

**An empirical focus on the Task Force on Climate-related Financial Disclosures
framework as a climate reporting tool: a systematic literature review**

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Abstract

The study aims at exploring the extent of empirical attention given to the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) by the academic community. To achieve this, the study employs the systematic literature review methodology to review articles published on the framework over its half-decade life. The study reveals (i) a paucity on scholarly attention paid to the TCFD framework, albeit a steady increase in publications in 2022; (ii) a geographical skewness of articles towards G20 countries; (iii) a deficiency and practical implementation challenges with TCFD's recommendation for climate scenario analysis (CSA). The paper recommends further research on CSA and the deployment of computer-aided content analysis methodology in TCFD studies. In addition, the paper recommends the extension of research on the framework to cover non-G20 and UK-specific contexts. The study contributes to the achievement of the net-zero target by bringing to the fore areas that need further scholarly attention in making the framework a useful global guide on climate risk reporting.

Keywords: climate-related risks, climate change reporting, climate reporting frameworks, COPs, systematic literature review, TCFD

Word count: 6,997.

Track: Sustainable and Responsible Business

1.0 Introduction

As a current global defining crisis (Climate Vulnerable Forum and V20, 2022), climate change continues to engage the attention of global leaders, investors, and other stakeholders resulting in the development of measures for climate change mitigation and adaptation. Strategies for combatting climate change and achieving the net-zero target include the organisation of annual conferences by the UN Framework Convention on Climate Change (UNFCCC) dubbed Conferences of Parties (COPs), and the enactment of regulations by regional and national bodies. These, among others, have led to climate transition risks (TCFD, 2017; Stroebel and Wurgler, 2021) which, together with the physical climate-related risks (Krueger, Sautner and Starks, 2020; McKinsey Global Institute, 2020), are considered to have significant effect on companies and investors (Hong, Karolyi and Scheinkman, 2020; Reboredo and Otero, 2021). As important actors in the net-zero target (Halkos and Skouloudis, 2016), companies are pressured, or at least encouraged, to report their climate actions (Daradkeh *et al.*, 2022). Considered relevant in communicating climate actions (Siew, 2015), climate change reporting frameworks (CCRF) are developed to guide companies in their climate reporting. Several such frameworks have been developed (O'Dwyer and Unerman, 2020) and used in climate reporting studies including, the Carbon Disclosure Project (CDP), Global Reporting Initiative (GRI), and GHG Protocol.

A new CCRF attracting global attention in recent times (Friedrich, Velte and Wulf, 2022) is the Task Force on Climate-related Financial Disclosures framework (TCFDF). TCFDF is the recommendations of TCFD constituted by the Financial Stability Board tasked to develop guidelines for climate risk disclosure (Demaria and Rigot, 2021). The framework has been hyped by scholars, regulators, world bodies, and policy makers (Cho *et al.*, 2022; Huiskamp *et al.*, 2022; World Bank Group, 2021) as a useful guide in climate risks disclosure. It has enjoyed support from both private and public organisations and poised to become mandatory in many jurisdictions, including the G20 and G7 countries (TCFD, 2021). Importantly, TCFDF recommends the mainstreaming of climate disclosures in annual reports (TCFD, 2017; Baboukardos, 2018), aligns with the Sustainable Development Goals (SDGs) (TCFD, 2017;

Adams and Abhayawansa, 2022), and intended to assist investors in comprehending an entity's preparation for transition to a net-zero world (Abela, 2022).

Despite its value, support from the global community, and research opportunities offered, TCFDF has not witnessed significant empirical exposure (O'Dwyer and Unerman, 2020). Besides, the empirical literature on climate risk management evidences a low awareness of climate-related risks and inadequate exploitation of climate opportunities (Toma and Stefanelli, 2022). Consequently, after half a decade of its implementation, this study sets out to investigate the question "to what extent has the scholarly community explored the value of the TCFD framework as a climate change reporting guide?". It therefore reviews the empirical literature to determine the scholarly exposition on the TCFD framework. The study also aims to determine the theoretical and methodological approaches deployed in the TCFD literature.

Though prior literature (O'Dwyer and Unerman, 2020) has highlighted the need for research on the TCFDF, to the best knowledge of the authors, this study is the first systematic literature review (SLR) on this five-year old framework. The study differs from prior SLRs on climate change reporting (CCR) in that it has climate-related risk reporting as its central focus rather than carbon disclosure (Hahn, Reimsbach and Schiemann, 2015), climate change (Daddi *et al.*, 2018) and integrated reporting (Veltri and Silvestri, 2020). The study contributes to the empirical literature on this novel framework by mapping out the gaps and future research areas for the scholarly community to focus attention in making the framework useful in climate-related risks disclosure. Specifically, the study draws attention to the practical challenges posed by CSA in ensuring compliance with TCFDF and recommends further research on CSA. The study also contributes to the TCFD literature by directing scholarly attention to non-G20 context in order to explore the well touted global orientation of the framework.

The rest of this paper is structured as follows. The methodology employed in conducting the SLR is presented in section 2. Section 3 describes the descriptive statistics aimed at providing some spotlights on the results. The discussion of findings is done in section 4. Section 5 presents the research gaps and recommendations for future research. The paper ends with the concluding remarks in section 6.

2.0 Methodology

Following prior literature in climate reporting (Hahn, Reimsbach and Schiemann, 2015; Daddi *et al.*, 2018), this study employs the SLR methodology in achieving its objectives. The choice of SLR is further premised on its strength as a transparent, scientific, and replicable tool for knowledge gathering (Tranfield, Denyer and Smart, 2003). The study sourced articles from three databases; Scopus, Web of Science (WoS), and Science Direct (SD). The article search was conducted on 25th December, 2022 and repeated on 31st December, 2022.

2.1 Articles search process

With TCFDF being at the centre of this study, the keyword used was "TCFD". The choice of this keyword, instead of "Task force on Climate-related Financial Disclosures", is predicated on its popularity and preference among researchers (Demaria and Rigot, 2021; Alshahrani *et al.*, 2022; Moreno and Caminero, 2022) due the length of its expanded form. However, as the abbreviation "TCFD" is also used in non-business fields, its choice led to a few unrelated articles being turned out, including "time correlated fatigue damage" (Yu *et al.*, 2017), "Trend Correlation based Fault Detection" (Fu *et al.*, 2021), and Terai Central Forest Division" (Yadav *et al.*, 2021; Musthafa and Singh, 2022). Following the suggestion of Paul and Criado (2020), the keyword was searched in the title, abstract, keywords, and main texts in the databases.

2.2 Inclusion and exclusion criteria

The initial search produced a total of 760 documents from the three databases (Table 1). Limiting the search results to only peer-reviewed articles (Centobelli *et al.*, 2020) brought the results to 715. Again, given that the TCFD taskforce was commissioned in 2015 (Carney, 2015; Moreno and Caminero, 2022), a further review of the results to reflect articles published between 2015 and 2023 reduced the search results to 576. Consistent with prior reviews (Veltri and Silvestri, 2020; Suchek *et al.*, 2021), the sample included only articles published in the English language. The titles, abstracts, and main texts of the remaining articles were reviewed to determine their suitability for analysis. In line with Li *et al.* (2018), the study targets two categories of articles depending on the level of coverage of TCFDF; (i) empirical TCFD articles which employed the framework in their methodology; and (ii) non-empirical TCFD articles which do not include TCFD in their methodology but provide extensive discussion on the framework.

Table 1: Details of Search Results

Database	Search Results	Limited to Articles	Limited to 2015–2023	AJG 2 and above	Duplicates	Final Sample
Scopus	518	513	403	27	–	–
WoS	41	37	36	8	–	–
SD	201	165	137	8	–	–
Total	760	715	576	43	11	32

In the TCFD empirical category, the inclusion criterion is publication in journals ranked 2 and above under the Chartered Association of Business Schools (2021)’s Academic Journals Guide (AJG). Though article quality is often associated with a minimum of rank 3 of the AJG ranking (Paul and Criado, 2020), the nascent nature of TCFDF (Cho, Senn and Sobkowiak, 2022; Friedrich, Velte and Wulf, 2022) makes it difficult to attract a large pool of publications in high rank journals (O’Dwyer and Unerman, 2020). To ensure that this does not affect the study’s quality, the 2021 Scopus cite score of above 1 was included as part of the qualification criteria (Paul and Criado, 2020). This resulted in the inclusion of three relevant publications in 2-star journals (Bingler *et al.*, 2022; Cosma, Principale and Venturelli, 2022; Maji and Kalita, 2022), some of which (Bingler *et al.*, 2022; Cosma, Principale and Venturelli, 2022) have been extensively cited by high rank article in this study (Ding, Liu and Chang, 2022; Friedrich, Velte and Wulf, 2022) (Table 4).

For the non-TCFD empirical literature category, articles included were ranked 3 and above. The inclusion of this category is intended to determine the extent of support or criticism of the recommendations of the TCFD. These articles are therefore classified as supporting, criticising or providing general information on the framework (Appendix 2).

3.0 Descriptive Statistics

The final sample of 32 publications comprises 12 TCFD empirical articles and 20 non-TCFD empirical articles. The TCFD empirical results (Figure 1) show a low exposition on the framework. Out of the five-year life of the framework, only two years have witnessed publications. The first two TCFDF articles (Demaria and Rigot, 2021; Wedari, Jubb and Moradi-Motlagh, 2021) were published in 2021. The year 2022 experienced an astronomical growth in publication on the framework. This sharp growth was predicted by Belloque *et al.* (2021) who flagged the TCFDF as a hot area for research. Evidently, 2023 has so far not witnessed any publication. However, as a new research area in its growth stage, this paper predicts growth in TCFD publications in 2023 (Figure 1) as more data become available on corporate TCFD adoption. Unlike the former category, publications of the non-TCFD empirical literature started

much earlier in 2018. Though also showing a proliferation of publications in 2022, the picture shows some marginal growth in the previous two years.

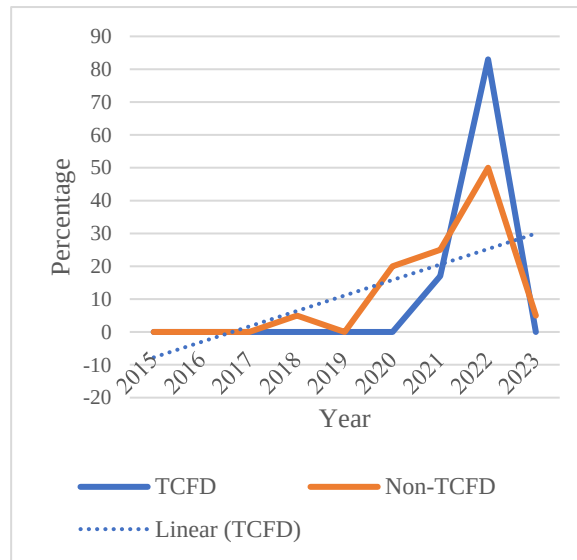


Figure 1: Results on TCFD publications by years

The study evidences the dominance of Business Strategy and the Environment (BSE) in the publication of TCFD empirical articles (Table 3), followed by Accounting, Auditing and Accountability Journal (AAAJ). As climate reporting is an environmental issue, attraction of BSE among TCFD researchers is no surprise. With the exception of the skewness towards environment, there appears to be a normal spread among the various sub-disciplines in the realm of accounting as the focus of journals of publication included accounting, finance, ethics, and governance. It is evidenced that 75% of the articles were published in 3-rated journals. Apparently, TCFD articles have not been able to get published in journals of distinction (4- and 4*-rated journals). Addressing this gap in TCFD publications requires the adoption of rigorous theory and great amount of data (Chartered Association of Business Schools (CABS), 2021). The dominance of BSE, and AAAJ, in the non-TCFD empirical category is again demonstrated (Table 2).

Table 2: Journals of publication of non-TCFD empirical articles

S/N	Journal	AJG Ranking	Impact factor (Scopus)	Frequency	Percentage
1.	Business Strategy and the Environment	3	11.90	3	15
2.	Ecological Economics	3	10.90	2	10
3.	Accounting, Auditing and Accountability Journal	3	6.80	2	10
4.	British Accounting Review	3	7.30	2	10
5.	Abacus	3	3.90	1	5
6.	Accounting, Organizations and Society	4*	6.40	1	5
7.	Corporate Governance: An International Review	3	–	1	5
8.	Critical Perspectives on Accounting	3	6.50	1	5
9.	Energy Economics	3	11.3	1	5
10.	Insurance: Mathematics and Economics	3	2.80	1	5
11.	International Review of Financial Analysis	3	7.20	1	5
12.	Journal of Business Ethics	3	10.80	1	5
13.	Journal of Monetary Economics	3	4.90	1	5
14.	Organization and Environment	3	8.60	1	5
15.	Review of Accounting Studies	4	5.80	1	5
	Total			20	100

Table 3: Journals of publication of empirical TCFD articles

S/N	Journal	AJG Ranking	Impact factor (Scopus)	Frequency	Percentage
1.	Business Strategy and the Environment	3	11.90	5	42
2.	Accounting, Auditing and Accountability Journal	3	6.80	2	17
3.	International Review of Financial Analysis	3	7.20	1	8
4.	Journal of Business Ethics	3	10.80	1	8
5.	Finance Research Letters	2	9.30	1	8
6.	Corporate Governance (Bingley)	2	5.80	1	8
7.	Society and Business Review	2	1.10	1	8
	Total			12	100

4.0 Discussion of Findings

4.1 Coverage of the thematic areas of the TCFD framework

The framework is anchored on four thematic elements comprising of governance, strategy, risk management, and metrics and targets (TCFD, 2017; Hummel, Laun and Krauss, 2021) which are split into 11 sub-indicators (Alshahrani *et al.*, 2022). The review reveals (Figure 2) a significant coverage (75%) of these elements (Alshahrani *et al.*, 2022; Friedrich, Velte and Wulf, 2022). However, only a few of the studies presented a comprehensive picture of their utilisation (Demaria and Rigot, 2021; Alshahrani *et al.*, 2022) and construction of climate reporting indices (CRIs) (Demaria and Rigot, 2021; Alshahrani *et al.*, 2022). The other empirical works simply made mention of the elements without indicating how they are applied in drawing their conclusions. For instance, though Maji & Kalita (2022) indicate in their abstract the utilisation of the four thematic areas in the construction of CRI, they did not demonstrate this in their methodology. Two papers had a narrow focus on single elements of the framework, strategy (Huiskamp, ten Brinke and Kramer, 2022) and risk management (Ben-Amar, Comyns and Martinez, 2022).

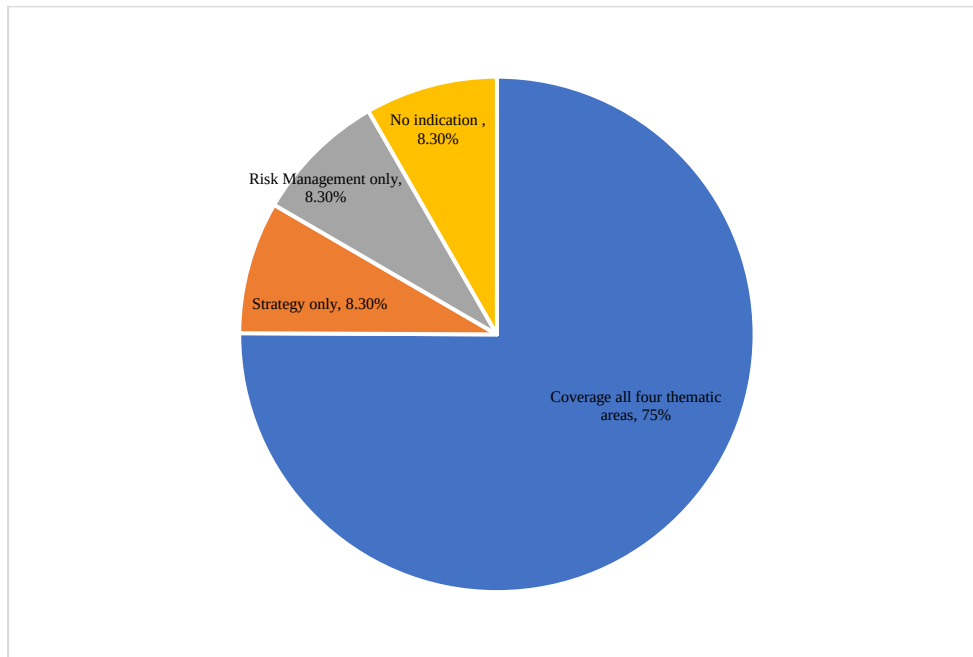


Figure 2: Coverage of Thematic TCFD Reporting Areas

Besides the core elements, the 11 sub-indicators of the framework have received some highlights in a couple of studies (Demaria and Rigot, 2021; Alshahrani *et al.*, 2022; Friedrich, Velte and Wulf, 2022; Moreno and Caminero, 2022). The legendary work of Demaria & Rigot (2021) as a pivot for other TCFD studies is revealed in this review as it is found to be the most cited article (Table 4). Their work served as reference and premise for the construction of the climate reporting indices (CRIs) of some of the recent empirical works (Cosma, Principale and

Venturelli, 2022; Friedrich, Velte and Wulf, 2022). Interestingly, the expectation of Wedari, Jubb and Moradi-Motlagh (2021) of their study serving as reference for future TCFD studies has not been realised as only one TCFD empirical (Ding, Liu and Chang, 2022) cited that study.

Table 4: Cross-citation of empirical TCFD articles

Number times Cited in	Cosma et al. (2022)	Ding et al. (2022)	Friedrich et al. (2022)	Huiskamp et al. (2022)	Maji and Kalita (2022)	Total
Bingler et al. (2022)	0	11	1	0	0	12
Cosma et al. (2022)	0	0	8	0	0	8
Demaria and Rigot (2021)	2	0	8	2	5	17
Moreno and Caminero (2022)	0	0	8	0	0	8
Wedari et al. (2021)	0	1	0	0	0	1
Total	2	12	25	2	5	46

4.2 Analysis of findings of the studies

The review evidences mixed findings among the authors. Ding et al. (2022) reveal that, except for the governance category, CO₂ emissions motivates reporting on all elements. Still on the governance score, Cosma et al. (2022) find gaps on board characteristics, albeit highlighting the relevance of the climate committees in corporate disclosures. While noting a general improvement in the CCR quality, Friedrich et al. (2022) find reporting quality weakness on the metrics and targets and strategy (especially, scenario analyses). Their finding on climate scenario analysis (CSA) of the strategy element is consistent with the findings of Demaria and Rigot (2021) and Moreno and Caminero (2022) who respectively find gaps in the corporate reporting on this aspect of the framework. Evidently, though considered critical for corporate sustainability (TCFD, 2017), CSA's application is scarce (Demaria and Rigot, 2021; Huiskamp, ten Brinke and Kramer, 2022).

Some studies (Cosma, Principale and Venturelli, 2022; Ding, Liu and Chang, 2022), however, have contrary findings on CSA. For example, Cosma et al. (2022) reports that the positive effect of climate committees on the TCFD-aligned reporting has a consequential implication of a high corporate performance on CSA. Besides, Ding et al. (2022) document an association between carbon emission level and overall climate strategy analysis in Australia, UK, Canada, and US with UK corporates portraying a stronger relationship. Similarly, Bingler et al. (2022) find generally lower disclosure on strategy and targets and metrics than the other two elements. Another finding of significance, and closely related to the CSA, is the gap on the forward-looking nature of corporate reports on financial impacts of climate-related risks which is one of the key recommendations of the framework (TCFD, 2017; Huiskamp, ten Brinke and Kramer, 2022). A score of the studies have reported a lack forward-looking orientation climate reports (Cosma, Principale and Venturelli, 2022; Friedrich, Velte and Wulf, 2022). Given that all these studies used samples drawn from European, and mostly G20 countries, together with the observation in the literature on the corporate non-compliance with this aspect of the framework (Huiskamp, ten Brinke and Kramer, 2022), further investigations are required in determining corporate performance on the twin-challenges of CSA and future orientation of climate information.

4.3 Industrial focus of TCFD articles

The TCFDF is generally intended to regulate climate disclosure in financial institutions. It is, however, evidenced that regulatory institutions might extend their regulatory tentacles to non-financials as their corporate reporting could equally be impacted by climate-related risk (Ding, Liu and Chang, 2022). Given the significant effect of industrial variation on disclosure of

climate change information (Jaggi, Allini, Macchioni and Zagaria, 2018), this study deems it necessary to review the industrial focus of TCFD empirical works. Using the composition of their samples, the empirical literature is classified as financial, non-financial and multi industries (Appendix 1).

As one of the primary targets of the TCFDF (TCFD, 2017; Demaria and Rigot, 2021), the financial industry, has received the most empirical attention of TCFD scholars. In addition to its inclusion in the four multi-industry studies, three studies exclusively focused on the financial industry (Cosma, Principale and Venturelli, 2022; Moreno and Caminero, 2022). Though the financial industry is not considered highly polluting (TCFD, 2017), it has a high exposure to climate risks. Though as a group, the non-financial article category constitutes the highest proportion of the sample, each individual industry in this group of industries has the lowest representation. Multi-industry studies drawing samples from both financial and non-financial industries have also assumed some prominence among the scholars (Demaria and Rigot, 2021; Ben-Amar, Comyns and Martinez, 2022; Ding, Liu and Chang, 2022). This sampling is often avoided researchers because of the wide differences in regulatory environment, nature of business, and reporting style (Jaggi, Allini, Macchioni and Zagaria, 2018; Jaggi, Allini, Macchioni and Zampella, 2018), especially in the study of financial impacts of climate-related risks using annual reports.

The over overconcentration of TCFD literature on the financial industry needs a relook because the risks posed by climate change to the financial industry emanates from non-financial corporates (Chenet, Ryan-Collins and van Lerven, 2021; Toma and Stefanelli, 2022). It is therefore imperative that empirical attention on TCFDF is also paid to non-financial industry, especially as they have a high carbon foot print and exposure to climate risks.

4.4 Geographical focus of the studies

The empirical TCFD articles comprise of both single and multi-country studies, with multi-country studies having a slight dominance. Australia dominates the chart of single country (Wedari, Jubb and Moradi-Motlagh, 2021; Alshahrani *et al.*, 2022) and also included in two other multi-country studies making it the country with the most exposition on the TCFD. Other countries featured in single country publication include France (Demaria and Rigot, 2021), Spain (Moreno and Caminero, 2022), and India (Maji and Kalita, 2022). Though a country with great support for TCFDF (Bingler *et al.*, 2022), the UK has only been included in two multi-country publications (Ben-Amar, Comyns and Martinez, 2022; Ding, Liu and Chang, 2022) with no UK specific study. At the regional level, Europe dominates the TCFD publications with region-specific publications and as well as multi-country publications (Ben-Amar, Comyns and Martinez, 2022; Bingler *et al.*, 2022).

Using the advanced/emerging country categorisation (Roberts *et al.*, 2021), the results indicate the dominance of advanced countries in studies. Understandably, the study context mainly represented G20 countries which championed TCFDF's development (Friedrich, Velte and Wulf, 2022; Moreno and Caminero, 2022) and corporate adoption (Alshahrani *et al.*, 2022; Ben-Amar, Comyns and Martinez, 2022). The relevance attached to the availability of data in selection of sample (Ben-Amar, Comyns and Martinez, 2022) may be a motivator in the choice of these study contexts. Only one single country publication (Maji and Kalita, 2022) focused on an emerging country. Asia has a marginal reflection in multi-country and single country studies. With only two multi-country publications drawing samples from South Africa (Ben-Amar, Comyns and Martinez, 2022; Bingler *et al.*, 2022), Africa has not received any significant publication.

This skewness against emerging and climate vulnerable regions, though reflects a general evidence gap on climate impact (Climate Vulnerable Forum and V20, 2022), requires the attention of the scholarly community. This is especially so because of the global orientation of the TCFD framework.

4.5 Theoretical dimensions of TCFD studies

Theories are important in explaining or predicting an outcome (Saunders, Lewis and Adrian Thornhill, 2019). Consistent with prior reviews (Hahn, Reimsbach and Schiemann, 2015; Daddi *et al.*, 2018; Li *et al.*, 2018) and position some authors (Goodall, 2008; Wittneben *et al.*, 2012), this study (Figure 3) documents the nondisclosure of theory by a significant proportion (42%) of the articles. Further, the review highlights a wide theoretical leaning of the studies on the socio-political theories which is a widely held view in climate reporting literature (Comyns and Figge, 2015; Baldini *et al.*, 2018). The legitimacy theory is noted attracts more attention which is again consistent with the findings of recent study on a related SLR on biodiversity (Roberts *et al.*, 2021).

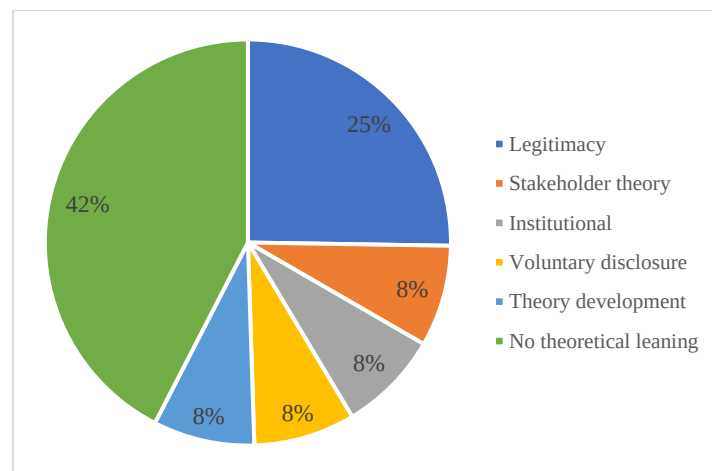


Figure 3: Theories used in articles

All articles with socio-political orientation have utilised CA, and its related textual analysis (TA) methodology (Carley, 1997). A yawning gap in theoretical underpinnings is the adoption of the institutional and voluntary disclosure theories. The generally held view of paucity in the adoption of the institutional theory (Deegan, 2017) in climate reporting literature is documented in this study. Given that the only theory-based paper with this theoretical perspective without a CA adoption and methodologically aligned to the case study method, the application of the institutional theory to the CA methodology could result in some insightful findings.

4.6 Methodological focus of TCFD literature

The review finds the dominance of quantitative studies as only two of the twelve articles (Huiskamp, ten Brinke and Kramer, 2022; Rowbottom, 2022) in this literature category assumed a qualitative approach. A further analysis of the methodological stance of the sample evidences a widespread adoption of the CA methodology. As a methodology that is mostly employed by climate reporting scholars (e.g. Demaria & Rigot, 2021), a corpus of the studies (58%) utilises CA (e.g. Alshahrani *et al.*, 2022; Cosma *et al.*, 2022) and its associated TA methodology (Ding, Liu and Chang, 2022).

CA is conducted using two main approaches, manual or computerised (Duriau *et al.*, 2007; Krippendorff, 2004; Williams & Shepherd, 2017). Except for three studies (Bingler *et al.*, 2022; Ding, Liu and Chang, 2022; Moreno and Caminero, 2022), the empirical literature employing the CA

technique used the manual method, despite the subjectivity associated with it (Tate, Ellram and Kirchoff, 2010; Hofer, Cantor and Dai, 2012). The negligible adoption of computerised CA technique is probably associated with the use of different types of reports and requirement for use of pdf and machine-readable files (Tate, Ellram and Kirchoff, 2010; Moreno and Caminero, 2022) which may not be accessible for some data sources. Besides the use of CA, text mining (TM) has seen some adoption among the authors (Friedrich, Velte and Wulf, 2022; Moreno and Caminero, 2022).

The study reveals a significant adoption of climate reporting indices (CRIs) in the quantitative TCFD empirical literature. On the basis for construction of CRIs, the articles are categorised into two; CRIs based solely on the TCFD recommendations; and CRIs based on extant literature. In the former category, Demaria and Rigot (2021) developed a 38-indicator CRI based on the four core elements of TCFDF to assess compliance with the framework. However, Wedari et al. (2021) constructed an index hinged on four frameworks, including the 11 sub-indicators of TCFDF.

Following these maiden works, four other studies constructed indices based on the 11 sub-indicators of TCFDF. For instance, Moreno and Caminero (2022) adopted all the sub-indicators as CRI. Similarly, Alshahrani et al. (2022) used the average of the sub-indicators as an index for the measurement of the independent variable of their study, though other indices are constructed on the basis of prior literature. In addition, Cosma et al. (2022) built an index on the basis of these recommendations. However, unlike Alshahrani et al. (2022), this index served as the dependent variable for their regression analysis. Ding et al. (2022) developed a TCFD-aligned climate index which is akin to CRIs. Following other authors, Maji and Kalita (2022) constructed CRI based on these recommendations. Only one study (Friedrich, Velte and Wulf, 2022) is identified with the deployment of indices based on extant literature. With some modification to reflect the financial industry-specific, Friedrich et al. (2022) built a CRI hinged on one created by (Demaria and Rigot, 2021).

The review evidences a clear orientation towards the use of secondary data which is inconsistent with the conclusion of Daddi et al. (2018) on the recent shift to the use of surveys by CCR scholars. Further, the review documents dominance of publications drawing data from annual reports (67%). Other data sources include stand-alone sustainability reports (Cosma, Principale and Venturelli, 2022; Friedrich, Velte and Wulf, 2022) and databases (Wedari, Jubb and Moradi-Motlagh, 2021; Ding, Liu and Chang, 2022).

An analysis of the time horizons covered by the study data reveals a significant adoption of longitudinal analysis which is considered effective in establishing trends in climate reporting (Guthrie, Cuganesan and Ward, 2008; Tate, Ellram and Kirchoff, 2010). Except for one article without indication of study period (Huiskamp, ten Brinke and Kramer, 2022) and two others using single-year post-TCFD implementation data (Ben-Amar, Comyns and Martinez, 2022; Cosma, Principale and Venturelli, 2022), all articles were longitudinal. The review documents Alshahrani et al. (2022) as the article with the longest study period of 14 years. As a study employing the CA methodology, this period is significant in establishing reporting trend. However, that article covers only two years of post-implementation period (Appendix 1). Of the remaining publications using the CA method, Moreno and Caminero (2022) comes next with a seven-year study period, followed by Bingler et al. (2022) with six years. The study of Rowbottom (2022) comes next with the longest post-implementation period of four years.

There appears to be an alignment between methodology and theoretical underpinnings in the studies. As the dominant methodological approach as espoused in this study, the CA methodology is identified with the socio-political theories (Appendix 1). Except for studies

that did not disclose their theoretical orientation, all studies employing the socio-political theory adopted the CA methodology. An apparent observation of this study is the non-application of the institutional theory to the CA methodology.

4.7 The value of the TCFD framework

The review finds a tremendous support from the academic world for the framework (Figure 4). All articles in the empirical TCFD category agree to the usefulness of the framework as a reporting tool. TCFDF is evidenced to have support from governments, regulators, and global institutions such as the G20, G7, World Bank Group, and CDP (Alshahrani *et al.*, 2022; Rowbottom, 2022). For example, Rowbottom (2022) and Bingler *et al.* (2022) note the huge political support for the framework from G20 and standard setters. Also, Demaria and Rigot (2021) report the support of the European Union (EU) and the Government of France leading to the establishment of specific guidelines for disclosure of climate risks. In agreement, Friedrich *et al.* (2022) note that the relevance of the TCFDF lies in its adoption by International Sustainability Standards Board (ISSB) of the IFRS Foundation and the EU as reference for development of their standards (Friedrich, Velte and Wulf, 2022). In addition, TCFDF is accepted by many countries across the globe, including Australia, Canada, Japan, New Zealand, South Korea, Switzerland, and UK (Blake and Cairns, 2021; Alshahrani *et al.*, 2022).

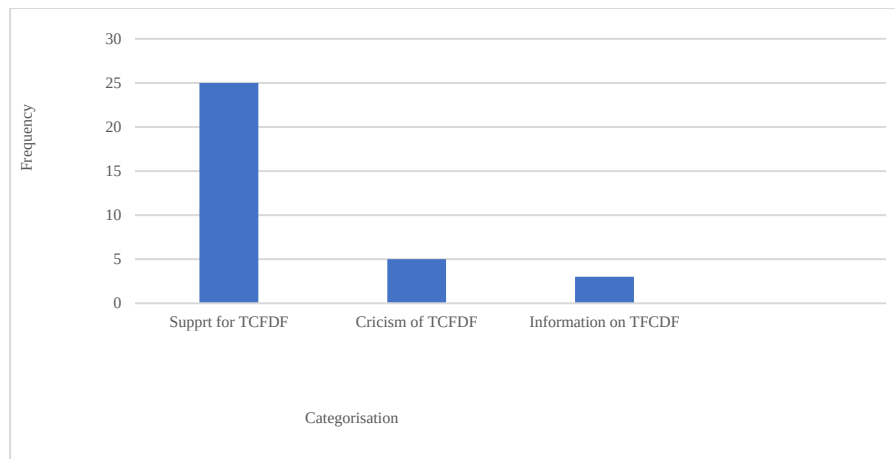


Figure 4: Categorisation of empirical support for TCFDF

As a climate risk reporting guide, relevant attributes of TCFDF objectivity (Alshahrani *et al.*, 2022), transparency (Demaria and Rigot, 2021), alignment with other reporting frameworks (Ding, Liu and Chang, 2022), specificity (Friedrich, Velte and Wulf, 2022), future-orientation and decision-usefulness (Huiskamp, ten Brinke and Kramer, 2022), reliability, comparability, consistency, and clarity (Demaria and Rigot, 2021; Maji and Kalita, 2022), and standardisation (Moreno and Caminero, 2022). The framework equally enjoys overwhelming support in the non-TCFD empirical category (Appendix 2) as a significant proportion (60%) of the authors align themselves with it. This study finds a high level of consensus between authors in the TCFD and non-TCFD categories of the literature on the novel attributes of the framework. Consistent with Huiskamp *et al.* (2022), Khan *et al.* (2022) note that the framework aids in providing reliable climate risk and carbon information. Similarly, Chenet *et al.* (2021) and Toma and Stefanelli (2022) agree with Demaria and Rigot (2021) with respect to its usefulness in ensuring transparency of information. Other relevant attributes identified by the non-TCFD literature include quantification of environmental impacts (Baboukardos, 2018), incorporation of emission disclosures (Bayne, 2022), demonstration of resilience in strategies for climate risks (Daradkeh *et al.*, 2022), a guide for the effective assessment and pricing of climate-related risks and opportunities (Hummel, Laun and Krauss, 2021), contribution to corporate reduction of

GHG (Nguyen, Diaz-Rainey and Kuruppuarachchi, 2021), and a reference in developing guidelines for disclosure of biodiversity risk (Nedopil, 2022).

Despite this scholarly support TCFDF enjoys, it has received some criticisms from some authors. For instance, Friedrich et al. (2022) note the interpretational gaps associated the framework's imprecise definition of some metrics. Further, TCFDF's focus on corporate value effect of climate change, rather than the impact of corporate activities on climate change (Rowbottom, 2022), is a major societal concern. Bingler et al. (2022) argue that corporate support for the framework is "cheap talk" (p. 2) as the companies report immaterial climate information. The majority of the criticism of the framework comes from the non-TCFD empirical category. Cort and Esty (2020) find issues with the framework's focus on improved disclosure of climate-related risks without the indication of risks that may be applicable to specific entities or industries. The authors' concern on TCFDF's over flexibility is supported by Clune and O'Dwyer (2020) who argue that this emanates from its voluntary nature. Consistent with Rowbottom (2022), Hansen (2022) argues that TCFDF is imprecise with respect to its analysis, quality certification, and use of climate information.

Perhaps, the study identified in this review as the biggest critic of TCFDF is Senkl and Cooper (2022). The study finds several challenges with the framework, including its over-emphasis on provision of improved information for the purpose of pricing climate risk, which may not be easily measurable. Finally, the study argues that the framework's assumption of utility maximisation, profit seeking, and growth in equity, among others, makes it a dangerous tool for dealing with climate change. Agreeing with Senkl and Cooper (2022), O'Dwyer and Unerman (2020) argue that TCFDF's emphasis on climate-related risk disclosure, instead of corporate impacts on climate change, presents issues in the preparation and utilisation of appropriate information. Other challenges identified by the authors include difficulty in using the prescribed CSA, incorporating climate-related risks into overall enterprise risk management, and determination of climate-related materiality.

Of the TCFD recommendations, CSA is identified in the literature as most challenging (O'Dwyer and Unerman, 2020; Hansen, 2022; Nguyen *et al.*, 2023). According to Chenet et al. (2021), CSA approach leads to a bias of emphasis on short-term climate transition risks against the more long-term economically and financially destructive physical risks of climate change. Hansen (2022) argues that the approach requires high level risk analysis tools and a clear identification of the stakeholder required to do the analysis, financial institutions or their regulators. In addition, Nguyen et al. (2023) point out data requirement and the modelling of uncertainties as challenges posed by CSA. Noting CSA as a major challenge of TCFDF, O'Dwyer and Unerman (2020) urges corporates and investors to pay attention to resolving this challenge to realise TCFDF's value.

In conclusion, the overall analysis of the two strands of literature indicates a great support for the TCFD framework (Figure 4). However, despite the positive value attributed to the framework, ensuring its global adoption and effective utilisation in climate reporting requires that the few, but loud, dissenting voices on the deficiencies of the framework, to be investigated further. The view is supported by O'Dwyer and Unerman (2020) who identify high-quality evidence-based scholarly investigation as a way to dealing with these deficiencies.

4.8 Focus on contemporary issues

4.8.1 COPs

As the supreme decision-making body, Conferences of Parties (COPs) are organised annually by the UNFCCC. Starting with the first held in Germany in 1995, a lot of such conferences

have been held with the most recent being COP27 in Sharm el-Sheikh (Egypt) in 2022. The review reveals a marginal reflection of COPs and related issues in the TCFD empirical literature. While observing that some of the articles made no specific reference to the COPs (Wedari, Jubb and Moradi-Motlagh, 2021), the work of Ding et al. (2022) is found to make the most reference to the COPs and related issues. Though the study did not cite COP21 specifically, it made significant references to its resultant Paris Agreement (PA) in about all its relevant parts, including the methodology and discussion of findings. More importantly, the adoption of the PA was one of its criteria for sampling countries for the study (Ding, Liu and Chang, 2022). Following this is the study of Bingler et al. (2022) which makes the PA a focus in the discussion of results. The rest of the papers only touched on the COPs mainly in the literature review section (Table 5).

Of all the COPs, only COPs 21 and 26 are specifically espoused in the literature. The study identifies COP21 held in Paris in 2015 as the more frequently cited. The significance of COP21 partly lies in its resultant PA (Venturini, 2022). An important aspect of PA is the establishment of the of the 2°C/1.5°C/net-zero2050 target (Friedrich, Velte and Wulf, 2022; TCFD, 2022) which has become the main agenda for subsequent COPs such as COPs 26 (Glasgow) and 27. It is worth noting that the 2°C scenario of the TCFD (2017) framework emanates from PA. With the exception of Cosma et al. (2022) who made a cursory reference to COP26 with respect to provision of private finance which is another product of PA (Ben-Amar, Comyns and Martinez, 2022), all the authors focused on COP21 and its associated PA. While noting a post PA growth in all four core elements of the TCFD (2017) framework with metrics and targets experiencing the highest growth, Ding et al. (2022) associate the overall growth in the TCFD-aligned disclosure with the joint implementation of PA and TCFDF. In the contrary, Bingler et al. (2022) find better disclosure of climate information by TCFD-aligned reporting energy companies in pre-PA periods than post-PA periods. The authors attribute this result to PA's below 2°C target which appears to expose energy sector to transition risks.

In conclusion, the strong connection between PA and TCFDF together with the confounding findings on the effect of PA on the TCFD-compliant reporting makes it imperative for further investigation on these concepts. The incorporation of indicators from these two instruments in the construction of CRIs will be an important contribution of the academic community to the realisation of the PA target.

Table 5: Summary of contemporary themes

Theme		Study	Number of Studies using Theme	% of Total Articles
COPs	General reference to COPs	Ben-Amar et al. (2022)	1	8
	Significant discussion	Bingler et al. (2022), Ding et al. (2022)	2	16
	Discussion in literature review	Ben-Amar et al. (2022), Demaria and Rigot (2021), Friedrich et al. (2022), Huiskamp et al. (2022), Maji and Kalita (2022), Rowbottom (2022)	6	50
	COP26	Cosma et al. (2022)	1	8
SDGs		Cosma et al. (2022), Moreno and Caminero (2022)	2	16

4.8.2 SDGs

SDGs are global thoughts identified by governments as the challenges confronting the world and their associated coping tools (Bebbington and Unerman, 2018). The TCFD recommendations are considered to be in alignment with the SDGs (Adams and Abhayawansa, 2022). Though another product of the PA, this review points to a low exposition of the TCFD literature on the

SDGs. This paucity of research on the SDGs generally is well noted in prior literature (Bebbington and Unerman, 2018; O'Dwyer and Unerman, 2020). Only two studies (Cosma, Principale and Venturelli, 2022; Moreno and Caminero, 2022) made specific references to the SDGs. With climate committees at the centre of their study, Cosma et al. (2022) argues that constituting such committees is critical in ensuring the achievement of the SDGs. The authors note that the lead role of Europe on SDGs implementation is demonstrated in their incorporation into the strategies and priorities of European Commission. Moreno and Caminero (2022) note the relevance of the SDGs as medium of communicating UN goals. Notably, these studies do not make the SDGs an integral part in their methodological approaches. This analysis, therefore, evidences a wide empirical gap in the exploration of the association between the TCFDF and the SDGs.

5.0 Research Gap and Recommendations for Future Research

As documented in this study, there is currently a paucity in research on climate risk disclosures based on TCFDF, though the subject has witnessed a proliferation of research in the past year. However, the context of the studies is skewed towards the developed world with minimal inclination towards the emerging economies. Given that this finding is consistent with prior literature on climate reporting (O'Connor, 2006), and business (Xu and Meyer, 2013; Meyer, Peng and Meyer, 2016), and the dominance of G20 countries in study contexts (Ding, Liu and Chang, 2022), this finding is highly expected. However, the pervasive nature of climate risks (Flammer, Toffel and Viswanathan, 2021) makes it imperative for research on TCFD-aligned climate reporting to spread to all parts of the globe. In the light of these, and in response to the concerns raised on global community's "blind spot" on climate vulnerable countries on climate effects (Climate Vulnerable Forum and V20, 2022), this study recommends an investigation of the variables drawn from the framework in emerging non-G20 countries. Equally recommended is an investigation on the framework under a UK-specific context. Though the UK is the first among G20 members to declare and initiate the implementation of nationwide requirement for mandatory TCFD-aligned reporting (Carbon Disclosure Project, 2021), research on TCFDF reporting in that context is scarce.

Though more companies are evidenced to be producing TCFDF-aligned reporting (Atkins *et al.*, 2022), the quality of reporting leaves much to be desired as growth in climate-related reporting is not a pointer to CCR quality (Houque and Khan, 2022). The study reveals the strategy element of the four thematic areas of TCFDF as posing a challenge to companies with CSA being key. Other deficiencies are mainstreaming of climate risks in annual reports, incorporation of CSA, strategic resilience, and financial impacts as well as making reports forward-looking (Cosma, Principale and Venturelli, 2022). Given that TCFDF provides the wide range noble theoretical and empirical setting for climate reporting studies (O'Dwyer and Unerman, 2020), this study joins other studies (O'Dwyer and Unerman, 2020; Cho, Senn and Sobkowiak, 2022) in calling for further investigations on these aspects of the framework by the scholarly community. In addition, the imprecise prescription and flexibility of the framework (Cort and Esty, 2020; Friedrich, Velte and Wulf, 2022) equally require scholarly investigations on the probability of legislating the framework, at least in the G20 and G7 countries.

As a framework focused on provision of climate risk information required by investors, lenders, and insurance underwriters (Matsumura, Prakash and Vera-Muñoz, 2022), it is no surprise that the majority of the samples used in the TCFD literature is drawn from the financial industry. However, transition risks (and indeed physical risks) are important considerations for companies in all industries (Nguyen, Diaz-Rainey and Kuruppuarachchi, 2021). Besides, climate risks often hit the financial industry through companies in non-financial industries (Chenet, Ryan-Collins and van Lerven, 2021; Toma and Stefanelli, 2022). On these scores, scholarly

TCFD attention in respect of the non-financial industries is imperative in ensuring a comprehensive reporting on climate risk exposure on all industries across the globe.

Though consistent with extant literature (Daddi *et al.*, 2018) and a popular position among some CCR researchers (Goodall, 2008), not demonstrating the theoretical anchor in TCFD studies as noted in this study makes it difficult for these studies to find space in high impact journals. The few theory-based studies have been evidenced to lean more on the socio-political theories by the authors. However, as a new research area, an exploration of other theories is relevant in establishing the theoretical basis of the TCFD framework. Future research may therefore consider utilising institutional and voluntary disclosure theories as they have witnessed low adoption in the literature. Using these theoretical anchors with the CA methodology may produce some interesting results.

Further, the study observes the dominance of quantitative studies in TCFD research with the manual CA methodology being deployed by most scholars. While this finding reflects the general picture of climate reporting studies (Demaria and Rigot, 2021), the choice of manual CA over available advanced computerised CA methods may partly be responsible for the inability of TCFD articles to get published in high impact journals. The pervasive nature of technological adoption requires the deployment of technology in the conduct of CA. This argument is supported by TCFD aligned studies (Ding, Liu and Chang, 2022; Moreno and Caminero, 2022) and the availability of varieties of computer-aided CA technologies adopted by CCR scholars (Engle *et al.*, 2020; Moreno and Caminero, 2022). CCR scholars should therefore consider the use of computer-aided technologies in the conduct of TCFD-aligned CA. Given the minimal use of primary data and the survey method, it is suggested to the CCR researchers to consider the survey method, especially in emerging economies where secondary data on climate change may be non-existent or inaccessible.

The study documents a coverage of the four core reporting themes as well the 11-point sub-indicators in most of the studies. The climate reporting indices used in the CA studies were constructed using largely the 11 sub-indicators. Given that the only study that constructed CRI using extant literature (Friedrich, Velte and Wulf, 2022) used CRI based on TCFDF (Demaria and Rigot, 2021), the framework becomes the main source for the construction of CRIs. However, to reflect the adoption of older climate reporting frameworks (such as the GRI and CDP) prior to TCFDF, it is recommended that studies on climate reporting include indicators drawn from these frameworks in the construction of CRIs. This is particularly relevant in studies focused on measuring growth in climate reporting quality over the pre- and post-TCFD implementation periods.

Instructively, the study reveals a proportionately low reflection of these contemporary issues in the TCFD literature. Though few, the findings in these articles will require further investigation under different contexts. For example, the preliminary, varying and confounding findings on the effects of COPs (particularly, COP21) on the quality of reporting under TCFDF (Bingler *et al.*, 2022; Ding, Liu and Chang, 2022) will require further exploration. Further, this study recommends the inclusion of indicators from SDGs and the COPs in determining the methodology for TCFDF studies, especially the construction of CRIs under the CA methodology.

The discussions in this section have thus identified the gaps in the TCFD literature and the areas academics may concentrate attention in realising the reporting value of the framework. By so doing, the academic community is well positioned to contribute to an effective global reporting on climate risks and the achievement of the net-zero ambition.

6.0 Conclusion

This study was conducted to assess the extent of empirical attention paid to the TCFD framework which is generally acclaimed as a useful tool for reporting climate-related risks and opportunities. The study finds that, though the framework has experienced a lot of exposition in recent years, especially 2022, the number scholarly articles appears too low.

Also found in this study is the gap in reporting with respect to the strategy (particularly, CSA) component of the TCFD recommendations. Besides, the mainstreaming of climate risk disclosure in annual reports of companies has witnessed a deficiency. As one of the audiences for the framework, the financial sector appears to dominate the TCFD literature. The legitimacy theory has been identified as the most adopted theoretical hinge for the articles. Despite the availability of modern technology for the conduct of CA, the manual CA methodology has been largely used. Secondary data, mainly drawn from annual reports and a few databases, have assumed prominence over primary data in TCFD literature. Further research is recommended on the strategy component of the framework. Also recommended is the use of computer-aided CA methodology under non-socio-political theoretical perspective.

As the first SLR on TCFDF, this study contributes to the literature by highlighting research opportunities to the academic community to explore the value of this framework that is poised to become a global climate risk reporting guideline (Friedrich, Velte and Wulf, 2022; Huiskamp, ten Brinke and Kramer, 2022). The study's main contribution is derived from its identification of non-G20 emerging and vulnerable economies a centre of attention in future TCFD studies. Further, the study draws attention to the practical challenges posed by CSA in ensuring corporate TCFD-aligned reporting and recommends further research on the CSA by scholars. Methodologically, the study recommends the use of computer-aided CA methodology under non-socio-political theoretical perspectives. Addressing these and many others gaps identified in this study positions TCFDF to be a useful guide for provision of consistent, standard, and, consequently, comparability climate information (Moreno and Caminero, 2022) across the globe.

This study is not devoid of the usual limitation of missing out on articles through the keyword-based search associated with SLR (Hiebl, 2021). The adoption of this method of sampling articles, together with the limitation posed by sampling only articles published in the English language, could have resulted in a few relevant articles not being drawn to the sample. However, given its scientific basis (Tranfield, Denyer and Smart, 2003) and popularity among climate reporting researchers (Daddi *et al.*, 2018; Veltri and Silvestri, 2020), the choice of SLR has minimal effect on the findings and conclusions of this study.

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Appendix 1: Summary of empirical works on the TCFD Recommendations

S/ N	Authors / Study	Ye ar	Journal	AJG Journ al Rank ing	Title	Sample Size	Thematic Area of TCFD Recommend ations Covered	Countries	Industri es Covered	Categoris ation	Methodol ogy	Theory	Source of Data	Perio d cover ed by Study	Main Findings
1.	Alshahrani et al. (2022)	20 22	Business Strategy and the Environm ent	3	Climate change performance and financial distress	212 Australi an Securiti es Exchang e	Governance, Strategy, Risk Management , and Target and Metrics	Australia	Non- financial Industrie s	Reporting consequ ence	Content analysis, ordinary least squares (OLS) regressio n analysis, GMM, propensit y score matching (PSM)	Stakehol der	Annual reports and sustainabili ty reports from Morningsta r database	2008– 2019	Corporate performance on to climate change reporting is negatively related to financial distress; the existence of low litigation risk, risk committee, employ Big4 auditing firms and high audit fees mediate in the relationship between climate change reporting performance and financial distress.
2.	Ben-Amar et al. (2022)	20 22	Accountin g, Auditing and Accounta bility Journal	3	The COVID- 19 pandemic: opportunity or challenge for climate change risk disclosure?	10 countrie s	Risk Management	Europe, UK, South Africa, Australia, Japan, New Zealand, South- Korea, US, Canada, and Brazil	Multi- industry	Reporting determina nts	Case study research strategy	Institutio nal	Pew Research Centre (2019a) report and Notre Dame- Global Adaptation Index	2019	Climate risk reporting evolves according to geographical setting; ambitious climate regulations and economic circumstances influence climate disclosures.
3.	Bingler et al. (2022)	20 22	Finance Research Letters	2	Cheap talk and cherry- picking: What ClimateBert has to say on corporate climate risk disclosures.	301 compani es	Governance, Strategy, Risk Management , and Target and Metrics	Multi- country	Multi- industry	Reporting quality	Descripti ve study	None	Corporate annual, stand-alone sustainabili ty, climate, or TCFD- reports, and corporate webpage	2015– 2020	Corporate CCR based on the TCFD framework is selective and non-material

Appendix 1 continues on page 24

Appendix 1 continues from page 23

S/ N	Authors / Study	Year	Journal	AJG Journal Ranking	Title	Sample Size	Thematic Area of TCFD Recommendations Covered	Countries	Industries Covered	Categorisation	Methodology	Theory	Source of Data	Period covered by Study	Main Findings
4.	Cosma et al. (2022)	2022	Corporate Governance (Bingley)	2	Sustainable governance and climate-change disclosure in European banking: the role of the corporate social responsibility committee	101	Governance, Strategy, Risk Management, and Target and Metrics	Europe	Financial Industry	Reporting determinants	Content analysis	Legitimacy	Annual financial and non-financial reports	2018	Banks in Europe have reached intermediate level TCFD-compliant reporting; climate disclosures are not proactive; observed differences in climate change committees among banks
5.	Demaria and Rigot (2021)	2021	Business Strategy and the Environment	3	Corporate environmental reporting: Are French firms compliant with the Task Force on Climate Financial Disclosures' recommendations?	40 companies on the Euronext Paris	Governance, Strategy, Risk Management, and Target and Metrics	France	Multi-industry	Reporting determinants	Content analysis	None	Documents published and audited annually	2015–2018	A gradual increase in the climate compliance index (CCI) though variations are observed across sectors.
6.	Ding et al. (2022)	2022	Journal of Business Ethics	3	Carbon Emissions and TCFD Aligned Climate-Related Information Disclosures	89 Companies listed on ASX30, FTSE350, TSX Composite and S&P500	Governance, Strategy, Risk Management, and Metrics and Targets	Australia, the UK, Canada, and the US	Multi-industry	Reporting determinants	Computerised textual analysis	Legitimacy	Annual reports from EDGAR database, Refinitiv Eikon and the corporate websites	2017–2019	High emission companies report more on climate change

Appendix 1 continues on page 25

Appendix 1 continues from page 24

S/ N	Authors / Study	Year	Journal	AJG Journ al Rank ing	Title	Sample Size	Thematic Area of TCFD Recommend ations Covered	Countries	Industri es Covered	Categoris ation	Methodol ogy	Theory	Source of Data	Perio d cover ed by Study	Main Findings
7.	Friedrich et al. (2022)	2022	Busine ss Strateg y and the Enviro nment	3	Corporate climate reporting of European banks: Are these institutions compliant with climate issues?	152 compan y years of Europea n banks listed on the STOXX Europe 600	Governance, Strategy, Risk Management , and Target and Metrics	13 Europe countries	Financia l Industry	Reporting quality	Content Analysis, text mining	Legitima cy	Manageme nt commentar ies, mandatory nonfinanci al declaration s, and voluntary sustainabili ty report	2017– 2020	Observed growth in CCR over the period of study; gaps in reporting found.
8.	Huiskamp et al. (2022)	2022	Busine ss Strateg y and the Enviro nment	3	The climate resilience cycle: Using scenario analysis to inform climate- resilient business strategies	Two mid- sized compani es	Strategy	–	HPI (Food and biochem ical)	Not applicabl e	Scenario analysis, Case study	Theory develop ment	Case study	–	Transdisciplinary studies are capable of spreading scientific insights into decision making by companies to achieve the net-zero target
9.	Maji and Kalita (2022)	2022	Societ y and Busine ss Revie w	2	Climate change financial disclosure and firm performance : empirical evidence from Indian energy sector based on TCFD recommenda tions	22 Compan ies	Governance, Strategy, Risk Management , and Target and Metrics	India	HPI (Energy sector)	Reporting consequ ence	Content analysis	None	Annual reports and/or sustainabili ty reports	2018– 2020	A moderate disclosure level among companies; a positive relationship between CCR and corporate performance.

Appendix 1 continues on page 26

Appendix 1 continues from page 25

S/ N	Authors / Study	Year	Journal	AJG Journal Ranking	Title	Sample Size	Thematic Area of TCFD Recommendations Covered	Countries	Industries Covered	Categorisation	Methodology	Theory	Source of Data	Period covered by Study	Main Findings
10.	Moreno and Caminero (2022)	2022	International Review of Financial Analysis	3	Application of text mining to the analysis of climate-related disclosures	12 Companies	Governance, Strategy, Risk Management, and Target and Metrics	Spain	Financial Industry	Reporting determinants	Text mining	None	Corporate reports	2014–2020	Annual growth in CCR quantity; some CCR disclosures done in other reports than annual reports and sustainability reports.
11.	Rowbottom (2022)	2022	Accounting, Auditing and Accountability Journal	3	Orchestration and consolidation incorporate sustainability reporting. The legacy of the Corporate Reporting Dialogue	20 interviews	Not applicable	Global	Not applicable	Not applicable	Interviews, documentary analysis and observation	None	Interviews, reports, standards, frameworks, minutes of standard setters	2013–2021	10 key reporting boundaries identified with clear description of boundary concepts
12.	Wedari et al. (2021)	2021	Business Strategy and the Environment	3	Corporate climate-related voluntary disclosures: Does potential greenwash exist among Australian high emitters reports?	150 companies	Governance, Strategy, Risk Management, and Target and Metrics	Australia	HPI	Reporting determinants	Content analysis	Voluntary disclosure and Socio-political	ASSET4, TCFD, GRI-04, ISO 14064	2016–2017	Low level of CCR in most companies; evidence of potential greenwashing among poor environmental performers.

Appendix 2: Summary of non-empirical TCFD articles

S/N	Authors / Study	Year	Journal	AJG Journal Ranking	Title	Categorisation	Summary evidence of stance
1.	Atkins et al. (2022)	2022	Journal of Business Ethics	3	Exploring the Effectiveness of Sustainability Measurement: Which ESG Metrics Will Survive COVID-19?	Supporting	TCFDF results in standardisation of reporting.
2.	Baboukardos (2018)	2018	British Accounting Review	3	The valuation relevance of environmental performance revisited: The moderating role of environmental provisions	Supporting	TCFDF is relevant in financially quantifying environmental impacts; it stresses on the relevance of disclosure of climate-related disclosures for investors and inclusion of disclosures mainstream annual reports
3.	Bayne (2022)	2022	Accounting, Auditing and Accountability Journal	3	Understanding reporting boundaries in annual reports: a conceptual framework	Supporting	TCFDF focuses on the understanding of material climate risks; it mainly targets financial performance and as well clearly incorporates emission disclosure.
4.	Blake and Cairns (2021)	2021	Insurance: Mathematics and Economics	3	Longevity risk and capital markets: The 2019-20 update	Supporting	Mandatory adoption of TCFDF by asset managers and listed companies in the UK; enjoys support from Lifetime Savings Association (PLSA) in the UK.
5.	Belloque et al. (2021)	2021	Abacus	3	55 years of Abacus: Evolution of Research Streams and Future Research Directions	Supporting	Expectation of proliferation of research on the TCFDF
6.	Chenet et al. (2021)	2021	Ecological Economics	3	Finance, climate-change and radical uncertainty: Towards a precautionary approach to financial policy	Criticising	As a market-based approach with emphasis on disclosure, transparency, scenario analysis and stress testing, the TCFDF has limited impact as climate risk are radically uncertain; direction of financial policy to short-term to the neglect of long-term impact of climate change.
7.	Clune and O'Dwyer (2020)	2020	Accounting, Organisations and Society	4*	Organising dissonance through institutional work: The embedding of social and environmental accountability in an investment field	Criticising	Being a voluntary, the TCFDF constitutes soft law and thus lacks legal obligation and enforceable rights, and too flexible.
8.	Cort and Esty (2020)	2020	Organisation and Environment	3	ESG Standards: Looming Challenges and Pathways Forward	Criticising	TCFDF emphasises quality of climate risks disclosure rather than the identification of risks that may apply to specific sectors or companies; it is too flexible to allow corporate choice of what to report and thus lacking comparability.

Appendix 2 continues on page 28

Appendix 2 continues from page 27

S/N	Authors / Study	Year	Journal	AJG Journal Ranking	Title	Categorisation	Summary evidence of stance
9.	Daradkeh et al. (2022)	2022	Corporate Governance: An International Review	3	Does managerial ability matter for corporate climate change disclosures?	Supporting	Study contributes to recommendations of the TCFD for corporate demonstration of resilience in strategies for climate risks
10.	Hansen (2022)	2022	Journal of Monetary Economics	3	Central banking challenges posed by uncertain climate change and natural disasters	Criticising	TCFDF clearly imprecise in synthesising and endorsing information
11.	Houqe and Khan (2022)	2022	Business Strategy and the Environment	3	What determines the quality of carbon reporting? A system-oriented theories and corporate governance perspective	General information	Central Bank of Brazil declaring mandatory TCFD-aligned disclosure; TCFDF recommends 7 principles for carbon and climate risks.
12.	Hummel et al. (2021)	2021	British Accounting Review	3	Management of environmental and social risks and topics in the banking sector - An empirical investigation	General information	The TCFDF is intended to provide investors, lenders, and insurance underwriters with information for the effective assessment and pricing of climate-related risks and opportunities; The TCFDF requires disclosure on the core elements of governance, strategy, risk management and targets and metrics
13.	Khan et al. (2022)	2022	Business Strategy and the Environment	3	Organic versus cosmetic efforts of the quality of carbon reporting by top New Zealand firms. Does market reward or penalise?	Supporting	TCFDF recommends disclosure of reliable climate risk and carbon information
14.	Matsumura et al. (2022)	2022	Review of Accounting Studies	4	Climate-risk materiality and firm risk	General information	TCFDF requires disclosure of climate risks in mainstream annual reports; focus on provision of climate risk information required by investors, lenders, and insurance underwriters
15.	Nedopil (2022)	2022	Business Strategy and the Environment	3	Integrating biodiversity into financial decision-making: Challenges and four principles	Supporting	TCFDF serves as guide to develop a framework for biodiversity risks by the Task Force for Nature-related Financial Disclosure (TNFD); it provides a framework for measurement of climate risks.
16.	Nguyen et al. (2023)	2023	International Review of Financial Analysis	3	Climate transition risk in U.S. loan portfolios: Are all banks the same?	Supporting	TCFDF aid climate risks reporting by banks and investigation of micro-prudential risks by regulators

Appendix 2 continues on page 29

Appendix 2 continues from page 28

S/N	Authors / Study	Year	Journal	AJG Journal Ranking	Title	Categorisation	Summary evidence of stance
17.	Nguyen et al. (2021)	2021	Energy Economics	3	Predicting corporate carbon footprints for climate finance risk analyses: A machine learning approach	Supporting	Expected reduction in GHG emission through the use of the TCFDF by regulators and investors.
18.	O'Dwyer and Unerman (2020)	2020	Accounting, Auditing and Accountability Journal	3	Shifting the focus of sustainability accounting from impacts to risks and dependencies: researching the transformative potential of TCFD reporting	Supporting	TCFDF is very distinctive and draws attention in policy-making; capacity development for scenario analysis of climate-related poses a major issue for corporate.
19.	Senkl Cooper (2022)	2020	Critical Perspectives on Accounting	3	On valuing (m)other nature in times of climate crises – A reflection on the non and nom of accounting for (m)other nature	Criticising	TCFDF is overly concerned about only one stakeholder, the investor; it glorifies the pursuit of profit caring less about its consequences; it targets capital growth irrespective of its destruction.
20.	Toma and Stefanelli (2022)	2022	Ecological Economics	3	What are the banks doing in managing climate risk? Empirical evidence from a position map	Supporting	Adoption of TCFDF enables the measurement of business strategy consistency and adequacy and timely and transparent communication of climate information

