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Climate risk disclosures. The risk perception perspective

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Organizations and institutions publish climate risk disclosures to provide information related to their carbon footprint and exposures to climate-related risks. While frameworks for climate-related risk disclosures, such as the Task Force on Climate-related Financial Disclosures (TCFD) have advanced this practice, challenges remain. Criticisms especially focus on some disclosures being more performative than substantive, focusing on improving the public image rather than driving meaningful impact. This paper explores in depth the mechanisms and relationships through which climate risk disclosures shape risk perceptions and further transferring risk and reliabilities among entities. It also examines how climate risk disclosures affect the understanding of both stakeholders and the broader public, and the extent to which they are enabling more risk-informed decision-making. To achieve this objective, we draw on insights from contemporary risk science with the main focus on risk perception research and current climate risk disclosure practices.

Keywords: Climate risk disclosure, climate risk, risk perception, risk science, TCFD, climate policy

1. Introduction

Recent years have witnessed growing recognition of climate change as a significant threat to financial stability. This realization of systemic climate risks has prompted action from central banks and global financial institutions (e.g., Reserve Bank of Australia, 2022; Financial Stability Board, 2015). Consequently, policymakers, central banks, and financial institutions have taken steps to address climate-related financial risks. One notable initiative is the Task Force on Climate-Related Financial Disclosures (TCFD), established in 2015 by the Financial Stability Board (FSB) to enhance global financial stability.

The TCFD aims to develop a standardized framework for climate-related risk disclosures, promoting consistency and reducing information asymmetry. In 2017, the TCFD released a comprehensive guide outlining how organizations should report and manage climate-related risks and opportunities, organized around four thematic areas: Governance, Strategy, Risk Management, and Metrics & Targets. The TCFD's recommendations have gained significant support from regulatory bodies worldwide, including the G20 and the European Union. By increasing transparency, the TCFD aims to empower financial investors to make informed decisions and drive market-based actions (Edwards et al., 2020).

While the TCFD has significantly advanced climate-related financial disclosures, it primarily focuses on managing climate risks within a business-as-usual (BAU) scenario. This approach, often overlooking a corporation's broader economic and social impacts on climate change, presents challenges in effectively utilizing disclosed information and driving radical, long-term systemic change (O'Dwyer & Unerman, 2020; Di Lernia, 2020). Furthermore, the voluntary nature of disclosure, the lack of comparable climate risk metrics, and the TCFD's primary focus on financial sector risks and transparency can undermine the effectiveness of disclosure requirements (Karatzoudi et al., 2024).

Some critics argue that climate risk disclosures are often superficial, prioritizing public image over genuine action. Research by Braasch and Velte (2022) supports this claim, showing that German firms often use such disclosures symbolically to enhance their social

legitimacy. However, other studies have shown that companies disclosing climate-related risks and opportunities are often rewarded with positive investor sentiment and a perception of increased social responsibility (Maji and Kalita, 2022; Ameli et al., 2020).

These contrasting perspectives underscore the importance of examining how climate risk disclosures affect the understanding of climate-related risks among stakeholders. Multiple papers across literature discuss the relationship between risk perceptions and climate change-related risks (see Pidgeon, 2012; Taylor et al., 2014; Van der Linden, 2017; Schneiderbauer, 2021). Many scholars advocate for further work related to climate change risk perceptions, describing it as crucial for climate policy and decision-making (Pidgeon, 2012).

This paper builds upon Karatzoudi et al. (2024), which adopts a systemic approach to climate risk disclosure, incorporating the public sector. This approach highlights how interdependencies between entities influence their risk exposure and disclosure practices. Crucially, one entity's disclosures can trigger cascading effects, impacting others' risk perceptions and decisions. Understanding these ripple effects is essential for comprehending the dynamics of risk propagation and interdependence within the system.

This paper contributes to the climate risk disclosure literature in the following ways. First, it offers a comprehensive review of current literature, highlighting the practical challenges and inherent limitations of disclosures as effective decision-making tools. Second, it investigates the relationship between climate risk disclosures and stakeholder understanding, building upon existing research on risk perception. Finally, it delves into the intricate mechanisms by which disclosures not only shape risk perceptions but also transfer further risk and reliability among entities and have the potential to incentivize more expanded disclosure practices.

The rest of the paper is organized as follows. Chapter 2 presents TCFD and other climate-related risk disclosure practices, as well as key risk perception concepts. Chapter 3 investigates the understanding of risk perception in the context of climate disclosures. Chapter 4 discusses mechanisms shaping risk perception, and finally, Chapter 5 introduces some concluding remarks.

2. Literature review

2.1. *A Review of climate-related financial disclosures*

Climate risk disclosures, initially a component of broader sustainability reporting, have gained significant prominence with the rise of mandated sustainability disclosures. Building upon the foundation laid by the United Nations' early voluntary initiatives and the evolving sophistication of various Non Governmental Organizations (NGO)-developed frameworks, the European Union (EU) has taken a leading role in driving Environmental, Social and Governance (ESG) regulation. For example, the Sustainable Finance Disclosure Regulation (SFDR) mandates financial market participants to disclose how they integrate ESG factors into their investment decisions, while the Taxonomy Regulation provides a crucial classification system for environmentally sustainable economic activities (Marczis et al. 2023).

Recognizing the limitations of the previous Non-Financial Reporting Directive (NFRD), the EU introduced the Corporate Sustainability Reporting Directive (CSRD). This directive mandates more detailed reporting on a company's environmental, social, and human rights impacts. Notably, the CSRD extends beyond the NFRD's scope to encompass all large EU companies, both listed and unlisted, with a phased implementation.

In the following section, we discuss how the focus of most prominent climate-related disclosures frameworks has evolved significantly over time.

2.1.1.*TCFD and other relevant frameworks: A changing focus overview*

Historically, climate risk reporting has been integrated within broader environmental or sustainability reporting frameworks, primarily voluntary and guided by diverse standards. A study by Jona and Soderstrom (2022) examines the focus evolution of climate-related reporting frameworks. Early focus centered on environmental impacts, such as greenhouse gas (GHG) emissions, with frameworks like Global Reporting Initiative (GRI) and Carbon Disclosure Project (CDP) emphasizing environmental metrics.

Over time, climate risk reporting became embedded within broader sustainability frameworks encompassing ESG factors, reflecting the interconnectedness of these issues. As the understanding of climate change's potential impact deepened, the focus shifted to the financial implications of climate risks. Frameworks like Climate Disclosure Standard Board (CDSB) and Task Force on Climate-related Financial Disclosures (TCFD) began emphasizing the impact of climate risks on a company's financial performance, strategy, and operations.

TCFD recommendations are now influencing mandatory climate-related reporting regulations. The EU issued supplementary guidelines based on TCFD recommendations (EC 2019/C 209/01), and other jurisdictions like New Zealand, Switzerland, and the UK have adopted mandatory disclosure policies aligned with TCFD. However, despite the TCFD's significance, inconsistencies persist across reporting frameworks and in their application by companies. This lack of consistent, comparable, and reliable disclosures presents challenges for investors and researchers.

The following section discusses challenges and limitations of current climate risk disclosure frameworks, highlighted in the literature.

2.1.2. *Criticism and limitations*

Despite increasing regulatory mandates, the landscape of corporate sustainability reporting remains fragmented, hindered by a proliferation of disclosure frameworks and standards. This fragmentation, exemplified by the existence of 17 distinct standards and frameworks utilized by EU companies for climate risk reporting alone (EFRAG, 2020), creates significant challenges for effective stakeholder decision-making. As Jona and Soderstrom (2022) highlight, this diversity in disclosure guidance leads to inconsistencies in reporting practices across companies and over time, hindering accurate comparisons of sustainability performance and assessments of corporate impact.

Furthermore, varying definitions of materiality across different frameworks significantly influence the focus and content of disclosures, exacerbating these challenges. These inconsistencies prevent investors and lenders from effectively using sustainability data in decision-making and make it difficult for researchers to conduct reliable analyses or draw meaningful conclusions.

Data collection and synthesis for reporting can be costly for companies, presenting challenges for both data providers and users. Acquiring and analyzing the necessary data can be resource intensive. Moreover, forward-looking information, crucial for assessing climate risks, is often required for disclosure, yet it remains challenging to assure and standardize. Compounding these challenges, the assurance of sustainability reporting is less standardized than financial reporting, leading to variability in the credibility and quality of the disclosed information.

The complexity of climate risk, encompassing physical and transition risks and opportunities, further complicates the task of comprehensive and accurate reporting. Finally, regulatory differences across jurisdictions intricate the task of ensuring consistent and comparable climate risk disclosures.

Several studies highlight other critical limitations of current climate risk disclosure practices. For example, as discussed in the introduction, Braasch and Velte (2022) observed that German companies often prioritize image enhancement over substantive disclosure, suggesting a gap between rhetoric and reality. Lee et al. (2022) found that companies, while recognizing the need for high-quality physical risk assessments, face challenges in accessing and utilizing such information effectively. Furthermore, Bastien & Giordano-Spring (2022) highlighted the inadequacy of current disclosures in the air transport sector, particularly regarding the strategic implications of climate change for companies. Chua et al. (2022) identified significant challenges in implementing scenario analysis and incorporating scientific uncertainties into corporate disclosures.

Beyond these challenges, some argue that the current focus on disclosure may be insufficient to drive the necessary systemic change. For example, Ameli et al. (2020) argued that transparency alone is insufficient to drive this necessary systemic change, while Christophers (2017, 2019) emphasized the potential for market volatility arising from investor behavior and questioned the effectiveness of disclosure-based approaches in ensuring financial stability. Di

Lernia (2018) argues that current disclosure requirements may not adequately address the long-term, systemic nature of climate change risks. Finally, Griffin & Jaffe (2021) stresses the need for a global, hybrid governance model to effectively address climate risk disclosure and ensure cross-border comparability.

Overall, while climate risk disclosure is valuable, its effectiveness is limited by inconsistent practices, varied materiality definitions, and a lack of standardized frameworks. Additional challenges include the complexity of climate risk, data constraints, and evolving regulations.

Moving forward, understanding how these disclosures shape risk perceptions among stakeholders is crucial. This leads us to explore the existing body of research on risk perception and its relationship with climate disclosures.

2.2. *Risk perception research*

In addressing limitations of climate risk disclosures, it is relevant to discuss the role of risk perceptions in shaping stakeholder responses to such information. Risk perception is understood as "a person's subjective judgement or appraisal of risk" (Aven, et al. 2018). Along with not being entirely objective, they are also heavily influenced by heuristics, cognitive biases, and other factors. Tversky and Kahneman (1974) discuss three heuristics in detail: representativeness, availability, and adjustment from an anchor.

The availability heuristic, for example, leads individuals to estimate the event based on their ability to recall familiar examples with ease (Tversky and Kahneman, 1973). An experience of a recent flood event can lead to heightened perceived climate risks. Another heuristic relevant to the context is the affect heuristic. In climate settings, a video of a polar bear stranded on a melting iceberg could provoke sympathy and concern, since polar bears often trigger positive emotions. Even visualizing unseen risk can lead to enhanced risk perception (Lee et al. 2023).

Researchers investigating risk perceptions have also developed a psychometric paradigm, a framework that categorizes risks based on dimensions such as dread, familiarity and controllability (Slovic, 1992). Studies using this framework show laypersons, but also experts, are prone to many of the same biases, especially when they have to go beyond the data available (Slovic, et al. 1982). An interesting example is by Bostrom et al. (2020) where they, by using the psychometric paradigm, found familiarity to be relevant, since climate change was perceived as an "old" risk, having a much clearer scientific understanding than at the time, less-known pandemic.

2.2.1. *How risk perceptions influence decision-making*

Perceptions of risk are crucial for understanding decision-making processes. Early research addressed rational evaluation of alternatives, but the 1980s brought an additional dimension of intuition and emotion (Böhm & Brun, 2008). How individuals and organizations perceive risks, strongly impacts how they prioritize, react, and make decisions. This is important for complex issues, such as climate change.

Further, the Social amplification of risk framework (SARF) suggests that the portrayal of certain risks can amplify or attenuate the perceptions of risks (Kasperson, et al. 1988). Renn (2011) explains that climate change risks have been amplified due to their impact resonating with concerns like monetary losses and human and ecological damage. However, as he elaborates, if both the problem and the solution lead to amplified risk, they can create political paralysis. Kasperson, et al. (2022) argue that also social amplification of risk should be taken into account when analyzing public and regulatory reactions to risk events.

To understand the relevance of risk perceptions for climate risk disclosures, we will investigate their relationship in the following chapter.

3. Understanding risk perception in the context of climate disclosures

Understanding risk perceptions can advance the effectiveness of climate risk disclosures and address their limitations. Research has shown that risk perceptions influence intention in mitigating climate change (Rodriguez et al. 2014; Van Valkengoed et al. 2023). Perceptions of climate risks help encourage corporate green investments (Li & Tian, 2024). At the same time, Bang & Burton (2021) explain that failing to incorporate contemporary flood risk perceptions into

England's climate risk management strategies led to increased flood impacts.

The goal of climate risk disclosures is to increase the transparency of climate risks (Amar et al., 2022), assigning them a key role in shaping perceptions of the stakeholders. However, the result depends on how the information is presented. Insufficient transparency can decrease trust (Bearth & Siegrist, 2021). On the other hand, transparency policies can unintentionally lead to risky public behaviors (Bouder et al., 2015).

Research in other fields shows how different disclosures shape risk perceptions. Delistavrou et al. (2023) detected a link between risk perceptions and the intention to buy new, green cosmetics and detergents. Linzenich et al. (2022) show that lower risk perceptions lead to greater openness toward CO2-based fuels.

In the financial sector, Linciano et al. (2018) investigated the relationship of financial information disclosures and Italian investors' risk perceptions. The complexity of the financial information disclosure leads to increased risk perceptions of solicited products. Similarly, Gentile et al. (2015) found that risk perception is context-dependent and deeply affected by the way financial information is disclosed. Baudot et al. (2020) addressing corporate responsibility disclosures, found that stakeholders' risk perceptions influence how risk is perceived.

Investigating environmental disclosures, Yu et al. (2021) found that increased environmental disclosures initially lower a firm's ex ante cost of equity, but beyond a certain threshold, the cost increase again.

4. Discussion: Risk perception shaping mechanisms of climate risk disclosures

Understanding risk perceptions in the context of climate risk disclosure is significant, as they do not only influence public behaviour, but also the behaviour of all relevant stakeholders in the process. Moreover, they can lead to enhanced transparency and positively impact the success of climate risk communication. In this framing, it is interesting to examine how climate risk-related disclosures transfer further risks and liabilities, as well as their implications in decision-making.

4.1. *Responsibility transfer*

Building upon the findings of Karatzoudi et al. (2024), which emphasize the interconnectedness of climate risk-related disclosures within a system including public sector, this paper explores how climate risk disclosures not only influence corporate behavior but also shape risk perceptions and potentially shift the responsibility for climate action. This systemic perspective recognizes that disclosures by one entity, whether a corporation or a government agency, can have ripple effects on the risk perceptions and decisions of others within the system. For example, when an entity discloses its climate-related risks, it not only exposes its own vulnerabilities but also transfers a degree of responsibility and liability to other interconnected entities. As seen in the Stephens Ranch Wind Farm case (Woodall, 2021), it highlights how cases of legal negligence are informed by public bodies' disclosures and the actions of other similar actors. This transfer of responsibility can incentivize others to reassess their own risks and disclosure practices, creating the prospect of increased awareness and transparency across the system.

Interestingly, this framing suggests that public sector disclosure itself can act as a powerful intervention. The act of public sector disclosure by government, such as the release of scientific reports, legal proceedings related to climate negligence (as exemplified by the Stephens Ranch Wind Farm case), or the publication of climate-related risk assessments, can significantly influence the broader disclosure regime. By providing crucial information and setting expectations, public sector disclosures can incentivize private sector entities to proactively address climate risks and enhance their own disclosure practices (Karatzoudi et al.2024). This approach suggests that achieving desired outcomes may not solely rely on directly mandating private sector disclosure, but rather on leveraging the power of public sector information to drive change within the system.

This observation aligns with the principal-agent problem, an economic concept where one party (the "principal") delegates a task to another (the "agent"). While the principal (e.g., society, regulators) seeks the agent's (e.g., corporations) actions to benefit them, the agent may have differing incentives. In the context of climate risk disclosure, the TCFD framework and other

relevant works represent the principal's (governments, regulators, and stakeholders) attempt to guide the agent (corporations) towards disclosures that benefit society. This aims to ensure accurate assessment and disclosure of climate-related risks and opportunities, enabling better-informed decision-making by investors, creditors, and other stakeholders.

4.2. *Decision-making implications*

Climate risk disclosures are seen as a key strategy guidance tool that can significantly influence decision-making. Frameworks, like TCFD, aim to standardize practices but face challenges such as inconsistent reporting, varying frameworks, and unclear disclosure requirements. These issues distort stakeholders' risk perceptions and hinder effective decisions.

The data in disclosures must be simple and accessible, ensuring that all stakeholders understand the implications of the disclosed risks. According to Yu et al. (2021), balanced disclosures positively influence investment decisions. Löfstedt & Bouder (2017) found that disseminating excessive raw scientific data can skew stakeholders' risk perceptions and lead to counterproductive outcomes. Further, Doran and Ogunbode (2023) reveal that emotionally engaging messages about climate risks raise more awareness and concern than plain facts. This relates back to the importance of the affect heuristic in a climate context. Such ambiguous situations could also lead to amplification or attenuation of risk perception, hindering the decision-making process.

Another challenge is risk literacy (Aven, 2023). It is understood as the ability to understand, evaluate, and act on risk-related information to make proper decisions. This is highly relevant for all the involved stakeholders in the climate risk disclosures context. For instance, poor characterization in The Norwegian Institute for Public Health (FHI, 2021) guidance on vaccination caused problems, and highlighted issues also present in climate risk disclosures.

5. Conclusions

This paper reviewed and emphasized key challenges in climate disclosure practices, including inconsistent reporting, limited comparability, and data quality issues, and examined the implications they create in decision-making. Furthermore, by recognizing the key role of risk perceptions in understanding the effectiveness of climate risk disclosures, we explored key concepts of risk perception research. We concluded that stakeholders' understanding, interpretation, and responses to disclosed information are strongly dependent on risk perception, and thus climate risk disclosures present the potential to further transfer risk and liability among actors in the system. Some key points:

- The effectiveness of climate risk disclosures can be advanced by enhanced understanding of risk perceptions and underlying biases and heuristics.
- Climate risk disclosures, particularly those from the public sector, function as a systemic tool to influence corporate behavior, shift risk perceptions, and distribute responsibility for climate action.
- Addressing inconsistency, comparability, and data quality is essential to improving climate risk disclosures and enabling more risk-informed decision-making.
- Improved risk literacy and clear communication are crucial for effective, decision-guiding disclosures.

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