



Whose risk counts? Climate risk frames in global green finance governance complex

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ABSTRACT

In recent decades, global green finance governance institutions (GGFGIs) have developed diverse frames for understanding climate-related risks. Understanding these risk frames is crucial because they lead to distinctive “de-risking” policies, empowering different types of actors. This paper examines how GGFGIs produce different climate risk frames, and what the prevailing climate risk frame is and whose risk it addresses. We investigate these questions by analyzing the current global green finance governance complex applying a constructivist approach emphasizing contestation over normative issues and a Critical Political Economy perspective. Our mapping based on 74 GGFGIs shows exercise that a risk framing focusing on climate impact on business actors became prevalent over other types of climate risks imposed on people and nature. Our finding shows the dominant influence of the Task Force on the Climate-Related Financial Disclosure created by G20’s Financial Stability Board. This development reflects broader trends of climate capitalism.

1. Introduction

The importance of finance to climate change appears in various ways. It ranges from calls for shifting trillions of dollars from carbon-intensive investments to low-carbon ones to meet 1.5 or 2-degree climate targets (Hansen et al., 2017), to the difficulties that people exposed to climate change are facing in obtaining insurance. Notably, in 2015, then Governor of the Bank of England, Mark Carney, gave a speech at the insurance company Lloyd’s of London in which he warned that climate change could become “a defining issue for financial stability” and called for efforts to address the *financial risks* associated with climate change (Carney, 2015). His speech marked the beginning of an exponential increase in the number of international institutions addressing the role of finance in climate change. These institutions range from Inter-Governmental Organizations (IGOs) and Multilateral Development Banks (MDBs) to Transnational Governance Networks (TGNs) covering central banks, financial regulators, banks, pension funds, insurance companies and Non-Governmental Organizations (NGOs). The growth and diversity of institutions reflects the growth in attention to green finance¹ and the diversity of their approaches to how such green

finance should be addressed. Central to the different approaches is how finance-related climate risk (from now on just climate risk) is framed, including to whom climate change poses a risk: to people, nature, business or states (Newell, 2021; Baer et al., 2021; Christophers et al., 2020). Framing climate risk is a politically contentious issue, because it shapes whose risks are addressed, particularly whether it is the risks of climate change to the financial sector (so-called single materiality) or also the risks of the financial sector to climate change (so-called double materiality) and consequently to society.

The diversity of institutions and their approaches to green finance increases the complexity of green finance governance; it is situated at the nexus between the larger complexes governing respectively climate, environmental, finance, and development (on nexuses between governance complexes, see Zelli et al., 2020; Frank et al. 2024). These higher-order complexes are characterized by diverging sets of actor constellations, institutions, and most fundamentally, core normative ideas about ‘what one ought to do’ (Schmidt, 2008). The climate governance complex aims to mitigate and adapt to anthropogenic climate change; the environment governance complex to ensure global environmental sustainability; the finance governance complex to ensure

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¹ The term green finance will be used throughout the paper to distinguish it from public finance (often referred to as climate finance) and the broader concept of sustainable finance. De facto, these three concepts are often used interchangeably, but green finance is the most widespread despite ongoing contestations on the terminology caused by competing political interests (Bracking and Leffel, 2021).

financial stability and growth; and the development governance complex to eliminate poverty and enhance development. Within all governance complexes, there are diverging interpretations of these normative ideas. Considering this diversity of normative ideas, one could expect a high degree of contestation over how climate risk is framed, i.e., as a contested idea based on different core values supported by diverse governance complexes. As Valbona Muzaka (2011) has argued, the framing of a governance issue situated at the nexus of different governance complexes is likely to be contested. This is because the framing of the issue, in this case climate risk, has repercussions for how the intersecting complexes are engaged in the governance of the issue and particularly which of their core normative ideas prevail in this governance. The likelihood of contestation increases the more diverging the core normative ideas are, e.g. the idea of financial stability versus the idea of environmental sustainability, as it is the case with green finance (see e.g. Maechler, 2023; Bracking and Leffel, 2021; Christophers, 2017). Yet, no conflicts over how to frame climate change as a financial risk have grabbed the headlines.

In this article, we seek to answer the following research question regarding the complexity of global green finance: *How do global green finance institutions frame climate change as a risk to whom?*

We answer this question by mapping the 74 institutions involved in global green finance governance, their risk framings as well as their characteristics (e.g., private/public/hybrid, TGN/IGO/MDB). This paper aims to analyze specifically: 1) how climate risk is framed in the current global green finance governance complex, 2) how a particular risk frame – climate risk as a risk to business – became predominant through adoption but also reinterpretation by different institutions. In doing so, we aim to identify predominant patterns of the institutions' risk framings in an Earth System Governance context – instead of understanding each institution's risk framing individually – in the existing global green finance governance complex.

From a Critical Political Economy perspective, we see the risk framings as part of political processes that affect relevant stakeholders unevenly. Based on this assumption, our analysis seeks to analyze 'the politics of framing' in the global green finance governance and its asymmetrical political impacts on different social entities and nature.

Thus, in answering the research question, we contribute to two bodies of literature. First, we contribute to the emerging literature on Critical Political Economy approaches to green – and climate or sustainable – finance (see e.g., Ameli et al., 2020; Bracking and Leffel, 2021; Christophers, 2017; Dimmelmeier, 2021; Monasterolo, 2020; Maechler, 2023) in International Political Economy. As Peter Newell (2021) emphasizes, "for whom and for what finance is intended makes a big difference to how it is governed and who benefits" (Newell, 2021, p. 129). Despite recent studies, this normative aspect of green finance is under-explored, particularly in connection with global governance and institutional complexes. Yet, how these issues play out in terms through interaction between global governance institutions and complexes is understudied. Kawabata (2021) is the sole overarching study, but one that leaves out normative and critical aspects.

Second, we contribute to the literature on governance complexes in the field of global governance and international organizations (see e.g., Elsässer et al., 2022; Green, 2022; Abbott and Snidal, 2010; Abbott et al., 2016; Cashore et al., 2021). We do so by following the recent call from Karen J. Alter (2022, p. 393) for research on how a "global governance problem gets defined and limited in the first place" (Alter, 2022, p. 393) in governance complexes. This paper's normative focus on "whose risks counts" in green finance governance complex moves beyond functionalist view on effective governance outcomes in most of the institutional literature on governance complexes (Alter, 2022; Scholte, 2021; Bäckstrand and Kuypers, 2017). It also contributes to the literature on governance complexes by studying an emerging governance complex at the nexus of four, diverging "meta-governance complexes" – from global environment, climate, finance, and development governance realms. The location at this nexus means that there is scope for framing climate

risks in very different ways depending on which meta-governance complex that prevails in this framing contest (Muzaka, 2011). Other scholars have used the term "climate-finance nexus" (e.g. Engen and Asdal, 2024; Täger, 2022) to describe the relation between climate and finance, but we find that on the level of international governance, it is most useful to define this nexus as also encompassing the governance complexes.

Our analysis finds that the key development regarding climate risk framing within the green finance governance complex has been the Task Force on Climate-related Financial Disclosures (TCFD)'s framing of climate risk that emphasizes climate risk imposed on business sectors over people or nature. This framing entails single materiality and strengthens climate capitalism (Newell and Paterson, 2010). The TCFD framing has been adopted by a range of other institutions within the governance complex. The TCFD was established in 2015 by the G20 (one of the primary global 'finance' governance institutions) as a task-force under the Financial Stability Board (FSB), and its climate risk frame was created in its 2017 recommendations on how to report climate-related risks. In 2023, the TCFD's duties were transferred to the International Sustainability Standards Board (ISSB). After 2017, two thirds of the Global Green Finance Governance Institutions have aligned themselves with the TCFD's risk frame. Yet, the majority of these institutions did not adopt the TCFD's risk frame slavishly, but re-interpreted climate change as a risk to other objects (e.g. people and nature) than business. These additions underscore the importance of reinterpretation of risk frames, as a subtype of defining a governance problem (Alter, 2022).

The paper proceeds with an outline of the political and academic debates on global green finance governance, followed by a discussion of the role of risk frames in this governance. The subsequent section outlines the theories of governance complexes that we draw upon in our analysis. The following analytical section maps the green finance governance complex, the institutions that constitute it as well as their risk frames within the institutional complexes.

2. Global green finance governance and risk frames

The financial aspects to climate change have not only received increasing political and academic attention over the last fifteen years, but the focus and the very framing of these financial aspects also became a crucial topic. While early political and academic debates focused on finance with a positive impact on climate mitigation and adaptation, increasingly the focus has turned to finance with a negative climate impact, e.g., funding for coal-fired power plants, oil extraction, etc., (Hansen et al., 2017; Hong et al., 2019, 2020; Krueger et al., 2020; Chen et al., 2021). Likewise, the focus expanded beyond finance's impact on climate change to climate change's impact on the financial system, i.e., double materiality in the sense that finance constitutes a risk for the climate and vice versa (Campiglio et al., 2018). The risks to the financial system have especially been framed in terms of the risk of fossil fuel-based investments becoming "stranded assets" due to the transition to low-carbon alternatives, so-called transition risks, and risks stemming from the impact of climate change on investments, so-called physical risks (Bolton et al., 2020; Campiglio et al., 2018; Semieniuk et al., 2021; IMF, 2021).

Against this background, a fundamental idea behind many climate finance governance institutions is that if financial actors start understanding climate change as a risk to their profits, that perception change would encourage them to shift their portfolio from brown (i.e., carbon-intensive assets) to green investment. Avoiding brown assets – i.e., assets that would be stranded by low-carbon transitions, particularly by new climate regulations (e.g., carbon pricing), is thus regarded as a rational choice of investors. Stable climate policies are thus an important part of the incentive of market actors to engage in low-carbon projects (Ameli et al., 2020). In the banking sector, this rationale is tied to the fiduciary duty that requires to maximize shareholders' interests, and can be seen

as part of a wider trend of financialization of the economy and the associated focus on accounting and financial reporting (Chiapello, 2020). Furthermore, this type of policy response to climate risk has emerged because the risk directly relates to systemic financial stability, for instance the risk from pension funds owning substantial stranded assets or banks' fiscal instabilities from climate risk potentially leading to sovereign risks because of their sovereign debts holdings (Agarwala et al., 2021). Thus, climate risk is dominantly framed as a risk imposed on financial actors and, reflecting the framing, investors price negative climate impacts and integrate this price into their risk management decisions.

This approach highlights what is known as single materiality – i.e., the impact of climate change on financial assets and market actors – rather than the double materiality that encompasses both this impact AND the negative impact of corporations' activities on the environment triggering climate change. In terms of academic literature, one strand mainly in economics and more policy-oriented literature, has sought to solve problems associated with green finance, with the purpose of increasing the overall efficiency of such finance (e.g., Hong et al., 2020; Krueger et al., 2020). It is closely tied to the predominant, single-material, approach to climate risk outlined above.

A second, generally more critical strand, have focused on the capitalist underpinnings of green finance, from the involvement of market actors in shaping the governance of various kinds of green finance (e.g., Bracking and Leffel, 2021; Newell, 2021). This group of scholars attempts to critically examine how climate finance mechanisms handle climate risk(s). Particularly, Christophers et al. (2020) claim that current climate finance mechanisms operate based on the 'privatization' of climate-related risks – i.e., individuals should deal with their own risks from climate change through markets. In this market system, for instance, insurers are reluctant to bear other risk types such as risks with high frequency and small (monetary) magnitude (e.g., small island states' sea-level rise) due to high transaction costs (Christophers et al., 2020, pp. 100–101). Likewise, Peter Newell (2021) argues that 'de-risking' framing for upscaling finance 'sits easily with dominant narrative' and hinders shedding light on vulnerable people's needs (e.g., the poor people's access to electricity or adaptation to climate change) and focuses on private investors' needs (Newell, 2021, p. 106). In other words, de-risking 'money' is regarded as an end goal while excluding many other social and environmental goals. Scholars such as Thiemann et al. (2023) and Skovgaard (2024) have found that when it comes to respectively central banks and the IMF, in recent years the framing of climate risk has been broadened beyond risks to the financial sector. This paper aims to examine the drastically emerging governance complexity of green finance by following such a critical approach and exploring the framing of climate risks.

3. Normative contestation in global governance complexity: a theoretical framework

The increasing complexity of global governance has been one of the main research themes among International Relations (IR) and Global Environmental Politics (GEP) scholars for recent decades. Yet, there is a lack of research on the institutional complexity of global green finance governance that explores how the relations and ideas of institutions affect the governance complex and vice versa. These relations and ideas are crucial for understanding the patterns of climate risk framings within the complex.

Governance (also referred to as regime and institutional) complex literature has been a major theoretical approach for analyzing institutional constellations in a specific governance issue area (e.g., Raustiala and Victor, 2004; Orsini et al., 2013; Keohane and Victor, 2011). A recent debate focuses on a new type of governance complexity consisting of multiple types of institutions and across different policy areas, e.g., interactions among "heterogenous interstate, intra-state, public-private and private transnational institutions, formal and informal"

(Abbott and Faude, 2022, p. 264). In addition, some scholars shed light on institutional interactions across different governance domains – such as supercluster complex consisting of trade-environment regime complexes (Kim and Morin, 2021) or a macro governance network built by climate, health, and economic superclusters (Frank et al. 2024).

However, only a few recent studies (e.g., Zelli et al., 2021; Pattberg and Widerberg, 2021; Faude and Große-Kreul, 2020) investigate the new mode of governance complexity across different governance issue domains. Importantly, there is a lack of research on green finance examined by the new mode of governance complexity, even though the governance issue links to many policy domains with diverse actors: respectively climate change, environmental protection, economy and finance and international development. In such situations, governance institutions have begun to address several issues simultaneously or expand their original governance scope to counteract newly emerging governance issues.

Most importantly, in addition to the gap, the existing governance complex literature tends to ignore the political and normative implications of the complexity among institutions – as a site of contestations between different normative ideas. This oversight appears to come from a dominant research question of whether regime complexes lead to "effective" governance outcomes (e.g., Abbott and Faude, 2022; Elsässer et al., 2022). This functionalist emphasis on efficiency or managerial outcomes is based on the notion that there is agreement among governance actors about the core objective of governance and, as a follow-up issue, how to achieve this objective as efficiently as possible. Yet, we argue there can be fundamental differences among governance institutions about what the "normative" objective of governance should be. Against this background, we aim to identify whose normative ideas frames prevail in the governance complex.

In that context, we follow Karen Alter's call for studying regime complexity by answering the question of "how the global governance problem gets defined and limited in the first place" from a constructivist perspective (Alter, 2022, p. 393). Similarly, Muzaka (2011) emphasizes a contentious dimension of regime complex. Muzaka argues that different "frames" of governance are competing and conflicting in a governance complex. Our paper adopts this approach of "critical" constructivism as its epistemological underpinning, rather than as a theory per se (e.g. about the role of norms)², and examines climate risk frames representing normative contestations among institutions in the emerging global green finance complex. This approach aims to understand the governance complex as a political battlefield, rather than a politically neutral realm, particularly by focusing on "frames" similar to Charmaz's emphasis on the attention to language in constructivist critical inquiry (Charmaz, 2017, p. 38). This epistemological underpinning serves as a grounding for a "critical" inquiry to "reject value-free inquiry" (Charmaz, 2017, p.39) and unpack the hidden politics of contested knowledge systems and interest, power imbalances, oppression, inequality, and injustice (Charmaz, 2017, p.35, see also Charmaz, 2020).

In the case of climate risk in global climate finance governance, divergent risk frames reflect different normative ideas among institutions about what ought to be protected. Risk is central to climate politics. Scholars in sociology and geography highlight how socially defined risks shape political, social, and ecological systems (e.g., Bulkeley, 2001), while problem-solving oriented research (usually economics or business studies) often reduce climate risk to economic terms. These disciplinary tensions is reflected in policy-making processes, where different *framings* of risk may clash. Following Schön and Rein (1994), policy positions are built upon "frames" – "underlying structures

² Our critical constructivist approach, which attempts to denaturalize a given context through seeing language and discourse, is distinguished from so-called "conventional" or "positivist" constructivism in International Relations, which "accepts a contingent universalism" and traces some causal explanations (Jung, 2019, p.3).

of belief, perception, and appreciation.” (Schön and Rein, 1994, p. 23). Drawing also on Slovic (2000), we view risk framing as a crucial political process involving social amplification of risk – e.g., filtering, decoding, and reinterpreting risk information and formulating behavioral intentions (Slovic, 2000, p. 238). From this perspective, we assume that different risk frames in global green finance governance initiatives (GGFGIs) empower a group of actors and support their political interest and values. This is the politics of risk framing in global green finance governance.

4. Mapping analysis

4.1. Methodology

We conducted desk-based research originating from and adding to the previous literature on climate finance governance (e.g., Bowman and Minas, 2019; Kawabata, 2019, 2021; Bracking and Leffel, 2021). Our research identified 74 global green finance governance institutions (GGFGI) and conducted a mapping exercise to find some important characteristics of the current green finance governance complex and major risk framings represented in official documents of each governance institution. In the case selection process, we defined GGFGIs as transnational political entities that are formally institutionalized (e.g., a membership-based institution) and “steer”/“govern” broad actions which affect the flow of money for climate mitigation and adaptation, such as guiding and mobilizing climate finance (Kawabata, 2021). Institutions that only provide finance are not included. These governance institutions provide, for instance, climate finance products (e.g., green bonds), build carbon-markets or shape the market environment for climate goals, e.g., through disclosure or taxonomies (Bracking and Leffel, 2021).

We cross-checked the lists of GGFGIs from the previous studies and supplemented additional cases matching our selection criteria, from the partnership lists provided by pre-selected initiatives e.g., the UNEP Finance Initiative (UNEP FI) and multilateral development banks (MDBs). In doing so, we identified many GGFGI cases as possible to examine a comprehensive picture of the current architecture of global green finance governance. However, the case selection did not include campaign-based networks (without an institutionalized setting) and regional or local governance institutions with limited effects on the global-scale governance procedures. The selected institutions were active as of December 2022.

In the first part of our mapping exercise, we analyzed the selected GGFGIs’ basic organizational characteristics to understand the architecture of global climate finance governance. We examined 1) when the governance institutions were established; 2) what organizational types they are; 3) what actors initiated the institutions; 4) what are their major policy goals for green finance; and 5) what primary roles the institutions take.

As a second step, we analyzed how each institution frames a risk (or risks) related to climate change – e.g., transition risk, physical risk, litigation risk, policy risk, etc. in what context, particularly related to the question of climate risk imposed on whom. Drawing a qualitative content analysis method (Neuendorf, 2019), we conducted coding each institution’s primary publications (e.g., annual reports, official brochures, policy standards or guidelines, etc.) uploaded on their official website. If there were many accessible documents from a governance institution, we prioritized the materials published 2017–2022. More specifically, we examined whose climate risk was particularly emphasized by each institution through various risk framings, i.e., different types of subjects at risk (business actors, government, people, or nature). Those framings were identified and analyzed based on a linguistic approach (extracting frames directly from “specific words and sentences in a text”) and a hermeneutic approach (interpreting texts deeply by considering cultural and contextual components) combinedly to minimize the risk of selection bias in a study of frame and framings (Matthes

and Kohring, 2008, p. 259, p. 260).

Specifically, we used the search function on each website and collected documents, then explored the textual usage of a “risk” mainly in connection to climate change and different types of climate finance policies (particularly regarding “whose risk” matters). For instance, in many cases, “climate-related risks” appeared in tandem with “physical and transition risks” as in the case of TCFD verbatim (e.g., Green Bank Network). We saved our first coding result in an Excel sheet and conducted the second coding built upon the first one – a more thematic and hermeneutic coding process to investigate the question of “whose risks.” Then, we investigated more specific contexts of the usage of texts appeared from the first coding by reading the whole selected documents on a deeper level (e.g., observing a prominent rationale of indicating climate change as a threat) and identified the main climate risk framings of each institution.

The last step was to categorize the 74 GGFGIs in a Venn diagram according to their climate risk framings, organizational characteristics – i.e., institutional types, and their original governance policy domains (environment, climate, finance, or development). This mapping shows what type of GGFGIs and how many of them emphasize what kind(s) of risk framing. In other words, it reflects what normative ideas are supported by whom. We also identified their relationships based on the official documents accessible on their websites, and coded a vertical relation if an institution works as the secretariat of another institution or established another one as an umbrella organization (mostly IGOs) with the authority to intervene, guide, or provide policy recommendations. The visual analysis presents a new structure of contested normative ideas (i.e., shown in different climate risk framings) emerging from the increasing complexity of global green finance governance architecture across the traditional governance policy areas. In addition, it also shows how those frames are adopted (or re-interpreted) and spread through vertical and horizontal institutional relations.

4.2. What the institutions look like

Our analysis result shows some key organizational characteristics of the current 74 GGFGI (see Table 1). First, except for 16 institutions (mostly IGOs and MDBs), the other 58 GGFGIs have been established since 2000. Interestingly, the GGFGI’s new establishment has been accelerated since 2015 and peaked in 2019 right before the Covid-19 outbreak (Fig. 1). 2015 is not only the year of the Paris Agreement but also of the launch of the Task Force on Climate-related Financial Disclosures (TCFD), the most influential GGFGI (see below).

Regarding GGFGIs’ governance functions, first, our analysis shows that mobilizing or scaling up climate finance is the most common governance goal (emphasized by 69 percent of GGFGIs). The second most common goal is stimulating transparency mechanisms that require investors to disclose their climate change impacts, e.g., the information on the amount of investing in green or brown assets or a climate-related risk assessment result (shared by 42 percent). In addition, some GGFGIs highlight decarbonizing assets as their policy goal, particularly through pricing climate change risks (19 GGFGIs, about 26 percent) or carbon pricing mechanisms (3 GGFGIs, about 4 percent). In terms of other governance functions, although these GGFGIs sometimes take a role in financing climate projects directly (20 GGFGIs), most GGFGIs facilitate information sharing and networking (46 GGFGIs, about 62 percent).

The members of the GGFGIs include many different types of public and private actors. GGFGIs established after 2015 are mostly hybrid governance institutions (15 GGFGIs) consisting of public and private actors both, as transnational public-private partnership initiatives– e.g., The Network for Greening the Financial System (NGFS) created in 2017. This trend shows that global actors governing green finance have been diversified, beyond public actors such as governments, and transnational coalitions among different types of actors have become more common. Currently, private GGFGIs consisting of private actors only (for instance, insurers, bankers, and other corporations) are the most

Table 174 Global Green Finance Governance Institutions (GGFGI) & Establishment Year^{3 4}.

1933	Bank of International Settlements (BIS)	2012	Global Sustainable Investment Alliance (GSIA) ⁴
1944	International Monetary Fund (IMF)		Sustainable Banking Network (SBN)
1947	World Bank (WB)		Principles for Sustainable Insurance Initiative (PSI)
1958	European Investment Bank (EIB)	2014	DivestInvest (DI)
1959	Inter-American Development Bank (IADB)		Portfolio Decarbonization Coalition (PDC)
1960	Organisation for Economic Cooperation and Development (OECD)		We Mean Business coalition (WMBC)
1964	African Development Bank (AfDB)	2015	Carbon Pricing Leadership Coalition (CPLC)
1966	Asia Development Bank (ADB)		Climate Risk and Early Warning Systems Initiative (CREWS)
1970	International Investment Bank (IIB)		Green Bank Network (GBN)
1975	Group of Seven (G7)		Insurance Development Forum (IDF)
1989	European Bank for Reconstruction and Development (EBRD)		Partnership for Carbon Accounting Financials (PCAF)
1991	United Nations Environment Programme Finance Initiative (UNEP FI)		Science Based Targets initiative (SBTi)
	Principles for Responsible Banking (PRB)		The Task Force on Climate-related Financial Disclosures (TCFD)
1992	United Nations Framework Convention on Climate Change (UNFCCC)	2016	Finance for Tomorrow initiative (F4T)
1997	Global Reporting Initiative (GRI)		Mainstreaming Climate in Financial Institutions (MCFI)
1999	Group of Twenty (G20)		UNDP Sustainable Insurance Forum (SIF)
2000	Carbon Disclosure Project (CDP)	2017	Climate Action 100+ (CA 100)
2002	Renewable Energy and Energy Efficiency Partnership (REEEP)		InsuResilience Global Partnership (IGP)
2003	Ceres Investor Network on Climate Risk and Sustainability (Ceres)		International Network of Financial Centres for Sustainability (FC4S)
	Equator Principles (EP)		Network for Greening the Financial System (NGFS)
2005	Munich Climate Insurance Initiative (MCII)		Transition Pathway Initiative (TPI)
	ShareAction's Investor Decarbonisation Initiative (SA IDI)	2018	Climate and Development Knowledge Network (CDKN)
2006	Private Financing Advisory Network (PFAN)		Climate Finance Leadership Initiative (CFLI)
	Principles for Responsible Investment (PRI)	2019	Asia Sustainable Finance Initiative (ASFI)
2007	Forest Carbon Partnership Facility (FCPF)		Cities Climate Finance Leadership Alliance (CCFLA)
2008	Climate Investment Funds (CIF)		Climate Investment Platform (CIP)
	Global Climate Change Alliance (GCCA)		Climate Technology Centre and Network's Adaptation Fund Climate Innovation Accelerator (CTCN-AFCIA)
	Global Energy Efficiency and Renewable Energy Fund (GEEREF)		International platform on sustainable finance (IPSF)
	UN-REDD Programme (UN-REED)		Net-Zero Asset Owner Alliance (NZAOA)
2009	Climate Bonds Initiative (CBI)		Paris Aligned Investment Initiative (PAII)
	Climate Policy Initiative (CPI)		The Coalition of Finance Ministers for Climate Action (CFMCA)
	Global Alliance for Banking on Values (GABV)		UNDP Sustainable Finance Hub (UNDP SFH)
	Global Impact Investing Network (GIIN)	2021	Glasgow Financial Alliance for Net Zero (GFANZ)
	Sustainable Stock Exchanges Initiative (SSEI)		International Sustainability Standards Board (ISSB)
2010	Banking Environment Initiative (BEI)		Net-Zero Banking Alliance (NZBA)
	Toniic (Toniic)		Net-Zero Insurance Alliance (NZIA)
2011	International Development Finance Club (IDFC)		The Investor Agenda (IA)

³ IGOs are marked green and MDBs are marked blue in this table.⁴ The official website does not show the establishment year clearly, but their first review report was published in 2012 (see more details at <https://www.gsi-alliance.org/latest-trends-report/>).

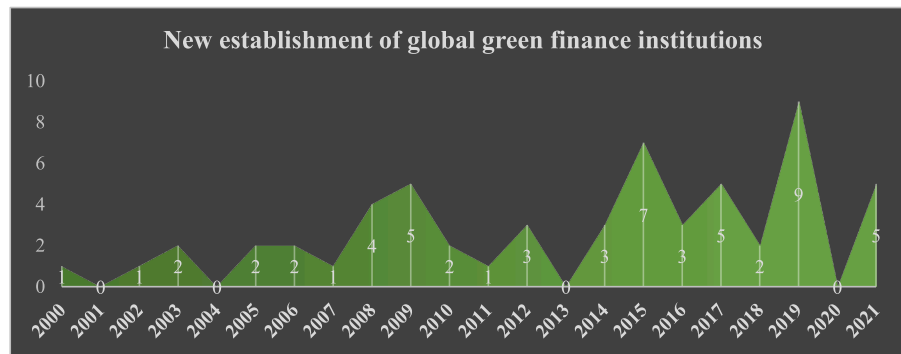


Fig. 1. Historical trajectory of the new establishment of GGFGI.

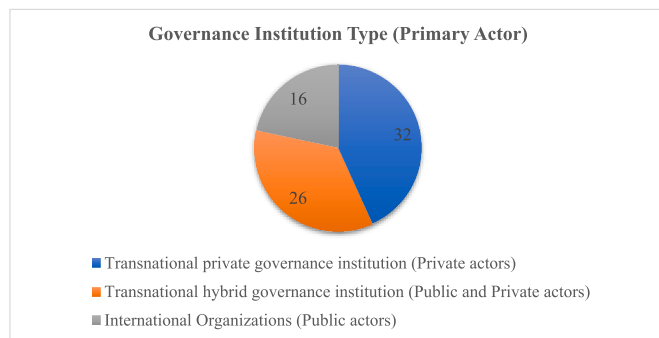


Fig. 2. 74 GGFGI's governance type.

common kind in the global green finance governance complex – followed by hybrid GGFGI and public GGFGI consisting of public actors (See Fig. 2).

Despite private-actor-based GGFGIs constituting the plurality of institutions, our analysis shows that IGOs and MDBs have been the most active governance actors initiating GGFGIs (total 37 institutions out of our 74 cases), compared to other types of actors – business actors (25 institutions), states (19 institutions), civil society actors (8 institutions), and philanthropists and impact entrepreneurs, such as Michael Bloomberg (7 GGFGIs). Notably, many current GGFGIs are “UN-convened” organizations. Particularly, UNEP FI has taken an important incubator role in initiating specialized and sector-based GGFGIs, including the Principles for Responsible Investment (PRI), and the Net-Zero Insurance Alliance (NZIA). Among the IGOs, UNEP and UNEP FI facilitate the highest number of GGFGIs followed by UNDP and MDBs.

4.3. Risk framing in global green finance governance

We examined how the selected GGFGIs frame climate change as what types of risks and whose risks – i.e., risks to business actors, national or sub-national governments, people, or nature. Our focus was whether GGFGIs coherently frame climate change as one specific type of risk or provide different, contesting framings of climate change risks, as the fragmentation literature often argues (e.g., Biermann et al., 2009; Zelli and van Asselt, 2013). This analysis shows two explicit patterns of climate risk framings in the GGFGIs.

First, the climate risk frames dominantly emphasize business actors' risks (Fig. 3). About 97 percent of 74 GGFGIs (72 GGFGIs) appear to highlight climate change's negative impacts on business actors and apply the risk frame into major green finance policy debates. In comparison to that, 39 GGFGIs (53 percent) discuss climate risks affecting government and people. The least number of GGFGIs counts risks imposed on nature (33 GGFGIs, 44 percent). This analysis result indicates that the primary green finance policy discussions and governance mechanisms primarily focus on the benefits or losses of business

actors in comparison to other actors' interests. In other words, the business-risk frame highlights only one side of double-materiality – i.e., how climate change causes potential dangers to business actors, not those actors' negative impact on climate. This result reflects power asymmetries among those actors because it tells us about whose interests matter and ‘for whom’ green finance should be spent (Newell, 2021, p. 129).

Yet, we also found other types of climate risks in the GGFGIs' major policy documents (Table 2). The most explicit differences among those risk frames relate to the question of whose risks do matter most. Beyond risks to business, several GGFGIs highlight national governments or city governments, people (risks linked to human rights or indigenous communities), and nature (such as negative climate impacts on biodiversity). For instance, the Investor Decarbonisation Initiative (IDI) convened by ShareAction introduces climate change as a threat “posing serious risks to life” (IDI's official website, emphasis added) and emphasizes a broader scope of climate risks, e.g., “risk of human rights violations, environmental pollution, and [people's] health risks” caused by extracting critical minerals for low-carbon products.⁵ UNEP's Principles for Responsible Banking (PRB) is another governance institution framing climate risk, not only limited to a business risk. In its 2021 Guidance Document, PRB asks for its members to commit to the following promise: “we [member companies] will continuously increase our positive impacts while reducing the negative impacts on, and managing the risks to people and environment resulting from our activities, products and services.” (PRB, 2021, p. 11). In the case of Carbon Disclosure Project, climate change's risk to cities has been emphasized, in particular, as a background rationale for its policies.⁶ Many GGFGIs emphasize more than one risk frame in their climate risk framing.

Second, TCFD's ‘climate-related risk’ (constituted by ‘transition risks’ and ‘physical risks’) is the dominant climate risk framing among GGFGIs. Notably, our coding result shows that more than the majority of the 74 GGFGIs (49 GGFGIs, about 66 percent) have adopted the TCFD frame, while the remaining 25 GGFGIs (34 percent) emphasize their own climate risk framing as a rationale for their green finance agendas (Fig. 4). For instance, the Asia Sustainable Finance Initiative (ASFI) endorses the TCFD and proclaims its aim to “coordinate dialogue between investors and regional stock exchanges to harmonize disclosure and listing requirements in line with TCFD” (ASFI's website, emphasis added).⁷ As another example, the Net-Zero Insurance Alliance (NZIA) convened by the UNEP Principles for Sustainable Insurance Initiative

⁵ See more details in the 2021 Report, “Decarbonising Corporate Fleets: A win-win for investors” (<https://shareaction.org/reports/decarbonising-corporate-fleets-a-win-win-for-investors>, accessed May 30, 2023).

⁶ See more details at its official website: <https://www.cdp.net/en/cities> (accessed May 30, 2023).

⁷ The official website of The Asia Sustainable Finance Initiative, “Regulations & Guidelines,” <https://www.asfi.asia/regulations-and-guidelines> (accessed May 30, 2023).



Fig. 3. 74 GGFGIs' risks frames focusing on different types of actors.

Table 2

Different climate change risk frames in 72 GGFGIs (* Risk frames with asterisk are from TCFD.).

Whose risks?	Climate risk frames
Business actors	Physical risks (Acute and Chronic risks)* Transition risks* Policy and Legal risks* (e.g., Litigation risks) Technology risks* Market risks* Reputation risk* ESG risk Operational risk Liability risks Portfolio risks
States (National governments and sub-national governments)	Physical risks (e.g., to cities: CDP) System-wide risks Financial stability risks Sovereign risks
People (Including local communities)	Risk to people (Human Rights risk, e.g., PRI, PRB) Health risks Food security risks Natural disaster risks, particularly causing community risks
Nature/Earth	Environmental risk (e.g., CDP) Forest risks (e.g., CDP) Biodiversity risk (e.g., PRI) Sustainability risk (e.g., SSE initiative)

(PSI) requires companies to commit to “supporting the implementation of corporate disclosure frameworks ... such as the recommendations of the Financial Stability Board’s Task Force on Climate-related Financial Disclosures (TCFD)” (NZIA, 2021, p. 2, emphasis added).

TCFD’s climate-related risk frame consists of transition risks (policy and legal, technology, market, and reputational risks) and physical risks (acute and chronic risks). As Fig. 5 shows, those types of risks are often mentioned with economic ‘opportunities’ as a pair so that companies can calculate the ‘financial impact’ of climate change. For instance, a new climate policy regulating a fossil-fuel intensive companies can trigger ‘policy and legal risks’ under the TCFD’s transition risk category (e.g., a climate litigation against the company) potentially reducing profits, especially when “too rapid” transitions lead to stranded assets from sharp devaluation (Thiemann et al. 2023). The uncertainty of “the timing of technology development and deployment”⁸ for companies’

⁸ See more detailed definitions of each risk category of the TCFD in “the 2017 Final report: Recommendations of the Task Force on Climate-related Financial Disclosure,” p.5-6, (<https://assets.bbhub.io/company/sites/60/2020/10/FINAL-2017-TCFD-Report-11052018.pdf>, accessed May 30, 2023).

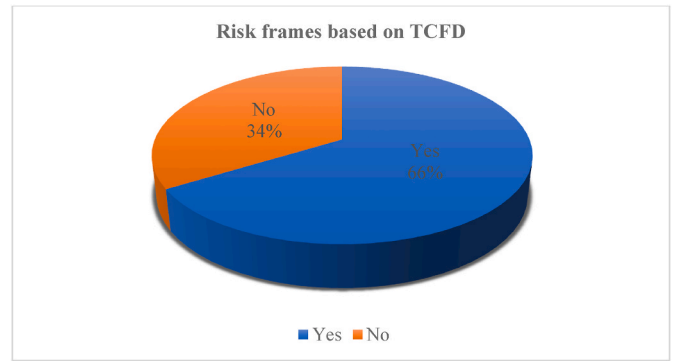


Fig. 4. 74 GGFGIs and TCFD’s risk frames.

low carbon transition (e.g., the technology of producing, so-called, ‘green steel’ products) could be a serious ‘technology risk,’ potentially leading to the decrease of short-term profits. This TCFD’s approach to climate risk is central to understanding how climate change, in the complexity of the current global green finance, has been framed as a risk causing economic gains or losses of business actors mainly.

4.4. Climate risk framings as a normative feature of the global green finance governance complex

In this section, we turn to climate risk framings as a normative feature of the global green finance governance complex, including the relationship between such framings and institutional characteristics. Fig. 6 shows nine categories of the 74 GGFGIs classified with color coding that describes four different climate risk framings (business, government, people, nature’s risk) and three institutional types – IGOs, intermediaries of IGOs, and transnational governance networks (TGN). In addition, the governance institutions marked with a red asterisk shows that they adopted TCFD’s climate risk framing.

This mapping highlights how the global green finance complex consists of conventional IGOs as well as transnational governance initiatives. Moreover, IGOs from different governance issue areas originally (e.g., G20, UNFCCC, UNDP, and UNEP) are developing their green finance agendas and policies simultaneously. Some IGOs initiated their sub-agencies as intermediaries to interact with non-state actors (particularly private investors) related to their green finance agendas. TCFD is one of the intermediaries created by the G20 and the FSB, while the UNFCCC includes the Global Climate Fund (GCF) and the Global Environment Facility (GEF). In addition, the UNEP established UNEP FI to reinforce private finance actors’ engagement in 1992, which triggered the creation of some TGN under the UNFEP FI’s governance umbrella – such as PRI, PSI, PRB, SSEI, NZIA, NZBA, and NZAOA.

That institutional complexity also includes the complexity of normative ideas as another important constituent of the complex – that is, different climate risk framings in this analysis. There are several groups of GGFGIs (section 1 to 9 in Fig. 6), emphasizing different types of climate risk framings— from a group focusing on business risks narrowly to another one understanding climate risk as all four types of risk framings (risks imposed on business, government, people, and nature). Above all, the most prominent characteristic in this governance complex is that, except for a few cases (e.g., IIB or GCCA), most GGFGIs frame climate risk as business risk regardless of their institutional type (see section 1, 2, 3, 4, 5, 7, and 8). Notably, most institutions emphasizing business risk follow and support the TCFD, an intermediary of G20 (see institutions marked with an asterisk in Fig. 6). It is worth paying attention to that the GGFGIs (section 6 and 9) outside the category, not emphasizing a business risk, did not adopt the TCFD recommendations.

To be specific, among the nine categories, the largest group of GGFGIs (24 institutions) emphasize business actors’ risks only. This pattern in section 1 is contrary to section 9: only one GGFGI (IIB) frames

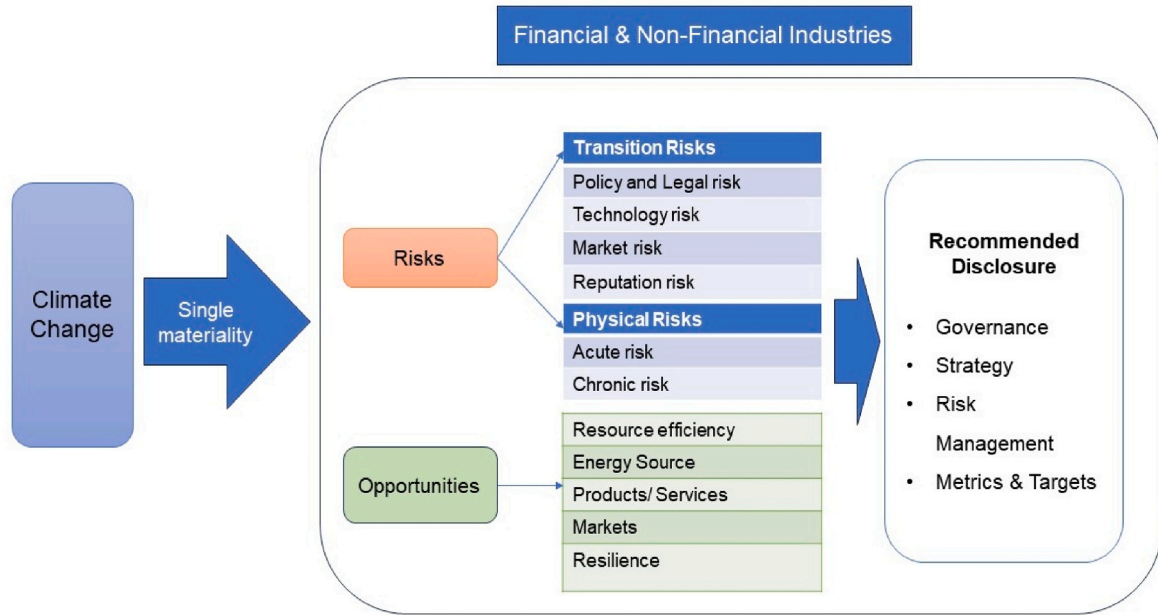


Fig. 5. TCFD's climate-related risk framings (Source: Author based on data from TCFD's official website).

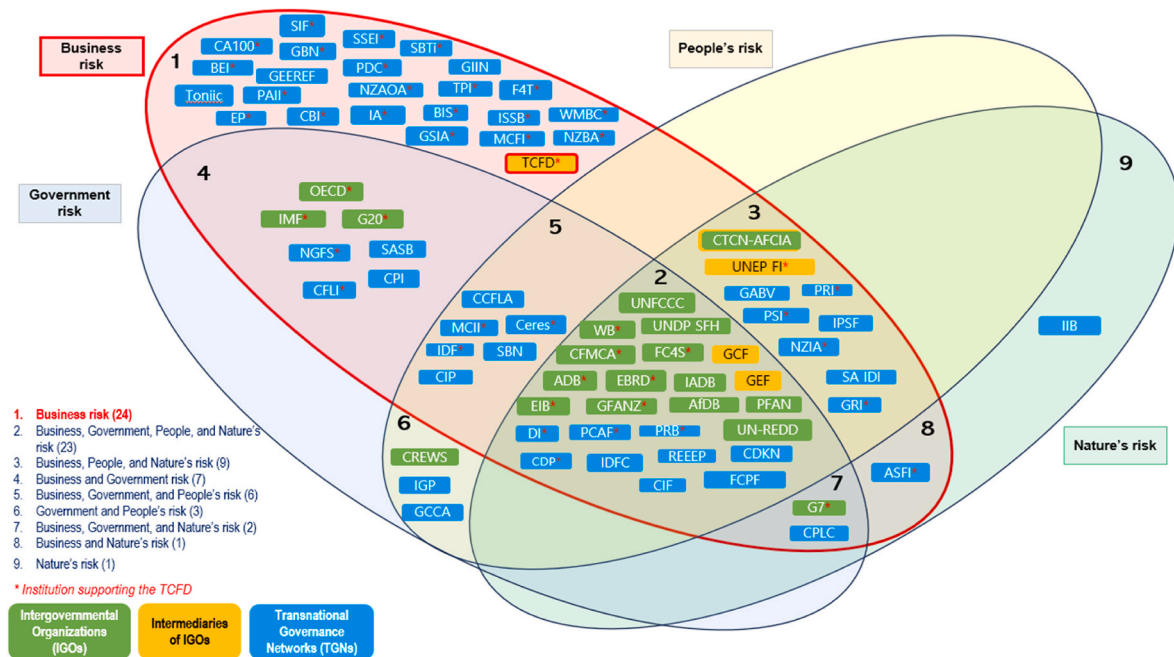


Fig. 6. Climate risk framing in the global green finance governance complex.

climate risk as a threat imposed on nature. Importantly, the institutions in section 1 are mostly TGNs consisting of private actors and adopted the TCFD standards. Even some institutions created by UNEP FI (e.g. the NZAOA, the NZBA, and the SSEI) focus only on single materiality (i.e., climate change's impact on financial markets) rather than double materiality.

Meanwhile, the second-largest group of 23 GGFGIs of 74 GGFGIs frame climate risks broadly as a threat to all four types of subjects – business actors, governments, people, and nature (section 2 in Fig. 6). Interestingly, this group of governance institutions are usually conventional and often powerful IGOs, originally established for climate change and international development agendas, such as UNFCCC (including its

intermediaries – GCF & GEF) and MDBs like the WB, the Asian Development Bank, and the European Investment Bank channeling billions of dollars.

As a third group (section 3), 9 GGFGIs focus on both people's and nature's risks combined, in addition to business risk but not government risk, in their policy discussions regarding green finance. Acknowledging risks imposed on people and nature simultaneously in those institutions would reflect that their policy makers consider both socio- and ecological impacts of climate change. These GGFGIs include UNFP FI and its PRI and PSI, and the Global Alliance for Banking on Values (GABV), a global network among alternative banks, many of them are closely linked to UNEP. UNEP FI was established by UNEP as its intermediary to

facilitate green finance policies based on finance-related expertise. As a UNEP-convened institution, UNEP FI reflects the UNEP's original core normative idea emphasizing the environment and people but, crucially, also business risks.

The role of the GGFGIs emphasizing climate risks to people and nature (section 2 and 3) can be crucial regarding growing climate justice concerns. Interestingly, the most of these GGFGIs adopted the TCFD standards – emphasizing business risks— but simultaneously highlight people and nature's risks from climate change impacts (i.e., more inclusive climate risk framings). Thus, the roles of environment, climate, and development IGOs appear to exercise influence in their respective governance domains and diversifying risk narratives away from an asymmetrical focus on a business-centric risk solely. While the IGOs regard climate change as a business risk, their climate finance policy debates have been developed based on their other original governance goals and values: such as, human development and environmental sustainability.

This observation implies the unique role of the key IGOs regarding climate risk framings, who steer the actors and set main policy agendas supported by particular normative ideas in each specific governance domain (e.g., UNFCCC as a climate governance orchestrator in Hickmann et al., 2021, UNEP as an orchestrator in Abbott and Snidal, 2010, or UNEP and the WB as an orchestrator in Hale and Roger, 2014). It is worth noting that some “non-financial” IGOs emphasize multidimensional climate risks, not only climate's business risks, even though the majority of GGFGIs (especially most emerging private TGNs) focus on climate risk as a business risk. UNDP-related GGFGIs and MDBs tend to emphasize climate risks to individual people, particularly local communities in developing countries, while UNEP and UNEP FI-related agencies count nature's risks more frequently than other types of GGFGIs. Hence, the original governance goal of IGOs (i.e., international development of UNDP and environmental protection of UNEP) seem to influence their framings of climate risks and those institutions appear to re-interpret TCFD's climate risk framing based on their normative principles and authority. This re-interpretation reflects widespread discussions concerning how to frame climate risk, also within the TCFD among different actors (Täger, 2022). Based on the mapping analysis above, Table 3 summarizes what IGOs and their sub-agencies focus on what climate risk framings, depending on their original governance policy domains—global finance, environment, climate, development governance.

The different climate risk frames appear to reflect distinctive

normative groundings of the four governance domains. Accordingly, the G20 and the FSB—global economic IGOs supporting the value of economic and financial stability—define climate risk as a business risk through the TCFD, while UNEP and UNEP FI—organizations originally built for the global environment—define climate change as people and nature's risk. For instance, UNEP was one of the co-founders of the GRI in 1997, which was originally established to promote “environmental conduct principles” for business accountability (GRI website). Since then, GRI has centered its reporting standards on the double materiality of corporate impacts—primarily social and environmental—which has also been adopted by UNEP FI to prevent greenwashing (GRI, 2022). GRI has consistently emphasized its broad impact-focused approach, particularly in the context of aligning with the TCFD based on the single-materiality, and more recently with the ISSB which succeeded the TCFD (CDP et al., 2019; GRI, 2022), as well as the Taskforce on Nature-related Financial Disclosures (TNFD), which addresses biodiversity and nature-related reporting based on the double-materiality (TNFD and GRI, 2024). Notably, UNEP FI was one of the founding partners of the TNFD with UNDP, WWF, and Global Canopy (UNEP FI, 2021), while receiving global support, including the G20 (TNFD official website). This relatively recent case of the TNFD also resonates with our finding of UNEP FI's emphasis on business, people, and nature's risk.

Meanwhile, a noticeable finding is that G20, FSB and TCFD, originated from global finance governance, seem most influential in framing climate risk (in line with e.g. Maechler, 2023; Täger, 2022), despite other multiple potentially powerful institutions in the global green finance governance complex. Although G20's original governance domain has been global financial and economic issues, it seems to have become a powerful player in global climate governance based on its influence in shaping green finance debates and in emphasizing the integration of climate change objectives into financial systems.

The TCFD became the most influential institution as a main hub wherein the dominant perception of climate risk imposed on business actors is disseminated, based on its emphasis on single materiality – i.e., one-sided approach to focus on how global warming affect companies and investors, not the other way round.

Crucially, the TCFD's framing of climate risk is seen as a “game changer” and a “catalyst of portfolio decarbonization” (UNEP FI, 2017). Its prevalence of the TCFD's climate risk framing reflects a long range of decisions with political implications. These decisions start with the G20 decisions to establish a taskforce on climate financial risk and do so within the FSB, decisions that delineated how far from business interests

Table 3
Climate risk framings of GGFGIs originated from different governance domains.

Governance Domain	Global Finance Governance	Global Environment Governance	Global Climate Governance	Global Development Governance
IGOs	G20 (the most influential orchestrator)	UNEP	UNFCCC	MDBs
Sub-agencies from IGOs and relevant TGNs	TCFD (from the FSB) Relevant TGNs adopting the TCFD standard	UNEP FI Relevant TGNs (e.g., GRI), particularly, UNEP FI-convened initiatives (e.g., PSI, PRI, and PRB)	GCF, GEF	N/A
Predominant climate risk frames	Business risk	Business, people, and nature's risk	Business, government, people, and nature's risk	Business, government, people, and nature's risk

the risk framing could be (Täger, 2022, chapter 2). The subsequent decision to recruit only private (mainly financial) sector representatives to join the TCFD and exclude NGOs and academics in order to enhance its legitimacy – by reflecting “by the market and for the market”-logic (ibid., p. 99) – further limited the scope for framing. A final set of decisions consists of several green finance institutions swiftly endorsing and aligning with the TCFD soon after its launch in 2016–2017. For example, Ceres and PRI in 2016, and PDC and SSEI in 2017—adapting existing mechanisms to fit its recommendations. CDP redesigned its climate questionnaire to reflect TCFD guidance “in response to market needs” (CDP, 2018). This alignment accelerated after the G7 Finance Ministers’ 2021 decision to mandate TCFD-based disclosures, reinforcing investor demand for high-quality climate risk data (HM Treasury, 2021) and strengthening the TCFD’s global legitimacy. Even the GRI, originally focused on corporate social and environmental impacts, began integrating financial materiality by aligning with TCFD (GRI, 2022), thus underscoring that the TCFD was indeed considered legitimate.

The predominance of the TCFD highlights the ‘normative’ impacts of the business-centric climate risk framing in the global green finance governance complex. The business-focused risk frame leads to policies of “de-risking business risks” (i.e., enhancing economic profits and avoiding economic loss) primarily, not necessarily “de-risking” the risks imposed on weaker actors in market e.g., indigenous communities or to nature’s biodiversity.

5. Discussion and conclusion

Climate change became defined as a risk by policymakers in a heterogeneous set of governance institutions, but the answer to the question of to whom it was framed as a risk was not pre-given. Our paper shows that a business-centric risk framing became pre-eminent in the global green finance complex. This prevailing framing focusing on climate’s impact on the financial sector is shared by the majority of GGFGIs, particularly rapidly emerging private governance networks and IGOs centered on global financial stability, especially the G20 and the FSB. We found that this dominant framing is particularly based on the TCFD recommendations and its focus on single materiality – i.e., climate change’s impact on companies and financial assets. While several “non-financial” IGOs in global environment, climate, and development governance, emphasize people and nature’s risks along with business risk, risk to business was emphasized across all governance domains as a reflection of various political decisions in the context of the TCFD that restricted the possible risk framings.

From a critical constructivist perspective, this paper contributes to our understanding of ‘the politics of climate risk framing’ and ‘whose idea matters most’ in global green finance governance by exploring how the development and uptake of the business-centric risk frame functioned as a mechanism through which the relationship between climate change and finance came to be characterised by “trasformismo” rather than fundamental transformation (Newell, 2019). Importantly, this finding challenges the value-free notion of global governance complexity and sheds light on the hidden power dynamics underlying the growing diversity of actors and institutions in the global green finance governance realm—extending beyond a single governance domain, whether global finance or climate governance alone. With the integration of the TCFD into the ISSB and the widespread focus on climate change as a material risk to business and particularly investors, climate risks have been brought into the operations of the financial system. Thus, the business-centric risk approach prioritizing financial stability and single materiality - protects business actors’ interests as the status quo and the hegemonic power of the private sector (Kedward et al. 2024), rather than advancing structural redistribution serving the most vulnerable and our ecosystem. The spread of the TCFD underscores that creating the TCFD guidelines “by the market and for the market” (Täger, 2022, p. 99) did indeed enhance their legitimacy not only within the

financial governance complex but also within other governance complexes. Diverging approaches were handled by governance institutions from multiple governance domains through re-interpretation rather than rejection or contestation. While it is beyond the scope of this article to explain why institutions beyond the global finance governance domain adopted the TCFD risk frame, this adoption is testament to the power of the financial system to have its definition of a global governance problem adopted beyond its own governance domain. And this power has repercussions for which voices (business) are heard and which are silenced (e.g. nature, people), and consequently for whose risks are addressed – as well as for how transparency rather than hard regulation is used to address climate finance risks.

Consequently, the asymmetrical focus on business climate risk raises normative issues that threaten the ability of green finance governance to achieve its goal: a ‘just’ transition to net-zero, in the following ways.

First, it is possible that climate finance could flow into only “bankable climate projects” (Long, 2021), and thus avoid investment that benefit the most vulnerable because such investment is deemed too ‘risky’ to obtain adequate profit margins. This would mean that climate adaptation or loss and damage measures, particularly in lower-income countries but also in places such as wildfire-prone Californian regions may remain under-financed.

Second, if social and ecological considerations are not at the center of green finance governance, ‘green’ finance could de facto damage vulnerable communities and nature. For instance, investments in hydropower dams that lead to the displacement of indigenous communities and damage eco-systems would continue.

Third, on a more general level, the global green finance governance complex is becoming another venue for ‘climate capitalism,’ that is, ‘climate for business’ (Newell and Paterson, 2010). The limits of this approach in terms of achieving net-zero is becoming rapidly evident as (1) the long-term risk of climate change to the financial sector does not translate into the sector redirecting investments to make them compatible with net-zero (Kaplan and Levy, 2025) and (2) major banks and hedge funds follow the signal of the Trump administration and leave GGFGIs such as the Net-Zero Banking Initiative.

Yet, questions emerge from the finding that the TCFD was re-interpreted in ways incorporating other governance objectives than business interests such as people or nature –e.g., the UNEP FI and GRI’s re-alignment of the TCFD alongside their emphasis on risk to nature and people. Answering these questions may point in other directions than the trasformismo inherent in the TCFD framing. Particularly, the re-interpretations may form the basis for more transformative framings of climate risk emphasizing non-business risks. While transformative framings may currently be marginalized, windows of opportunity may emerge from the challenges to the prevalent framing from (1) its inability to meet its objective of redirecting finance (Kaplan and Levy, 2025) and (2) the Trump administration’s animosity towards both liberal governance institutions and environmental protection. Drawing on Cox (1981), the potential challenges to the institutionalization of the TCFD can be seen as coming as much from changes to material power (the changing role of the US) as from rival ideas and framing. The multitude of institutions and the involvement of three non-financial governance complexes means there are a range of different venues such reinterpretations could emerge.

It is a topic for future research whether the business-centric framing will uphold its predominant position (e.g. due to the ideational power of the financial sector), or if other framings prevail as an indication of cracks in the hegemony of the financial sector. Moreover, from which governance institutions would such non-business framings emerge, e.g. would it be the UNEP or the UNEP FI, given their role in re-interpreting the TCFD’s framing, or would it be more conventionally economic institutions such as the MDBs?

Other future research that could build on the findings concerns the dynamics behind the dominant role of the TCFD (its replacement, the ISSB) on the global green finance architecture. These relate to the role of

the TCFD, e.g., why did GGFGIs from different governance domains adopt the TCFD guidelines? And has the TCFD's involvement of financial participants in global climate governance has led to changes in their investment portfolios toward net zero?

Answering these questions can provide a significant step towards "just" green finance policies in Earth System Governance.

CRedit authorship contribution statement

Hyeyoon Park: Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jakob Skovgaard:** Writing – review & editing, Writing – original draft, Validation, Methodology, Funding acquisition, Conceptualization.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data will be made available on request.

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