

Shifting the focus of sustainability accounting from impacts to risks and dependencies: Researching the transformative potential of TCFD reporting

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Abstract

Purpose:

This paper problematizes TCFD (Task Force on Climate-related Financial Disclosures) reporting in a way that demonstrates areas where academic research can contribute towards realising the transformative potential of this unique form of sustainability accounting in its early stages of development.

Design/methodology/approach:

The paper proposes a number of research agendas for impactful interdisciplinary research into new forms of corporate reporting of sustainability risks, opportunities and dependencies.

Findings:

There are several major challenges that both reporting corporations and investors need to address in realising the potential of TCFD-style risks, opportunities and dependencies reporting. Key among these is developing new practices of climate-related scenario analysis and reporting.

Practical implications:

There is potential for many different academic research studies to provide solid evidence in helping improve the practical impact of TCFD-style sustainability reporting. These impacts may assist in moving corporate policies and actions towards zero carbon.

Originality/value:

This is the first agenda-setting paper that addresses the need for, and opportunities of, academic research into TCFD reporting and its potential to transform corporate accounting and reporting of sustainability.

Keywords:

TCFD; Task Force on Climate-related Financial Disclosures; dependencies reporting; scenario analysis; sustainability accounting and reporting.

1 Introduction

While evidence of dangers from human-induced climate change has been mounting over many years, public and business awareness of the severity of these problems has increased much more rapidly over the last decade. In the 2015 Paris Agreement, governments recognized the urgency of limiting global warming to a maximum of 2°C above pre-industrial temperatures or risk severe impacts on many natural systems upon which we depend (UN, 2015). In its 2018 update, the Intergovernmental Panel on Climate Change (IPCC) made clear that scientific evidence now firmly indicates any global warming greater than 1.5°C could cause catastrophic climate change (IPCC, 2018). As we have already exceeded warming of 1°C, there is an urgent need for significant action to decarbonize the economy to prevent much further warming.

Any failure to adequately decarbonize the economy will expose many businesses to potentially significant risks from the physical impacts of climate change. These risks are likely to make many existing business models unviable through severe disruptions in supply chains and destruction of assets (TCFD, 2017a). However, transitioning to zero (or even net-negative) carbon economies also exposes businesses to a variety of significant novel risks, including regulatory, market and reputational risks. It also presents many business opportunities, for example for new products and services required in a zero carbon economy (Committee on Climate Change, 2019; Duke *et al.*, 2019). Investors and lenders need information about these physical and transitional risks and opportunities to help them evaluate and price possible financial outcomes for a corporation flowing from the corporation's dependencies on the changing state of the climate. A growing number of investors are recognizing the materiality of such climate-related financial risks across their investment portfolios and are demanding this type of information to help them judge these risks (Moody's, 2019; WEF, 2020).

There is a long tradition of sustainability reporting in many countries that communicates information to a range of stakeholders about a corporation's impacts on society, the natural environment and the economy. Where this plethora of sustainability reporting frameworks (FSB, 2015b; Tett, 2020; The Reporting Exchange, 2020) is used by investors and lenders, it can provide relevant information to help encourage the flow of finance for 'green' investments, for example through environmental, social and governance (ESG) investment funds. However, this sustainability impact reporting does not focus upon providing a broader range of (mainstream) investors or lenders with information about the potentially substantial risks to financial returns resulting from a corporation's dependencies upon climate. An exception is the 2017 reporting framework encapsulated in recommendations from the *Task Force on Climate-related Financial Disclosures* (TCFD).

This type of corporate reporting framework, focusing on disclosing financial implications of climate-related risks and dependencies rather than revealing a corporation's impacts on climate change, poses many challenges in the preparation and effective use of the disclosed information. In common with development of policies and practices in many areas, these challenges are likely to be more effectively addressed using high-quality evidence provided by academic research. However, despite the opportunity and need for research in this unique area, TCFD reporting has yet to be explored substantively within the accounting or finance academic literatures.¹

In this context, the aim of this paper is to problematize TCFD reporting in a way that demonstrates several areas where academic research can contribute towards realising the ground-breaking potential of this form of sustainability accounting and reporting in its early

stages of development. TCFD reporting is so distinctive and has been receiving so much attention in policy circles that we believe it merits intense academic scrutiny to help advance both the development and the potentially positive impact of this type of climate dependencies disclosure². As other policy initiatives are being developed that use the approaches underlying TCFD for reporting corporate dependencies on a range of other environmental factors (such as biodiversity) (Better Nature, 2020), sustainability reporting of this nature appears to be on an upward trajectory.

The following are among the key challenges that have been experienced by preparers and users of TCFD information and that are addressed in this paper:

TCFD reporting is based around modelling a number of plausible future global warming scenarios. The key physical and transitional risks and opportunities for a corporation's business model in each scenario are then identified and reported from this modelling. However, scenario planning is not a common practice in all sectors. In those which do more commonly use scenario planning (such as energy exploration), it tends to be used for financial scenarios rather than climate scenarios. Partly based on our experience of work in this area, understanding and developing skills in climate-based scenario analysis has been an area where corporations that are committed to reporting in accordance with TCFD principles have faced major challenges.³ Section 3 of this paper explains the TCFD scenario approach, identifies some of the key challenges this poses, and suggests research directions where academic work could help improve the effectiveness of climate-based scenario planning in identifying organizational climate dependencies.

Once the nature of climate-related risks and opportunities have been identified through TCFD-style climate scenario analysis, both corporations and the finance sector need to develop skills in incorporating this risk information into their corporate-level risk analysis and management processes. Challenges faced by corporations in this regard, and research that can help identify, problematize and address these challenges, are explored in Section 4.

Materiality of the resulting risks is a major component in both undertaking and reporting upon climate-based scenario analysis, and in the way this analysis is incorporated into corporate-level risk management processes. Section 5 of this paper identifies the major complications in applying materiality considerations to climate scenario dependencies, and suggests avenues for research addressing these complications.

Moving to a broader level of resolution, material sustainability dependencies risks need to be reported in a consistent manner. Existing corporate reporting frameworks could help in providing such consistency in this reporting. Section 6 discusses challenges in aligning TCFD reporting with existing reporting frameworks and research opportunities to advance effective (or question ineffective) alignment.

As a major aim of consistently reporting climate risk dependencies information is to inform investment and other financing decisions, the finance sector needs to develop skills in understanding this novel information. Section 7 examines some of the challenges for investors in making effective use of TCFD reporting information, and prospects for research in this area.

Finally, Section 8 addresses some other ongoing implementation challenges of TCFD reporting, before Section 9 summarizes key elements of the research agenda developed in the preceding sections and draws overall conclusions.

Before embarking on the tasks covered in the sections discussed above, to help readers of this paper better understand the nature of TCFD-related challenges, Section 2 explains the philosophy and antecedents underlying development of the TCFD initiative. It also outlines key elements of the TCFD framework and offers a broad overview of how TCFD reporting requires different perspectives from those provided by prior research in sustainability impact reporting, ESG finance, and integrated reporting.

2 Understanding TCFD's fundamental principles

2.1 TCFD's underlying philosophy and antecedents

A fundamental principle that has driven the TCFD's reporting proposals from the outset is a belief that when markets operate efficiently, they can help deliver effective pricing and management of risks (FSB, 2015b). While we recognize that the notion of market efficiency is a contested ideological belief (Collier, 2019), it does guide the development of much economic and accounting policy and practice. A prerequisite for markets efficiently pricing risks in this context is the provision of high-quality, understandable, and reliable information.

Climate-related financial risks pose a major challenge in this regard as they are of a fundamentally different nature to many other risks routinely priced by markets, often involving considerably more complex underlying factors and a need to substantially extend time horizons (Carney, 2015) to internalise what have traditionally been regarded as economic externalities (Unerman *et al.*, 2018). Carney (2015, p. 3) has termed this 'the tragedy of the horizon' whereby scientific time lags between: (1) taking action to curb greenhouse gas emissions, and (2) the impact of this action on global warming are much longer than the risk and return time horizons typical in financial investment decisions and markets. Unless the time horizons of financial markets are considerably extended, widespread severe impacts of climate change are likely to manifest themselves once it is too late for these markets to effectively price such risks and for corporations to take meaningful action in addressing them.

For example, if global societies as a whole take little action to significantly curb the upward trajectory of greenhouse gas emissions, increases in adverse weather events such as severe storms, droughts and bush/forest fires are likely to lead to major increases in insurance claims for destroyed property along with uninsured losses for businesses and residential property owners (Bank of England, 2019; Carney, 2015). These climate change hazards pose physical risks to the tangible assets and supply chains of businesses, threatening their financial viability. They can also diminish the value of these assets over which banks may have taken charges as security for loans, threatening the stability of the banking sector – with, for example, 10% of UK bank mortgage lending being for properties at significant risk of flooding (Bank of England, 2019).

Conversely, where societies mandate effective policies to avoid catastrophic climate change by drastically curbing greenhouse gas emissions, such policies are likely to limit burning of fossil fuels to a level where a large proportion of the proven energy reserves reflected in the valuation of oil, gas and coal corporations can never be used. Removing these 'stranded assets' from the market valuations of these corporations is likely to lead to a significant downward correction in these market values as societies transition to a low (or zero

or net-negative) carbon economy (Bebbington *et al.*, 2020). Such transitional adjustments also pose significant threats to the stability of the financial system. For example, the Bank of England (2019, p. 3) has estimated that: “In the UK, loan exposures to fossil fuel producers, energy utilities and emission-intensive sectors amount to around 70% of the largest UK banks’ Tier 1 capital”.

Complex and long-term climate-related financial risks of this nature may be outside the expertise and experience of both preparers and users of corporate risk disclosures. Despite such challenges from these added complexities, a view underlying TCFD has been that adequately informing markets through high-quality longer-term climate-related corporate financial risk disclosures can help deliver more effective market-based outcomes (FSB, 2015b; TCFD, 2016). In this regard, transparent financial commensuration of climate-related risks (and opportunities) is regarded as a way to help ensure capital flows are more appropriately directed, which can then result in a corporation’s managers actively identifying and managing these climate-related risks and opportunities (Carney, 2015; TCFD, 2016).

Conversely, inadequate climate-related risk disclosure is regarded as likely to lead to market mispricing of these risks (Monasterolo *et al.*, 2017), resulting in inefficient capital allocations and little pressure on corporate executives to actively identify and manage these risks. In a time of growing awareness of the potentially catastrophic and widespread impacts of global warming, failure to adequately incorporate climate-related risks into investment decisions has been regarded by some policymakers and regulators as a risk to the success of business models and to the stability of the global financial system (Carney, 2018).

Accordingly, at the April 2015 G20 *Finance Ministers and Central Bank Governors Meeting*, the Financial Stability Board⁴ was asked “to convene public- and private-sector participants to review how the financial sector can take account of climate-related issues.” (G20, 2015, p. 5). Such a meeting was convened in September 2015 at which a number of complex risks from climate change to the resilience of financial institutions were discussed. These were broadly categorised into “physical”, “liability” and “transition” risks (FSB, 2015b, p. 1). The meeting identified a key role for “appropriate disclosure” (p. 2) of corporate-level information in helping markets understand such climate change risks, thereby ensuring better functioning markets. Corporate disclosure was also identified as a means to help the corporations themselves understand and adapt in a timely manner to the material climate risks and opportunities they face, thus reducing the likelihood of (or need for) even more disruptive abrupt changes in the future. The meeting noted that the existence of several hundred sustainability/climate reporting frameworks indicated a lack of the sort of consensus likely to be needed to drive real change through effective corporate disclosure of climate-related risks. It recommended the establishment of a task force “to develop voluntary, consistent climate-related disclosures of the sort that would be useful to lenders, insurers, investors and other stakeholders in understanding material risks” (FSB, 2015b, p. 1).

Drawing on insights from this meeting, in a speech to the Lloyd’s of London insurance market the FSB’s then Chair (and Governor of the Bank of England), Mark Carney (2015, p. 13), explained that:

... a framework for firms to publish information about their climate change footprint, and how they manage their risks and prepare (or not) for a 2 degree world, could encourage a virtuous circle of analyst demand and greater use by investors in their decision making. It would also improve policymaker understanding of the sources of CO₂ and corporate preparedness.

Carney subsequently announced the TCFD's establishment at the December 2015 Paris Climate Change Conference (COP21) (FSB, 2015a). It was to be chaired by Michael Bloomberg, with membership comprising a number of other high-profile finance leaders from both information preparer and user organizations.

On 31 March 2016 the TCFD published a report from Phase I of its work that established the scope of the TCFD's remit and the basic principles that should inform a disclosure framework (TCFD, 2016). This Phase I report reiterated concerns about fragmentation among existing climate-related sustainability reporting frameworks, with few covering disclosures of financial risks for reporting corporations from climate change – unless these were captured by existing financial reporting regulations covering material risks/liabilities. The report defined the scope of the TCFD's work as encompassing reporting of climate-related risks and opportunities over a range of timescales primarily for both financial-sector organizations and listed corporations in non-finance sectors (i.e. firms in the real economy). It “identified seven fundamental principles that are critical for an effective regime for climate-related financial disclosure” (TCFD, 2016, p. 4). These were summarized as follows:

1. Present relevant information
2. Be specific and complete
3. Be clear, balanced, and understandable
4. Be consistent over time
5. Be comparable among companies within a sector, industry, or portfolio
6. Be reliable, verifiable, and objective
7. Be provided on a timely basis

Based on the above considerations, criteria and market-based philosophy, and following public consultation, the TCFD published a set of corporate climate-related financial disclosure recommendations in July 2017 (TCFD, 2017a). These focus on provision of information through corporate reporting about the financial risks and opportunities to which a corporation is exposed from probable impacts of climate change on its operations. In other words, TCFD focuses on reporting the financial *dependencies a corporation has on different levels, or scenarios, of climate change*. This focus is distinct from other sustainability reporting frameworks that instead focus on reporting the *impacts on climate change from a corporation's operations* (and other aspects of sustainability) (Unerman, 2019), in some cases also covering some financial impacts on the corporation. While the level of a corporation's contributions to global warming, for example thorough the greenhouse gas emissions from its own operations and in its supply chains, will have an impact on global warming, its exposure to risks of global warming are a result of much higher levels of global greenhouse gas emissions from *all* businesses, governments and households globally – to which it will have only contributed a part. Therefore, even the most environmentally enlightened businesses that reach zero or net-negative greenhouse gas emission levels will nevertheless be exposed to climate-related risks from the emissions of others (Unerman *et al.*, 2018).

In providing disclosures on the above factors, the TCFD 2017 report recommended that corporations in both the financial sector and non-financial sectors provide climate-related financial disclosures covering the areas of: governance, strategy, risk management and metrics and targets. The specific recommended disclosures in each of these areas are outlined in Figure 1.



Figure 1: TCFD disclosure recommendations, quoted and adapted from TCFD (2017a, p. 14)

2.2 Linkages between TCFD principles and prior accounting and finance research

Andrew and Baker (2020) explore a large body of research published in leading journals since the mid-1970s investigating corporate social responsibility reporting. Their analysis indicates that this research covers a range of issues connected with the reporting of corporate sustainability policies and practices. As such, this literature addresses the reporting of corporate impacts on social and environmental sustainability rather than the risks to which corporations are exposed from changes in society and the natural environment. Some research in accounting has addressed climate-related risks from an organizational climate adaptation perspective (see, for example, Linnenluecke *et al.*, 2015). However, the broader TCFD climate dependencies approach to corporate reporting provides a unique empirical and theoretical landscape for sustainability accounting research.

A number of factors related to ESG performance and investing have also been addressed in the finance literature (see, for example, Brooks & Oikonomou, 2018). While corporate actions and investments connected with ESG impacts can represent an opportunity to mitigate some corporate risks inherent in transitioning to zero-carbon economies, they are likely to only form part of any corporation's climate dependencies. Before publication of a 2020 *Climate Finance* special issue of *The Review of Financial Studies*, there had been a dearth of research into the types of climate-related financial risks underlying TCFD reporting (Hong *et al.*, 2020). While a few of the papers in the *Climate Finance* special issue researched aspects of these risks, such as hedging of climate risks (Engle *et al.*, 2020) and the impact of short term local temperature shocks on firm performance (Addoum *et al.*, 2020), issues of core relevance

to a broader range of TCFD climate-related financial risks and opportunities have yet to be addressed substantively in the finance literature. As such, while ESG research addresses the financing of green investments, innovative TCFD research in finance has the more powerful potential to begin addressing the greening of finance more broadly.

An area of related accounting and finance research that has developed rapidly over the past decade is research into integrated reporting. A search in early April 2020 found over 400 articles published in Scopus-listed business and management journals that mentioned *integrated reporting* in their titles, abstracts or key words. Two special issues on this topic were published in just a four-year span in *Accounting, Auditing and Accountability Journal* alone (de Villiers *et al.*, 2014; Rinaldi *et al.*, 2018). This is an impressive volume of integrated reporting research given that integrated reporting policy and practice has mainly developed over just the past 10 years.

Given the investor focus of both integrated reporting (Humphrey *et al.*, 2017) and TCFD reporting, integrated reporting research could have the potential to inform aspects of TCFD research and practice. However, despite the common investor audience for both TCFD reporting and integrated reporting (as opposed to the wider stakeholder accountability purpose of other forms of sustainability reporting), TCFD reporting is fundamentally different from integrated reporting in the former's focus on sustainability dependencies rather than the latter's focus on sustainability impacts. Appreciation of this distinction between dependency and impact reporting could result in academics becoming more sceptical (Unerman, 2020) about the potential of integrated reporting. This is because:

- Broad stakeholder-targeted sustainability reporting (such as GRI reporting) aims to provide accountability information to a range of stakeholders about the impacts on these stakeholders from a corporation's actions. It therefore discloses corporate sustainability impact information to stakeholders whose primary information needs relate to these sustainability impacts;
- TCFD reporting aims to provide the finance sector with information about dependencies-related financial risks to which a corporation is exposed. It therefore discloses corporate sustainability dependencies information to financial stakeholders whose main sustainability information needs relate to these corporate dependencies (and risks flowing therefrom);
- However, integrated reporting primarily discloses corporate sustainability impact information to financial stakeholders who, in this role, are primarily interested in a corporation's sustainability dependencies (Humphrey *et al.*, 2017). As such, there may be a mismatch between the information provided by integrated reporting and the information needs of the investor target audiences for integrated reports.

While integrated reporting might have been an important stepping-stone towards TCFD reporting in its use of the concept of business reliance on various capitals, its focus is on reporting the impacts a reporting business has had on these capitals. Distinguishing between impact and dependency reporting (and the different audiences for each type of reporting) could thereby indicate a fundamental misspecification in integrated reporting. Awareness of this underlying conceptual flaw could encourage some academics who have been researching integrated reporting to now refocus towards addressing the potentially more impactful practice of TCFD reporting (and dependencies reporting more broadly). The remaining sections of this paper suggest a number of research areas seeking to address the challenges of TCFD reporting.

As indicated towards the end of section 1, a substantial unique challenge faced by corporations in developing their TCFD reporting is undertaking climate-related scenario planning (explicitly covered in item (c) under the recommended ‘strategy’ disclosures in Figure 1). The nature of this challenge is addressed in the next section.

3 Challenges of TCFD scenario analysis

Scenario planning can be confronting, because it challenges the conventional wisdom of strategizing based on known trends and competition. Scenario planning presents decision-makers with plausible inconvenient truths ... about trends that are currently just out of view but could put an organization into counter-intuitive or unsettling situations (Haigh, 2019, p. 20)

The first major challenge of TCFD reporting we address in this paper is the use of scenario planning in understanding and reporting climate-related risks and opportunities. To inform capital markets about a corporation’s financial dependencies arising from climate change, TCFD recommends that corporations model their climate-related risks and opportunities for different levels of global warming – in other words, for a variety of global warming scenarios. These should include at least one low emissions scenario consistent with intergovernmental commitments to keep warming below 2°C above pre-industrial levels (TCFD, 2017a) (after the IPCC (2018) report, a 1.5°C warming scenario is now more appropriate).

In common with any type of scenario planning, these scenarios are not intended to provide a prediction, projection or an average forecast, of the state of global warming that will be achieved in the future (Haigh, 2019). Rather, they are “powerful narratives to help [corporations] anticipate and prepare for possible changes [they] might encounter in future” (Haigh, 2019, p. 6). Climate scenarios are therefore intended to allow a corporation to identify the challenges, risks and opportunities it might face at different possible levels of future global warming, with it being highly unlikely that actual global warming will be exactly as portrayed in any one of the scenarios (TCFD, 2017b). The purpose of this TCFD climate scenario analysis is to demonstrate how resilient a corporation’s strategy and operations are in different scenarios of future global warming. By so doing, it can raise management awareness and focus executives’ attention on developing strategies to improve such resilience.

TCFD (2017b, p. 3) explains that to achieve the above outcomes, each of the scenario’s modelled by a corporation needs to be: “plausible”, “distinctive ... [and] differentiated”, “internally consistent”, “relevant” and “challeng[ing of] conventional wisdom and simplistic assumptions about the future”. The TCFD explains that scenarios will often most effectively be developed and communicated qualitatively, although additional use of quantification can make them more powerful tools as reporting corporations become more experienced with the type of analytics and modelling relevant for their scenarios (TCFD, 2017b).

A corporation developing scenarios using the above criteria might identify substantial differences in the nature of climate-related risks and opportunities to which it is exposed between the different scenarios of global warming it has used. As noted in section 2 above, in scenarios where there is low policy intervention or other societal pressure for rapid transformation to low carbon economies, there are likely to be significant physical risks to

many corporations' operations (including their supply chains) from resultant high levels of global warming. The TCFD report describes two main sources of such physical risks: *acute*, comprising "increased severity of extreme weather events such as cyclones and floods" (TCFD, 2017a, p. 10) and *chronic*, comprising "changes in precipitation patterns and extreme variability in weather patterns; rising mean temperatures; and rising sea levels" (TCFD, 2017a, p. 10). Many countries have experienced increased manifestations of these physical climate-related risks in recent years even at current levels of global warming (for example, the devastating Australian bushfires in late 2019 coupled with severe flooding in early 2020). Therefore, some physical climate-related risks will likely be a factor even in low global warming scenarios – however, they are likely to be much more significant and intense in high warming scenarios.

The greater the policy impetus and social pressure to transform to low emission economies in a scenario, the greater will be the financial risks and opportunities associated with transitioning to these low carbon economies. TCFD (2017a, pp. ii-iii) explain that:

... climate-related risks and the expected transition to a lower-carbon economy affect most economic sectors and industries. While changes associated with a transition to a lower-carbon economy present significant risk, they also create significant opportunities for organizations focused on climate change mitigation and adaptation solutions ... Organizations that invest in activities that may not be viable in the longer term may be less resilient to the transition to a lower-carbon economy; and their investors will likely experience lower returns. Compounding the effect on longer-term returns is the risk that present valuations do not adequately factor in climate-related risks because of insufficient information. As such, long-term investors need adequate information on how organizations are preparing for a lower-carbon economy.

TCFD (2017a, p. 10) specifies four key areas of transitional risks and five areas of transitional opportunities. These are outlined in Table 1.

Transitional risks	Transitional opportunities
<p>Policy and legal</p> <ul style="list-style-type: none"> • Increased pricing of GHG emissions • Enhanced emissions-reporting obligations • Mandates on and regulation of existing products and services • Exposure to litigation 	<p>Resource efficiency</p> <ul style="list-style-type: none"> • Use of more efficient modes of transport • Use of more efficient production and distribution processes • Use of recycling • Move to more efficient buildings • Reduced water usage and consumption
<p>Technology</p> <ul style="list-style-type: none"> • Substitution of existing products and services with lower emissions options • Unsuccessful investment in new technologies • Costs to transition to lower emissions technology 	<p>New energy sources</p> <ul style="list-style-type: none"> • Use of lower-emission sources of energy • Use of supportive policy incentives • Use of new technologies • Participation in carbon market • Shift toward decentralized energy generation
<p>Market</p> <ul style="list-style-type: none"> • Changing customer behaviour • Uncertainty in market signals • Increased cost of raw materials 	<p>Products and services</p> <ul style="list-style-type: none"> • Development and/or expansion of low emission goods and services • Development of climate adaptation and insurance risk solutions • Development of new products or services through R&D and innovation • Ability to diversify business activities • Shift in consumer preferences
<p>Reputation</p> <ul style="list-style-type: none"> • Shifts in consumer preferences • Stigmatization of sector • Increased stakeholder concern or negative stakeholder feedback 	<p>Markets</p> <ul style="list-style-type: none"> • Access to new markets • Use of public-sector incentives • Access to new assets and locations needing insurance coverage
	<p>Resilience</p> <ul style="list-style-type: none"> • Participation in renewable energy programs and adoption of energy-efficiency measures • Resource substitutes/diversification

Table 1: TCFD climate-related transitional risks and opportunities, quoted from TCFD (2017a, tables 1 and 2, pp. 10-11)

3.1 Challenges of climate-related scenario analysis for reporting corporations

In making climate-related scenario analysis central to its recommendations, the TCFD recognised that this form of planning was likely to be unfamiliar and challenging territory for many corporations' managers and investors (TCFD, 2017a, 2017b). For example, while scenario planning has been commonly used in some business contexts for strategic decision-making on large-scale infrastructure investments (such as exploring for oil in a new region), it has been used less in consumer products businesses. This is because the likely financial outcomes of investments by consumer businesses are reliant upon future decisions which will be repeatedly taken by millions of consumers, so averages in forecast consumption patterns are appropriate. In contrast, scenario planning involves future states that will occur once, so

averages are not good guide to the future. Rather, the future state will be just one of a range of possibilities, and resilient businesses need to be prepared for the eventuality of any of these possible future states being the one they actually face (TCFD, 2017b). Scenario planning therefore requires many corporations to develop new abilities in this type of planning compared to basing plans on the forecasting of averages to which they are accustomed. It also requires those corporations that do have experience in using scenario planning for infrastructure investments to adapt its use for modelling scenarios of long-term climate risks, opportunities and outcomes.

Consistent with the challenging nature of climate-related scenario planning, the TCFD's 2018 and 2019 surveys of large company reporting of climate-related financial risks found very low levels of disclosures about the resilience of corporate strategy in different global warming scenarios (TCFD, 2018, 2019). For example, the 2019 survey of relevant disclosures in the 2016, 2017 and 2018 financial and sustainability reports of 1,126 large corporations from eight industries across 142 countries (a total of approximately 8,000 individual reports were analysed) found that the lowest TCFD disclosure category was 'resilience of strategy under different scenarios of climate change', having risen from 6% of all corporations disclosing this type of information in 2016 to only 9% in 2018 (TCFD, 2019, p. 8). The second lowest TCFD disclosure category was 'integration of climate risks into overall risk management' with the proportion of corporations disclosing this information rising from 11% in 2016 to 17% in 2018. In comparison, the lowest proportion of corporations disclosing in the remaining TCFD categories (as shown in Figure 1 above) in their 2018 reports was 31% for each of three categories (board oversight on climate governance; management role in climate governance; and risk management processes). This picture is reinforced by a Climate Disclosure Standards Board (CDSB) survey that found only one out a sample of 80 corporations they surveyed disclosed the results of their scenario analyses in their management reports, with a further four corporations disclosing that they had conducted such scenario analysis but not providing further information (CDSB, 2018a).

Numerous attempts have been made to assist corporations in this regard. For example, CDSB has run workshops and webinars to train corporate executives to improve their climate reporting practices in line with the TCFD recommendations, including addressing challenges from climate-related scenarios (CDSB, 2018b), and the World Business Council for Sustainable Development (WBCSD) has convened a number of sector-specific TCFD preparer forums to develop insight and capacity in this regard (WBCSD, 2020).

Development of corporate capacity and abilities to undertake meaningful climate-related scenario analysis therefore appears to be posing a major challenge. Innovative interdisciplinary academic research has the potential to help corporations address these challenges. For example, evaluating the likely incidence and outcomes of material physical risks from climate changes in an organization's supply chain will often require detailed and complex scientific knowledge and understanding of a multitude of interacting impacts and changes from climate change on many different raw materials and physical infrastructure in several different geographies. Developing such knowledge and understanding is likely to require interdisciplinary teams, including university-based natural science academics who can provide ready access to a range of relevant insights from environmental science research. Where there are gaps in such data, sector-wide efforts might be needed to commission scientific research to fill these gaps. In the longer term, more systematic TCFD reporting will require the development of new tools to allow businesses of all sizes in many sectors to quickly and meaningfully interrogate data from diverse scientific research fields and studies. Developing

these novel interdisciplinary skills and tools for environmental data capture and analytics in an effective manner is likely to benefit from innovative collaborative research between accounting academics and natural scientists – working with policymakers and businesses from a range of sectors and different sizes. This provides exciting opportunities for a stream of impactful research studies which can make significant contributions both to advancing the interdisciplinary accounting literature and, more importantly, to helping transform business practices in a direction needed for a zero carbon economy.

3.2 Scenario analyses for investors

Reporting corporations are not the only TCFD constituents who need to develop expertise in scenario analyses. Several comprehensive TCFD-related investor initiatives have emerged in response to investors' challenges from conducting and evaluating scenario analyses. For example, the UN's Principles for Responsible Investment launched a free-to-use online tool for assessing climate transition risk in investor portfolios. The tool - the Paris Agreement Capital Transition Assessment (PACTA, 2020) - analyses exposure to transition risk in equity and fixed income portfolios over multiple scenarios (2i Investing Initiative, 2020). It allows investors to visualise the gap between their existing portfolio and 2°C benchmarks. An earlier version was used by over 250 investors and four regulators, including the Swiss financial regulator, the California Insurance Commission and the Dutch Central Bank. Monasterolo *et al.* (2017) have also developed an index which enables investors ('financial actors') such as banks, investment funds, pension funds, governments and individuals to capture the exposure of their respective portfolios to climate transition risks. They complement this with an index capturing the market share of each financial actor weighted by its contribution to greenhouse gas emissions. Simultaneously studying these two indices enables the identification of actors who are most exposed to climate risk and who are likely to have the greatest impact on price adjustments in a low carbon transition and on the introduction of decarbonization policies (Monasterolo *et al.*, 2017, p. 497)⁵.

In 2019, the UNEP Finance Initiative published a pilot study covering 20 institutional investors aimed at developing methodologies for forward-looking scenario-based assessments of the climate-related risk and opportunities faced by their portfolios (UNEP Finance Initiative, 2019). They constructed a methodology which estimated the financial value at risk from climate change or the 'climate value at risk' under several future scenarios, incorporating both physical and transition-related impacts of climate change for listed equity, corporate debt and real estate assets⁶. Dietz *et al.* (2016) also estimated the impact of climate change on global financial asset values. They calculated US\$2.5 trillion climate value at risk from global financial assets (equating to 1.8% of such assets) under a business-as-usual scenario. They did, however acknowledge that much of this risk was in the tail with the 99th percentile climate value at risk coming to 16.9%. If carbon emissions were cut to limit warming to no more than 2°C, the climate value at risk was reduced by an expected 0.6 percentage points, with the 99th percentile reduction being 7.7 percentage points.

The outputs and evaluations of the methodologies developed by the UNEP Finance Initiative offer a first step towards understanding the potential for enabling investors to adopt TCFD recommendations on scenario-based risk assessment in financial disclosure. The pilot explicitly aimed to boost 'investor savviness' and support industry-wide harmonisation. It highlighted how corporate disclosures were failing to produce risk assessments that were forward looking as well as information at the level of physical assets owned by a corporation.

The need to capture the interactions between physical and transitional risks which would require analyses extending beyond the next 10 to 15 years was deemed paramount. According to the report, there remains an open question around the role of standardisation of scenarios, modelling frameworks and outputs, for the purposes of TCFD disclosure around scenario-based analysis. A role is envisaged for financial regulators in guiding investors by providing a set of shocks or scenarios that they would like investors to use in scenario based analyses of investment portfolios. Parallel to the many opportunities for innovative interdisciplinary research needed to help corporations develop abilities and capacity to readily undertake effective climate-related scenario analysis for business operations, there are needs for such collaborative research to help investors develop abilities to incorporate insights from climate scenarios in their investment risk and pricing models.

The Institutional Investors Group on Climate Change has also issued a guide to scenario analysis for investors (IIGCC, 2019). They emphasise the importance of the investment industry improving their own disclosures in order to offer a full system-wide picture of risk. They warn against seeking a single methodology and advise investors to balance comprehensiveness with simplicity. While more complex models might be better able to capture a fuller range of climate change impacts, they claim that simpler models can be more practical to apply and interpret. One of their central messages is that climate-related scenario analysis is a dynamic process that needs to be embedded into mainstream risk management practice. The traditionally competitive investment community is also now regularly calling for investor collaboration, evident in the UNEP Finance Initiative (2019) pilot study, to identify ways of developing scenario analyses to support and evaluate disclosures consistent with TCFD recommendations. This provides further opportunities for these collaborative efforts to encompass interdisciplinary research including academic accounting research.

4 Integrating climate risks into risk management

Moving on from climate-related scenario analysis: when corporations have developed expertise and experience in undertaking such analysis, TCFD reporting requires corporations to describe how processes for identifying, assessing, and managing climate-related risks are integrated into their overall risk management processes, including governance. While risk management aims to bring uncertainty and complexity to heel, ‘counting and calculating’ climate change risks adds additional complexity, allied with limited (or no) control.

An organisational risk culture should be part of a continuous process, or processes, which repeats and renews itself, but may be subject to shocks. Climate change risk is one such potential shock with consequences for risk cultures that requires careful context-specific study. Research into the processes underpinning risk management integration in the context of TCFD reporting is important in order to uncover the everyday practices of climate risk management and reporting that the TCFD framework encourages (see, Labelle & Rouleau, 2017; Mikes, 2008; Mikes, 2009, 2011; Palermo et al., 2017). It is also possible that incorporation of climate-based risks will shift enterprise risk management systems’ focus on ‘rule based compliance’ towards an approach addressing the “critical management of alternative futures” (Power, 2009, p. 852) which is central to dealing with climate change risks and implementing scenario analyses. An area of research in this regard could investigate how TCFD requirements are shifting risk cultures in organisations and what the implications are for the role of strategic Chief Risk Officers both generally and in the reporting of climate risks (CRO Forum, 2019; Ford et al., 2020).

It would also be instructive to understand how climate risk is conceived and addressed to allow for its reporting in line with the TCFD recommendations. Organizations may adopt approaches to risk management informed by cultures of quantitative enthusiasm which are dedicated to precise risk measurement that seeks to organise climate uncertainty into recognisable categories of quantifiable risk (Mikes, 2011). They may alternatively focus on risk envisionment (Mikes, 2011) in which future scenarios and expert opinions on climate risk are prevalent and risk managers move beyond the use of precise measurement frameworks. How these strategies co-exist and/or clash in specific organisational contexts is important to study.

Kaplan and Mikes (2016, p. 21) have cautioned against replacing management judgement with practices such as “[v]alue-at-risk, sensitivity analyses, risk maps, scenario planning, and risk appetite radar charts”. They contend that “[t]hey are best used to trigger in-depth, analytical, and rigorous discussions among managers and employees about the different types of risks faced by the firm, and about the dilemmas (financial and moral) involved in responding to them (Kaplan & Mikes, 2016, p. 21, emphasis added). In the context of the TCFD recommendations, academics could engage in participant observation to study these discussions which ultimately determine how dilemmas are identified, debated, measured, and reported upon. Such studies could also examine the changing role of Chief Risk Officers as climate risks are constructed and reported upon in compliance with TCFD requirements (see, Hall et al., 2015).

5 TCFD disclosure - a new materiality context

Materiality is a key element in a corporation’s evaluation and prioritization of the risks and opportunities it faces, and climate-related risks and opportunities are no exception to this. Materiality has tended to be defined using a financial reporting framing which accords it the role of ascertaining the importance of the disclosure of an item of information (or its omission) to users. The concept has, however, persistently evaded precise codification (Edgley, 2014) with abundant definitions from professional accounting bodies, common law and statute rarely reaching complete agreement (Edgley, 2014; Power, 1997a, 1997b). This ambiguity is amplified when the concept is transferred to new domains (Canning *et al.*, 2019). The TCFD recommendations acknowledge this amplified ambiguity when stating that “the financial impacts of climate-related issues on organizations are not always clear or direct” (TCFD, 2017a, p. 8). As materiality judgements tend to consider the needs of information users, the TCFD seeks to simplify this process by focusing on the needs of an investor, lender or insurance underwriter audience. However, this still encompasses a diverse group with a mixture of long- and short-term time frames and overriding objectives.

The Climate Disclosure Standards Board’s (CDSB’s) report on materiality and TCFD recommendations outlines four key complications in making materiality judgements in the area of climate risk disclosure (CDSB, 2018c): a lack of guidance on how management should apply judgement; use of an inappropriate lens in determining what might be important to investors; over-reliance on quantitative tests; and fear of litigation or enforcement from making mainstream disclosures as opposed to voluntary reporting. The CDSB conclude that climate issues should be treated as material if they give rise to financial impacts (now or in timescales over which materiality is determined), threaten the resilience of a company’s strategy or business model, affect its ability to generate or preserve value, and keep the directors awake at night. The broad nature of these tentative ‘acid tests’ for materiality illustrates the potentially

variable and inevitably subjective nature of climate issue materiality determination. Moreover, the CDSB are concerned that the TCFD “simply advises reporters to use the approach to materiality that applies to other mainstream reports” (CDSB, 2018c, p. 23) despite the struggles mainstream reporters continue to have with existing materiality approaches. These complications may explain the concerns expressed in the 2019 TCFD Status Report regarding materiality disclosures. The Report found that companies frequently failed to explain the process by which they determined the materiality of climate-related risks to their business. Moreover, many of the metrics and targets disclosed did not directly relate to the risks and opportunities identified by companies in their strategy and risk management disclosures. This led to uncertainty as to what risks companies viewed as material. Notwithstanding its rather vague guidance on materiality determination and the evidence of limited, low quality disclosure, the TCFD envisages that disclosure of material risks by *individual* companies will allow for systemic assessments of the materiality of climate change risks for *entire* sectors.

Many of the complications above have traditionally plagued sustainability reporting. For example, there are currently significant discrepancies between the way in which material issues are identified and disclosed in mainstream corporate financial reports and in sustainability reports. Research by the WBCSD found that “only 29% of material issues disclosed in sustainability reporting” were also disclosed in the risk section of mainstream reports (WBCSD, 2017, p. 11), with material climate change information often being disclosed outside mainstream reports. The TCFD recommendations also imply that sustainability and finance professionals will need to work closely together in determining materiality of climate-related risks. However, sustainability and other non-financial reporting professionals frequently use different concepts of materiality than their financial reporting counterparts (see: Canning *et al.*, 2019; O’Dwyer, 2011). To work together, both groups will need to gain knowledge of and reconcile their respective notions of materiality. There is contradictory evidence in the area of non-financial assurance as to how these professionals interact around issues of materiality (Canning *et al.*, 2019; O’Dwyer, 2011).

Academic research into this process of inter-profession interaction and decision-making around notion of the materiality with respect to TCFD reporting could offer insights into how materiality is conceived and enacted in complex business environments. We could gain more insight into how materiality assessments are conducted “within admissible levels of ambiguity” (Power, 1995, p. 327). For example, to what extent are intuitions about materiality levels rationalised and presented as cognitive (Power, 1996), even though assessing the materiality of climate risks often involves operating in enigmatic situations (Pentland, 1993). Such studies are required in light of the CDSB’s claim that mainstream financial reporting might not be ready for the integration of climate information, especially as conventional ‘market’ practice is not to disclose climate information through mainstream channels. Moreover, the CDSB also suggests that the mainstream financial reporting model has failed to resolve the problem of how to apply materiality. This presents adopters of TCFD reporting with a predicament in that TCFD’s recommendations claim to be market-led, but the ‘market’ in mainstream reporting still struggles to apply materiality consistently.

Several aspects of the TCFD guidance might create complications with respect to materiality judgement processes within corporations. For example, the TCFD recommends that disclosures on risk and governance should be regarded as material in *all* cases given that climate-related risk is non-diversifiable (TCFD, 2017a). This may cause considerable unease in boardrooms where materiality assessments of certain climate-related risk and governance issues render them immaterial (and indeed undesirable to report from a signalling perspective)

but they nevertheless have to be disclosed. The guidance also introduces a subjective, process-oriented aspect to materiality determination. For example, companies are encouraged to consider climate-related issues that are not yet deemed material but *may* become material in the future. While disclosures should be avoided if they are likely to obscure relevant information, in situations where climate-related issues could become material in the future, companies are encouraged to commence disclosing climate-related financial information outside financial filings so that it can later be more easily incorporated into financial filings if the climate-related issues become material (CDSB, 2018c, pp. 7-8). This requires a forward-looking assessment of materiality *likelihoods* that many companies may find troublesome despite the IASB indicating the need to evaluate the materiality of *emerging* climate-related risks (Anderson, 2019b).

It is essential to understand how corporations are assessing the materiality of non-financial issues that can only, or predominately, be assessed on a qualitative basis. Furthermore, forward looking information on climate-related risks and opportunities in the short-, medium- and long-term can be highly speculative, especially in the absence of more specific guidance from TCFD on what is meant by short-, medium- and long-term. There are also differences among companies as to when climate-related issues are likely to become material. The 2019 TCFD Status Report found that 60% of 198 preparers surveyed considered that climate-related issues were material now or in the next 1 to 2 years whereas 19% considered them to be material in the next 3 to 10 years (TCFD, 2019, p. 55). There is therefore a need for research studies to evaluate how corporations will choose from the plethora of KPIs, metrics and targets that could be relevant to TCFD reporting in ways that reflect *their own* materiality judgements rather than external audience expectations.

In conclusion, a key issue underlying these materiality concerns is how climate-related financial disclosures can be integrated into a mainstream corporate reporting model that might insufficiently cater for them. Especially as mainstream corporate risk reporting is also continually evolving to address the limitations of its own approach to materiality. There is a risk that the TCFD's advice to adopt the approach to materiality that is applied to a corporation's mainstream financial reporting might result in these limitations being transferred to the TCFD reporting domain.

6. Corporate reporting and the TCFD framework

Where and when corporations (and investors) have developed appropriate skills and capacity to undertake and use climate-related scenario analysis, including embedding it in refined risk evaluation practices with appropriate materiality determination, it will be important for TCFD disclosures to be clearly and reliably communicated. Indeed, it could be argued that prominent corporate reporting of TCFD information is essential to realise its potential strategic and operational benefits for the natural environment. A major challenge in this regard is the risk of TCFD information being swamped within sustainability reporting by a large volume of potentially contradictory and confusing impact-type disclosures. As explained earlier, regular concerns have been raised by corporations and investors about a plethora of non-financial reporting frameworks, guidelines and standards causing confusion and disclosure overload (see also: WBCSD, 2019, p. 4). Hans Hoogervorst, the International Accounting Standards Board's chair (IFRS Foundation, 2019), recently summed up some of these frustrations:

... there are simply too many standards and initiatives in the space of sustainability reporting. This leads to a lot of confusion among users and corporations themselves. To give one example, Tesla is ranked highest in terms of the sustainability index of MSCI, while FTSE ranks it as the worst carmaker globally on ESG issues. Yet another agency puts it somewhere in the middle. People may be forgiven for not making heads or tails of it. Moreover, with so many standards, the potential for disclosure overload is enormous. Consolidation is clearly needed.

The TCFD recommendations offer a framework against which many existing frameworks are being benchmarked. For example, The Corporate Reporting Dialogue⁷, established to “strengthen cooperation, coordination and alignment between key standard setters and framework developers that have a significant international influence on the corporate reporting landscape” (Corporate Reporting Dialogue, 2020), issued a report in late 2019 as part of its *Better Alignment Project* which mapped the frameworks of the Sustainability Accounting Standards Board (SASB), the Global Reporting Initiative (GRI), and CDP (formerly the Carbon Disclosure Project) against the TCFD’s recommendations (Corporate Reporting Dialogue, 2019). The TCFD’s seven principles for effective disclosure (see section 2.1) were found to be largely aligned and complementary with the frameworks and standards of the other three bodies. The mapping showed that 80 per cent of the TCFD’s 50 illustrative metrics were ‘fully or reasonably’ covered by indicators in the other three frameworks. While the mapping exercise showed a pronounced alignment between the various frameworks and standards, the report acknowledged that this was not well-appreciated or understood by report preparers or users. The SASB and CDSB 2019 TCFD implementation guide also focuses on how SASB’s standards and CDSB’s reporting framework can be used to align with TCFD requirements (CDSB and SASB, 2019). The guide promotes both bodies’ “TCFD-aligned reporting tools” (p.1) which they claim makes them “uniquely positioned” (p. 1) to provide guidance on TCFD implementation. This guide succeeded a 2017 SASB report illustrating how the CDSB and SASB approaches were aligned with the TCFD recommendations as “two of the most extensively referenced organizations throughout the TCFD recommendations” (SASB and CDSB, 2017, p. iii).

In January 2020, The World Economic Forum’s International Business Council issued a report proposing a common set of ESG metrics and recommended disclosures that its members could use to align their mainstream reporting (WEF, 2020). These proposals seek to offer disclosures on “meaningful and relevant aspects of [corporations’] performance on environmental, social and governance matters and their contribution to progress on the SDGs on a consistent and comparable basis.” (p. 5). TCFD-aligned reporting was recommended as the template for climate risk reporting under the ‘Planet’ reporting pillar. Accountancy in Europe has also launched an effort to harmonise non-financial reporting and connect it with financial reporting (Accountancy Europe, 2019) where TCFD disclosures are likely to play a major role.

There are areas of accounting research that could examine non-financial reporting framework alignment and the role of TCFD reporting therein, thereby advancing policy and practice towards more sustainable business practices. There is a need for studies into how alignment processes focused on the TCFD are emerging. For example, how different reporting philosophies (dependencies v. impacts) with different targeted users (financial investors v. broader stakeholders) can co-exist and complement one another without adding to preparer and user confusion and reporting overload. Longitudinal studies are also needed into the

development of TCFD disclosures which replace as oppose to complement existing frameworks.

Given the TCFD's desire for climate risk disclosure to be integrated into mainstream corporate reports, it is also important to study how TCFD disclosures are impacted by and impact upon current financial reporting standards and practices. The International Accounting Standards Board (IASB) recently issued an update highlighting how climate risks are potentially material for reported financial assets and liabilities, and therefore for future corporate profits and dividends (Anderson, 2019a). This update emphasises that it is not sufficient for directors to make a quantitative assessment of the impacts of climate-related risks. There are financial reporting implications arising from climate-related risks including: asset impairment, goodwill valuation; changes in the useful life of assets; changes in the fair valuation of assets; effects on impairment calculations because of increased costs or reduced demand; changes in provisions for onerous contracts because of increased costs or reduced demand; changes in provisions and contingent liabilities arising from fines and penalties; and changes in expected credit losses for loans and other financial assets. Assessing these links and researching how they are applied in practice could be invaluable to understanding the TCFD's integration efforts. CDSB's study on how International Financial Reporting Standards (IFRS) can be used to report on climate change addresses some of these issues (CDSB, 2018d). It merges aspects of several financial reporting standards together with established climate change accounting methodologies into a framework, and then complements this with a set of principles. The desirability of such alignment of TCFD with financial reporting standards is a matter open to debate informed by research. If it is helpful in aiding implementation of TCFD disclosures, how we align the vast array of other guidance on non-financial disclosure emanating from bodies such as the SASB, GRI, CDP, CDSB and the European Commission remains a conundrum, the resolution of which could benefit from rigorous academic evidence.

7 The TCFD framework and the investment community

Some of the issues discussed in the foregoing sections touch on the usefulness of TCFD information to investors. This section explores four key areas where research into investor use of TCFD reporting could benefit from academic insights. These research challenges explore: the impetus from non-ESG investors for TCFD reporting; how shareholder activists can influence the uptake of TCFD; how TCFD information can be incorporated into investor valuation models; and the appetite of rating agencies for TCFD reporting.

7.1 Mainstream investor impetus for TCFD information

As with other efforts to instigate corporate reporting and behavioural change, the TCFD's impact will largely depend upon pressure emanating from investors, particularly large investment institutions including superannuation pension funds. This appears to be escalating. For example, Morningstar reported a major increase in sustainable funds, with European investors more than doubling their fund investments to €120 billion in 2019 (Flood, 2020). Around 80 per cent of leading lenders are now also undertaking climate risk assessments. In September 2019, Climate Action 100+, an investor initiative aimed at ensuring the world's largest corporate greenhouse gas emitters take action on climate change, released a progress report ([Climate Action 100+, 2019](#)) that showed investors are mobilising internationally to

motivate corporate action on climate change, thereby fuelling a trebling in support for TCFD reporting recommendations. McKinsey states that more than a quarter of global assets under management seek to integrate sustainability principles despite almost seven in ten asset managers claiming that there is a lack of high quality information upon which to base their decisions⁸ (van Steenis, 2020).

Investors are also starting to exercise their voting power to stimulate corporate action on climate change. For instance, several of the UK's largest asset managers have voted against corporations' chairs and boards over environmental concerns such as material climate risk. For example, Legal & General Investment Management voted against the election of 3,864 directors globally in 2018, citing climate change, diversity or other governance factors (Mooney, 2018). UBS Asset Management and Allianz Global Investors have also increasingly voted against directors over ESG-related concerns (Mooney *et al.*, 2019). State Street Global Advisors' \$3.1 trillion investment division has stated that it will vote against the boards of large corporations that lag behind on ESG standards (Wigglesworth, 2020). In early 2020, Larry Fink, CEO of Blackrock (the world's largest investment manager with \$6.52 trillion of assets under management as at 31 March 2019 (Blackrock, 2020)), which has consistently voted against climate resolutions at annual general meetings (Mooney, 2020), announced a shift in Blackrock's investment policy to address the risks attached to global warming. Fink claimed that "we are on the edge of a fundamental reshaping of finance" as "the evidence on climate change risk is compelling investors to reassess core assumptions about modern finance". He committed to lowering Blackrock's exposure to fossil fuel corporations in which it is hugely invested, and to exiting investments that "present a high sustainability-related risk" (Henderson, 2020; Henderson *et al.*, 2020; Thompson, 2020). He explicitly endorsed TCFD (and SASB's) reporting recommendations, lauding their 'flexibility' (Mooney & Nauman, 2020).

Not all investors have been as supportive with their voting practices. Several fund managers have defended their poor voting record at annual general meetings by emphasising their use of private meetings with corporations as a tool to address climate-related risks. For instance, UK asset managers such as Aviva Investors, DWS and HSBC asset management claim to use their vote only when these engagements fail (Mooney *et al.*, 2019). The role that TCFD disclosures play in framing these engagements and the extent to which these engagements lead to improved reporting are questions that would benefit from academic research. In effect, we need to trace engagement processes around the TCFD between analysts and corporations and their impact on climate risk policy, activity and disclosures. Such research could seek to ascertain whether investors and TCFD standard setters are likely to be aligned, or whether there is evidence of dissonance between the TCFD and users similar to that uncovered by Georgiou (2018) in the financial reporting domain.

7.2 The role of individual shareholder activists

As another investor-related TCFD issue, individual activist investors are playing an increasingly influential role in stimulating a shift toward the TCFD reporting adoption. Climate change issues have become a topic among high profile activist investors and TCFD information may enable them to probe corporations more comprehensively. For example, the non-profit group *As you Sow* filed a shareholder proposal to the large US poultry producer, Sanderson Farms, requesting it to align its disclosures with SASB guidelines as its vulnerability to climate change and water scarcity was unclear (Temple-West, 2019). Christopher Hohn, an activist

hedge fund investor with a \$28 trillion investment fund has stated that he will vote against the re-election of directors at corporations who fail to disclose carbon emission details to the CDP. He also wrote directly to Mark Carney requesting that it become mandatory for UK banks to require their large corporate borrowers to disclose in line with the TCFD recommendations (Mooney *et al.*, 2019). However, in the US, there are moves afoot to restrict this influence by increasing the thresholds that shareholders must meet to bring proposals to a vote at a corporation's annual general meeting (Shubber, 2019). Research examining the 'institutional biographies' (Lawrence *et al.*, 2010) of these individual activist investors could offer insights into how they mobilise TCFD reporting to pressurise corporations on their exposure to climate risks and how this can compel corporations to engage more substantively with TCFD scenario analysis requirements. Academic research could also provide evidence of a *cohort effect* whereby younger generations of corporate executives and investors are much more aware than their predecessors of the urgency of, and have deeper commitments to, action needed to reduce carbon impacts. We also need in-depth case studies tracing evolutions in TCFD reporting in response to targeted individual activism.

7.3 TCFD information and valuation modelling

A further investor-related TCFD challenge requiring exploration concerns how investment analysts use TCFD reporting around scenario analyses in their valuation models. Recent research suggests that analysts seek to commensurate ESG-related information in their analysis processes (Arjaliès & Bansal, 2018). Future studies could focus more specifically on how climate change risk assessments influence this modelling. The CFA Institute has advised its members about how to integrate ESG data into their equity and fixed income analysis, but finds that models are rarely adjusted on the basis of ESG data (CFA Institute, 2019). Further research could investigate whether advances in the level and quality of TCFD reporting facilitate or encourage greater integration and if this has a material influence on investment decision-making. Tracing when, how and why analysts adjust their investment models in response to this new information environment could tell us a lot about the potential impact that TCFD disclosures may have on analyst decision-making.

7.4 The role of credit ratings and green bond assessments

Credit ratings agencies can also drive demand for TCFD reporting. The S&P Global Ratings agency has outlined how insufficient ESG disclosures are presenting a major problem for analysts assessing a corporations' creditworthiness and has urged corporations to adopt the TCFD reporting framework (McGrath, 2019). Fitch Ratings launched an integrated scoring system in January 2019 that shows how ESG factors affect individual credit rating decisions. According to the firm, about 3 per cent of its current ratings actions have been instigated by an ESG issue (Makower, 2019). Moody's not only encourages compliance with TCFD requirements, but in 2019 published its own TCFD report (Moody's, 2019)⁹. In 2016, Moody's Investors Service introduced Green Bond Assessments, forward-looking opinions on the relative effectiveness of a bond issuer's approach to managing, administering and allocating proceeds to environmental projects financed with the proceeds of green bonds¹⁰. TCFD reporting may come to play a significant role in informing these assessments as the Green bond market grows¹¹. Moreover, sectors excluded from issuing green bonds, such as oil and gas, who want to issue so-called transition bonds may also benefit from TCFD requirements which enable them to disclose to potential bondholders relevant climate change risk and opportunity-

related information. All of these developments could become more deeply embedded with insights from both sustainability accounting and finance researchers.

The investor-related activities outlined in this section combine proclamations accompanied by varying levels of action. These initiatives should stimulate academic research into how the investment community seeks to use and influence TCFD reporting. We also need studies examining the TCFD reporting practices of investors. Tracing this reporting evolution will enable us to develop a more complete picture of how potential systemic risks are being traced in investor scenario analysis disclosures.

8 Interrogating TCFD framework implementation

Our last challenge concerns the ongoing implementation of the TCFD framework. In its 2019 status report, the TCFD found that climate-related disclosures were increasing but remained insufficient for investors (TCFD, 2019) as corporations were still not disclosing enough about their climate-related risks and opportunities. In May 2018, CDSB and TCFD developed a knowledge hub to provide tools, implementation resources, references, and links to climate-related disclosure frameworks that have incorporated TCFD recommendations (TCFD and CDSB, 2018). SASB and CDSB also published a good practice handbook and implementation guide, albeit with a focus on using their standards to comply with TCFD requirements (CDSB and SASB, 2019). WBCSD and TCFD have convened “Preparer Forums” for priority sectors and industries such as oil and gas, electric utilities and chemicals. These Forums bring leading corporations together to discuss accounting and disclosure practices in order to enhance disclosure and implement the TCFD’s recommendations (WBCSD, 2020).

There are several areas of potential research into the TCFD implementation process that invite in-depth case-based work offering both academic and practice-based insights. For example, academic studies could focus on: the integration of climate-related risk into conventional risk management approaches (as elaborated above); how corporations cope internally with the escalating number of reporting frameworks; how TCFD implementation processes align and integrate perspectives from finance teams, operations, strategy, ESG/sustainability specialists, and risk analysts; the experimentation and development of corporation-specific metrics aligned with the TCFD requirements; and how corporations decide upon the transitional and physical risks (and opportunities) they report on (and neglect to report on).

As noted earlier, concerns are increasingly raised about clutter in conventional financial reporting. This poses researchable challenges about how TCFD reporting can become embedded in mainstream corporate reports. In light of the 2019 TCFD status report, longitudinal studies into the establishment of and evolution in approaches to scenario analysis as a dynamic process are crucial to enhancing our understanding of the nature and robustness of these processes. When deciding upon reporting scenario analyses, research insights are needed on the ways corporations cope with concerns surrounding possible investor (mis)interpretation of medium- and long-term impacts. Research is also needed which considers the role and impact on users of visualisation in reporting, especially related to the presentation of scenario analyses, given that TCFD recommends using visuals to make scenarios more accessible.

Any focus on implementation also needs to acknowledge the role of assurance in ensuring the credibility of TCFD reporting. Given the subjective, qualitative nature of early efforts at scenario analysis and the importance of the underlying assumptions, we need to know more about how assurers can offer assurance on these disclosures and the processes they need to adopt. Many assumptions will be unverifiable and/or debatable and assurers will need to find a way of dealing with this lack of auditability. For example, what procedures are required to enable assurers to conclude that a TCFD reporter has covered ‘a reasonable range of future outcomes’ in its scenario analysis? What levels of assurance are assurers willing and/or able to provide on risks identified through TCFD reporting and will these be valued by users? Do external assurers need to be actively involved in making TCFD reporting ‘auditable’ (Power, 1996), and if so, how might this impact on their independence when assessing the identification of material physical and transitional risks?

9. Conclusions

The aim of this paper has been to problematize TCFD reporting in a way that demonstrates several aspects in which further academic research can contribute towards realising the ground-breaking potential of this form of sustainability accounting in its early stages of development. Having outlined the innovative nature of TCFD risks, opportunities and dependencies reporting, the paper proceeded to explain several of the key challenges involved in developing and using TCFD reporting practices for both reporting corporations and investors, and the needs and opportunities for substantive and impactful research in these areas. The specific challenges covered were: undertaking and understanding novel climate-related scenario planning, both for reporting corporations and investors; integrating climate risks into corporate-level risk management; the challenges of climate-related materiality determination; aligning TCFD reporting with other corporate reporting frameworks; the challenges for investors in using TCFD information; and other challenges in the implementation of TCFD reporting. In developing arguments in the above areas, the paper presents a detailed and multifaceted TCFD accounting and finance research agenda, with many interdisciplinary aspects (see Table 2 for a summary of some of the suggested research areas). In the remainder of this concluding section, we briefly comment on several overarching issues that we believe also need to be considered and addressed in developing TCFD academic research.

A main issue of concern is that, at the time of writing, in more than four years since the TCFD framework was first mooted in December 2015 there has been little, if any, substantive academic accounting research published on this potentially transformative corporate reporting initiative. We are aware that a considerable number of academics are attracted to researching sustainability accounting because they want to make an impact on helping transform business practices towards a sustainable society and planet. Academics seeking to make a substantive impact on sustainability need to be alive to, and be quick to study, potentially transformative unique policy initiatives. However, this does not appear to have been the case with TCFD reporting. We should also note that Bebbington and Unerman (2018) found a similar lack of awareness among accounting academics in relation to the early development of research into how accounting can further achievements of the UN Sustainable Development Goals.

Theme	Research area
Scenario analyses	Trace evolutions in resilience assessments and the decision making processes underpinning external reporting on resilience. Evaluate likely incidence and outcomes of physical risks from climate change in supply chains. Development of tools enabling interrogation of data from diverse scientific research fields to enable robust scenario analysis reporting. How can scenario analysis reporting be incorporated into investment risk and pricing models? What is the nature of investment community collaboration around scenario analyses for investors? How is scenario analysis reporting amalgamated to determine systemic risks?
Risk management	How is climate change risk integrated into overall risk management processes and related reporting? How are the TCFD requirements shifting 'risk cultures' in companies and investment institutions? How is climate change risk conceived of and managed to enable reporting in line with TCFD recommendations?
Materiality	How are companies determining the materiality of climate-related risks to accord with TCFD guidance? How do financial accountants and 'sustainability accountants' interact around and decide on material climate risk disclosures? How do different companies/industry sectors determine and report on <i>expected</i> material climate-related risks? How do investment institutions determine materiality when aggregating climate risks across their portfolio(s)?
Reporting alignment	How are sustainability reporting alignment processes focused on TCFD reporting emerging? How have TCFD disclosures complemented or replaced key sustainability disclosures? How is TCFD reporting integrated into mainstream financial reporting?
The investment community	How does TCFD reporting frame private company-analyst interactions? How are investment analysts integrating TCFD reporting in valuation models? What is the role of shareholder activism in stimulating TCFD reporting adoption? How is TCFD reporting enabling the growth of the Green bond market?
Implementation	Decision processes underlying the identification of, and reporting on physical and transitional risks. TCFD implementation processes and the alignment of diverse operational expertise. The role and impact of visualisation in the reporting of scenario analyses.
Assurance	How do external assurers address the assurance of scenario analyses based on unverifiable assumptions? How is external assurance on sustainability reports combined with assurance on TCFD reporting? How are levels of assurance determined for TCFD reporting?

Table 2: Selected areas for research on TCFD reporting

Related to these concerns, the speed and enthusiasm with which transformative TCFD-style sustainability reporting practices have been championed by policymakers and regulators worldwide (see, for example: Ambrose, 2020; Harris, 2020) emphasises the rapid pace of change in this area of sustainability accounting. Academics such as ourselves need to recognise there may have been a generational shift in attitudes towards sustainability held by senior executives in many (although by no means all) corporations, as the previous cohorts of executives are replaced by new cohorts who were exposed to major social and environmental concerns as they grew up and progressed through their education. Hence, while the roots of some researchers' cynicism towards the substance of corporate commitments to sustainability might have been well-justified for previous generations of executives, perhaps accounting academics need to be more alive to cohort changes in attitudes towards meaningful action on sustainability that we have seen in our own work recently among some executives.

Concepts underlying climate dependencies reporting also highlight issues in the sustainability impacts of the academic sector, which we have an opportunity to be proactive in addressing. As societies develop commitments to zero-carbon, universities will be exposed to many of the types of transitional climate-related risks and opportunities highlighted by TCFD reporting. In responding to these transitional risks, universities will be under increasing pressure to substantially reduce greenhouse gas emissions, possibly by controlling activities and impacts through carbon budgeting to run alongside financial budgets. Scope 3 greenhouse gas emissions (non-energy indirect carbon emissions), which include travel-related emissions, are substantial for many universities (Davies & Dunk, 2015). A key climate-related transitional risk (and opportunity) for both universities and individual academics in this area is the increasingly urgent need to avoid travelling long distances by air. This will necessitate development of alternatives to international conferences, workshops and seminars as ways both to workshop papers and to network. Rapidly becoming adept at interacting via video conferencing, as necessitated by required social isolation during the COVID-19 health crisis we are living through while completing this paper, may increase academics' openness to embracing electronic means to workshop papers and network. While many academics might regret the loss of the benefits of live interaction, especially in the social margins of conferences, addressing transitional risks for universities in responding to the planetary emergency requires us all to adapt – with this adaptation sometimes involving trade-offs in favour of a more equitable and sustainable future. Another possible adaptation in addressing these transitional risks is to increase the use of a number of local conferences as an alternative to large international conferences. The *Centre for Social and Environmental Accounting Research* (CSEAR) provides a strong example here, with the development of many country-based conferences that enable accounting academics to workshop their papers and network through live interaction without having to fly across the globe to attend the annual founding conference in Scotland.

Finally, the many impactful opportunities for research around development and embedding of TCFD principles are likely to be magnified further as policymakers, corporations and investors realise that the benefits of sustainability risks, opportunities and dependencies reporting extend far beyond carbon risks and dependencies. Among other areas of corporate sustainability dependencies that feature currently in policy debates are air, water, biodiversity and soils. Developing high quality research insights into many aspects of TCFD reporting, as suggested in (but also extending beyond) the research agenda sketched in this paper, should position the academic community strongly to make timely contributions to the development of highly impactful and innovative reporting frameworks in these areas of sustainability. We look

forward to seeing accounting researchers rising to the challenges of this novel and exciting area of research.

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¹ We appreciate that there are many sustainability-related corporate reporting frameworks and guidelines with, for example The Reporting Exchange listing over 2,060 such requirements globally in early 2020 (The Reporting Exchange, 2020). In this context, it is possible for new reporting frameworks to stay below the academic radar.

² In March 2020, the UK's Financial Conduct Authority released a [consultation paper](#) entitled: "Proposals to enhance climate-related disclosures by listed issuers and clarification of existing disclosure obligations". The proposal introduces a new listing requirement for companies with a 'Premium Listing' on the London Stock Exchange. If the proposal is implemented, these companies' annual reports for financial years beginning on or after 1 January 2021, will have to include climate-related disclosure as recommended by the TCFD and/or to explain any non-compliance.

³ One of the authors has recent in-depth experience as part of a small research team which advised a major multi-national on how to implement and report on climate-based scenario analyses.

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- 4 The Financial Stability Board was formed by the G20 in 2009 and replaced the Financial Stability Forum (formed by the G7 in 1999). Its membership comprises central banks, key financial regulators and the finance ministries of the G20 member states plus Hong Kong, the Netherlands, Spain, Singapore and Switzerland, along with a number of intergovernmental financial regulators and standard setters. As its name suggests, its role is to help promote stability of the global financial system. For more information on its remit, see: <https://www.fsb.org/about/>.
 - 5 Industrial companies and investment funds emerged as key stakeholders in the analysis conducted as they were “at the same time vulnerable and yet relevant” (Monasterolo et al., 2017, p. 506).
 - 6 The methodology was co-constructed by participating investors, the consulting firm Carbon Delta, and external experts convened by UNEP FI.
 - 7 Comprising: CDP, Climate Disclosure Standards Board, Financial Accounting Standards Board (observer), Global Reporting Initiative, International Accounting Standards Board, International Integrated Reporting Council, International Organization for Standardization, Sustainability Accounting Standards Board.
 - 8 We should point out that while the investor pressure and impetus is growing, many commentators offer evidence of investor support and interest that is at variance with their investment policies. For example, by late 2019, Global banks had not cut funding to the fossil fuel industry despite 40 of the world’s biggest lenders signing up to the TCFD (Thompson, 2019).
 - 9 Moody’s Investors Service (MIS) publishes a comprehensive heat map assessing the credit impact of global environmental risks which assesses credit exposure to environmental risks across 84 industry sectors (Moody’s, 2019).
 - 10 A Green Bond Assessment reflects Moody’s evaluation of: the use of Bond proceeds; ongoing reporting; organization; management of proceeds; and disclosure on use of proceeds (Moody’s, 2019).
 - 11 The total value of the outstanding green bond market is now around \$500 billion, just under 1% of the total bond market.