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RESEARCH ARTICLE

Climate reporting quality following the recommendations of the task force on climate-related financial disclosures: A Focus on the German capital market

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Email: velte@leuphana.de**Abstract**

This paper investigates the quality of climate reporting by German DAX30 companies based on legitimacy theory. The study refers to a content analysis of climate-related corporate disclosures from 2018 to 2020, related to the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD). The results show that there is still considerable room for improvement among carbon-sensitive as well as less carbon-sensitive firms. In particular, the companies showed poor reporting rates in the corporate governance domain, indicating that they use climate reporting symbolically to present themselves in a favorable light and to gain legitimacy in society. Moreover, carbon-sensitive companies were more likely to report strategically relevant information on climate issues. The results are most relevant for researchers, business practice and regulatory bodies.

KEYWORDS

climate reporting, corporate directive, corporate governance, sustainability reporting, sustainability reporting, task force on climate-related financial disclosures

1 | INTRODUCTION

At the latest since the financial crisis of 2008/09, deceptive reporting behavior has significantly impaired the trust of various stakeholder groups in the quality of corporate practices and disclosures. As a result, (inter)national standard setters have introduced several reforms to strengthen corporate governance and corporate social responsibility (CSR) in public interest entities (PIEs) (Pucheta Martinez et al., 2018). In view of the strict climate protection targets of the 2015 Paris Climate Agreement, recent debates on further regulatory expansions focus primarily on climate-related information. Among the many established standard setters is the Task Force on Climate-related Financial Disclosures (TCFD)—an industry-led initiative that was launched at the COP 21 in Paris. Since TCFD published its reporting recommendations in 2017 (TCFD, 2017), many companies have voluntarily adopted the

framework as part of their sustainability reporting. Furthermore, it can be assumed that the TCFD recommendations will play a central role in future reporting regulations, both in the European Union (European Commission, 2022) and internationally through the new International Sustainability Standards Board (ISSB) (ISSB, 2022).

Along with its increasing societal and political relevance, climate reporting has been gaining prominence in academic literature over the last decade (e.g., Demaria & Rigot, 2021). However, due to its novelty, there are still several gaps in the literature. The German capital market is particularly understudied. This seems surprising since Germany has a long tradition of environmental reporting and, as the most significant European emitter, is among the top global contributors to climate change (Armstrong, 2019). In addition, only a few studies address the TCFD recommendations despite their growing global relevance (Demaria & Rigot, 2021).

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Apart from the scarcity of studies, climate reporting literature suffers from the issue of symbolic reporting practices. According to *legitimacy theory* (Dowling & Pfeffer, 1975; Suchman, 1995), companies may opportunistically use climate reporting as a tool to legitimize in society (Lyon & Maxwell, 2011; Mahoney et al., 2013). Against this backdrop, an investigation of the *quality* of climate reporting seems necessary. Yet, most studies to date have focused on the degree to which companies comply with certain reporting standards (e.g., Demaria & Rigot, 2021). In the German case, only Wulf et al. (2020) have so far examined the reporting quality by DAX 30 companies based on the EC reporting guidelines. However, the authors merely evaluated the firms' mandatory corporate disclosures in terms of their level of detail. Given the risk of symbolic reporting behavior, a different quality measure may be more appropriate.

This paper aims to address these gaps in the literature by assessing the quality of German DAX 30 companies' 2018–2020 climate-related disclosures with a close alignment to the TCFD recommendations. More specifically, and in line with previous environmental studies (Al-Tuwaijri et al., 2004), the paper uses a manual content analysis of the sample companies' disclosures to assess the quality of reporting with a focus on *specificness* and *quantification*. To derive implications for practice and policy, the paper further investigates selected determinants for climate reporting from the literature. Viewed through a legitimacy theoretical lens, the study addresses the question of whether carbon-sensitive firms disclose climate-related information at a higher quality than companies from less carbon-sensitive industries or vice versa.

The results of the empirical analysis highlight significant reporting gaps despite an improvement in the overall quality of climate reporting over the studied period. Based on the findings, the contribution of this paper is manifold. First, it supplements the current literature body on climate reporting in Germany and extends the research on the TCFD recommendations by focusing on reporting quality. Second, it presents supporting evidence for the usefulness of legitimacy theory for assessing the quality of corporate climate reporting practices. Third, the study provides implications for policymakers, standard setters, companies, and researchers.

The remainder of this paper is structured as follows. Section 2 outlines the theoretical background and the regulatory environment for climate reporting in Germany. Section 3 reviews relevant (inter) national studies on environmental and climate-related disclosures and presents the research questions. Section 4 describes the methodology and shows the descriptive results of the analysis. Finally, section 5 discusses the results and provides concluding remarks.

2 | THEORETICAL AND NORMATIVE BACKGROUND

2.1 | Legitimacy theory

Scholars draw on a range of different theories to explain why companies report on environmental information, and in particular, climate-related aspects (Hahn et al., 2015). However, to date, sociopolitical

narratives under *legitimacy theory* (Dowling & Pfeffer, 1975; Suchman, 1995) present the prevailing lens on climate reporting (Qian & Schaltegger, 2017; Velte et al., 2020). The underlying assumption of legitimacy theory is that a company will gain, preserve, or restore its legitimacy status when its activities are consistent with society's values, norms, and beliefs (Dowling & Pfeffer, 1975; Suchman, 1995). If a company fails to uphold this *social contract*, it may become subject to greater stakeholder scrutiny, risk its so-called *license to operate*, and in extreme cases, peril its very existence (Deegan, 2002). Accordingly, legitimacy theory provides an explanation for corporate climate reporting (Qian & Schaltegger, 2017; Velte et al., 2020), as it suggests that companies use disclosure as a tool to counter social and political pressures.

In particular, legitimacy theory suggests that companies from carbon-sensitive industries are under great pressure to legitimize their activities through climate reporting (Deegan, 2002). From another legitimacy theoretical perspective, companies with high carbon performance and genuine engagement in climate-related activities have a special interest in communicating this to their (non-)shareholding stakeholders (Hummel & Schlick, 2016).

However, legitimacy theory also implies the risk that companies opportunistically use climate reporting to present themselves in a favorable light (Mahoney et al., 2013). On the one hand, firms may deliberately disclose large quantities of climate-related information despite poor carbon performance (Yu et al., 2020) and provide disconnected climate-related and financial information. These reporting tactics create *information overload* and thereby reduce the readability and decision usefulness of disclosures for stakeholders (Gerwanski et al., 2019). On the other hand, companies may engage in *greenwashing* practices by selectively disclosing mainly positive information (Lyon & Maxwell, 2011). For the above reasons, some studies suggest that climate reporting is unlikely to present a company's actual carbon performance and climate-related activities (Qian & Schaltegger, 2017). Nevertheless, literature agrees that high-quality (i.e., accurate and quantitative) disclosures reduce the risk of symbolic reporting behavior (Hummel & Schlick, 2016). Moreover, some scholars assume that a company's climate-related activities and overall carbon performance will improve with its climate reporting quality in the long term due to stakeholders' critical feedback.

2.2 | Regulatory framework

2.2.1 | European sustainability reporting regulations

As in most countries around the world, there is no explicit obligation for climate reporting in German commercial law. However, non-financial reporting requirements with an indirect climate reference have been in place for more than a decade. As early as 2004, the legislator introduced a disclosure of non-financial performance indicators in management reporting (Wulf et al., 2020). After the financial crisis, the European Non-Financial Reporting Directive (Directive 2014/95/EU); NFRD has strengthened the reporting requirements through the

non-financial declaration (NFD). As a result, since 2017, certain public interest entities (PIEs) in Germany have been required to report on climate-related aspects in their NFD if the information is material to the firm from a financial and societal perspective. In response to the growing debate on climate change, the EC therefore published voluntary *guidelines on reporting climate-related information* in 2019. To tighten the climate-related reporting requirements for PIEs, and following their commitment to the Paris Agreement, the EU standard setter published a new Corporate Sustainability Reporting Directive (CSRD) in 2022 that substitutes the current NFRD. The European Financial Reporting Advisory Group (EFRAG) currently prepares European Sustainability Reporting Standards in line with the environmental, social, and governance (ESG) concept, based on a strict cooperation with the Global Reporting Initiative (GRI).

2.2.2 | Task force on climate-related financial disclosures

Since climate-related disclosures have been voluntary in most countries around the world, many climate-related standards and frameworks established over the last decades. As a result of the growing recognition of climate-related financial risks, in 2015/2016, the Financial Stability Board initiated the TCFD with the aim to improve the transparency of climate-related financial reporting (Eccles & Krzus, 2017). In its 2017 final report, TCFD gives 11 disclosure recommendations that cover four reporting areas: governance, strategy, risk management, and metrics and targets. While the recommendations incorporate various climate-related reporting criteria of other standards, for example carbon emissions metrics in line with the Greenhouse Gas (GHG) Protocol (inside-out perspective), they are the first to require climate-related information concerned with companies' strategies. More specifically, the TCFD recommendations request the disclosure of risks and opportunities, financial impacts, and overall business model resilience in the face of climate change (outside-in perspective), which renders them particularly relevant for investors, lenders, and policymakers (Demaria et al., 2019; Garcia Sanchez et al., 2011). The German government's Sustainable Finance Committee advocates mandatory TCFD reporting for German PIEs (Sustainable Finance Committee of the German Federal Government, 2020). In addition, the TCFD recommendations are central to the strategy of the ISSB to implement global sustainability reporting standards. As a first step, the ISSB will establish a climate-related financial disclosure standard in line with investors' information needs towards climate risks (ISSB, 2022).

3 | LITERATURE REVIEW

3.1 | Research on climate-related disclosure

In tandem with its increasing societal and regulatory relevance, climate reporting has been gaining prominence in empirical research since the financial crisis of 2008–09 (Hahn et al., 2015). Thus, compared to corporate environmental reporting, which has been a

growing research area since the early 1980s (Demaria & Rigot, 2021), the subarea of climate reporting is a relatively new field of study

One research strand of climate-related empirical works, of which this paper is a part, is concerned with companies' level of climate reporting itself (Demaria et al., 2019). Regarding the level of climate reporting, little research exists so far (Kouloukoui et al., 2019). However, consistent with findings from environmental reporting literature (Cho et al., 2015), recent (inter)national studies show improving but still insufficient degrees of climate-related disclosures (Giannarakis et al., 2017). Similarly, papers that specifically address the TCFD recommendations show reporting deficiencies in global (KPMG, 2020), European (European Climate Initiative, 2020), French (Demaria & Rigot, 2021), and German samples (Loew et al., 2021). In particular, the studies show fragmented reporting in the strategy domain, including information on the companies' resilience under different climate scenarios (TCFD, 2020; Demaria & Rigot, 2021; Loew et al., 2021). Furthermore, according to TCFD's (2020) latest status report, companies' climate-related disclosures often lack quantitative information, especially regarding the financial impacts of climate-related risks and opportunities. Yet, the reviewed studies focus only on companies' level of compliance with the TCFD recommendations and do not evaluate the quality of climate disclosures. For example, Demaria and Rigot (2021) derived 38 questions from TCFD's (2017) Guidance for All Sectors to investigate French CAC 40 companies' TCFD compliance. Similarly, Loew et al. (2021) investigated German companies' fulfillment of TCFD's 11 reporting criteria.

Regarding the quality of German companies' climate disclosures, a thorough literature review yielded only one paper by Wulf et al. (2020). The authors examined the level of detail of DAX-30 companies' climate reporting in accordance with the European Commission's 2020 climate reporting guidelines (Wulf et al., 2020). In this study, too, the authors noted generally restrained but improving levels of climate reporting. However, Wulf et al. (2020) did not differentiate between verbal and quantitative data to examine the quality of reporting in light of legitimacy theory and the risk of symbolic reporting behavior.

Based on the above research gaps, this study advances the following overarching research question while drawing on the TCFD recommendations and using the specificity and quantification of disclosures as a quality measure for the analysis.

Q1. What is the status quo of climate reporting quality by German DAX 30 companies?

3.2 | Research on the determinants of climate-related disclosure

Another strand of climate-related reporting research consists of quantitative studies that deal with the determinants and financial implications of climate disclosure (Demaria & Rigot, 2021). Among them, several studies have found evidence for the assumptions of legitimacy theory. For example, scholars observed that media coverage

(Berthelot & Robert, 2011) and company size (Kouloukoui et al., 2019) positively influence the quality of climate reporting. Furthermore, in line with legitimacy theory, the findings on the relationship between carbon performance and climate reporting are mixed (Hummel et al., 2020). On the one hand, numerous studies revealed that companies from carbon-sensitive industries report on climate issues at a higher quality (Liu & Anbumozhi, 2009). On the other hand, several global studies found a negative impact of carbon emission intensity on the quality of climate-related disclosures (Gallego-Alvarez et al., 2011). This study aims to provide new insights to the debate on the impact of carbon sensitivity on climate reporting.

Q2. How does the quality of climate reporting differ between German DAX 30 companies from carbon-sensitive and less carbon-sensitive firms?

4 | EMPIRICAL ANALYSIS

4.1 | Data and methodology

4.1.1 | Sample data

The overall aim of this paper is to examine the status quo of climate reporting quality in Germany by performing a content analysis of corporate disclosures. The sample consists of companies that were headquartered in Germany and listed in the DAX 30. The rationale behind focusing on the DAX 30 is threefold. First, large companies are expected to have a special interest in communicating climate-related information to stakeholders according to the legitimacy theory (Hahn et al., 2015). Second, the DAX 30 companies are subject to the strictest environmental reporting regulations in Germany. Third, as outlined in the previous sections, stakeholders are increasingly pressuring German PIEs to disclose climate-related information, particularly in line with the TCFD recommendations. From a legitimacy theoretical point of view, the DAX 30 are therefore likely to display the most mature climate reporting practices in the German capital market. However, the sample only includes disclosures from non-financial firms to increase the comparability of the results. Financial service providers and insurance companies are excluded due to their deviating asset structure and exposure to generally stricter industry-specific reporting requirements (Gerwanski et al., 2019).

Building on the regulatory framework of this paper, the reports under investigation are the sample companies' management reports (including the remuneration report), corporate governance reports, non-financial declarations, and voluntary sustainability-related reports (e.g., sustainability-, CSR-, or integrated reports). Thus, the analysis includes both, mandatory disclosures and voluntary non-financial disclosures. The sample does not include standalone climate reports, as none of the studied companies published such a report for the years under investigation. Moreover, the companies' responses to the CDP Climate Change Questionnaire are not considered as only a small number of companies' reports are publicly available via a direct

link in their reporting, on their website, or via search engine query. In addition, web-based disclosures are disregarded because they are not tied to an annual publication pattern. This approach is consistent with most studies on environmental disclosure (e.g., Beck et al., 2010; Gerged et al., 2018) and provides "more structured, comprehensive and reliable information" (Demaria & Rigot, 2021, p. 5).

The reports under examination cover the years 2018–2020. In this way, the analysis allows for an assessment of the evolution in climate reporting quality since the publication of the TCFD recommendations. However, based on a preliminary analysis of the companies' reference documents, disclosures from 2017 are not included in the quality assessment because none of the sample companies applied the TCFD recommendations in 2017. Lastly, one company is not included because it did not publish either a non-financial declaration or a corporate governance statement for the years studied. Furthermore, the company was not headquartered in Germany over the whole study period. In total, the sample data therefore consists of 153 reference documents (49 from 2018; 52 from 2019; 52 from 2020) from 25 non-financial DAX 30 companies.

4.1.2 | Climate reporting quality assessment model

As the study employs the method of content analysis, it entails a detailed examination of reference documents with subsequent consolidation and quantification of the results. Scholars agree that the method requires a thoroughly designed coding scheme and a uniform set of reporting criteria (Krippendorff, 2012). For the content analysis of the DAX 30 companies' reference documents, the *CRQ Assessment Model* was therefore created as a first step. Following previous works (Demaria & Rigot, 2021), the model is based on the TCFD recommendations. Thus, the sample companies' disclosures from the reference documents are scored against the task force's 11 recommended reporting criteria.

The scoring follows clearly defined rules to ensure consistent and reliable results (Wulf et al., 2020). Firstly, the point allocation strictly focuses on climate aspects. This means that disclosures relating to sustainability or environmental issues in general, are not considered unless the reporting company explicitly refers to climate aspects within the given text passage. Secondly, TCFD's sector-specific guidance documents with further reporting suggestions are disregarded because of their limited applicability due to the small number of sample companies. Thirdly, following Loew et al. (2021), the scoring is based on individual assessment rationales defined for each TCFD reporting criterion. Unlike Loew et al. (2021), however, the paper uses a quantitative reporting quality measure based on environmental reporting studies that assigned different weights to reporting items depending on the type of information and the perceived value to stakeholders (Wiseman, 1982).

Specifically, the sample companies' disclosures are rated on a scale from zero to three, following Wiseman's (1982) seminal work and several subsequent studies (e.g. Cormier et al., 2005): Three points are awarded for items covered by quantitative or, if

TABLE 1 Climate reporting quality (CRQ) assessment model

No.	Scoring rationales for each reporting criterion recommended by TCFD (2017) and explanation of deviations from the TCFD recommendations, if applicable.	Point range
1	Governance	0–6
1.1	<p>TCFD: “Describe the board’s oversight of climate-related risks and opportunities.”</p> <p>Note: According to TCFD (2017), the “board of directors (or board) refers to a body of elected or appointed members who jointly oversee the activities of a company or organizations. Some countries use a two-tiered system where ‘board’ refers to the ‘supervisory board’” (p. 70). As Germany adopts a two-tier board system, only disclosures regarding the <i>supervisory board</i> are considered for reporting criterion 1.1. Monetary information is not considered, as it is currently still widely discussed whether supervisory board remuneration should be linked to climate-related aspects, and only a small number of companies already consider such figures in their remuneration policies. This is highlighted by the results of the analysis, which show that none of the sample companies reported on such a link in 2018 and 2019</p> <p>1 = Non-specific qualitative disclosure, for example, if the board addresses climate-related issues within the respective reporting year, although it has no clear responsibility for monitoring the company’s climate-related risks and opportunities</p> <p>2 = Specific qualitative disclosure, for example, information that specifically states the supervisory board’s monitoring of climate-related risks and opportunities</p> <p>3 = Quantitative disclosure, for example, frequency by which the supervisory board / board committee is informed over climate-related risks and opportunities; number of climate experts on the supervisory board</p>	0–3
1.2	<p>TCFD: “Describe the management’s role in assessing and managing climate-related risks and opportunities.”</p> <p>Note: According to TCFD (2017) “[m]anagement refers to those positions an organization views as executive or senior management positions and that are generally separate from the board” (p. 71). As Germany adopts a two-tier board system, only disclosures regarding the <i>management board</i> or senior executives from board committees are considered for reporting criterion 1.2.</p> <p>1 = Non-specific qualitative disclosure, for example, if reference is made to non-financial indicators within the relevant text passage and it becomes clear throughout the report that climate-related measures are part of these indicators; if the CEO mentions climate change in his/her letter</p> <p>2 = Specific qualitative disclosure, that is, detailed description of management processes or remuneration policy with climate reference</p> <p>3 = Quantitative/Monetary disclosure, for example, climate-related remuneration; frequency of climate-related management processes</p>	0–3
2	Strategy	0–9
2.1	<p>TCFD: “Describe the climate-related risks and opportunities the organization has identified over the short, medium, and long term.”</p> <p>1 = Non-specific qualitative disclosure, for example, climate risks identified but no time-horizons; statement regarding/plans to implement processes for identifying climate-related risks and opportunities (in line with the TCFD recommendations)</p> <p>2 = Specific qualitative disclosure, that is, climate risks are described in detail (incl. Time horizons and/or how these risks are identified)</p> <p>3 = Quantitative disclosure, for example, climate risks and opportunities are described using quantitative information such as the year a certain risk will potentially occur (incl. Transition risks through new reporting regulations)</p>	0–3
2.2	<p>TCFD: “Describe the impact of climate-related risks and opportunities on the organization’s business, strategy, and financial planning.”</p> <p>1 = Non-specific qualitative disclosure, for example, the impacts of climate-related risks and opportunities are only mentioned</p> <p>2 = Specific qualitative disclosure, for example, the impacts of climate-related risks and opportunities are comprehensively described</p> <p>3 = Quantitative/Monetary disclosure, for example, monetarization of identified climate-related risks or opportunities</p>	0–3
2.3	<p>TCFD: “Describe the resilience of the organization’s strategy, taking into consideration different climate-related scenarios, including a 2° C or lower scenario.”</p> <p>1 = Non-specific qualitative disclosure, for example, scenario analysis/analyses is/are used</p> <p>2 = Specific qualitative disclosure, for example, scenario analysis/analyses is/are used, and the impacts on the business are described</p> <p>3 = Quantitative/Monetary disclosure, for example, monetarization of impacts identified through (a) scenario analysis/analyses</p>	0–3
3	Risk Management	0–9
3.1	<p>TCFD: “Describe the organization’s processes for identifying and assessing climate-related risks.”</p> <p>1 = Non-specific qualitative disclosure, for example, determination of significance/materiality and classification of risks</p> <p>2 = Specific qualitative disclosure, for example, consideration of current and potential regulations, and other relevant factors</p> <p>3 = Quantitative/Monetary disclosure, for example, consideration of limits on emissions, climate change models, data and analytics</p>	0–3
3.2	<p>TCFD: “Describe the organization’s processes for managing climate-related risks.”</p> <p>1 = Non-specific qualitative disclosure, for example, specific measures for one/several identified climate-related risk(s) are described</p> <p>2 = Specific qualitative disclosure, for example, information on decision-making processes for mitigation, transfer, acceptance, or control of risks</p>	0–3

TABLE 1 (Continued)

No.	Scoring rationales for each reporting criterion recommended by TCFD (2017) and explanation of deviations from the TCFD recommendations, if applicable.	Point range
3.3	<p>3 = Quantitative/Monetary disclosure, for example, prioritization of identified transition and physical climate-related risks incl. How materiality determinations are made within their organization</p> <p>TCFD: “Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management.”</p> <p>1 = Non-specific qualitative disclosure, for example, information that states that climate-related risks are integrated into risk management</p> <p>2 = Specific qualitative disclosure, for example, information that states how climate-related risks are integrated into risk management</p> <p>3 = Quantitative/Monetary disclosure, for example, information on weighting of climate-related consideration in overall risk management</p>	0–3
4	Metrics and Targets	0–9
4.1	<p>TCFD: “Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management processes.”</p> <p>Note: Following Loew et al. (2021), the measures are considered even though the company does not state that they inform its strategy.</p> <p>1 = Non-specific qualitative disclosure, for example, measures defined, but not yet applied 2 = Specific qualitative disclosure, for example, qualitative measures; historical evolution of measures 3 = Quantitative disclosure, for example, quantitative measures regarding climate-related opportunities (revenue, services, etc.) or the companies' carbon performance (CO₂, energy consumption, etc.); quantitative historical evolution of measures</p>	0–3
4.2	<p>TCFD: “Disclose Scope 1, Scope 2 and, if appropriate, Scope 3 greenhouse gas (GHG) emissions, and related risks.”</p> <p>Note: Following Loew et al. (2021), the related risks are not considered in the assessment, as none of the companies disclose such information in the reference document.</p> <p>1 = Non-specific qualitative disclosure, for example, emissions are only mentioned</p> <p>2 = Specific (partly) qualitative disclosure, that is, emissions are (qualitatively) specifically described; emissions are quantified but no reference is made to the GHG emission scopes</p> <p>3 = Quantitative disclosure, that is, emissions are quantified and classified as Scope 1, Scope 2, or Scope 3 emissions</p>	0–3
4.3	<p>TCFD: “Describe the targets used by the organization to manage climate-related risks and opportunities and their performance against targets.”</p> <p>Note: Targets need to be defined at company level. It is not sufficient for the company to claim that it is committed to achieving (inter)national climate targets</p> <p>1 = Non-specific qualitative, that is, non-specific qualitative target with/without performance disclosure</p> <p>2 = Specific (partly) qualitative disclosure, that is, quantitative target with qualitative performance disclosure; specific qualitative target with quantitative performance disclosure</p> <p>3 = (Fully) quantitative disclosure, that is, quantitative goal with quantitative performance disclosure</p>	0–3
Total		0–33

Note: If the company does not disclose information regarding a reporting criterion, zero points are awarded for this criterion. Source: [where indicated] TCFD (2017); Loew et al., (2021).

Abbreviations: CEO, Chief Executive Officer; GHG, Greenhouse gas emissions; TCFD, Task Force on Climate-related Financial Disclosures.

appropriate, monetary disclosures. Two points are awarded for specific qualitative information. One point is awarded for non-specific qualitative information that only mentions or generally discusses the respective reporting items. Zero points are assigned, if a company did not disclose information on a given item. For a detailed overview of the TCFD reporting criteria and the scoring rationales for each reporting criterion see table 1.

Lastly, the reference documents are thoroughly screened until the highest suitable score is awarded. Hence, the maximum number of points is given if at least one statement in a reference document meets the thresholds defined in the CRQ Assessment Model. If the reporting media under investigation are embedded in a mainstream report (e.g., an annual report), disclosures from the entire reference document are considered because a differentiated analysis would be

very time consuming and error prone. For the same reason, and because climate reporting in Germany is still voluntary given the discretionary character of the current non-financial regulations, the assessment does not differentiate between voluntary and mandatory non-financial reporting disclosures.

After the assessment, a re-evaluation of the companies' disclosures is conducted to ensure consistency across firms and to reduce the degree of subjectivity. For this purpose, similar to Demaria and Rigot's (2021) approach, the initial scoring process involves a referenc- ing of all awarded points by relevant quotes from the companies' reports. Subsequently, each company's total CRQ score is calculated by dividing the sum of its achieved points by the maximum of achiev- able points. Thus, the maximum number of 33 points corresponds to a total CRQ score of 100%. Similarly, based on the scoring range per

TABLE 2 Weighting of TCFD reporting areas in the CRQ assessment model

Reporting area	No. of criteria	Maximum No. of points	Unweighted share	Weighted share
Governance	2	6	18.1%	25%
Strategy	3	9	27.3%	25%
Risk Management	3	9	27.3%	25%
Metrics and Targets	3	9	27.3%	25%
Total	11	33	100%	100%

Note: The unweighted shares of the reporting areas correspond to the rating approach in which all reporting criteria are weighted equally to form the companies' total climate reporting quality (CRQ) scores. The weighted shares account for the uneven distribution of criteria across the reporting areas and differences in the point scale and thus form the basis for the weighted total CRQ scores.

Abbreviations: CRQ, Climate Reporting Quality; TCFD, Task Force on Climate-related Financial Disclosures.

TCFD reporting area, each company receives a sub-score for its respective climate-related disclosures on governance, strategy, risk management, and metrics and targets. In this way, the analysis allows for a profound reflection on reporting gaps in the companies' disclosures.

However, one shortcoming of the total CRQ scoring results is that some disclosures are weighted more heavily than others due to the varying point ranges between TCFD reporting areas. To date, TCFD (2020) has not made such a distinction of relevance. For this reason, in a separate step, the *weighted total CRQ score* is formed by equal weighting of the four sub-scores. Again, this approach follows scholars' (Toms, 2002) suggestion to focus on substance rather than the number of required disclosures when constructing a reporting quality index (see Table 2).

To draw overall conclusions about the quality of the sample companies' climate reporting, the following rating scale is used, consistent with previous works on climate reporting (Wulf et al., 2020): A score of up to 25% indicates *rudimentary* reporting quality. A score between 25% and 50% indicates *restrained* reporting quality. A score of more than 50% up to 75% indicates *satisfactory* reporting quality. Finally, a score of more than 75% indicates *comprehensive* reporting quality.

4.1.3 | Decarbonization targets

Recognizing the fact that the climate targets by many companies are currently not aligned with the Paris Climate Agreement (Loew et al., 2021), the reference documents are re-screened for *science-based targets*. The term *science-based* often refers to decarbonization targets, which are in line with scientists' call to limit global warming to at least well below 2°C degrees compared to pre-industrial temperatures (KPMG, 2020). Following KPMG (2020), the screening checks whether the companies had a so-called net zero (or *carbon neutrality target*), using a binary scale from zero (=no) to one (=yes). Net zero refers to achieving an overall balance between carbon emissions produced and those released into the atmosphere (IPCC, 2018). However, whether companies' net zero targets are truly in line with global decarbonization goals depends on their scope and short-term stewardship. Therefore, the analysis further examines the underlying emission scope(s) of the companies' respective targets and whether the

companies have set any other (interim) reduction targets for their Scope 1, Scope 2, or Scope 3 emissions in 2018–2020. In addition, it is checked whether the companies have set an official science-based target in line with the criteria defined by the Science-Based Target Initiative. Due to the lack of climate reporting at the global scale, in a final step, the analysis focuses on the quality of the companies' supply chain related decarbonization targets using the three-point scale from the CRQ Assessment Model.

4.1.4 | Determinants for climate reporting

To identify differences in the quality of climate reporting based on carbon sensitivity, the sample companies are allocated to carbon-sensitive sectors (materials and buildings, transportation, energy) and less carbon-sensitive sectors using the Global Industry Classification Standard (GICS) and TCFD's (2017) guidance. After the CRQ assessment of all companies, an independent sample t-test assuming unequal variances is conducted to test whether the quality of climate reporting differs significantly between the two sector groups.

4.2 | Results

4.2.1 | Results of the CRQ assessment

Overall CRQ. Figure 1 illustrates the distribution of the (weighted) total climate reporting quality for the 25 sample firms. On average, the climate reporting quality increased from restrained levels in 2018 to satisfactory levels in 2019 and 2020 for both the unweighted and weighted total CRQ scores with respective average growth rates of 18% and 19%. However, the quality scores vary considerably between companies. The extreme values of the (weighted) total CRQ range from rudimentary reporting in 2018 and 2019, and restrained reporting in 2020 to satisfactory reporting in 2018 and comprehensive reporting quality in 2019 and 2020. The overall results are on average well below the 75% threshold for comprehensive reporting. The slightly lower scores for the weighted CRQ compared to the unweighted CRQ can be explained by higher weighting of governance in the former case. The increased quality scores over time as learning

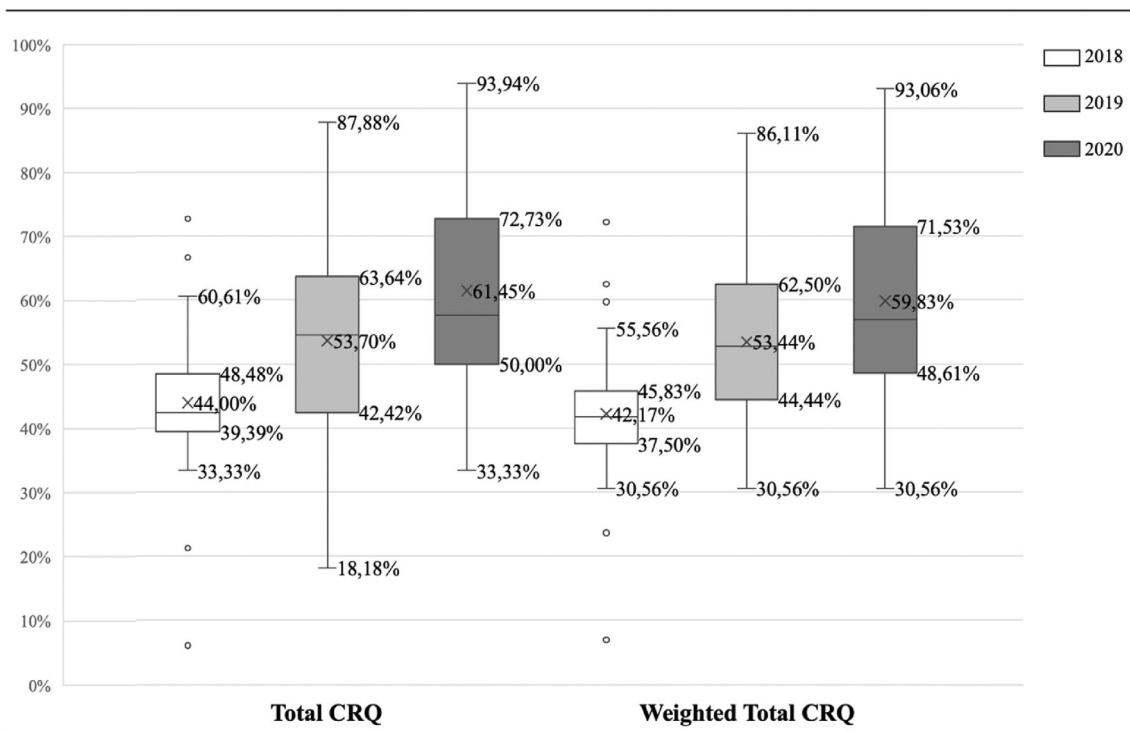


FIGURE 1 Climate reporting quality (CRQ) scores across sample companies

effects are in line with prior studies on the German capital market (e.g., Loew et al., 2021; Wulf et al., 2020), which also stresses reporting gaps and possible greenwashing behavior of included corporations.

CRQ Across TCFD Reporting Areas. Table 3 displays the mean CRQ across the areas of governance, strategy, risk management, and metrics and targets. On average, the companies showed the lowest levels of climate reporting quality in the governance and risk management domains ranging from rudimentary quality in 2018 to restrained quality in 2019 and 2020. Although most companies reported on sustainability-related governance, they rarely referred explicitly to climate-related issues, especially regarding the board oversight of carbon disclosure. Throughout the years, only about three companies have explicitly stated that their supervisory board has the role to oversee carbon risks and opportunities. Regarding the management's role in assessing and managing carbon risks and opportunities, the companies rarely provided quantitative information. For example, only eight (2019: three; 2018: two) companies included climate-related metrics or targets in their 2020 management compensation policies. As with the governance-related reporting, the companies' non-comprehensive CRQ in risk management stems from a lack of quantitative and descriptive items. For example, only eight companies in 2020 (2019: seven; 2018: five) reported that they integrate climate risks into their overall risk management, with only two companies indicating how this information is weighted. Despite the weakest results in these two areas, CRQ in governance and risk management has improved considerably in over the years, with growth rates of 38% and 58%, respectively. Thus, the sample companies appear to be

paying increasing attention to climate issues. The results in the area of strategy have developed from restrained to just about satisfactory over the examined period. Here, too, there is therefore clear potential for improvement in reporting. In particular, it became apparent that physical climate-related risks, such as greater probability of extreme weather events, were seldomly reported among the sample companies.

These findings are consistent with Loew et al. (2021), who claim that a focus on transition risks and opportunities, which are related to a shift towards a low-carbon economy, is an indication of companies' reluctance to adapt their business strategies. Moreover, the results can also be attributed to the low number of sample companies that used climate scenario analyses to inform their strategy. Thus, after 2018 still only three companies reported on the impact of climate scenarios on their business resilience. Hence, it is unclear to what extent the companies have truly integrated climate-related aspects into their strategies. These results can be explained by the tactical character of the information (Demaria & Rigot, 2021). In the area of metrics and targets, companies performed the strongest - almost all companies provided quantitative metrics for evaluating carbon risks and climate targets, which resulted in an average rating within the comprehensive range. Nonetheless, the companies reported a variety of different metrics, and targets for different scopes, which hamper their comparability, even within single industries. Furthermore, the results do not reflect whether the metrics have been managerially relevant to the respective companies, as essentially no company explicitly reported this information. These findings are in line with Loew et al. (2021) and highlight the need for companies to further improve and harmonize

TABLE 3 Scoring results

Year	Governance			Strategy			Risk management			Metrics and targets			Total CRQ score			
	1.1	1.2	Sub-score	2.1	2.2	2.3	3.1	3.2	3.3	Sub-score	4.1	4.2	4.3	Sub-score	Weighted Total score	
2020	Mean	0.76	1.76	42.00%	1.80	2.12	0.72	1.76	1.04	49.78%	2.88	3.00	2.76	96.00%	61.45%	59.83%
2020	Median	0.00	2.00	50.00%	2.00	2.00	1.00	2.00	1.00	55.56%	3.00	3.00	3.00	100.00%	57.58%	56.94%
2019	Mean	0.56	1.44	33.33%	1.72	2.00	0.56	1.16	0.72	35.11%	2.76	2.96	2.67	92.00%	53.70%	52.00%
2019	Median	0.00	1.00	33.33%	2.00	2.00	0.00	1.00	0.00	44.44%	3.00	3.00	3.00	100.00%	54.55%	51.39%
2018	Mean	0.28	1.04	22.00%	1.64	1.60	0.20	0.80	0.20	20.00%	2.64	2.84	2.48	84.44%	44.00%	42.17%
2018	Median	0.00	1.00	16.67%	1.00	2.00	0.00	1.00	0.00	11.11%	3.00	3.00	3.00	100.00%	42.42%	41.67%
	Mean Growth Rate	-	-	+38%	-	-	-	-	-	+58%	-	-	-	+4%	+18%	+19%
	Carbon sensitive	-	-	+31%	-	-	-	-	-	+72%	-	-	-	+3%	+19%	+20%
	Less carbon sens	-	-	+73%	-	-	-	-	-	+36%	-	-	-	+6%	+16%	+17%
	Two-sided T-test	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2020	t-value	-	-	2.145	-	-	-	-	-	2.131	-	-	-	2.079	2.201	2.201
2020	p-value	-	-	.071	-	-	-	-	-	.414	-	-	-	.710	.329	.270
2019	t-value	-	-	2.145	-	-	-	-	-	2.145	-	-	-	2.160	2.179	2.179
2019	p-value	-	-	.043 ^a	-	-	-	-	-	.668	-	-	-	.579	.319	.252
2018	t-value	-	-	2.068	-	-	-	-	-	2.160	-	-	-	2.178	2.179	2.160
2018	p-value	-	-	.005 ^b	-	-	-	-	-	.514	-	-	-	.681	.645	.474

^ap < .05.

^bp < .01.

TABLE 4 Results on the ambitiousness of decarbonization targets

Year		Carbon neutrality/net zero target			Other supply chain related target(s) Share of companies	Science-based target(s) Share of companies		
		Share of companies	Scope description	Scope 1			Scope 2	Scope 3
2020	Total	84.00%	85.71%	100.00%	88.89%	38.89%	44.00%	28.00%
2020	Carbon sensitive	87.50%	85.71%	100.00%	83.33%	41.67%	37.50%	18.75%
2020	Less carbon sensitive	77.78%	85.71%	100.00%	100.00%	33.33%	55.56%	44.44%
2019	Total	60.00%	80.00%	100.00%	83.33%	41.67%	16.00%	12.00%
2019	Carbon sensitive	62.50%	80.00%	100.00%	75.00%	37.50%	12.50%	6.25%
2019	Less carbon sensitive	55.56%	80.00%	100.00%	100.00%	50.00%	22.22%	22.22%
2018	Total	36.00%	88.89%	100.00%	62.50%	25.00%	16.00%	0.00%
2018	Carbon sensitive	43.75%	85.71%	100.00%	50.00%	16.67%	6.25%	0.00%
2018	Less carbon sensitive	22.22%	100.00%	100.00%	100.00%	50.00%	33.33%	0.00%

Note: The supply chain-related target(s) refer to quantitative targets. The science-based targets refer to emission reduction targets confirmed by the Science Based Targets Initiative.

their reporting on climate-related metrics. In addition, it is important to note that only a small number of companies reported their performance against their climate-related targets over multiple years, questioning the genuineness of their target setting. Lastly, the CRQ assessment focused on the quality of disclosures and did not address the content component of the companies' climate-related targets. Overall, the high CRQ scores in the metrics and targets domain therefore do not necessarily correspond to the actual reporting quality.

4.2.2 | Results on the ambitiousness of Decarbonization targets

Illustrating the ambitiousness of the companies' decarbonization targets, table 4 shows the number of companies that have set a net zero or carbon neutrality target for each year under investigation. Moreover, it presents the number of companies that provided information on the underlying scope(s) of their net zero or carbon neutrality target (in the following: net zero targets), and whether the companies have science-based target confirmed by the SBTi. In total, with 21 target setters in 2020, almost all have set themselves a net zero target. The most frequent time horizons among these were 2050, followed by 2040. These results correspond with the EU's long-term climate neutrality goal for 2050. However, research has shown that near-term action by 2030 is critical to meet the climate targets set under the Paris Agreement (United Nations Environment Programme, 2021). By 2020, only five of the companies examined have set themselves a time horizon of 2030, while only one company has set its target at 2025. Two companies did not provide any time horizon for their net zero or carbon neutrality target, suggesting that they have used the disclosure purely as a legitimization tool. It is also noticeable that not all companies described the underlying scopes of their net zero targets, making them incomprehensible and intransparent. Furthermore, only about one third of the companies that described the scopes of their target also related this target

to their upstream and downstream scope 3 emissions. Accordingly, most of the net zero targets relate to GHG emissions arising from the companies' own operations and emissions from energy supply. Apart from the net zero targets, not all companies have set other (interim) quantitative carbon reduction targets. This indicates that these companies had not established a clear strategy for achieving net zero or carbon neutrality, thereby limiting the credibility of their targets. The analysis further investigated the sample companies' decarbonization targets related to their supply chain (other than Scope 3 emissions reductions). Well below half of the companies have defined decarbonization targets other than carbon neutrality/net zero for their supply chain. Combined with the low number of Scope 3-related net zero targets, this shows that the supply chain is generally poorly considered in the decarbonization targets of the sample. Overall, as with the overall CRQ, a positive development of the decarbonization efforts of the sample companies was observed. However, the observed lack of target-specific information, including GHG emission scopes and time horizons, therefore stands to reason that most of the DAX 30 companies report decarbonization targets to present themselves in a favorable light rather than to alter their business activities in favor of a net zero carbon-neutral economy. This assumption is underlined by the small number of companies with confirmed science-based targets by the Science-Based Target Initiative. Thus, it is unclear whether the decarbonization targets of the remaining companies are largely tied to offsets instead of substantial emissions reductions from their own operations. Previous findings on climate reporting show a comparably low rate (9%) of science-based target setters among Germany's 17 largest companies (KPMG, 2020).

4.2.3 | Carbon-sensitive industries

Figure 2 displays the differences in the mean climate reporting quality scores based on the companies' levels of carbon sensitivity.

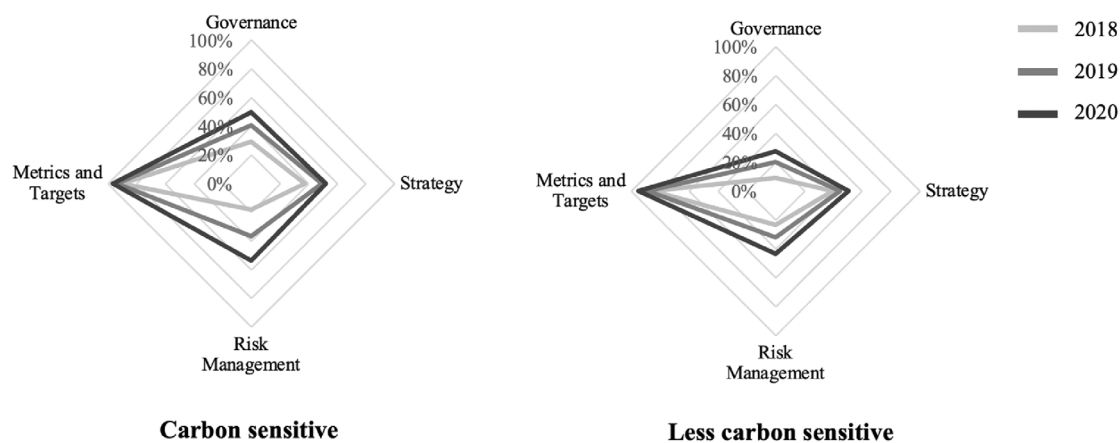


FIGURE 2 Mean CRQ across TCFD reporting areas

Although both, companies from carbon sensitive and less carbon sensitive industries have remained in the restrained to satisfactory range over the examined reporting years, carbon sensitive achieved higher overall CRQ scores in group comparison. These findings are consistent with previous studies that have found a positive relationship between carbon sensitivity and climate reporting quality (e.g., Hahn et al., 2015; Velte et al., 2020). At reporting level, the same pattern can be seen. Within the governance domain, carbon-sensitive firms achieved on average considerably higher CRQ scores than less carbon-sensitive firms. On the one hand, this result could be explained by the fact that companies from less carbon-sensitive industries already have a lower carbon impact, and therefore their boards may be less concerned with monitoring and managing climate issues. On the other hand, carbon-sensitive firms may face greater pressure from stakeholders to report on their boards' commitment to addressing climate aspects. Thus, the superior performance of carbon-sensitive firms can be explained from a legitimacy theory perspective. However, the quality of less carbon-sensitive firms improved by 73% over the period under review, while the growth rate for carbon-sensitive firms was only 31%. This indicates that less carbon-sensitive firms have also started to place greater importance on climate-related governance in recent years. The opposite development can be seen for risk management. While in 2018 less carbon-sensitive firms still scored higher than carbon-sensitive firms in this domain, the quality of carbon-sensitive firms improved by 72% by 2020, while the growth rate for less carbon-sensitive firms was only around 36%. In the strategy and metrics and targets sections, the results showed no major differences in the quality of reporting related to companies' carbon sensitivity. The latter could be explained by the long tradition of environmental reporting among German companies and the long persistence of the GHG protocol. The assessment of the ambitiousness of targets resulted in mixed performance results for the two groups. Overall, relatively more carbon sensitive companies have set themselves a carbon neutrality or net zero target. However, a difference in the targets' ambitiousness in terms of their emission scopes is evident. All carbon neutrality or net zero target setters that defined the scope of their target referred to direct emissions from their own

operations (scope 1). Apart from this, relatively more less carbon sensitive companies referred to indirect emissions in their carbon neutrality or net zero target. For example, 100% of the less carbon-sensitive target setters and only 83.33% (in 2020) of the carbon-sensitive companies have incorporated purchased energy for their own use, namely scope 2 emissions, into their targets. For scope 3 emissions, which relate to the upstream and downstream activities of firms, less carbon sensitive firms also performed better in 2018 and 2019. In 2020, carbon sensitive firms caught up in terms of scope 3 reference, but with a still modest rate of 42% among the target setters. This implies that carbon-sensitive companies use their targets as a legitimization tool rather than setting a goal to decarbonize their business, as their indirect emissions are inherently higher than their direct emissions, and account for the largest share of emissions generated in the DAX 30. Lastly, the less carbon-sensitive sample firms also performed better than carbon-sensitive companies regarding the setting of other quantitative emissions reduction targets for their supply chains.

In summary, the detailed examination of decarbonization targets revealed that carbon sensitive companies tend to report less ambitious emission reduction targets compared to less carbon sensitive firms considering the companies' main emission sources. This implies that carbon sensitive firms are more likely to engage in symbolic climate reporting practices and greenwashing behavior. However, corresponding t-tests (see Table 3) only showed statistical significance for the differences in CRQ in the governance domain for the years 2018 and 2019.

5 | DISCUSSION AND CONCLUDING REMARKS

5.1 | Implications for academia, business practice, and policy

The present study contributes to the climate reporting literature by providing a novel analysis of the quality of climate-related disclosures by German DAX 30 companies. On average, the results showed

higher climate reporting quality scores for carbon-sensitive firms compared to less carbon-sensitive companies. However, this difference was only found to be statistically significant for the governance domain in 2018 and 2019. The results can thus be justified by the following assumptions of legitimacy theory. The findings lead to the assumption that carbon-sensitive companies are more likely to report strategically relevant information on climate issues (e.g., to investors), whereas less carbon-sensitive firms are more likely to report about their good carbon performance and genuine climate-related activities. The more ambitious decarbonization targets of less carbon-sensitive firms' underscore this assumption. Thus, the findings support the usefulness of legitimacy theory in explaining the phenomenon of climate reporting. Moreover, the findings support the legitimacy theory assumptions that companies report the minimum to avoid stakeholder scrutiny and that companies' carbon sensitivity increases their pressure to legitimize their activities through climate-related disclosures (Hahn et al., 2015). However, even though firms with a lower carbon impact may be less pressured by stakeholders to disclose climate-related information (Hummel & Schlick, 2016), the results of this study suggest that they still use climate reporting as a tool to preserve legitimacy.

In addition to the academic contributions, this paper provides several implications for companies, and regulators. To begin with, it became clear throughout the analysis that the reporting behavior of the DAX 30 is very heterogeneous in terms of disclosure type. This does not only hamper the comparability of disclosures but also allows companies to engage in information overload and greenwashing (Yu et al., 2020). Consistent with previous climate reporting studies, the results of this paper thus stress the need for an integrated reporting (Velte, 2022). In the new CSRD, the EU standard setter includes a mandatory integration of sustainability in the management report. However, an integrated reporting of financial and ESG contents is not the consequence. The study also supports the introduction of mandatory (limited) assurance by the CSRD, considering the observed indications for symbolic reporting among the DAX 30 and previous evidence for the positive effect of assurance on climate reporting quality (Giannarakis et al., 2018). Furthermore, the lack of climate reporting (quality), particularly among less carbon-sensitive firms, indicates that the double materiality definition of the current NFRD has been too stringent. With regard to the new CSRD, the EU clarified that companies must also disclose information that are material from only the outside-in or the inside-out perspective (Stawinoga & Velte, 2022). Consequently, companies should no longer have an excuse for not reporting on climate issues in their non-financial declarations.

Overall, it should be mentioned that climate change is a global issue and thereby also requires solutions at the global level. It is therefore necessary to integrate climate-related aspects in the requirements of corporate reporting at the international level. While the ISSB will publish global sustainability reporting standards with a strong reliance on the TCFD recommendations, we expect an increased importance of climate-related financial disclosures in the following years. However, the current competition between the EU and the ISSB reporting standards represents a major challenge for European and

especially German firms. This study suggests that the EFRAG and ISSB standards should be carefully designed to ensure consistency with the TCFD recommendations and to avoid impeding a global solution in the future.

Lastly, in view of the risks of symbolic reporting, literature shows that climate reporting alone is unlikely to promote sustainable change towards a net zero future and that an integration of climate considerations into corporate governance systems and financial planning is likewise important. According to World Economic Forum (WEF, 2019), corporate climate governance is essential as companies' supervisory and management boards are responsible for the strategic and organizational integration of climate considerations (Pucheta Martinez et al., 2018). This suggests that governance constitutes an overarching role in fostering companies' climate mitigation and adaptation efforts (Velte, 2022). Future regulations should focus on the role of governance to account for the long-term interests of stakeholders. The paper supports suggestions to establish a set of binding key performance indicators and to foster green investments to meet the Paris Agreement (Garcia Sanchez et al., 2011). Since European companies must report on the environmental sustainability of their investments under the *EU Taxonomy* (as part of the EU Green Deal) since the fiscal year 2021, there is great potential for improvement in this regard.

5.2 | Limitations

The findings of this paper must be interpreted in light of limitations. A main limitation of this paper is the small sample size. Future research should also investigate the climate reporting quality by financial firms and small and medium-sized companies (SMEs), as their quality of climate reporting might differ to the results of this paper. While legitimacy theory suggests that these companies should have a lower quality of climate reporting than large PIEs, so far only one study investigated climate-related disclosures by German SMEs (Loew et al., 2021). In view of the increased amount of companies which must fulfill the new CSRD, researchers should therefore examine larger samples of both listed and non-listed firms in the future to provide further implications for policy and practice.

In addition, it is possible that the results do not capture all the information disclosed by the sample companies because some reporting media were excluded from the analysis. For the same reasons, a certain degree of subjectivity, especially in the scoring, cannot be ruled out. By using automated text analysis procedures, future studies could circumvent scoring inconsistencies, fatigue, and incorrect application of scoring rules among analysts, which are common issues of manual content analyses. In addition, big-data analytics would enable researchers to analyze large datasets in a short period of time, allowing for more accurate and comprehensive data on the quality of climate reporting in German or international samples. Furthermore, even though this study has examined a longer time period than the previous studies on climate reporting by German firms (Loew et al., 2021;

Wulf et al., 2020), the analysis still covers only three years. Future research should therefore continue to investigate the evolution of climate reporting quality in Germany.

5.3 | Summary and outlook

Climate change and its associated impacts are among the greatest risks facing businesses and the global economy. Stakeholders increasingly demand companies to report on their carbon performance and climate change mitigation and adaptation measures. Moreover, based on the current political discussion on compliance with the Paris Climate Agreement and companies' slow implementation of non-financial disclosure requirements, stricter climate reporting regulations within the European and German setting will likely follow in the coming years. Specifically, the TCFD recommendations are about to gain regulatory relevance in Germany. Against this backdrop, this paper aimed to assess the quality of climate reporting by German DAX 30 companies based on the TCFD recommendations. For this purpose, the paper applied a quantitative quality measure in line with legitimacy theory assumptions and environmental reporting research. The study thus contributes to the literature on climate reporting, which predominantly focuses on companies' compliance with reporting frameworks. Furthermore, the paper complements the studies on TCFD reporting and climate-related disclosures by German companies by adding the quality dimension.

While the overall quality of the sample companies' climate-related disclosures improved substantially between 2018–2020, the results show that there is still considerable room for improvement among carbon-sensitive as well as less carbon-sensitive firms. In particular, the companies showed poor reporting rates in the governance domain, indicating that they use climate reporting only symbolically to present themselves in a favorable light and to gain legitimacy in society.

Overall, the paper shows that the societal pressure on the DAX 30 companies regarding climate action, has not yet led to an adequate level of climate reporting quality. For this reason, stricter regulatory enforcement of climate reporting seems necessary. In this context, the paper provided several recommendations for policymakers in addition to implications for companies and future research. Even though some of the recommendations pose major challenges for companies, they should see the provision of climate-related information as an opportunity, as it can help them improve their climate-related activities. A recent study has found lower stock price declines for firms with high sustainability activities in the wake of the Covid-19 crises (Ding et al., 2021). Accordingly, timely and systematic management of climate risks and opportunities is essential for companies to avoid crisis mode (Haberl-Arkhurst & Sternisko, 2020) and to survive in the long term.

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REFERENCES

- Al-Tuwaijri, S. A., Christensen, T. E., & Hughes, K. E., II. (2004). The relations among environmental disclosure, environmental performance, and economic performance: A simultaneous equations approach. *Accounting, Organizations and Society*, 29, 447–471. [https://doi.org/10.1016/S0361-3682\(03\)00032-1](https://doi.org/10.1016/S0361-3682(03)00032-1)
- Armstrong, M. (2019). Europe's Biggest Greenhouse Gas Emitters. <https://www.statista.com/chart/19937/europes-biggest-greenhouse-gas-emitters/>
- Beck, A. C., Campbell, D., & Shrivs, P. J. (2010). Content analysis in environmental reporting research: Enrichment and rehearsal of the method in a British–German context. *The British Accounting Review*, 42, 207–222. <https://doi.org/10.1016/j.bar.2010.05.002>
- Berthelot, S., & Robert, A. M. (2011). Climate change disclosures: An examination of Canadian oil and gas firms. *Issues in Social and Environmental Accounting*, 5, 106–123. <https://doi.org/10.22164/isea.v5i2.61>
- Cho, C. H., Michelon, G., Patten, D. M., & Roberts, R. W. (2015). CSR disclosure: The more things change...? *Accounting, Auditing & Accountability Journal*, 28, 14–35. <https://doi.org/10.1108/AAJ-12-2013-1549>
- Cormier, D., Magnan, M., & van Velthoven, B. (2005). Environmental disclosure quality in large German companies: Economic incentives, public pressures or institutional conditions? *European Accounting Review*, 14, 3–39. <https://doi.org/10.1080/0963818042000339617>
- Deegan, C. (2002). The legitimizing effect of social and environmental disclosures - a theoretical foundation. *Accounting, Auditing & Accountability Journal*, 15, 282–311. <https://doi.org/10.1108/09513570210435852>
- Demaria, S., & Rigot, S. (2021). Corporate environmental reporting: Are French firms compliant with the task force on climate financial Disclosures' recommendations? *Business Strategy and the Environment*, 30, 721–738. <https://doi.org/10.1002/bse.2651>
- Demaria, S., Rigot, S., & Borie, S. (2019). A new measure of environmental reporting practice based on the recommendations of the Task Force on Climate-related Financial Disclosures. AFC 2019.
- Ding, W., Levine, R., Lin, C., & Xie, W. (2021). Corporate immunity to the COVID-19 pandemic. *Journal of Financial Economics*, 141, 802–830. <https://doi.org/10.1016/j.jfineco.2021.03.005>
- Dowling, J., & Pfeffer, J. (1975). Organizational legitimacy: Social values and organizational behavior. *Pacific Sociological Review*, 18, 122–136. <https://doi.org/10.2307/1388226>
- Eccles, R. G., & Krzus, M. P. (2017). An Analysis of Oil & Gas Company Disclosures from the Perspective of the Task Force on Climate-Related Financial Disclosures. SSRN. <https://doi.org/10.2139/ssrn.3091232>
- European Climate Initiative. (2020). 2020 Research Report: An analysis of the climate-related disclosures of 300 companies from Central, Eastern and Southern Europe pursuant to the EU Non-Financial Reporting Directive. <https://www.euki.de/euki-projects/nachhaltigkeitsbericht-unternehmen/>
- European Commission. (2022). Directive of the European Parliament and of the Council amending Directive 2013/34/EU, Directive 2004/109/EC, Directive 2006/43/EC and Regulation (EU) No 537/2014, as regards corporate sustainability reporting. https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en
- Gallego-Álvarez, I., Rodríguez-Domínguez, L., & García-Sánchez, I. M. (2011). Study of some explanatory factors in the opportunities arising from climate change. *Journal of Cleaner Production*, 19, 912–926. <https://doi.org/10.1016/j.jclepro.2011.02.012>
- Gerged, A. M., Cowton, C. J., & Beddewela, E. S. (2018). Towards sustainable development in the Arab Middle East and North Africa region: A

- longitudinal analysis of environmental disclosure in corporate annual reports. *Business Strategy and the Environment*, 27, 572–587. <https://doi.org/10.1002/bse.2021>
- Gerwanski, J., Kordsachia, O., & Velte, P. (2019). Determinants of materiality disclosure quality in integrated reporting: Empirical evidence from an international setting. *Business Strategy and the Environment*, 28, 750–770. <https://doi.org/10.1002/bse.2278>
- Giannarakis, G., Konteos, G., Sariannidis, N., & Chaitidis, G. (2017). The relation between voluntary carbon disclosure and environmental performance: The case of S&P 500. *International Journal of Law and Management*, 59, 784–803. <https://doi.org/10.1108/IJLMA-05-2016-0049>
- Giannarakis, G., Zafeiriou, E., Arabatzis, G., & Partalidou, X. (2018). Determinants of corporate climate change disclosure for European firms. *Corporate Social Responsibility and Environmental Management*, 25, 281–294. <https://doi.org/10.1002/csr.1461>
- Haberl-Arkurst, B., & Sternisko, A. (2020). Reporting on climate-related risks and opportunities—status quo and recommendations. *Die Unternehmung*, 74, 285–295. <https://doi.org/10.5771/0042-059X-2020-3-285>
- Hahn, R., Reimsbach, D., & Schiemann, F. (2015). Organizations, climate change, and transparency: Reviewing the literature on carbon disclosure. *Organization & Environment*, 28, 80–102. <https://doi.org/10.1177/1086026615575542>
- Hummel, K., Michelin, G., & Mittelbach-Hoermanseder, S. (2020). Sustainability Reporting: Information for whom? [Editorial]. *Die Unternehmung*. https://arc.eaa-online.org/sites/default/files/die_unternehmung_call_for_papers-sustainability_reporting.pdf
- Hummel, K., & Schlick, C. (2016). The relationship between sustainability performance and sustainability disclosure—reconciling voluntary disclosure theory and legitimacy theory. *Journal of Accounting and Public Policy*, 35, 455–476. <https://doi.org/10.1016/j.jaccpubpol.2016.06.001>
- IPCC. (2018). Masson-Delmotte, V., Zhai P., Pörtner H.-O., Roberts D., Skea J., Shukla P.R., Pirani A., Moufouma-Okia W., Péan C., Pidcock R., Connors S., Matthews J.B.R., Chen Y., Zhou X., Gomis M.I., Lonnoy E., Maycock T., Tignor M., and Waterfield T., Summary for policymakers. In: Global warming of 1.5°C. Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, (p. 32).
- ISSB. (2022). Exposure Draft. IFRS Sustainability Disclosure Standard. Draft IFRS S2 Climate-related Disclosures. <https://www.ifrs.org/projects/work-plan/climate-related-disclosures/exposure-draft-and-comment-letters/>
- Kouloukoui, D., de Oliveira Marinho, M. M., da Silva Gomes, S. M., Kiperstok, A., & Torres, E. A. (2019). Corporate climate risk management and the implementation of climate projects by the world's largest emitters. *Journal of Cleaner Production*, 238, 1–12. <https://doi.org/10.1016/j.jclepro.2019.117935>
- KPMG. (2020). Towards net zero: How the world's largest companies report on climate risk and net zero transition. KPMG Impact. <https://assets.kpmg/content/dam/kpmg/nl/pdf/2020/services/towards-net-zero-how-the-worlds-largest-companies-report-on-climate-risk-and-net-zero-transition.pdf>
- Krippendorff, K. (2012). Content analysis: An introduction to its methodology. Sage Publications.
- Liu, X., & Anbumozhi, V. (2009). Determinant factors of corporate environmental information disclosure: An empirical study of Chinese listed companies. *Journal of Cleaner Production*, 17, 593–600. <https://doi.org/10.1016/j.jclepro.2008.10.001>
- Loew, T., Braun, S., Fleischmann, J., Franz, M., Klein, A., Rink, S., & Hensel, L. (2021). Management von Klimarisiken in Unternehmen: Politische Entwicklungen, Konzepte und Berichtspraxis. Umweltbundesamt. https://www.umweltbundesamt.de/sites/default/files/medien/5750/publikationen/2021_02_01_cc_05-2021_management_klimarisiken_0.pdf
- Lyon, T. P., & Maxwell, J. W. (2011). Greenwash: Corporate environmental disclosure under threat of audit. *Journal of Economics & Management Strategy*, 20, 3–41. <https://doi.org/10.1111/j.1530-9134.2010.00282.x>
- Mahoney, L. S., Thorne, L., Cecil, L., & LaGore, W. (2013). A research note on standalone corporate social responsibility reports: Signaling or greenwashing? *Critical Perspectives on Accounting*, 24, 350–359. <https://doi.org/10.1016/j.cpa.2012.09.008>
- Pucheta-Martinez, M. C., & Chiva-Ortells, C. (2018). The role of directors representing institutional ownership in sustainable development through corporate social responsibility reporting. *Sustainable Development*, 26, 835–846.
- Qian, W., & Schaltegger, S. (2017). Revisiting carbon disclosure and performance: Legitimacy and management views. *The British Accounting Review*, 49, 365–379. <https://doi.org/10.1016/j.bar.2017.05.005>
- Stawinoga, M., & Velte, P. (2022). Single versus double materiality of corporate sustainability reporting? Which concept will contribute to climate neutral business? *Journal of Environmental Law and Policy*, 45, 210–248.
- Suchman, M. C. (1995). Managing legitimacy: Strategic and institutional approaches. *Academy of Management Review*, 20, 571–610. <https://doi.org/10.5465/amr.1995.9508080331>
- Sustainable Finance Committee of the German Federal Government. (2020). Interim Report. The Significance of Sustainable Finance to the Great Transformation. https://sustainable-finance-beirat.de/wp-content/uploads/2020/03/200306_SFB-Zwischenbericht_EN.pdf
- Task Force on Climate-related Financial Disclosures. (2017). Final report: recommendations of the task force on climate-related financial disclosures. <https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-TCFD-Report-062817.pdf>
- Task Force on Climate-related Financial Disclosures. (2020). 2020 Status Report: Task Force on Climate-related Financial Disclosures. <https://www.fsb.org/wp-content/uploads/P291020-1.pdf>
- Toms, J. S. (2002). Firm resources, quality signals and the determinants of corporate environmental reputation: Some UK evidence. *The British Accounting Review*, 34, 257–282. <https://doi.org/10.1006/bare.2002.0211>
- United Nations Environment Programme. (2021). Emissions Gap Report 2021: The Heat Is On—A World of Climate Promises Not Yet Delivered. <https://www.unep.org/resources/emissions-gap-report-2021?cldce=bnRlY29vcG1hbkJmMcyLm5ldA%3d%3d&recipientid=contact-ecd2390327e8e81181465065f38a3ba1-b91824f65e3d49c9b5a32c23e390fbfd&esid=a361a8b3-8d38-ec11-b6e6-002248242f47>
- Velte, P. (2022). Does sustainable corporate governance have an impact on materiality disclosure quality in integrated reporting? International evidence. Sustainable Development (online first).
- Velte, P., Stawinoga, M., & Lueg, R. (2020). Carbon performance and disclosure: A systematic review of governance-related determinants and financial consequences. *Journal of Cleaner Production*, 254, 120063.
- Wiseman, J. (1982). An evaluation of environmental disclosures made in corporate annual reports. *Accounting, Organizations and Society*, 7, 53–63. [https://doi.org/10.1016/0361-3682\(82\)90025-3](https://doi.org/10.1016/0361-3682(82)90025-3)
- World Economic Forum. (2019). How to Set Up Effective Climate Governance on Corporate Boards. http://www3.weforum.org/docs/WEF_Creating_effective_climate_governance_on_corporate_boards.pdf
- Wulf, I., Friedrich, T. J., Senger, A., & Staikowski, R. A. (2020). Klimabezogene Angaben in der nichtfinanziellen Pflichtberichterstattung –

Deskriptive Analyse und empirische Evidenz zur Berichtsqualität der DAX30-Unternehmen. *Zeitschrift für Umweltpolitik & Umweltrecht*, 4, 460–495.

Yu, E. P. Y., van Luu, B., & Chen, C. H. (2020). Greenwashing in environmental, social and governance disclosures. *Research in International Business and Finance*, 52, 101192. <https://doi.org/10.1016/j.ribaf.2020.101192>

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