IEU LEARNING PAPER

03/2021

ASSESSING THE LIKELIHOOD FOR TRANSFORMATIONAL CHANGE AT THE GREEN CLIMATE FUND

Jyotsna Puri, Martin Prowse, Emma De Roy and David Huang

GREEN CLIMATE FUND | Independent Evaluation Unit

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Assessing the likelihood for transformational change at the Green Climate Fund

Jyotsna Puri, Martin Prowse, Emma De Roy and David Huang

03/2021

175, Art center-daero
Yeonsu-gu, Incheon 22004
Republic of Korea
Tel. (+82) 032-458-6450
Email: ieu@gcfund.org
https://ieu.greenclimate.fund

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Head a.i. of the GCF Independent Evaluation Unit: Mr. Andreas Reumann
Task manager: Martin Prowse, Evaluation Specialist, Independent Evaluation Unit
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About this IEU Learning Paper

This paper reviews the project documents of GCF investments through March 2020. It uses bivariate statistics and multivariate cluster analysis to examine whether mitigation, cross-cutting or adaptation thematic areas show the greatest likelihood of contributing to transformational change.

About the author(s)

Jyotsna Puri is the Director of the Environment, Climate, Gender and Social Inclusion Division at the International Fund for Agricultural Development (IFAD). Before joining IFAD, she was the Head of the Independent Evaluation Unit and wrote this paper during this period. Jo is also a Research Fellow with the Center for Evaluation and Development and an Adjunct Associate Professor, School of International Public Affairs, Columbia University, New York.

As an Evaluation Specialist, Martin is applying his 15 years of work experience in international development to support the IEU's workstreams on impact evaluation (LORTA), evidence reviews and behavioural science. He has published widely and is an editor of the European Journal of Development Research. Martin holds a Ph.D. from the University of Manchester.

Emma De Roy assisted the IEU with its work on evidence reviews. Emma has worked in academic research for several years, including working at the Great Lakes Institute for Environmental Research in Ontario, Canada. She holds a Bachelor of Science in Behaviour, Cognition and Neurology and a master's degree in Environmental Science.

David Huang was an Evaluation Researcher with the IEU, where he focused on contributing statistical analysis and visualizations to the IEU's evaluation reports and learning papers. He holds a

bachelor’s degree in Economics and a master’s degree in Data Science and Analytics from University College Cork in Ireland.

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ABSTRACT

Global climate finance institutions aim to spur the transition to low-carbon, climate-resilient economies. The GCF is one such institution and aims to assist the most vulnerable to adapt to and mitigate climate change as part of its mandate to contribute to a paradigm shift towards low-carbon and climate-resilient development pathways. In this paper, we review project documents from 125 GCF investments through March 2020 to examine progress towards these goals. We examine attributes of investments made by the GCF, by applying a framework for transformational change comprising 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 analysis shows that adaptation and cross-cutting projects showed a greater need for and expectation of behaviour change relative to mitigation projects. In addition, adaptation projects showed greater intention to integrate policy change into national planning processes than the other two portfolios but a similar likelihood of catalysing policy change. Multivariate cluster analysis shows that adaptation projects are more likely to be transformational. However, even this likelihood is modest: those GCF investments that show the greatest likelihood of transformational change do not display all eight components under consideration. These findings present learning opportunities for the GCF's future project selection. The GCF has the opportunity to leverage its current resources to carefully target transformational change more than is currently witnessed. This opportunity is present especially within the Fund's adaptation portfolio, where its investments address a greater share of global needs compared to mitigation investments.

ABBREVIATIONS

AE	Accredited entity
AF	Adaptation Fund
CIF	Climate Investment Funds
DMA	Division of Mitigation and Adaptation (of the GCF)
FP	Funding proposal
GCF	Green Climate Fund
GEF	Global Environment Facility
IEO	Independent Evaluation Office (of the GEF)
IEU	Independent Evaluation Unit (of the GCF)
IPCC	Intergovernmental Panel on Climate Change
PSF	Private Sector Facility (of the GCF)
UNFCCC	United Nations Framework Convention on Climate Change

A. INTRODUCTION

The current and projected effects of climate change emphasize the need for immediate action. It is highly likely that 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 underscores the need for adequate finance levels to fund its climate goals (UNFCCC, 2015), but it is widely recognized that current finance flows are 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).

Shortfalls in climate finance and delays in 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 emphasize the need for a paradigm shift or transformational change, understood as the fundamental restructuring of systems (IPCC, 2012; Blythe et al., 2018).[1] The Green Climate Fund (GCF) aims to mobilize such action and was established to "promote the paradigm shift towards low-emission and climate-resilient development pathways" (GCF, 2011). 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. 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.

The GCF started in 2015. It is still a young organization, and although it has committed more than USD 6 billion in investments, many investments have not yet been implemented. Hence, we do not undertake an ex post assessment of the GCF portfolio. Rather, with the aim of helping to support adaptive management that may also entail mid-course correction, we undertake an ex ante analysis of the **likelihood** that the current portfolio of investments will realize a transformational change. Specifically, we examine the extent to which the GCF's current portfolio of investments (through March 2020) is likely to contribute to such a paradigm shift. For this, we develop a framework of transformational change composed of eight components. With the overall aim of examining the portfolio for its likelihood of transformation, we ask three specific questions:

1) To what extent is the GCF's investment portfolio consistent with its objective of promoting a paradigm shift towards low-emission, climate-resilient paradigm-shifting?
2) To what extent do current investments fit into the overall framework for examining the likelihood of transformational change?
3) What could the GCF do better with respect to project selection and design going forward?

Within this paper, the next section offers a literature review of transformational change in the context of climate and development interventions. It also describes the continuum of transformational change and compares climate agencies with respect to their aims and mandates in this area. Section C describes how the terms "transformational change" and "paradigm shift" are understood and applied by the GCF Secretariat. It presents a framework for transformational change comprising eight components. Section D discusses data extraction and variable construction. Section E presents our findings. Section F discusses these findings in the context of the GCF. We conclude by comparing the GCF's position vis-à-vis other multilateral agencies, highlighting an opportunity for the GCF to distinguish itself within the climate finance space.

[1] The terms "transformational change" and "paradigm shift" are not used within the Paris Agreement, and the GCF's Governing Instrument only refers to "paradigm shift". Policy and academic literature as well as IPCC reports use either one or the other of these terms to convey the systemic or broad changes necessary for low-carbon, climate-resilient societies. This paper uses the terms interchangeably. Section C discusses the relationship between these two terms in greater depth.

B. AN OVERVIEW OF CURRENT MITIGATION AND ADAPTATION ACTIONS: WHY DO WE NEED TRANSFORMATION?

Ideally, climate finance should promote systemic and sustained change on mitigation and adaptation trends in countries. Countries that are recipients of climate finance are expected to 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, so far mitigation and adaptation actions have realized limited success. Current investments and projects[2] often focus on incremental adjustments that are unlikely to affect climate change or adaptation to it (Termeer et al., 2017). Furthermore, current levels of climate finance, as well as pledges and actions, fall short of the commitment required to reach the Paris Agreement's goals (Lebling et al., 2020). Specifically, progress towards emissions reduction targets across sectors is not occurring fast enough to meet the goal of achieving a low-carbon economy by 2050 (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 (World Meteorological Organization, 2020).[3]

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 (Bassett & Fogelman, 2013; Watts, 2015). Overall adaptation 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 insufficient for the scale of expected 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 adaptation programmes to be "transformational" (see for example, GEF IEO, 2018; Grimm et al., 2018; and Puri, 2018).

1. AN OVERVIEW OF TRANSFORMATIONAL CHANGE AS A CONCEPT

Transformational change is often viewed as a multidimensional 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).

While there is a clear consensus regarding 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 are also significant differences within development agencies

[2] We use the words "investments" and "projects" interchangeably in this paper. This is because the GCF makes its investments in climate mitigation and adaptation through projects.
[3] These figures do not include emissions for methane, nitrous oxide or fluorocarbons, which have also increased in the past decade and have a greater level of radiative forcing.

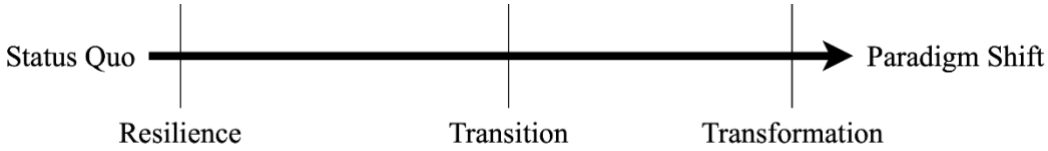
regarding the nature of transformation and its preconditions (Puri, 2018). In many cases, organizations use the concept as a metaphor for systemic change (Feola, 2015). Such a broad definition provides a common ground among diverse disciplines (Godfrey-Wood & Naess, 2016). However, it also subjects the term to misappropriation (Feola, 2015). When discussing the term transformational change, it is also important to consider the term 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, early on highlighted 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 came to be preferred later. The GCF has 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 fluid use of these terms within the GCF and elsewhere, we refer to both interchangeably.

2. REVIEW OF TRANSFORMATIONAL CHANGE IN ADAPTATION AND MITIGATION INTERVENTIONS

Overall, transformational approaches should challenge, rather than 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 the notion of a paradigm shift is to see it as a continuum that stretches from incremental change at one end to transformational at the other (Waddell, 2016; Ajibade & Adams, 2019).

The dearth of transformational approaches is particularly salient in adaptation interventions (Godfrey-Wood & Naess, 2016; Brooks et al., 2017), despite their 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). Adaptation is often depicted in reactionary terms and is frequently framed as an adjustment process (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 the proximate, incremental approaches in the adaptation space that we witness globally. Kates et al. (2012) argue 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.

Figure 1. Continuum of adaptation to climate change and associated scale of change



Source: Adapted from Pelling (2011)

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). The World Bank argues that transformational projects should reduce implementation barriers for subsequent projects, thereby catalysing larger impacts (World Bank, 2020). Similar 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 are a mitigation mechanism that attempts to foster low-carbon-centric transformational approaches through emissions reductions in developing countries (GCF, 2014; UNFCCC, n.d). However, in tying a project's success to its emission reductions, projects may fail to articulate clear road maps to transformational change (ICF International, 2014). Furthermore, there may be some tension between the current emphasis on demonstrable emission reductions and the need for country ownership, itself a necessary precondition for transformational change (Winkler & Dubash, 2016; Asfaw et al., 2019).

3. A PROPOSED FRAMEWORK FOR TRANSFORMATIONAL CHANGE

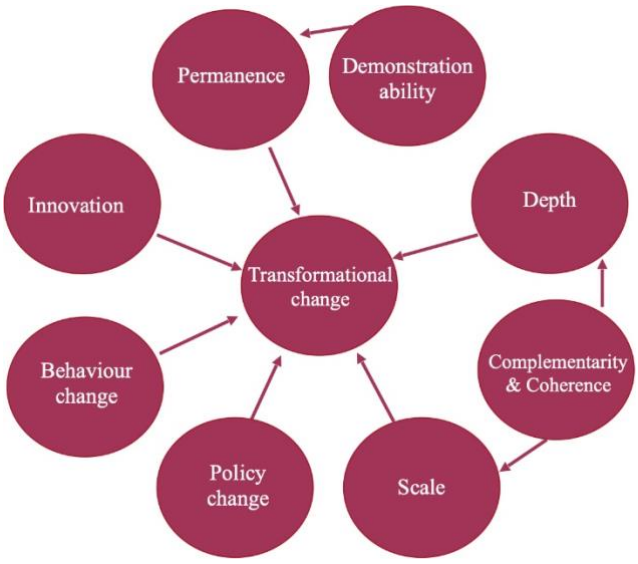
Transformational change is contingent on comprehensive and cross-sectoral interventions (Wienges et al., 2017), which may involve reconfiguring social, political, technical and policy elements of society (Murray et al., 2010; Olsson et al., 2017; Hall & Dijkman, 2019). It has recently gained attention 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 organizational ambitions in this space (GEF, 2012; GEF IEO, 2018; Grimm et al., 2018; Itad, 2019; see Table 1). Despite a nascent focus on transformation, clear pathways towards achieving this aim are scarce (van den Berg & Cando-Noordhuizen, 2017).

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 are contingent on breaking down the (abstract) concept into smaller components – similar to other forms of systems change (Muehlenbein, 2018). We operationalize transformational change by deconstructing it into eight proxy variables (hereafter referred to as components or attributes) based on Puri (2018) and the wider literature, including 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 elements. We postulate that combinations of these components may create an enabling environment to support transformational change (Figure 2). We recognize that transformation is a protracted process and may not occur within the confines of a given project or investment. 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.

In our view, these eight components are central to precipitating transformational change. Following Puri (2018) and the Independent Evaluation Unit (IEU, 2019), investments must have sufficient scale and depth of change, permanence of change,[4] support for policy change and behaviour change. Interventions should also be innovative, moving away from traditional forms of technical assistance. Complementarity and coherence with other investments and demonstration ability can act as impact multipliers. Specifically, complementarity and coherence between climate funds can increase the scale of impacts and the depth of impact per beneficiary. Demonstration ability (that leads to 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 more evidence is available, we cannot make assertions about what are *sufficient* conditions for transformations to occur.

[4] Some researchers use the term "durability" in place of "permanence" to refer to impacts that endure after an intervention ends (e.g. Global Environment Facility Scientific and Technical Advisory Panel, 2019).

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



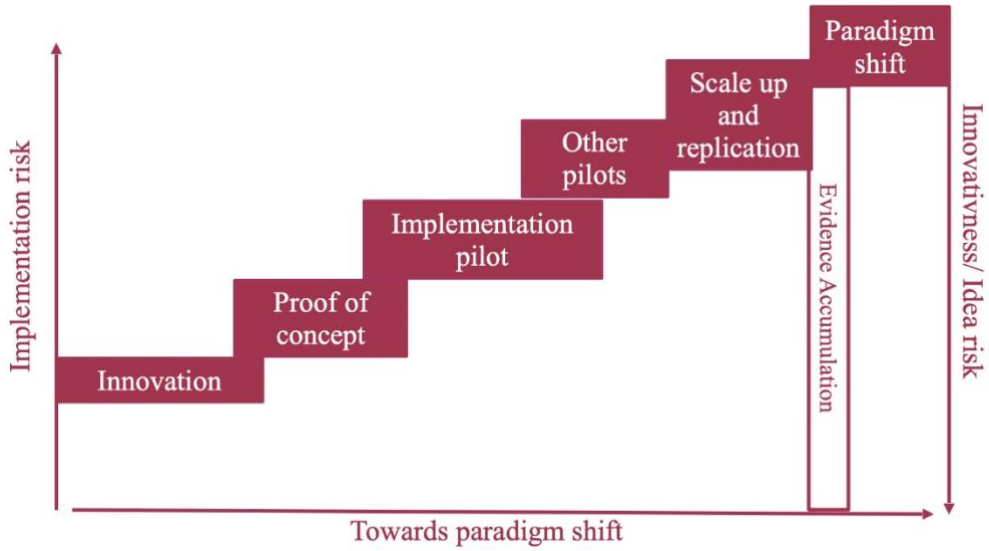
Source: Authors

Table 1. Relevant components of a framework for potential transformational change, as defined by both the literature and by select climate funds (other than the GCF)

Components of and contributors to transformational change	Use in other climate funds	Literature reference
Scale	Climate Investment Funds (CIF) Global Environment Facility (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 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)	Adaptation Fund (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	

We now introduce a simple illustration that describes the foundations of our conceptual framework. Figure 3 illustrates the steps to support the realization of transformational change. 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 x-axis) increases. As evidence on the efficacy and implementation effectiveness of an innovation[5] accumulates, it leads to a tipping point for a new paradigm. As there is a considerable degree of similarity between the eight components of transformational change summarised in Table 1 and attempts to achieve scale within international development, we now briefly review six aspects of effective scaling pathways and highlight how they interact with our understanding of transformational change.

Figure 3. Foundations of conceptual framework



Source: Authors

4. ACHIEVING SCALE WITHIN INTERNATIONAL DEVELOPMENT

International development organizations are increasingly concerned with achieving impacts at scale (Hartmann et al., 2013): specifically, interventions that scale out, up and deep (Olsson et al., 2017). Organizations achieve this goal through an iterative three-part process that involves innovation, learning and scaling up (Linn et al., 2010). Unfortunately, many organizations have struggled to effectively execute this schema. There are six aspect of effective scaling pathways which we now summarise before turning back to our conceptual framework of transformational change.

The first aspect is innovation. In the presence of an enabling environment, an innovation is likely to be developed, implemented and scaled up. Hartmann & Linn (2008) argue that innovations that are scaled up should be carefully selected as these innovations can 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 can 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 we can witness a transformation (see Puri et al., 2020).

[5] Also called "anomalies" in Thomas Kuhn's 1962 book, *The Structure of Scientific Revolutions*.

Table 2. An overview of innovation organized by 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: Adapted from Chase et al. (2020)

The second attribute of an effective scaling pathway is scaling up implementation to ensure widespread access to interventions (for a recent review, see GEF IEO, 2019). 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 the adaptability of the scaled intervention (GEF IEO, 2019). Innovation can occur across multiple dimensions (International Institute of Rural Reconstruction, 2000; Cooley & Linn, 2014; Do, 2019). At each stage of scaling, barriers must be tackled to allow for change.

The third attribute is a supportive 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) and 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).

The fourth attribute is that impacts are sustained over time. Sustained impacts are often the hallmark of effectively scaled interventions (Global Environment Facility Scientific and Technical Advisory Panel, 2019). These are in turn dependent on multiple dimensions. Notably, programme beneficiaries are critical to the adoption and use of interventions. Communities in which interventions take place must actively promote scaling and innovation adoption (Westley & Antadze, 2010). For this reason, the literature predominantly identifies the idea that scaled up programmes are bottom up, driven by local engagement and government ownership (Hartmann & Linn, 2008; Linn, 2012; Brooks et al., 2017; Low & Thiele, 2020). Engagement predisposes communities to change norms and values and to demonstrate behaviour change, a requirement of long-lasting interventions (O'Brien et al., 2012). Additionally, to increase chances of success, the process of behaviour change in interventions must be explicitly articulated as opposed to implicitly assumed (Metternicht et al., 2020).

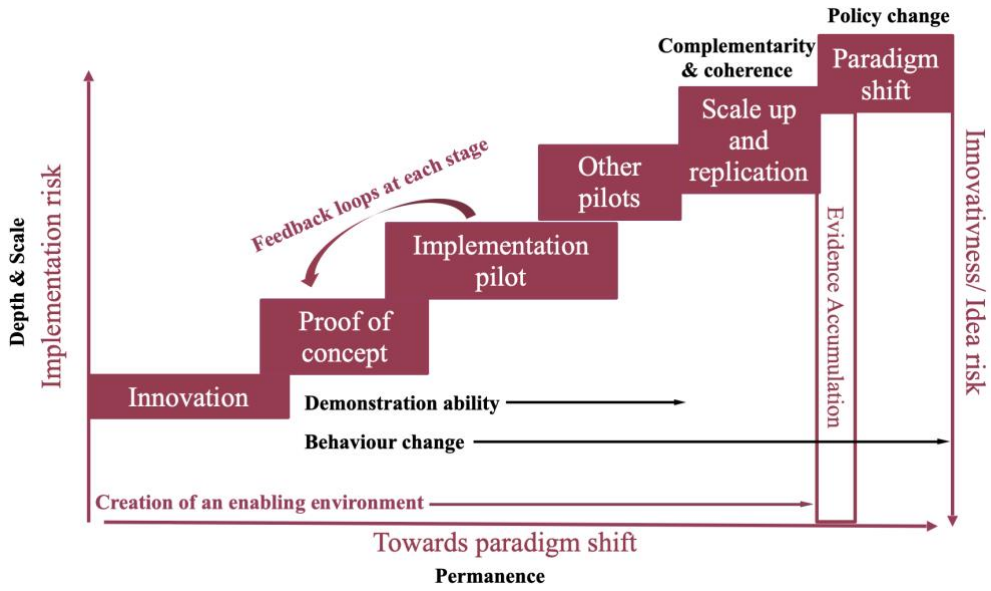
The fifth attribute is replication. Once evidence of impact is accrued from multiple settings, an innovation needs to be replicated within and outside a target region (Cooley & Ved, 2012). In this context, collaborations between organizations can help bring piloted innovations to scale (Hartmann & Linn, 2008; Cooley & Ved, 2012; Do, 2019), extending both the scale and depth of impact of a

project. Indeed, in this sense, coherence and complementarity between organizations can contribute to such collaboration.

The sixth attribute is 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. All these attribute – from a pilot through replication – require evidence, produced via real-time monitoring and evaluation (Cooley & Linn, 2014). This can promote feedback loops that may channel into subsequent programme planning and execution (Boodoo et al., 2018).

As will be clear to the reader, many of these requirements also feature in discussions of transformational change (see Table 1). Based on the notion of an effective scaling pathway within international development, Figure 4, below, applies the eight attributes of transformational change introduced in Table 1 to the steps of scaling outlined in Figure 3. As noted above, each 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. We now turn to how the GCF approaches and applies transformational change within its portfolio and approach.

Figure 4. Innovation and transformational change



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C. How do climate funds and the GCF apply transformational change?

As with 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 2015 as a designated operating entity of the financial mechanism of the UNFCCC and invests in climate change mitigation and adaptation projects (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 (GCF, 2016, para.129; IEU,

2019; Bertilsson & Thörn, 2020). These inconsistencies occur despite such terms featuring prominently in internal documents (GCF, 2018). The GCF 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, the IEU has found that management frameworks within funding proposals often lack any relationship with how project outcomes contribute to a paradigm shift (Fiala et al., 2019; IEU, 2019).

We use the framework developed in above and apply it to the GCF's project portfolio to understand the extent to which there is a potential or likelihood for a paradigm shift, ex ante. To analyse the transformation attributes of GCF investments, we reviewed projects and investments in the GCF's current portfolio (through March 2020). We assessed funding proposals (FPs) approved by the GCF Board across the eight components of transformational change described in Table 1. To translate these components into measurable variables, we mapped the components to measurable proxy variables described in Table 3.

Table 3. Mapping the attributes of transformational change to their proxy variables

ATTRIBUTE	DEFINITION AND PROXY VARIABLES
1. Scale	Definition: Breadth of impact Proxy variable: This is measured by the number of beneficiaries or geographic area.
2. Depth	Definition: Impact per unit beneficiary Proxy variables: This is measured by hectares and/or CO_2 emissions reductions). Specifically: • For adaptation and cross-cutting portfolios, impact is measured in terms of adaptation improvement in relation to the nature of the intervention (for example, in terms of the number of hectares improved for a nature-based solution). • 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 interactions with other climate funds will increase the scale and depth of impact to targeted beneficiaries. Proxy variables: These are 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? 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)? 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.

ATTRIBUTE	DEFINITION AND PROXY VARIABLES
7. Policy change	Definition: Does the project aim to catalyse policy changes, strengthen policies or increase spending on policy initiatives? 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. Proxy variable: This is measured by the description of innovation described in the project proposal.

Source: Authors

Specifically, we extracted data from the GCF's portfolio of FPs (N=125), including projects invested through the simplified approval process (N=13). Projects and investments that were approved as part of the results-based payment scheme (REDD+ projects (N=4)) were not included as these FPs followed a different format. We included FPs approved through March 2020 from the GCF's three thematic areas: adaptation (N=59), mitigation (N=32) and cross-cutting (N=34) projects. All extracted data refer only to planned activities self-reported by accredited entities.

Data 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 separately and independently extracted data from the same FPs. Variable definitions and extraction guidelines were subsequently revised and made more precise, after discussion, if there was a discrepancy. In the second phase, two independent evaluators pulled relevant information from all 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 data set. In the third phase, after extraction, we selected 10 per cent of the FPs at random to screen for discrepancies in coding *post hoc*. An alternate reviewer then cross-checked these FPs to highlight data coding differences and verify the data's accuracy. We recoded variables for the entire portfolio if we found apparent discrepancies.

Table 4. Variables included in multivariate cluster analysis

Attribute	Variable and where information was extracted	Direction	Original form	Transformation	Final form	Standardized	Outliers
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 standardization, 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 financial IRR or economic IRR) 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	
3. Permanence	Government co-financing proportion of total financing	Higher value increases likelihood of transformative change	Scale Positively skewed	Log10	Scale Normal distribution	Yes	Before standardization, zeros converted to one unit below minimum value
4. Behaviour change	Whether social norms are included in a project (created from binary variables)	Higher value increases likelihood of transformative change	Ordinal	Logit transformation	Scale Normal distribution	Yes	

Attribute	Variable and where information was extracted	Direction	Original form	Transformation	Final form	Standardized	Outliers
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 the country's population at the 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 intracountry and intercountry)	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 standardization, zeros converted to one unit below minimum value

Source: Authors

Table 5. Bivariate analysis of full set of variables across GCF thematic areas. Significant relationships ($P \leq 0.05$) are denoted by an asterisk (*)

COMPONENT	VARIABLE	DESCRIPTIVE STATISTIC
1. Scale	Per capita direct beneficiaries affected	Kruskal-Wallis: $\chi2 = 2.89$, df = 2, P > 0.10
	Number of total beneficiaries affected	Kruskal-Wallis: $\chi2 = 18.36$, df = 2, P = 0.0001*
	Per capita CO2 emissions reductions	Wilcoxon: W=546, P>0.10
	CO2 emissions reductions as a function of baseline emissions	Kruskal-Wallis: $\chi2 = 0.49$, 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: $\chi2 = 9.47$, df = 2, P = 0.01*
	Project lifespan	Kruskal-Wallis: $\chi2 = 8.68$, df = 2, P = 0.01*
	Economic feasibility	Fisher's exact test: P=0.006*
	EIRR	Kruskal-Wallis: $\chi2 = 1.09$, df = 2, P > 0.10
	FIRR	Kruskal-Wallis: $\chi2 = 1.26$, df = 2, P > 0.10
	Self-sustaining impact	Kruskal-Wallis: $\chi2 = 22.31$, df = 2, P < 0.0001*
	Government co-financing	Fisher's exact test: P<0.0001*
	Government co-financing proportion of total financing	Kruskal-Wallis: $\chi2 = 18.02$, df = 2, P < 0.0001*
	Number of relevant stakeholder groups consulted	Kruskal-Wallis: $\chi2 = 4.10$, 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: $\chi2 = 3.51$, df = 2, P = 0.17

COMPONENT	VARIABLE	DESCRIPTIVE STATISTIC
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

Source: Authors

D. DATA PREPARATION AND ANALYTICAL METHODS

We undertook data cleaning and analysis in R (R Core Team, 2020) and SPSS 25 (IBM Corporation, 2020). To analyse emergent trends for each adaptation, mitigation and cross-cutting focus, 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 a cluster analysis. Cluster analysis identifies patterns and substructures within the data set by grouping observations based on measures of similarity. We used theory-based feature selection to determine a subset of variables for inclusion to (Table 4).[6] Prior to conducting the cluster analysis, we cleaned and standardized data (also see Table 4). First, we imputed variables containing missing values. Missing values were imputed using predicted values from a normal distribution (R Core Team, 2020). Second, 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 standardized all scale variables. Lastly, we removed outliers – that is, those observations whose values exceeded three standard deviations from the mean. We replaced these values with those that were 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 maximize 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 (although the cluster analysis never required this number of iterations).

E. FINDINGS

Table 5 shows a summary of descriptive statistics for all eight components and their constituent variables. We conducted bivariate analysis with the GCF's themes – namely, mitigation, adaptation and cross-cutting – and assessed whether differences across these three groups were statistically significant.

Scale and depth: The three thematic areas had similar scale (*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) and depth of impact (unit impact per beneficiary) (*mitigation:* Wilcoxon: W=210, P>0.10; *adaptation:* Wilcoxon: W=255, P>0.55).

Permanence: Potential for sustained impact or permanence in the context of stakeholder engagement was similar among thematic areas, during both project design and implementation (permanence in project design: Fisher's exact test: P>0.10; permanence in project implementation: Fisher's exact test: P>0.10). 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 (Fisher's exact test: P=0.006). Furthermore, government co-financing varied significantly among the portfolios (Fisher's exact test: P<0.0001). The adaptation portfolio had the highest rate of government co-financing relative to either mitigation (P<0.0001) or cross-cutting portfolios (P=0.0008).

Behaviour change: The thematic areas differed significantly in their identified *need* for behaviour change (*in general:* Fisher's exact test: P=0.02; *individual-level:* Fisher's exact test: P<0.0001) as

[6] Before conducting the cluster analysis, we checked 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.

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 (*individual-level*: P<0.0001*; general:* P=0.04) and expectation of behaviour change 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 (Fisher's exact test: P=0.02) but a similar likelihood of catalysing policy change (Kruskal-Wallis: $\chi^2 = 3.51$, df = 2, P = 0.17).

Innovation and demonstration ability: The presence of innovation was sporadic throughout the portfolio. Just over 50 per cent of FPs self-reported an innovative aspect of their project. Mitigation projects reported the greatest prevalence of innovation, though this was not significant (Fisher's exact test: P>0.10). Demonstration ability was similarly mixed among portfolios. Job creation was most prevalent in mitigation projects (Fisher's exact test: P=0.001), though expected employment impacts were similar across the three portfolios (Kruskal-Wallis: $\chi^2 = 0.31$, df = 2, P > 0.10).

Complementary and coherence: Finally, the portfolios differed markedly in the context of complementarity and coherence. There was a significant difference in co-finance ratios between portfolios (Kruskal-Wallis: $\chi^2 = 28.62$, df = 2, P < 0.0001). The adaptation portfolio showed smaller co-finance ratios funds compared to mitigation (P<0.0001) and cross-cutting (P=0.0006) portfolios (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). 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*.

F. CLUSTER ANALYSIS

Cluster analysis formed three groups after seven iterations: one with 36 projects, one with 49 projects and one with 40 projects. Eleven variables showed statistically significant differences among the three groups, which is not unexpected as we selected clusters that maximized intracluster 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 intracountry and intercountry potential for replication and scale).

It is important to highlight that these clusters "emerged" from our analyses, and other than imposing an internal condition that there should be least intracluster heterogeneity, we did not predetermine the attributes of clusters. The attributes of these clusters therefore emerged as a result of our clustering. When the attributes of the three clusters were matched with those of the eight for transformational change, we found that 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 transformation attributes. Cluster 1 included projects that 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), the 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).

Cluster 2 showed the highest scores for 6 of the 12 transformation attributes: 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 does not show statistical significance. This cluster did not show the lowest score for any of the 12 components.

Cluster 3 showed the highest scores for 3 of 12 transformation attributes: 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 four 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).

Table 6. ANOVA results for clusters created using K-means (P-values correct to three 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 Financial IRR or Economic IRR) 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		1	36	-0.82	0.79	0.13	28.36	0.000

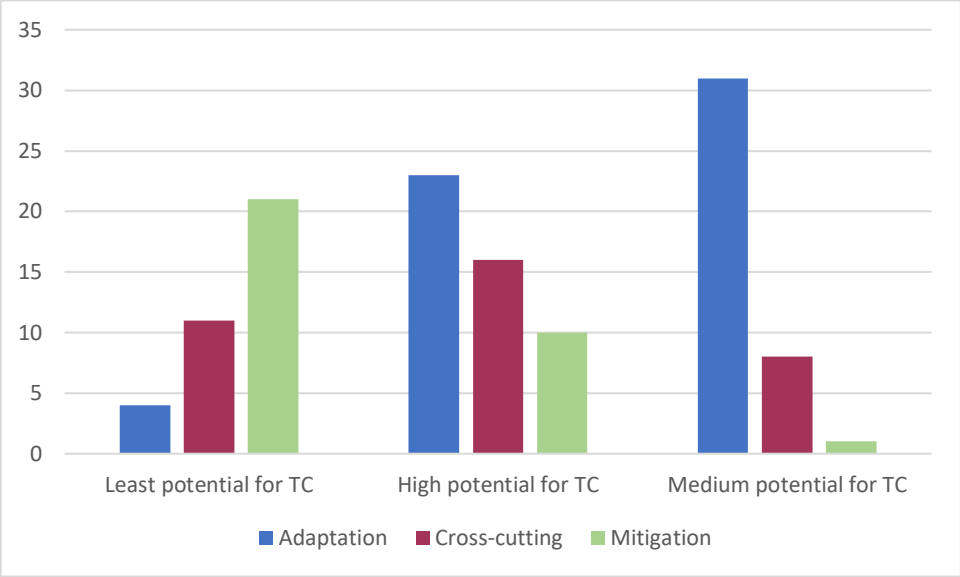
Component	Variable	Cluster	N	Mean	SD	SE	F-statistic	P-value
	Whether social norms are included in project (created from binary variables)	2	49	0.10	0.90	0.13		
		3	40	0.61	0.79	0.12		
		Total	125	.0000	1.00	0.09		
4. Policy change	Degree to which FP will lead to policy change	1	36	-0.68	1.25836	0.21	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 intracountry and intercountry)	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		

Component	Variable	Cluster	N	Mean	SD	SE	F-statistic	P-value
		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

Figure 5 shows the frequency of adaptation, cross-cutting and mitigation projects in the three clusters. We can see that this varied significantly (χ^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, Cluster 2 (high potential for transformational change) and Cluster 3 (medium potential for transformational change) had a large (23, 46.94 per cent) and very large (31, 77.5 per cent) number of adaptation projects.

Figure 5. Transformative clusters by thematic area



Source: Authors

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) predominantly 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 (χ^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. the executing entity). Here we found a much higher number of projects where project managers were also implementers in Cluster 1 (least potential for transformational change) compared to Clusters 2 and 3 (χ^2 =9.899, df = 2, P =.007, Chi-squared). We reflect on this finding below. 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.

G. 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 literature from climate funds and international development, and by consolidating relevant attributes identified in the literature. Using this framework, we assessed the likelihood of the GCF's project portfolio contributing to a paradigm

shift. This paper builds on and complements previous attempts to define and conceptualize transformational change (e.g. Uitto et al., 2019). In doing so, this work helps bridge the considerable knowledge and evidence gaps concerning climate finance's role in contributing to a paradigm shift (Uitto et al., 2019).

Projects and investments 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 up an innovation and contain the characteristics key to contributing to a paradigm shift. Investments that demonstrated a medium potential for paradigm shift depicted showed the highest score for government co-financing, the per capita number of direct beneficiaries and the inclusion of social norms (behaviour change).

Our analyses revealed several knowledge gaps within the current portfolio. Many of the attributes 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 attributes necessary for transformational change. These findings may provide learning opportunities for the GCF to help leverage maximum impact within its project portfolio. Regarding thematic focus, the dominance of pure adaptation projects within the high and medium potential clusters highlights an area for further investigation. Currently, the GCF plays a larger financial role (with respect to meeting relative needs) within the context of adaptation finance relative to mitigation finance (Binet et al, 2021). As a result, the GCF has the potential to expand its comparative advantage in adaptation finance by focusing on adaptation investments 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 small. Collaboration on adaptation projects between the GCF's two divisions (PSF–DMA) could incentivize greater private sector participation. Overall, the GCF is yet to fully distinguish itself from other organizations in its deployment of resources to leverage impact. For example, it is also currently difficult to distinguish the GCF's portfolio from comparable institutions (IEU, 2019). This suggests the GCF is yet to reflect its paradigm shift ambitions in its project portfolio.

Through its early years, the GCF has operated under conventional aid management practices, an approach that 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 organization has been criticized for failing to convey its paradigm shift ambitions to project applicants (Bertilsson & Thörn, 2020). The GCF could also consider how it can support its accredited entities to deliver projects that align with its objectives. The GCF could also develop a clearer road map towards its goals and consider better ways of strongly signalling and calibrating transformational change / paradigm shift. Doing so may provide the additional benefit of receiving higher-quality proposals that adhere to and comply better with its expectations. Other climate funds have recognized the ambiguity surrounding concepts of transformational change and paradigm shift. They have used this to spur research and learning opportunities (e.g. the CIF's Transformational Change Learning Partnership).

Moving forward, the GCF can capitalize on several opportunities. First, focusing on the quality rather than the quantity of FPs may be more useful when considering paradigm shift. Signalling this better, especially through an emphasis on innovation as well as by providing clear guidelines on the aforementioned attributes of transformational change, is one possible step in this direction. Project proposal selection could be particularly relevant for mitigation interventions, as a paradigm shift in

mitigation is currently under way. Secondly, the GCF currently supports several results areas. With such a diffuse approach, it can be challenging to have a large impact across all sectors.Concentrating on fewer results areas may support a more targeted approach that can better leverage transformational change (Vieweg & Noble, 2013). Lastly, the GCF currently uses innovation and scalability as criteria for paradigm shift potential (GCF/B.09/23 (Annex III)). 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 provide valuable opportunities within the GCF to deliver transformational impacts at scale. Collaborating with other climate funds can help leverage each organization's comparative advantages for a more significant cumulative impact. Furthermore, the GCF could develop a specific strategy that focuses on complementing and leveraging investments by other climate funds (e.g. GEF, CIF and AF).

H. CONCLUSION

This paper contributes to the burgeoning literature attempting to conceptualize and calibrate transformational change. Using proxy indicators for transformational change and self-reported data, we assessed the GCF portfolio's paradigm shift potential to inform the organization's future activities. Our results indicate that the GCF's portfolio contains a mixture of projects with high transformation potential and projects that appear limited in their ability to contribute to a paradigm shift.

Moving forward, the GCF Secretariat 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 a paradigm shift, capitalizing on relationships with other climate funds to increase both depth and breadth of impact. As a young organization, the GCF can learn from past experiences to inform future project selection and enhance its investments' transformative impact.

Finally, it is difficult to compare the GCF's performance with other climate funds given its comparatively young portfolio. Many projects are in the early stages of implementation or have yet to commence. As a result, our analysis is limited to project documentation reporting expected impacts. *Ex post* assessments of projects should be undertaken to assess the extent to which projected and realized impacts on transformational change align. Before that, however, it will be useful for Secretariat staff to also examine how course correction in the current portfolio may be informed. The design of future investments may also be informed by this analysis. Waiting until we start to realize the overall impact of the portfolio to calibrate and change may be too late for the institution and for the world.

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Independent Evaluation Unit
Green Climate Fund
175 Art center-daero, Yeonsu-gu
Incheon 22004, Republic of Korea
Tel. (+82) 032-458-6450
ieu@gcfund.org
https://ieu.greenclimate.fund

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