | 3 | 40 | -0.39 | 0.99 | 0.16 | | |
| | | Total | 125 | .0000 | 1.00000 | 0.09 | | |
| | Internal rate of return (either FIRR or EIRR) to estimate the profitability of the project (proportions) | 1 | 36 | -0.44 | 0.85 | 0.14 | 8.26 | 0.000 |
| | | 2 | 49 | 0.39 | 0.95 | 0.14 | | |
| | | 3 | 40 | -0.09 | 1.02 | 0.16 | | |
| | | Total | 125 | .0000 | 1.00000 | 0.09 | | |
| | Inclusion of stakeholder engagement with eight different groups (created from binary variables) | 1 | 36 | -0.83 | 0.80 | 0.13 | 26.32 | 0.000 |
| | | 2 | 49 | 0.49 | 0.79 | 0.11 | | |
| | | 3 | 40 | 0.15 | 0.94 | 0.15 | | |
| | | Total | 125 | .0000 | 1.00 | 0.09 | | |
| | Government co-financing proportion of total financing | 1 | 36 | -0.51 | 0.86 | 0.14 | 7.87 | 0.001 |
| | | 2 | 49 | 0.11 | 0.96 | 0.14 | | |
| | | 3 | 40 | 0.33 | 1.01 | 0.16 | | |
| | | Total | 125 | .0000 | 1.00 | 0.09 | | |
| 3. Behaviour change | Whether social norms are included in project (created from binary variables) | 1 | 36 | -0.82 | 0.79 | 0.13 | 28.36 | 0.000 |
| | | 2 | 49 | 0.10 | 0.90 | 0.13 | | |
| | | 3 | 40 | 0.61 | 0.79 | 0.12 | | |
| | | Total | 125 | .0000 | 1.00 | 0.09 | | |
| 4. Policy change | Degree to which FP will lead to policy change | 1 | 36 | -0.68 | 1.25836 | 0.21 | 13.99 | 0.000 |
| | | 2 | 49 | 0.30 | 0.68 | 0.10 | | |
| | | 3 | 40 | 0.24 | 0.77 | 0.12 | | |
| | | Total | 125 | 0.0000 | 1.00000 | 0.09 | | |

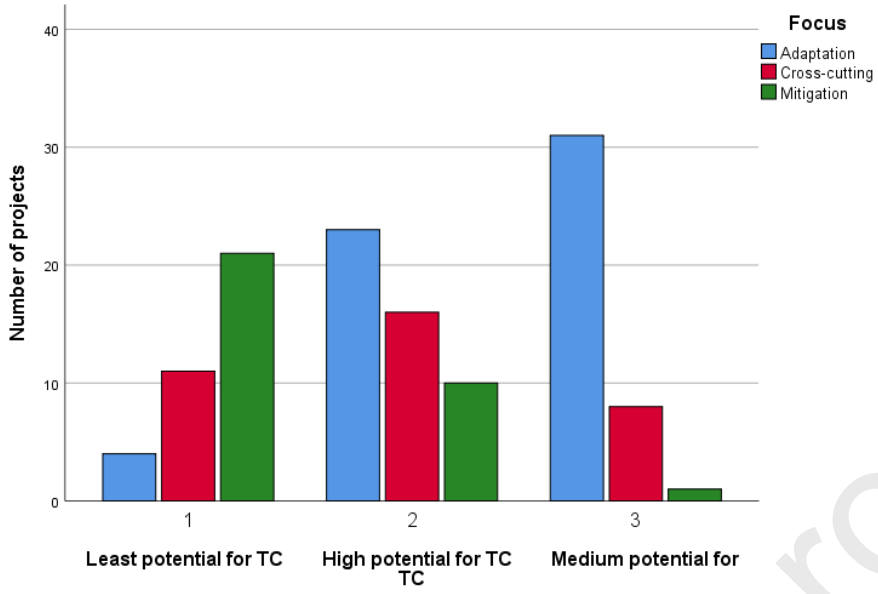
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5. Demonstration ability | Number of jobs created divided by country population at national level (proportion) | 1 | 36 | 0.23 | 0.83 | 0.14 | 63.24 | 0.000 |
| | | 2 | 49 | 0.65 | 0.67 | 0.10 | | |
| | | 3 | 40 | -1.01 | 0.63 | 0.10 | | |
| | | Total | 125 | 0.0000 | 1.00000 | 0.09 | | |
| | Combined potential for replication and scale (both intra-country and inter-country) | 1 | 36 | -0.22 | 1.15 | 0.19 | 1.85 | 0.161 |
| | | 2 | 49 | 0.20 | 0.99 | 0.14 | | |
| | | 3 | 40 | -0.05 | 0.83 | 0.13 | | |
| | | Total | 125 | .0000 | 1.00000 | 0.09 | | |
| 6. Innovation | An overall metric for innovation potential, based on the interaction between project risk (implementation risk) and project innovation. | 1 | 36 | 0.23 | 0.99 | 0.16 | 2.31 | 0.103 |
| | | 2 | 49 | 0.04 | 1.03 | 0.15 | | |
| | | 3 | 40 | -0.25 | 0.94 | 0.15 | | |
| | | Total | 125 | .0000 | 1.00000 | 0.09 | | |
| 7. Complementarity and coherence | Number of existing plans/ strategies/ policies aligned | 1 | 36 | -0.39 | 1.17 | 0.20 | 4.70 | 0.011 |
| | | 2 | 49 | 0.26 | 0.91 | 0.13 | | |
| | | 3 | 40 | 0.02 | 0.83 | 0.13 | | |
| | | Total | 125 | 0.0000 | 1.00000 | 0.09 | | |
| | Total amount of co-financing divided by the Fund's investment in the project | 1 | 36 | 0.68 | 0.62 | 0.10 | 19.54 | 0.000 |
| | | 2 | 49 | -0.02 | 0.83 | 0.12 | | |
| | | 3 | 40 | -0.58 | 1.10 | 0.17 | | |
| | | Total | 125 | .0000 | 1.00000 | 0.09 | | |

Source: Authors

**Cluster 2 showed the highest scores for 6 of the 12 components:** internal rate of return (permanence); stakeholder inclusion (permanence); policy change potential (policy change); the number of jobs as a function of the population (demonstration ability); combined potential for replication and scale (demonstration ability); and alignment with existing plans/strategies/policies (complementarity and coherence). The second last of these variables doesn't show statistical significance. Surprisingly, this component doesn't show the lowest score for any of the 12 components.

**Cluster 3 showed the highest scores for 3 of 12 components**: the *per-capita* number of direct beneficiaries (scale), government co-financing (permanence) and the project's inclusion of social norms (behaviour change). It also showed the lowest scores for 4 components: the expected lifespan of the proposed project/ programme (permanence); the *per-capita* number of jobs created (demonstration ability); the overall metric for innovation potential (innovation); and the total amount of co-financing divided by the Fund's investment in the project (complementarity and coherence).

**Figure 5**. Transformative clusters by thematic area




Source: Authors

Figure 5 shows the frequency of adaptation, cross-cutting and mitigation projects in the three clusters. We can see that the three GCF thematic areas varied significantly ($\chi^2$ =43.301, *df* = 4, *P* < .0001, *Chi-squared*). Cluster 1 – which showed the least potential for transformative change – contained disproportionately more mitigation projects. Conversely, clusters 2 (high potential for transformational change) and 3 (medium potential for transformational change) had a large (23, 46.94%) and very large (31, 77.5%) frequency of adaptation projects (Figure 5).

We also found significant differences concerning the GCF's operational divisions. Cluster 2 (high potential for transformational change) and Cluster 3 (medium potential for transformational change) predominately contained projects from the GCF's Division of Mitigation and Adaptation (DMA). Over two thirds of the GCF's Private Sector Facility (PSF) projects were in the low potential cluster ($\chi^2$ =32.489, *df* = 2, *P* < .000, *Chi-*

*squared*). These differences reflect the preponderance of adaptation projects in DMA and mitigation projects in PSF.

A further characteristic that differed significantly between the three transformational clusters was whether the project manager (the accredited entity) was also the implementing agency (e.g. executing entities). Here we found a much higher number of projects where project managers are also implementers in Cluster 1 (least potential for transformational change) compared to clusters 2 and 3 ($\chi^2$ =9.899 , *df* = 2, *P* = .007, *Chi-squared*). On the other hand, we found no significant differences across clusters concerning the year of project approval, whether the project was implemented in a GCF priority country, or whether the project manager (the accredited entity) was national or international.

**Section 6 - Discussion**

Climate interventions must transition from incremental solutions towards transformational changes to deter the wide-ranging impacts of climate change. This paper developed an eight-part framework for transformational change by drawing on evidence from climate funds, international development and consolidating relevant attributes identified in the literature. Using this framework, we assessed the extent to which the GCF's project portfolio is likely to contribute to a paradigm shift. This paper builds on and complements previous attempts to define and conceptualise transformational change (e.g. Uitto et al., 2019). In doing so, this work helps bridge the considerable knowledge

and evidence gaps concerning the role of climate finance in contributing to a paradigm shift (Uitto et al., 2019).

***Overview of the portfolio***

Projects within the GCF's portfolio varied significantly in their paradigm shift potential. Projects with the highest paradigm shift potential demonstrated aspects of permanence, policy change, demonstration ability, and complementarity and coherence. These projects cover many of the steps needed to scale an innovation and contain key characteristics to contribute to a paradigm shift. Projects which demonstrated a medium potential for paradigm shift depicted an ambivalent relationship with permanence, show the highest score for government co-financing but the lowest score for the expected lifespan. In addition, these projects showed the highest scores for scale and behaviour change.

Our analyses revealed several knowledge gaps within the current portfolio. Many of the components for transformational change were not reflected within the GCF's project portfolio. Specifically, projects with the highest paradigm shift potential lacked high scores for four of the eight components necessary for transformational change. These findings may provide learning opportunities for the GCF to help leverage maximum impact within its project portfolio. In terms of thematic focus, the dominance of pure adaptation projects within the high and medium potential clusters highlights an area for further investigation. The GCF plays a larger role within the context of adaptation finance relative to mitigation

finance (IEU, forthcoming). As such, the GCF has potential to expand its comparative advantage in adaptation finance by focussing on the type of projects that display the attributes of transformational change. Of particular interest here is the potential role of private sector-funded adaptation projects. The GCF's PSF was developed to catalyse high-impact, transformative climate projects (GCF, 2019b). Currently, there are only two private sector adaptation projects within the GCF's portfolio and the pipeline of PSF adaptation projects is very thin. Collaborations on adaptation projects between the GCF's two divisions (PSF-DMA) could incentivize greater private sector participation.

**Is the GCF's current approach appropriate?**

The GCF is the world's largest and youngest climate fund. However, the GCF is yet to fully distinguish itself from other organizations through the way it deploys its resources to leverage impact. For example, it is also currently difficult to distinguish the GCF's complement of projects from analogous institutions (IEU, 2019). This suggests that the fund has not yet reflected its ambitions in terms of paradigm shift in its project portfolio.

Through its early years, the GCF has operated under conventional aid management practices, an approach which may conflict with the paradigm shift it seeks (Boodoo et al., 2018). As a young organization, the GCF can learn from past experiences to forge new pathways. For instance, the organisation has been criticised for failing to convey its paradigm shift ambitions to project applicants (Bertilsson & Thörn, 2020). In

this respect, the GCF should consider how it can support its accredited entities deliver projects that are in line with its objectives and are realistic in terms of the degree to which they will precipitate transformational change. One inherent risk within GCF's current approach is that it incentivises accredited entities to make claims within funding proposals or project documentation regarding the extent to which projects will contribute to transformational change. For example, proposals are assessed against a range of investment criteria including paradigm shift potential where projects need to demonstrate the potential for replication and scaling up, including the long-term sustainability of results, through a robust and convincing theory of change.[25]

Currently, the GCF does not have the necessary systems in place to verify and cross-check whether the claims of replicability, scalability and sustainability in project proposals are laudable or even feasible. One way in which the GCF is attempting to mitigate this risk is through strengthening the results management framework of the Fund such that it offers accurate and timely assessments of contributions to actual results regarding paradigm shift outcomes. The first step in this regard was the adoption of the GCF's Updated Strategic Plan in Decision B.27/06 which reaffirmed the Fund's objective to support partners to design projects and programmes that support paradigm shift objectives. The second step has been the adoption of the GCF's integrated results management framework (Decision B.29/01) which outlines how each programme/project will be assessed twice against their contributions to paradigm shift in terms of scale,

[25] Here, proposals need to also convey the project's contribution to knowledge and learning, the creation of an enabling environment, the contribution to the regulatory framework and policies, and for adaptation, the contribution to a climate-resilient development pathway that is consistent with a country's climate change adaptation plans.

replicability and sustainability (with the assessment using a scorecard approach and taking place within mandatory interim and final evaluations). One way in which the GCF can improve this approach is through stipulating that these interim and final evaluations must be completed  independent evaluators (which is currently not the case). In essence, self-reported interim and final evaluations are unlikely resolve the shortcomings from self-reported data in funding proposals.

Moving forward, the GCF can capitalize on several further opportunities. First, the quality as opposed to the quantity of funding proposals may be a practical consideration in relation to paradigm shift. Project proposal selection could be particularly relevant for mitigation interventions, as a paradigm shift in mitigation is further developed than in adaptation (IEU, 2019). Secondly, the GCF currently supports eight results areas. With such a diffuse approach, it can be challenging to contribute to a paradigm shift across all sectors. Concentrating on fewer focus areas may support a more targeted approach that can better support the likelihood of transformational change (Vieweg & Noble, 2013). Lastly, the GCF currently uses replicability, scalability and sustainability as criteria for paradigm shift potential [GCF/B.09/05]. While these are essential linkages for transformational change (Olsson et al., 2017; Feinstein, 2019), achieving impacts at scale is inherently difficult (Woltering et al., 2019). Scaling frameworks from international development can provide valuable opportunities within the GCF to deliver transformational impacts. Furthermore, collaborating with other climate funds can help leverage each organisation's comparative advantages for a greater cumulative impact. Namely, the GCF could leverage the experience of other climate funds that have experience scaling up pilot projects (e.g.

GEF IEO, 2019). Moreover, climate funds have recognized the ambiguity surrounding concepts of transformational change and paradigm shift and have used this to spur research and learning opportunities (e.g. the CIF's Transformational Change Learning Partnership).

## Conclusion

This paper contributes to the burgeoning literature attempting to conceptualise and measure transformational change. The article has presented an *ex-ante* assessment of the GCF's project portfolio based on the funding proposals that have been approved by the Board based on self-reported data from accredited entities. Using proxy indicators for transformational change, we provide a conservative estimate of the GCF portfolio's paradigm shift potential to inform the organisation's future activities. Our results indicate that the GCF's portfolio contains a mixture of projects with high transformation potential as well as those that appear limited in their ability to contribute to a paradigm shift. Moving forward, the GCF should consider leveraging lessons learned within international development as it steers its portfolio composition. The GCF is also encouraged to think more systematically about how to achieve and measure paradigm shift, capitalising on relationships with other climate funds to increase both depth and breadth of impact. As a young organisation, the GCF can learn from past experiences to inform future project selection and enhance the transformative impact of its investments. Finally, it is difficult to benchmark the GCF's performance with that of other climate funds given its comparatively young portfolio. Many projects are in early stages of implementation or have yet to break ground. As such, our analysis is limited to project documentation reporting

expected impacts. Whilst the GCF Secretariat's steps to improve the monitoring and reporting on paradigm shift, first through the Updated Strategic Plan and subsequently through the Intergrated Results Management Framework, are to the welcomed, ongoing and *ex-post* assessments of projects and programmes need to be completed by independent evaluator to assess the extent to which projected and realised impacts on transformational change align and actual results are being achieved on the ground.



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CONFLICT OF INTEREST STATEMENT

The authors whose names are listed immediately below certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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