technische universität dortmund

Corporate Scope 3 CO_2 Reporting as an Enabler of Supply Chain Decarbonization: A Series of Analyses on the Factors influencing Firms' Adoption and Response Behavior

DISSERTATION

submitted in partial fulfillment of the requirement for the

degree of doctor rerum politicarum (Dr. rer. pol.) at the

Department of Business and Economics

of the TU Dortmund University

by

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After a successful oral examination, this dissertation was approved by the examination committee consisting of Lorenz Graf-Vlachy, Simon Hensellek and Christiane Pott on Tuesday 19th November 2024 in Dortmund, Germany.

Summary

Firms worldwide are currently investigating how they can contribute to global supply chain decarbonization. The effects of climate change become more and more visible, and firms increasingly analyze how they can reduce their impact on climate change. In those endeavors, the decarbonization of entire supply chains is a particularly complex challenge. To address this challenge, corporate Scope 3 emission reporting is a vital first step.

Firms adoption of Scope 3 reporting is subject to a plethora of influencing factors. As of today, firms are not adequately prepared to conduct Scope 3 reporting at the level needed to meet the Paris agreement. A critical reason for that is its currently voluntary nature. Therefore, discontinuous regulatory change that mandates Scope 3 reporting is highly anticipated.

The purpose of this dissertation is to analyze the factors influencing firms' adoption and response behavior towards Scope 3 reporting. For that, this dissertation provides three related research papers that investigate if and how firms adopt Scope 3 reporting. Research paper 1 provides a holistic literature review and research agenda of corporate Scope 3 reporting. Research Paper 2 assesses how firms respond to anticipated discontinuous regulatory change in the context of prospectively mandatory Scope 3 reporting. Research Paper 3 addresses practitioners on why firms do not report Scope 3 emissions, and why and how they should.

This dissertation entails significant implications for academia and practice. It advances the academic knowledge of Scope 3 reporting as it adds a comprehensive research framework and uses it to holistically structure the literature and its gaps. Further, it expands the field of discontinuous change as it provides novel theory on firm response towards discontinuous regulatory change as a distinct type of discontinuous change. Finally, it enables practitioners to leverage academic knowledge to drive adoption of Scope 3 reporting and ultimately, to achieve supply chain decarbonization.

Acknowledgements

I gratefully acknowledge the thoughtful comments by the seminar participants at the TU Dortmund University and the participants of the SMS 41st Annual Conference in Toronto 2023, as well as the insightful recommendations of the anonymous reviewers that conducted the peer-review processes of the research papers presented in this dissertation. Further, I appreciatively acknowledge the support received by Metalshub GmbH on accessing their professional network within the European steel industry for the purpose of conducting qualitative research. Finally, I particularly want to thank Lorenz Graf-Vlachy for his outstanding guidance and mentoring throughout the process of preparing this dissertation.

Overview of Research Papers

Research Paper 1 - Corporate Scope 3 Carbon Emission Reporting as an Enabler of Supply Chain Decarbonization: A Systematic Review and Comprehensive Research Agenda

By Maximilian Hettler, Lorenz Graf-Vlachy

Published in June 2023 in Business Strategy and the Environment, 33(2), 263-282. https://doi.org/10.1002/bse.3486

Research Paper 2 - Incumbent Responses to Anticipated Discontinuous Regulatory Change: The Case of Scope 3 CO_2 Reporting in the Steel Industry

By Maximilian Hettler, Lorenz Graf-Vlachy

Published in November 2024 in Journal of Cleaner Production. Article number 144109.. *https://doi.org/10.1016/j.jclepro.2024.144109*

Research Paper 3 - Why Firms are not Reporting their Scope 3 CO_2 Emissions, Why they should, and How to do it right

By Maximilian Hettler, Lorenz Graf-Vlachy

Published in March 2024 in California Management Review Insights. *https://cmr.berkeley.edu/2024/03/why-firms-are-not-reporting-their-scope-3-co2-emissions/*

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List of Abbreviations and Acronyms

BAT	Best Available Techniques
CCF	Corporate Carbon Footprint
CDP	Carbon Disclosure Project
CEO	Chief Executive Officer
CO2	Carbon Dioxide
ESG	Environmental Social Governance
EU	European Union
FT50	Financial Times Top 50
FTE	Full-Time Equivalent
GDPR	General Data Protection Regulation
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
MSCI	Morgan Stanley Capital International
NGER	National Greenhouse and Energy Reporting
NGO	Non-Governmental Organization
PCF	Product Carbon Footprint
S&P	Standard & Poor's
SBTi	Science Based Targets initiative
TÜV	Technical Inspection Association (“Technischer Überwachungsverein”)
UK DEFRA	United Kingdom Department for Environment, Food & Rural Affairs
US EPA	United States Environmental Protection Agency
VHB NAMA	German Academic Association of Business Research’s scientific committee for sustainable management (“Verband der Hochschullehrer für Betriebswirtschaft Kommission für Nachhaltigkeitsmanagement”)

1 Introduction

Chapter 1 of this dissertation provides an overview of the central topic of this dissertation. It introduces this dissertation's motivation, conceptual background, and intended contribution, and summarizes the three research papers at the heart of this dissertation. Chapters 2, 3, and 4 contain the full-length versions of the three research papers. As Chapter 5 provides a thorough discussion and conclusion for all three research papers collectively, Chapter 1 only entails a brief summary of the implications of each individual research paper.

Firms worldwide and society more broadly start to experience the fatal effects of climate change and investigate how to address this complex issue. Average global temperatures continue to rise as the year 2023 marks the warmest calendar year ever recorded (EU Copernicus, 2024), while droughts, floods, and wildfires across the globe increase in abundance and severity (IPCC, 2023). In recent years, firms have significantly increased their efforts and commitments to reduce their impact on climate change (Blanco, 2021; CDP, 2023). For that, measuring and reporting a firm's carbon footprint is a vital first step (Lee, 2012; Weinhofer & Hoffmann, 2010).

A firm's total carbon emissions are comprised of three scopes, of which Scope 3 emissions (or "supply chain emissions") are the most complex to measure and hardest to abate. Scope 1 and 2 emissions, defined as "direct emissions from owned or controlled sources" and "indirect emissions from the generation of purchased energy consumed by the reporting company", respectively (Callahan et al., 2011, p. 5) are less complex in their measurement and reporting because they can mostly be determined via internal firm processes only (Hahn et al., 2015). The measurement of Scope 3 emissions, defined as "all other indirect emissions that occur in a company's value chain" (Callahan et al., 2011, p. 5), involves external stakeholder engagement with suppliers, customers, and others (Dahlmann & Rohrich, 2019; Downie & Stubbs, 2012),

requires more complex data (Busch et al., 2022), and is more extensive in its determination process (Patchell, 2018).

A more widespread adoption of Scope 3 reporting is required to support the decarbonization of global supply chains at the pace needed to meet the Paris agreement targets. For many firms, Scope 3 reporting is not yet an established business process (Blanco et al., 2016; Dahlmann & Rohrich, 2019). As Scope 3 emissions often constitute the large majority of a firm's total carbon footprint (Blanco et al., 2016; CDP, 2023), not measuring and reporting Scope 3 emissions may pose the risk of misinterpreting the firm's impact on climate change, lead to poor strategic decision making, and limit the firm's ability to decarbonize (Dhanda et al., 2022; Isil & Sebastianelli, 2020). As of today, Scope 3 reporting is not enforced under any regulatory framework and therefore fully voluntary (Blanco, 2021).

Mandatory Scope 3 reporting through prospective regulatory change is widely anticipated and would introduce a discontinuous change for most firms. As of today, Scope 3 reporting is not part of any enforced regulatory framework and therefore voluntary in nature (Blanco, 2021). Due to the urgent need to decarbonize global supply chains, a new regulation introducing mandatory Scope 3 reporting is widely anticipated (Euractiv, 2022; Reuters, 2023) and frequently called for in many industries (European Steel Association, 2020). Since many firms do not conduct Scope 3 reporting voluntarily, a forced implementation through regulatory change would represent a discontinuous regulatory change for these firms.

Prior research investigated carbon emission reporting and how firms disclose their carbon emissions in general. Hahn et al. (2015) and Velte et al. (2020) performed systematic literature reviews on carbon emission reporting, and developed research frameworks of theoretical perspectives, antecedents, consequences, and moderators. Other scholars further contributed studies that investigate relationships between emission reporting and one or more of its theoretical perspectives, antecedents, consequences, or moderators. For example, Patchell

(2018) assessed the relationship between a Scope 3 reporting standard and firms' Scope 3 reporting, and Wedari et al. (2021) analyzed the relationship between carbon emission reporting and firms' public perception. Notably, in a rare example, one group of scholars articulated their research in a practitioner oriented manner and explained to managers that enhancing Scope 3 reporting via supplier engagement will affect their firms' perceived total footprint due to more accurate data (Dahlmann et al., 2024).

Furthermore, scholars built a strong conceptual foundation on how firms respond to discontinuous and institutional change. How firms react to discontinuous change, i.e., disruptive elements that significantly change conventional structures of value creation, innovation, and organizational processes, has long been a vibrant field of research (Anderson & Tushman, 1990; Christensen, 2006; Christensen & Bower, 1996; Gilbert, 2005). Researchers identified various adaptation barriers and firmly established that firms respond heterogeneously to the same discontinuous change (Eggers & Park, 2018; Kammerlander et al., 2018; König et al., 2012). For example, König et al. (2021) portrayed the influence of managers' opportunity and threat perception on their firms' inertia in response to the same discontinuous change. Relatedly, scholars investigated how firms respond to institutional change, i.e., changes in one or more of the three (coercive, normative, and mimetic) institutional pressures (Scott, 2008), and also found that firms respond heterogeneously. For example, Greenwood et al. (2011) explained that firms experience institutional pressures differently based on their organizational characteristics and position in their field, and therefore react differently.

However, the extant literature is insufficient to holistically structure and explain the various relationships of Scope 3 reporting, lacks guidance for practitioners, and fails to differentiate the nuances of discontinuous regulatory change as a pronounced type of discontinuous change. The existing reviews structure the literature for Scope 1 and 2 reporting only, and due to the complexity of Scope 3 reporting (e.g., the need to engage external stakeholders), their findings

might not readily transfer to Scope 3 emissions. The literature specific to Scope 3 reporting is highly fragmented, entails only little empirical research, and for some relationships of Scope 3 reporting, lacks studies entirely (e.g., its impact on public perception). Practitioner-oriented work is scarce as well. Furthermore, discontinuous regulatory changes are understudied in the field of discontinuous change and institutionalism as, for example, in the recent review by Eggers and Park (2018), regulatory change is not mentioned as a key source of change. Scholars also mostly focus on discontinuous innovations as the main type of discontinuous change and therefore primarily investigate the timespan after the occurrence of a discontinuous change (Christensen et al., 2018; Kumaraswamy et al., 2018). For discontinuous regulatory changes, however, the timespan prior to its occurrence is particularly important because its design is developed exclusively during that period (Malesky & Taussig, 2016). Institutionalist perspectives further widen the understanding of firms' response to regulatory change but usually only consider incremental rather than discontinuous regulatory changes (Greenwood et al., 2011; Raaijmakers et al., 2014).

The shortcomings of the literature are problematic for several reasons. First, they make the current state of the academic literature on Scope 3 reporting difficult to oversee and therefore, researchers as well as practitioners may not be able to fully grasp which elements the literature about Scope 3 reporting already contains and which still need to be researched. Second, they may hinder a more effective application of the accumulated academic knowledge in practice and thereby limit academia's impact on battling climate change. Third, they limit our understanding of firms' behavior in response to discontinuous regulatory change, especially during the timespan prior to its occurrence, which may lead to imprecise or wrong recommendations and conclusions. Lastly, they inhibit policymakers' ability to design and enforce effective regulation and to optimally cooperate with firms' during that process.

This dissertation aims to mitigate these shortcomings and contribute to the existing academic literature via three distinct research papers. In Research Paper 1, I provide a holistic research framework for carbon emission reporting, structure the entire research landscape of Scope 3 reporting along that framework, and outline an extensive agenda for future research. In Research Paper 2, I explain how incumbents respond to anticipated discontinuous regulatory change, which is expected to be a key driver for the advancement of supply chain decarbonization, using the case of Scope 3 CO_2 reporting in the European steel industry. In Research Paper 3, I analyze why firms are not yet reporting Scope 3 emissions in practice, portray reasons why firms should report their Scope 3 emissions, and develop actionable recommendations for practitioners to improve their ability to implement Scope 3 reporting within their firms. In the remainder of Chapter 1, please find the summaries of these three research papers.

1.1 Summary of Research Paper 1

There is an urgent need to review and integrate extant research specific to corporate Scope 3 reporting. Research specific to Scope 3 reporting has seen a significant increase in recent years. Previously conducted literature reviews by Hahn et al. (2015) and Nuber and Velte (2021) only address Scope 1 and 2 reporting and their findings may not readily transfer to Scope 3 emissions. Consequently, researchers are currently not able to oversee the full research landscape on Scope 3 reporting. Hence, I seek to answer two interrelated research questions: (1) *What is the current state of the academic literature on corporate Scope 3 carbon emission reporting and how can the literature best be structured?* and (2) *What are promising areas for future research?*.

To address these research questions, I applied the well-established procedures of a systematic literature review (Rousseau et al., 2008; Webster & Watson, 2002). In line with previous reviews and related work (Graf-Vlachy et al., 2020; Hahn et al., 2015; Schaedler et al., 2022; Velte et al., 2020), I used two separate journal lists to include all relevant literature from broader strategic management as well as the more specialized field of sustainability management. Subsequently, I applied extensive keyword searches using the Web of Science database. As of August 2022, their approach led to 205 unique articles, which were then further filtered down to a list of 151 articles considered in this review. Thereof, 62 articles directly addressed Scope 3 emissions and were reviewed for the main purpose of this article. The remaining 89 articles were reviewed as a starting point and inspiration for the development of the agenda for further research.

The main finding of this paper is the research framework presented in Paper 1 | Figure 9. During the review process, I iteratively developed a research framework comprising the applied theoretical lenses, the characteristics of carbon emission reporting itself as well as its antecedents, consequences, and moderators. I identified three relevant theoretical lenses -

legitimacy theory, stakeholder and institutional theory, and the best available techniques concept (BAT) - and characterized emission reporting by scope and quality. Further, I differentiated antecedents of emission reporting along regulation, motivation, and ability, and differentiated consequences along environment, performance, and stakeholders. Finally, I identified moderators for the relationships between antecedents and emission reporting as well as between emission reporting and consequences.

I use this research framework to lay out the literature on Scope 3 reporting and to provide avenues for future research. In the results section of this research paper, I explain the relationships of Scope 3 reporting with its theoretical lenses, antecedents, consequences, and moderators by describing how each of the 62 identified articles contributes to the understanding of those relationships. Subsequently, I identify gaps in the literature on Scope 3 reporting and provide recommendations to the research community on how to leverage the previous work of the 89 articles on Scope 1 and 2 reporting for the purpose of advancing the understanding of Scope 3 reporting. Lastly, the research framework helps identify patterns within the extant literature. For example, the literature contains a relatively high share of case studies which implies that we are at an early stage of the development of this field, where a lot of work is still theory building rather than theory testing.

With this research paper, I make four valuable contributions to the academic literature. First, I developed a holistic research framework for general carbon emission reporting with a level of comprehensiveness unique to the extant literature. Thereby, I allow the reader to easily access the broad existing knowledge by selecting which aspect or relationship of emission reporting they intend to study. Second, I make the complex issue of Scope 3 reporting easier to digest by structuring it along the research framework. This may help both researchers and practitioners in understanding how supply chain decarbonization shall be approached. Third, I highlight patterns in the literature which supports researchers in choosing and evaluating different

research methodologies. Fourth, I contribute an extensive agenda for future research which enables other scholars to effectively advance the collective understanding of this important field of research.

1.2 Summary of Research Paper 2

There is an urgent need to investigate how firms respond to anticipated discontinuous regulatory change. Discontinuous regulatory changes are expected to occur ever more frequently to address and regulate emerging global issues, such as climate change, artificial intelligence, or data protection (Candelon et al., 2021; Council of the European Union, 2023; Peukert et al., 2022; US EPA, 2022). In the case of Scope 3 reporting, such discontinuous regulatory change is often explicitly called for by many industry participants. However, the extant discontinuous change and institutionalism literatures are insufficient to explain how firms behave in the context of such discontinuous regulatory changes, especially during their design phases prior to their occurrence. Consequently, researchers are currently not able to fully explicate if, why, and how firms respond to discontinuous regulatory change, which poses the risk of misinterpreting or missing behavioral patterns that firms exhibit and limits academia's ability to inform practitioners and policymakers. Hence, I ask the question: *How do incumbent firms act in the face of anticipated discontinuous regulatory change?*.

To address this research question, I conducted qualitative research in the form of an exploratory case study in the context of anticipated discontinuous regulatory change on corporate Scope 3 reporting in the European steel industry. The steel industry is suitable as a case study environment because it is a traditional industry with fairly homogeneous incumbents that is facing a significant transformation towardss "green steel", in which rigorous regulatory changes are frequently called for (European Commission's Joint Research Centre, 2022; European Steel Association, 2020). I collected data via extensive in-depth interviews with managers and experts in and around the European steel industry and complemented that with archival documents. Data collection was stopped once theoretical saturation was reached (Glaser & Strauss, 2017). I analyzed that data using the Gioia methodology (Gioia et al., 2013; Nag et al., 2007), which yields a data structure of *first-order categories*, *second-order themes*,

and *overarching dimensions,* and subsequently developed a process theory (Langley, 1999) on how firms behave prior to a discontinuous regulatory change. Throughout the theory development process, I repeatedly integrated extant literature to further "enfold" (Eisenhardt, 1989, p. 544) existing knowledge into the novel theory.

The main findings of this research paper are the data structure presented in Paper 2 | Figure 1 and the process theory presented in Paper 2 | Figure 2. I structured the data along three overarching dimensions - *expectations for the future context*, *motivation for today's behavior*, and *actions planned or taken until today* - which are comprised of multiple second order themes, which in turn are comprised of multiple first order categories. I further created a dynamic process model based on the data structure, which indicates direct, and possibly recursive, relationships between these expectations, motivations, and actions. I consistently provide extensive verbatim quotes of their interviewees to establish their findings.

In the results section of this research paper, I use the data structure and process model to lay out the individual constituents of the identified expectations, motivations, and actions, and explain their relationships. I differentiate expectations for the future context along *expected opportunities*, *expected circumstances,* and *expected risks*, motivation for today's behavior along *incentives for early movers*, *reasons for hesitation,* and *disincentives preventing implementation,* and actions planned or taken until today along *foundational preparatory actions, advanced early mover activities, sector monitoring*, and *lobbying*. Further, I explain how incumbents' expectations for the future influence their motivation today and how incumbents' planned or taken actions are driven by their motivation today.

With this research paper, I make three valuable contributions to the academic literature. First, I highlight the characteristics of discontinuous regulatory change as a distinct form of discontinuous change, and thereby widen the conversation around discontinuous change. Second, I highlight firm behavior prior to the occurrence of the discontinuous change, a

previously understudied phase of a discontinuous change, and thereby add nuance to the comprehension of heterogenous behavior in response to discontinuous change. Third, I detect that successfully adapting to a discontinuous regulatory change does not necessarily lead to solely positive effects for the incumbent firms but can also have negative effects (e.g., on reputation or competitiveness), which is not the case for other forms of discontinuous change. With that discovery, I expand the understanding of why some firms adapt to discontinuous changes while others do not, and further open up new research pathways in the field.

1.3 Summary of Research Paper 3

There is an urgent need to leverage the existing academic knowledge on Scope 3 reporting to convey to practitioners why and how they should conduct Scope 3 reporting. Existing practitioner-oriented work is scarce and mostly focuses on specific aspects or relationships of Scope 3 reporting. For example, Dahlmann et al. (2024) present their research on the effect of increased supplier engagement and primary data collection on the reported total carbon footprint towardss a practitioner-focused audience. In their work, they explain why a firm's total carbon footprint initially increases as supplier engagement for primary data collection increases. However, the practitioner-oriented literature falls short in holistically addressing the broader concerns of those managers who are not yet willing or able to do Scope 3 reporting at all and in providing managers with actionable recommendations on how to best conduct Scope 3 reporting operationally. Hence, I ask three interrelated research questions with a practitioner-oriented perspective: (1) *What are the reasons why firms do not conduct Scope 3 reporting?* (2) *Why should firms conduct Scope 3 reporting?* and (3) *How should firms conduct Scope 3 reporting?*.

To address these research questions, I combined my work from research papers 1 and 2 with additional quantitative analyses. I integrated the in-depth interviews with managers from the European steel industry, conducted as the basis for Research Paper 2, with the extant academic literature reviewed and structured in Research Paper 1. Furthermore, I conducted quantitative analyses of global economic and sustainability databases (MSCI climate and S&P Global Compustat) to verify and complement my findings.

In this research paper, I lay out my findings in response to the research questions rather forthrightly without substantially elaborating on theoretical background or methods to ensure practitioners' full comprehensibility of the presented ideas. First, I summarize three reasons why firms do not report Scope 3 emissions. Firms consider Scope 3 reporting not to be

worthwhile, firms are unable to report their Scope 3 emissions due to implementation barriers, or firms intentionally avoid reporting their Scope 3 emissions. Second, I portray the adverse consequences of no or low-quality Scope 3 reporting to both society and individual firms. I find that for society, no or low-quality Scope 3 reporting curbs global supply chain decarbonization and impairs the effectiveness of investor capital allocation, and for individual firms it diminishes their ESG rating, hampers their access to investor capital, challenges competitiveness, and leads to the neglection of strategic risks. Third, I provide five actionable recommendations to managers that help mitigate implementation barriers while serving additional strategic benefits. I recommend managers to *consider Scope 3 reporting as a risk management tool,* to *use Scope 3 reporting as a selling point in marketing,* to *collaborate with suppliers to start collecting primary data over secondary data early*, to *actively manage the perception of their reported Scope 3 footprint*, and to *go beyond the sustainability department and instill a sustainability culture across the entire firm*. Lastly, I provide managers with a roadmap towardss high quality Scope 3 reporting by illustrating how managers may assess the status quo of their firm to identify which implementation barrier(s) apply to their firm, draft an implementation plan to prioritize actions based on the status quo assessment, and monitor the progress of implementation.

With this research paper, I make three valuable contributions to the practitioner-oriented literature. First, I provide practitioners with a holistic perspective on Scope 3 reporting that enables them to fully grasp all relevant dimensions of it and address them through actionable recommendations. Second, I posit that Scope 3 reporting is not only a process related to a firm's ESG activities but also contributes to a firm's strategic management, which is a novel perspective in the extant literature. In doing so, I allow managers to not only enhance their Scope 3 reporting capabilities but also generate additional strategic benefits. Third, I contribute

to a more widespread adoption of Scope 3 reporting which is needed to drive supply chain decarbonization for the greater good.

1.4 References of Introduction

Anderson, P., & Tushman, M. L. (1990). Technological Discontinuities and Dominant Designs: A Cyclical Model of Technological Change. *Administrative Science Quarterly*, *35*(4), 604. https://doi.org/10.2307/2393511

Blanco, C. (2021). Supply Chain Carbon Footprinting and Climate Change Disclosures of Global Firms. *Production and Operations Management*, *30*(9), 3143–3160. https://doi.org/10.1111/poms.13421

Blanco, C., Caro, F., & Corbett, C. J. (2016). The state of supply chain carbon footprinting: analysis of CDP disclosures by US firms. *Journal of Cleaner Production*, *135*, 1189–1197. https://doi.org/10.1016/j.jclepro.2016.06.132

Busch, T., Johnson, M., & Pioch, T. (2022). Corporate carbon performance data: Quo vadis? *Journal of Industrial Ecology*, *26*(1), 350–363. https://doi.org/10.1111/jiec.13008

Callahan, W., James Fava, S. A., Wickwire, S., Sottong, J., Stanway, J., & Ballentine, M. (2011). Corporate Value Chain (Scope 3) Accounting and Reporting Standard Supplement to the GHG Protocol Corporate Accounting and Reporting Standard GHG Protocol Team.

Candelon, F., Di Carlo, R. C., Bondt, M. de, & Evgeniou, T. (2021). *ai* Regulation Is Coming How to prepare for the inevitable. *Harvard Business Review*, *99*(5), 102.

CDP (2023). CDP Supply Chain Report 2022. https://cdn.cdp.net/cdp-production/cms/reports/documents/000/006/918/original/CDP-Supply-Chain-Report-2022.pdf?1678870769

Christensen, C. M. (2006). The Ongoing Process of Building a Theory of Disruption. *Journal of Product Innovation Management*, *23*(1), 39–55. https://doi.org/10.1111/j.1540-5885.2005.00180.x

Christensen, C. M., & Bower, J. L. (1996). Customer power, strategic investment, and the failure of leading firms. *Strategic Management Journal*, *24*(4), 69–86. https://doi.org/10.1002/(sici)1097-0266(199603)17:3<197::aid-smj804>3.3.co;2-l

Christensen, C. M., McDonald, R., Altman, E. J., & Palmer, J. E. (2018). Disruptive Innovation: An Intellectual History and Directions for Future Research. *Journal of Management Studies*, *55*(7), 1043–1078. https://doi.org/10.1111/joms.12349

Council of the European Union. (2023). *Climate change: what the EU is doing.* European Union. https://www.consilium.europa.eu/en/policies/climate-change/

Dahlmann, F., Roehrich, J., & Brammer, S. (2024). Managing Scope 3 Emissions in Your Supply Chains: Why Firms Must Take a Step Back to Move Forwards. *California Management Review Insights*. https://cmr.berkeley.edu/2024/01/managing-scope-3-emissions-in-your-supply-chains-why-firms-must-take-a-step-back-to-move-forwards/

Dahlmann, F., & Rohrich, J. K. (2019). Sustainable supply chain management and partner engagement to manage climate change information. *Business Strategy and the Environment*, *28*(8), 1632–1647. https://doi.org/10.1002/bse.2392

Dhanda, K. K., Sarkis, J., & Dhavale, D. G. (2022). Institutional and stakeholder effects on carbon mitigation strategies. *Business Strategy and the Environment*, *31*(3), 782–795. https://doi.org/10.1002/bse.2917

Downie, J., & Stubbs, W. (2012). Corporate Carbon Strategies and Greenhouse Gas Emission Assessments: The Implications of Scope 3 Emission Factor Selection. *Business Strategy and the Environment*, *21*(6), 412–422. https://doi.org/10.1002/bse.1734

Eggers, J. P., & Park, K. F. (2018). Incumbent adaptation to technological change: The past, present, and future of research on heterogeneous incumbent response. *Academy of Management Annals*, *12*(1), 257–389. https://doi.org/10.5465/annals.2016.0051

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *Academy of Management Review*, *14*(4), 532. https://doi.org/10.2307/258557

EU Copernicus. (2024). *Warmest December concludes warmest year on record*. https://climate.copernicus.eu/warmest-december-concludes-warmest-year-record

Euractiv. (2022). *EU urged to align corporate climate reporting rules with global standards.* Euractiv. https://www.euractiv.com/section/economy-jobs/news/eu-urged-to-align-corporate-climate-reporting-rules-with-global-standards/

European Commission's Joint Research Centre. (2022). *EU climate targets: how to decarbonise the steel industry.* European Commission. https://joint-research-centre.ec.europa.eu/jrc-news/eu-climate-targets-how-decarbonise-steel-industry-2022-06-15_en

European Steel Association. (2020). *We are ready – are you? Making a success of the EU Green Deal*. https://www.eurofer.eu/assets/publications/position-papers/a-green-deal-on-steel-update/2020-10-14-EUROFER-Policy-paper-A-Green-Deal-on-Steel_V5.pdf

Gilbert, C. G. (2005). Unbundling the structure of inertia: Resource versus routine rigidity. *Academy of Management Journal*, *48*(5), 741–763. https://doi.org/10.5465/AMJ.2005.18803920

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology. *Organizational Research Methods*, *16*(1), 15–31. https://doi.org/10.1177/1094428112452151

Glaser, B. G., & Strauss, A. L. (2017). Discovery of grounded theory: Strategies for qualitative research. *Discovery of Grounded Theory: Strategies for Qualitative Research*, 1–271. https://doi.org/10.4324/9780203793206

Graf-Vlachy, L., Oliver, A. G., Banfield, R., König, A., & Bundy, J. (2020). Media Coverage of Firms: Background, Integration, and Directions for Future Research. *Journal of Management*, *46*(1), 36–69. https://doi.org/10.1177/0149206319864155

Greenwood, R., Raynard, M., Kodeih, F., Micelotta, E. R., & Lounsbury, M. (2011). Institutional complexity and organizational responses. *Academy of Management Annals*, *5*(1), 317–371. https://doi.org/10.1080/19416520.2011.590299

Hahn, R., Reimsbach, D., & Schiemann, F. (2015). Organizations, Climate Change, and Transparency: Reviewing the Literature on Carbon Disclosure. *Organization & Environment*, *28*(1), 80–102. https://doi.org/10.1177/1086026615575542

IPCC. (2023). *Climate Change 2023: Synthesis Report*. https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf https://doi.org/10.59327/IPCC/AR6-9789291691647

Isil, O., & Sebastianelli, R. (2020). Arcs of carbon awareness in the value chain and their antecedents. *Business Strategy and the Environment*, *29*(2), 503–518. https://doi.org/10.1002/bse.2383

Kammerlander, N., König, A., & Richards, M. (2018). Why Do Incumbents Respond Heterogeneously to Disruptive Innovations? The Interplay of Domain Identity and Role Identity. *Journal of Management Studies*, *55*(7), 1122–1165. https://doi.org/10.1111/joms.12345

König, A., Graf-Vlachy, L., & Schöberl, M. (2021). Opportunity/Threat Perception and Inertia in Response to Discontinuous Change: Replicating and Extending Gilbert (2005). *Journal of Management*, *47*(3). https://doi.org/10.1177/0149206320908630

König, A., Schulte, M., & Enders, A. (2012). Inertia in response to non-paradigmatic change: The case of meta-organizations. *Research Policy*, *41*(8), 1325–1343. https://doi.org/10.1016/j.respol.2012.03.006

Kumaraswamy, A., Garud, R., & Ansari, S. (2018). Perspectives on Disruptive Innovations. *Journal of Management Studies*, *55*(7), 1025–1042. https://doi.org/10.1111/joms.12399

Langley, A. (1999). Strategies for Theorizing from Process Data. *Academy of Management Review*, *24*(4), 691–710. https://doi.org/10.5465/AMR.1999.2553248

Lee, S. Y. (2012). Corporate Carbon Strategies in Responding to Climate Change. *Business Strategy and the Environment*, *21*(1), 33–48. https://doi.org/10.1002/BSE.711

Malesky, E., & Taussig, M. (2016). The Danger of Not Listening to Firms: Government Responsiveness and the Goal of Regulatory Compliance. *Academy of Management Journal*, *60*(5), 1741–1770. https://doi.org/10.5465/AMJ.2015.0722

Nag, R., Corley, K. G., & Gioia, D. A. (2007). The Intersection of Organizational Identity, Knowledge, and Practice: Attempting Strategic Change via Knowledge Grafting. *The Academy of Management Journal*, *50*(4), 821–847. http://www.jstor.org/stable/20159892

Nuber, C., & Velte, P. (2021). Board gender diversity and carbon emissions: European evidence on curvilinear relationships and critical mass. *Business Strategy and the Environment*, *30*(4), 1958–1992. https://doi.org/10.1002/bse.2727

Patchell, J. (2018). Can the implications of the GHG Protocol's scope 3 standard be realized? *Journal of Cleaner Production*, *185*, 941–958. https://doi.org/10.1016/j.jclepro.2018.03.003

Peukert, C., Bechtold, S., Batikas, M., & Kretschmer, T. (2022). Regulatory Spillovers and Data Governance: Evidence from the GDPR. *Marketing Science*, *41*(4), 746–768. https://doi.org/10.1287/mksc.2021.1339

Raaijmakers, A. G., Vermeulen, P. A., Meeus, M. T., & Zietsma, C. (2014). I Need Time! Exploring Pathways to Compliance under Institutional Complexity. *Academy of Management Journal*, *58*(1), 85–110. https://doi.org/10.5465/AMJ.2011.0276

Reuters (2023, November 20). US securities regulator signals it may curb climate rule ambitions. *Reuters Media*. https://www.reuters.com/business/environment/us-securities-regulator-signals-it-may-curb-climate-rule-ambitions-2023-11-20/

Rousseau, D. M., Manning, J., & Denyer, D. (2008). *Evidence in Management and Organizational Science: Assembling the Field's Full Weight of Scientific Knowledge through Syntheses.* https://doi.org/10.2139/ssrn.1309606

Schaedler, L., Graf-Vlachy, L., & König, A. (2022). Strategic leadership in organizational crises: A review and research agenda. *Long Range Planning*, *55*(2). https://doi.org/10.1016/j.lrp.2021.102156

Scott, W. R. (2008). *Institutions and organizations: Ideas, Interests and Identities* (3rd Edition). Sage Publications Inc.

US EPA. (2022). *Climate Change Regulatory Actions and Initiatives*. https://www.epa.gov/climate-change/climate-change-regulatory-actions-and-initiatives

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.* https://doi.org/10.1016/j.jclepro.2020.120063

Webster, J., & Watson, R. T. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, *26*(2), xiii–xxiii. http://www.jstor.org/stable/4132319

Wedari, L. K., Jubb, C., & Moradi-Motlagh, A. (2021). Corporate climate-related voluntary disclosures: Does potential greenwash exist among Australian high emitters reports? *Business Strategy and the Environment*, *30*(8), 3721–3739. https://doi.org/10.1002/bse.2836

Weinhofer, G., & Hoffmann, V. H. (2010). Mitigating climate change – how do corporate strategies differ? *Business Strategy and the Environment*, *19*(2), 77–89. https://doi.org/10.1002/BSE.618

2 Research Paper 1

Corporate Scope 3 Carbon Emission Reporting as an Enabler of Supply Chain Decarbonization: A Systematic Review and Comprehensive Research Agenda

Abstract

Firms worldwide are currently investigating ways to decarbonize global supply chains. Corporate Scope 3 carbon emission reporting is a critical first step but is not yet a common activity for most firms. The current literature on corporate Scope 3 reporting is highly fragmented and does not offer a comprehensive overview, and findings from Scope 1 and 2 emission reporting are often not readily transferrable. Therefore, we conduct a systematic literature review, develop an encompassing research framework, and generate a comprehensive research agenda. Our results identify several patterns in the literature, such as the widespread use of the Carbon Disclosure Project as a data source, a broad agreement on poor comprehensiveness of Scope 3 reports, and an overall low amount of empirical research. We contribute a holistic overview of the complex issue of Scope 3 reporting and develop numerous promising research avenues.

Keywords: Corporate carbon emission reporting; Scope 3 emissions; supply chain emissions; carbon performance; carbon disclosure

1 Introduction

Society and corporations worldwide are dealing with the effects of climate change. To comply with the Paris Agreement's goal of limiting temperature increase to 1.5°C, companies are investigating ways to reduce their impact. A critical first step is to measure and report the impact a company has on climate change (Lee, 2012; Weinhofer & Hoffmann, 2010). For this purpose, the *World Business Council for Sustainable Development* and the *World Resources Institute* jointly founded the "Greenhouse Gas (GHG) Protocol ", which has become the largest global standard for the assessment of corporate carbon emissions (Patchell, 2018).

A company's carbon emissions comprise three scopes which vary greatly in how complex they are to measure and report. The GHG Protocol defines Scope 1 as "direct emissions from owned or controlled sources", Scope 2 as "indirect emissions from the generation of purchased energy consumed by the reporting company", and Scope 3 as "all other indirect emissions that occur in a company's value chain" (Callahan et al., 2011, p. 5). Scope 1 and 2 emissions are relatively easier to measure and report as they lie mostly within the operational sphere of a corporation. Scope 3 emissions are significantly more complex and harder to determine (Busch, Johnson, & Pioch, 2022; Dahlmann & Rohrich, 2019; Downie & Stubbs, 2012). Consequently, the decarbonization of entire supply chains is a particularly complex challenge.

For the purpose of decarbonizing entire supply chains beyond the mere scope of individual corporations (i.e., scopes 1 and 2), firms need to develop targeted reduction actions with clear performance targets (Lewandowski, 2017). Transparency and accurate measurement of the carbon emissions that occur along supply chains (i.e., Scope 3 emissions) are needed to develop such reduction actions (Dahlmann & Rohrich, 2019; Isil & Sebastianelli, 2020).

In practice, corporate Scope 3 emission reporting is not yet a common reporting activity for most firms (Dahlmann & Rohrich, 2019), but it has gained attention over the last few years. A key reason is that it remains voluntary under all global regulatory frameworks even though, for

many corporations, Scope 3 carbon emissions make up 75% or more of their total carbon emission profile, primarily driven by the emissions generated by a firm's suppliers of purchased goods and services, and associated transportation (Blanco et al., 2016). Hence, firms that are not reporting Scope 3 emissions may miss the bigger picture of their total carbon footprint and make poor decisions with respect to their decarbonization strategies (Dhanda et al., 2022; Weinhofer & Busch, 2013). Notably, however, the Carbon Disclosure Project (CDP), the largest global NGO promoting supply chain emission transparency, has seen a three-fold increase in membership and suppliers disclosing information over the past five years (CDP, 2017, 2022; Matisoff et al., 2013).

The current literature on corporate Scope 3 carbon emission reporting is highly fragmented and does not offer a comprehensive perspective. This is particularly problematic due to the above-described risk of missing the bigger picture for supply chain decarbonization. Previously, Hahn et al. (2015) and Velte et al. (2020) conducted literature reviews on general carbon disclosure and derived frameworks of theoretical perspectives, antecedents, consequences, and moderators of carbon reporting. However, they investigated only Scope 1 and partially Scope 2 emissions. Due to the complexity of Scope 3 emission reporting (e.g., the need to engage external stakeholders), their findings from Scope 1 and 2 emissions might not readily transfer to Scope 3 emissions. Consequently, there is an urgent need to review and integrate extant research specific to corporate Scope 3 carbon emission reporting. Hence, we seek to answer two interrelated research questions: *(1) What knowledge does the current state of the academic literature on corporate Scope 3 carbon emission reporting entail and how can it best be structured?* and *(2) What are promising areas for future research?*

The main goal of this article is thus to synthesize the current knowledge on corporate Scope 3 carbon emission reporting and to outline a comprehensive research agenda. We first synthesize the existing literature specific to Scope 3 emissions and iteratively develop a

research framework for carbon emission reporting that comprises theoretical lenses, characteristics of emission reporting itself, as well as antecedents, consequences, and moderators of key relationships. We then outline patterns and gaps in the existing literature and finally identify additional research avenues based on critical research needs and impactful academic work previously undertaken on Scope 1 and 2 emissions.

This approach enables us to make four critical contributions. First, we create a holistic research framework that comprehensively structures the research landscape on corporate carbon emission reporting. This level of comprehensiveness is unique in the literature. Second, we break down the complexity of corporate Scope 3 carbon emission reporting and describe it using the aforementioned framework. This may ultimately advance researchers' and practitioners' understanding of how the decarbonization of global supply chains can be achieved. Third, we identify patterns in the research in this field. This allows us to understand which approaches are common and which are underutilized. Lastly, we provide a comprehensive agenda for future research. We identify promising avenues to be pursued based on particularly striking patterns, literature gaps, and specific needs for Scope 3 emissions. Thereby, we enable other researchers to effectively advance our understanding of corporate Scope 3 carbon emission reporting.

2 Method

We followed established processes for a systematic literature review to ensure a comprehensive account of the literature (Rousseau et al., 2008; Webster & Watson, 2002). In line with previous reviews (Hahn et al., 2015; Schaedler et al., 2022), we combined two individual journal lists from the fields of business management and sustainability, respectively. This ensures that our journal selection properly takes into account the novelty and cross-functional nature of the topic of corporate carbon emission reporting and ensures that no relevant high-quality journal is left out. First, we included all FT50 journals to ensure that a

broad selection of very high-quality business journals is included (Schaedler et al., 2022). Second, we added the 16 journals ranked B or better by the German Academic Association of Business Research's scientific committee for sustainable management in its JourQual 3 ranking—which broadly aligns with other formal journal rankings globally—to further ensure that all high-quality journals specialized in the field of sustainable management are included (Graf-Vlachy et al., 2020). Overall, to be particularly careful, we aimed to err on the side of including too many rather than too few journals. This process yielded a total of 65 journals. Table 1 presents the full list of the selected journals.

Paper 1 | Table 1: Overview of selected journals

Journals	Selection list	Journals	Selection list
Academy of Management Journal	FT50	Manufacturing & Service Operations Management	FT50
Academy of Management Review	FT50	Marketing Science	FT50
Accounting, Organizations and Society	FT50	MIS Quarterly	FT50
Accounting Review	FT50	MIT Sloan Management Review	FT50
Administrative Science Quarterly	FT50	Operations Research	FT50
American Economic Review	FT50	Organization Science	FT50
Contemporary Accounting Research	FT50	Organization Studies	FT50
Econometrica	FT50	Organizational Behavior and Human Decision Processes	FT50
Entrepreneurship Theory and Practice	FT50	Production and Operations Management	FT50
Harvard Business Review	FT50	Quarterly Journal of Economics	FT50
Human Relations	FT50	Research Policy	FT50
Human Resource Management	FT50	Review of Accounting Studies	FT50
Information Systems Research	FT50	Review of Economic Studies	FT50
Journal of Accounting and Economics	FT50	Review of Finance	FT50
Journal of Accounting Research	FT50	Review of Financial Studies	FT50
Journal of Applied Psychology	FT50	Strategic Entrepreneurship Journal	FT50
Journal of Business Ethics	FT50 & VHB NAMA (≥B)	Strategic Management Journal	FT50
Journal of Business Venturing	FT50	Business & Society	VHB NAMA (≥B)
Journal of Consumer Psychology	FT50	Business Ethics Quarterly (BEQ)	VHB NAMA (≥B)
Journal of Consumer Research	FT50	Business Strategy and the Environment	VHB NAMA (≥B)
Journal of Finance	FT50	Ecological Economics	VHB NAMA (≥B)
Journal of Financial and Quantitative Analysis	FT50	Energy Economics	VHB NAMA (≥B)
Journal of Financial Economics	FT50	Energy Policy	VHB NAMA (≥B)
Journal of International Business Studies	FT50	International Journal of Energy Sector Management	VHB NAMA (≥B)
Journal of Management	FT50	Journal of Cleaner Production	VHB NAMA (≥B)
Journal of Management Information Systems	FT50	Journal of Environmental Economics and Management	VHB NAMA (≥B)
Journal of Management Studies	FT50	Journal of Environmental Management	VHB NAMA (≥B)
Journal of Marketing	FT50	Journal of Industrial Ecology	VHB NAMA (≥B)
Journal of Marketing Research	FT50	Journal of World Business	VHB NAMA (≥B)
Journal of Operations Management	FT50	Organization & Environment	VHB NAMA (≥B)
Journal of Political Economy	FT50	Resource and Energy Economics	VHB NAMA (≥B)
Journal of the Academy of Marketing Science	FT50	ZfU - Zeitschrift für Umweltpolitik & Umweltrecht	VHB NAMA (≥B)
Management Science	FT50		

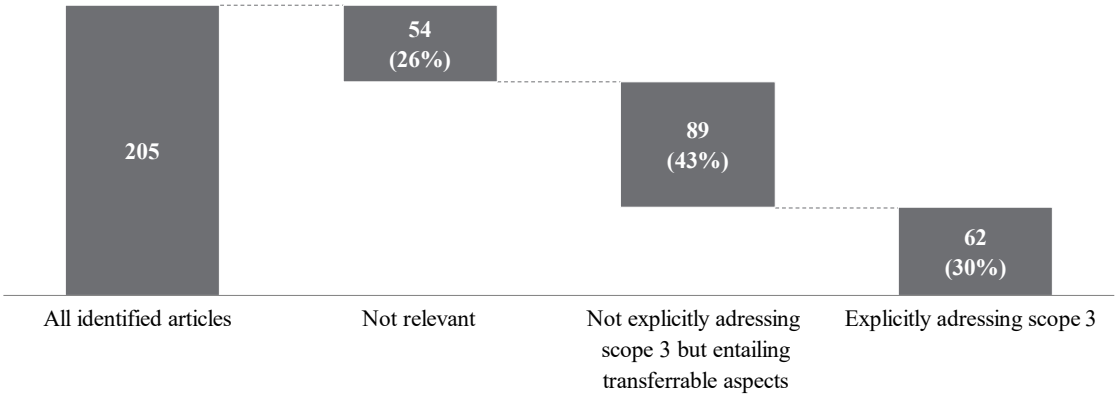
To identify relevant articles published in the selected journals, we performed two separate keyword searches in the Web of Science database in August 2022. First, we searched for *"Scope 3" AND "emission*"* to include all articles explicitly addressing the topic of Scope 3 emissions without any further restrictions. This search process led to 91 articles. Second, we searched for

"corporate" AND ("carbon" OR "CO2") AND "emission" AND ("reporting" OR "disclosure"). This search process aimed to identify all relevant literature on corporate emission reporting in general, which may also be relevant for Scope 3 emissions even if it only addresses Scope 1 or Scope 2. We explicitly added the restrictions of "corporate" and "carbon" or "CO2". The term "corporate" restricted the search results to corporate reporting and avoids articles focused on specific processes or products (e.g., waste incineration or broiler feeds) unrelated to corporate reporting. The terms "carbon" or "CO2" restricted search results to articles focused on carbon emissions relevant to climate change and avoided articles discussing wider environmental pollution from other emissions not contributing to climate change (e.g., wastewater disposal). The second search process led to 124 articles. Both search processes jointly led to a total of 205 unique articles.

We read all articles' abstracts and, if necessary, their full texts, and retained those articles that either explicitly address or entail aspects that could be transferred to Scope 3 emission reporting. We removed articles if they focused on specific products, processes, or structures that are not relevant in the corporate context (e.g., articles focused on biomass CO2 capture or inorganic salt as a sustainable catalyst system for CO2 utilization). Consequently, we removed 54 of the 205 articles, leaving us with a list of 151 peer-reviewed articles. Subsequently, we systematically coded each article regarding the characteristics of carbon emission reporting itself, the applied theoretical lenses as well as the discussed antecedents, consequences, and moderators of corporate Scope 3 carbon emission reporting, following the basic logic of prior literature reviews in the field (Hahn et al., 2015; Velte et al., 2020). In our coding, we differentiated between articles that explicitly address Scope 3 emissions and those that addressed Scope 1 or 2 emission reporting. Figure 1 summarizes the distribution of the 205 identified articles along whether they explicitly address Scope 3, do not explicitly address Scope 3 but entail potentially transferrable aspects, or are not relevant. It shows that most articles

(43%) do not explicitly address Scope 3 emissions but include potentially transferable aspects, 62 (30%) explicitly address Scope 3 emissions, and 54 (26%) are not relevant to this work.

Paper 1 | Figure 1: Research agenda for consequences



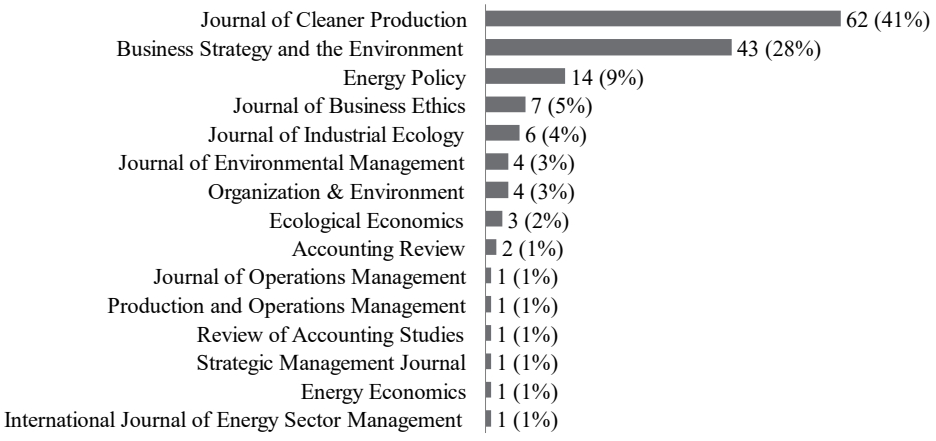
Unit: # of articles

3 Descriptive overview and research framework

3.1 Descriptive overview of the literature

Figure 2 presents the number of articles per journal. It shows that the relevant literature is strongly concentrated in only a few journals. The top three journals are home to more than 75% of articles. Thus, the conversation around the topic of corporate carbon emission reporting appears to take place in a somewhat narrow set of outlets.

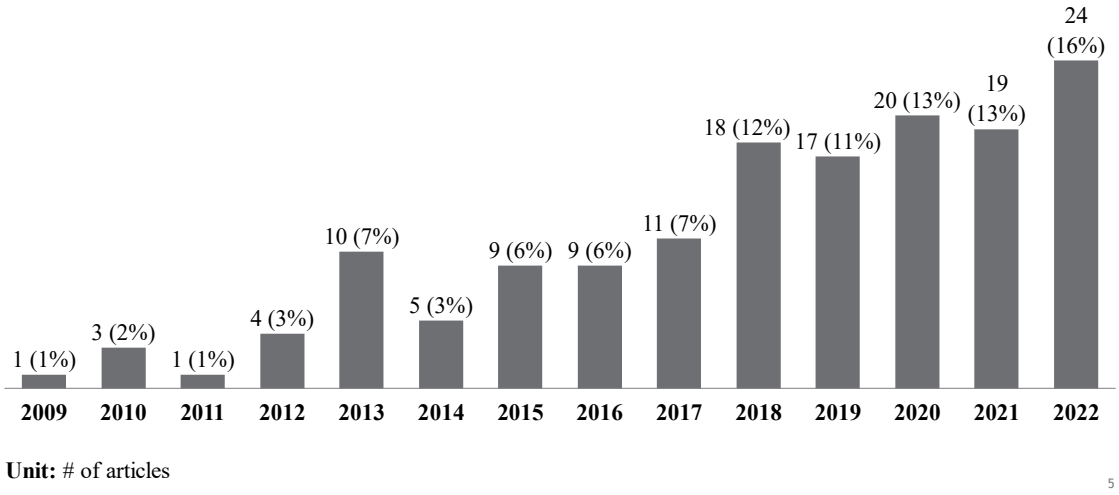
Paper 1 | Figure 2: Distribution of identified articles along journals



Unit: # of articles

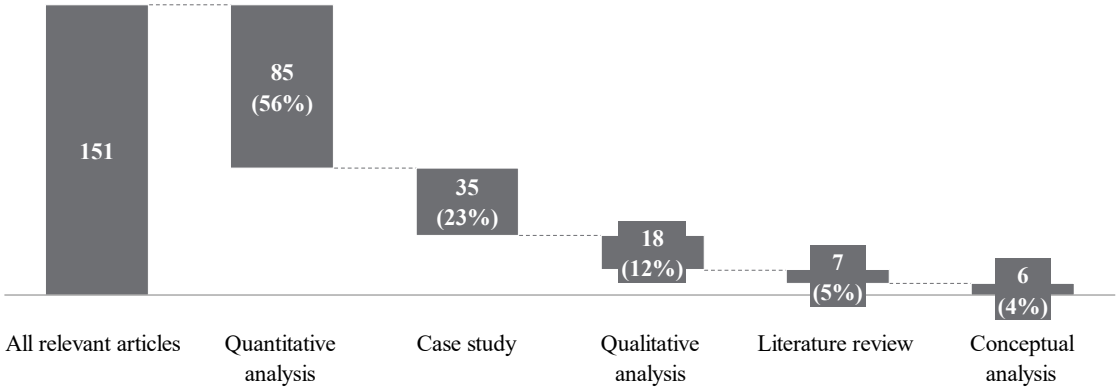
Figure 3 illustrates the number of articles published per year and it shows that the topic is quite new. Almost all research (93%) on the topic has been conducted from 2013 onwards, and the vast majority of articles (65%) have been published in the past 5 years.

Paper 1 | Figure 3: Distribution of identified articles over time



The research methods applied in the identified articles are highly heterogeneous. Figure 4 shows the number of articles by research method. Around half (56%) of the articles perform a quantitative analysis, 23% of the identified articles are based on a case study method, while 12% applied a different type of qualitative analysis. Only 5% of articles are literature reviews and 4% contain a conceptual analysis. This distribution is largely in line with the distribution found in a previous literature review on general carbon reporting by Hahn et al. (2015) , except for the share of case studies, which is significantly higher in our sample.

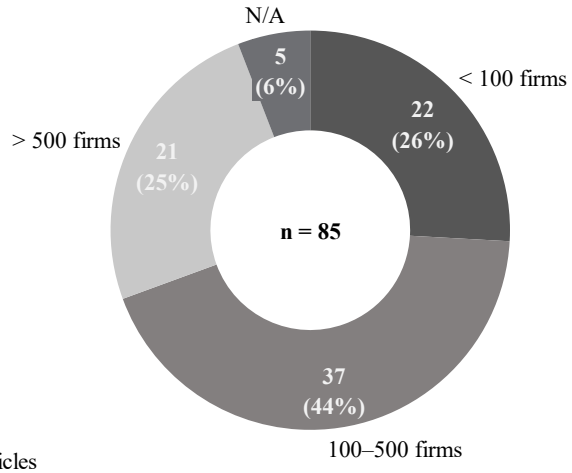
Paper 1 | Figure 4: Research methodologies used in relevant literature



Unit: # of articles

Figures 5, 6, and 7 provide further details on the identified quantitative analyses. First of all, it is important to note that ~80% of studies used panel data and ~20% used cross-sectional data. This indicates that developments over time are frequently incorporated in quantitative analyses. Figure 5 indicates that scholars work with samples of very different sizes, showing an almost equal distribution among less than 100, 100-500, and more than 500 firms.

Paper 1 | Figure 5: Sample sizes used in quantitative analyses



Unit: # of articles

Figure 6 further shows the share of data sources used. It underpins the importance of the CDP as the leading data source as almost half of the quantitative analyses (46%) used their database.

Paper 1 | Figure 6: Data sources of quantitative analyses

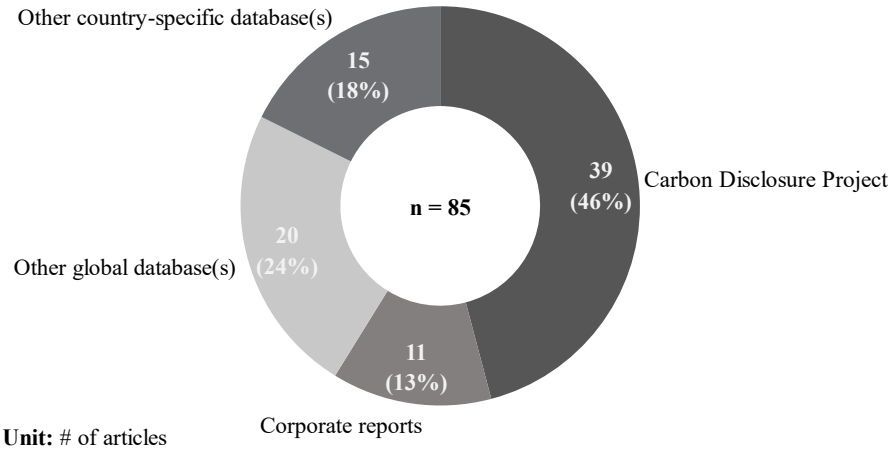
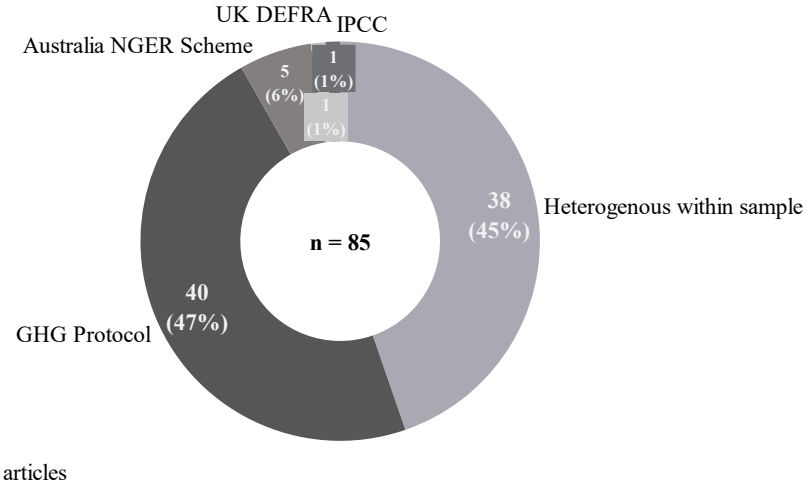


Figure 7 additionally outlines the share of different standards applied to generate the underlying data used in the quantitative analyses. It shows that a high share of articles (45%) utilizes data samples with varying calculation standards, which means that databases are used without ensuring that the same calculation standards are applied. Furthermore, it reinforces the importance of the GHG Protocol as the leading global standard, which is likely primarily driven by the fact that the CDP consistently applies the GHG Protocol as the standard of choice in their questionnaires.

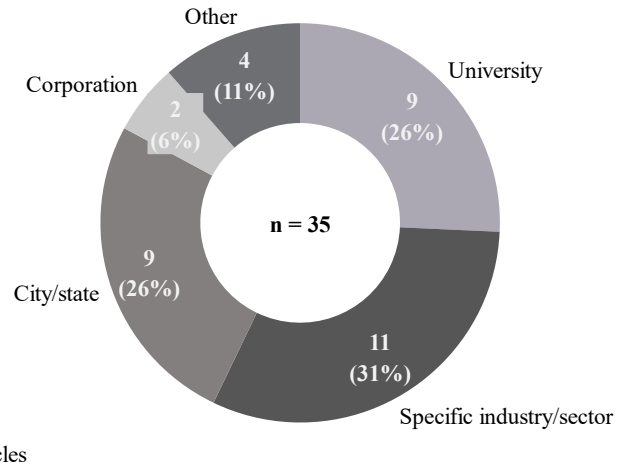
Paper 1 | Figure 7: Standards used for emission data in quantitative analyses



Lastly, Figure 8 illustrates the different settings in which researchers conducted case studies. It shows that settings in universities, specific industries or sectors (e.g., cement production),

and cities/states are dominant with more than 80% of case studies. In contrast, case studies of corporations, which would be the setting arguably most relevant to the corporate perspective of carbon emission reporting, are very rare (6%).

Paper 1 | Figure 8: Setting of identified case studies

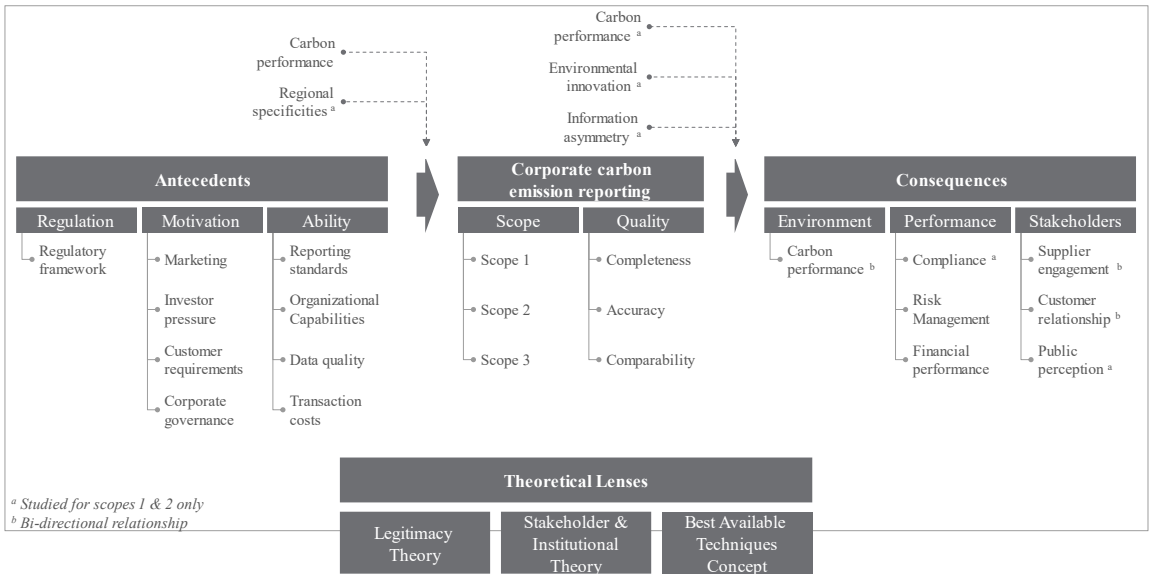


Unit: # of articles

3.2 Framework of corporate carbon emission reporting research

During the process of our review, we iteratively structured the literature on corporate carbon emission reporting along a framework comprising the applied theoretical lenses, the characteristics of carbon emission reporting itself as well as its antecedents, consequences, and moderators. Figure 9 shows the final framework.

Paper 1 | Figure 9: Research framework of corporate carbon emission reporting



We identified three relevant theoretical lenses: Legitimacy theory, stakeholder and institutional theory, and the best available techniques concept (BAT). We did not code studies regarding theoretical lenses if they mentioned theories only in passing.

We characterize corporate carbon emission reporting itself by its scope and quality. The scope includes Scope 1, 2, and/or 3 carbon emissions. Three distinctive attributes constitute the quality of corporate carbon emission reporting: Completeness, accuracy, and comparability (Bui et al., 2021; Lemma et al., 2020; Matisoff et al., 2013; Tang & Demeritt, 2018). Completeness refers to whether all emission sources are included in the reporting. Accuracy refers to the degree of accuracy with which the emission value of each relevant emission source is calculated. Comparability of emission reporting defines whether the reporting of a given firm is directly comparable to a different firm.

We categorized antecedents of reporting along three perspectives: Regulation, motivation, and ability. Regulation comprises only the regulatory framework, i.e., the applicable laws and formal requirements (Tang & Demeritt, 2018). Aspects related to a firm's motivation include image, investor pressure, customer requirements, and corporate governance (Blanco, 2021;

Dahlmann & Rohrich, 2019; Hansen et al., 2022). A firm's ability is determined by reporting standards, organizational capabilities, data quality, and transaction costs (Busch, Johnson, & Pioch, 2022; Hickmann, 2017; Isil & Sebastianelli, 2020; Matisoff et al., 2013).

We categorized consequences of reporting along three distinct perspectives as well: Environment, performance, and stakeholders. Environment comprises only the actual reduction of emissions (Alvarez et al., 2019; Downie & Stubbs, 2013; Rietbergen et al., 2015). Performance includes compliance, risk management, and financial performance (Dahlmann & Rohrich, 2019; Lewandowski, 2017; Patchell, 2018). Stakeholders include supplier engagement, customer relationship, and public perception (Dhanda et al., 2022; Lintukangas et al., 2022; Tidy et al., 2016; Villena & Dhanorkar, 2020). It is important to note that for two of these consequences (compliance and public perception) the articles in our sample address scopes 1 and 2 only. Furthermore, the relationship of corporate carbon emission reporting to three of these consequences (carbon performance, supplier engagement, and customer relationship) is of bidirectional nature (Braam et al., 2016; Dahlmann & Rohrich, 2019; Tidy et al., 2016), i.e., the factor listed under consequences also influences corporate carbon emission reporting itself.

Various factors moderate the relationships between antecedents and corporate carbon emission reporting, and between corporate carbon emission reporting and its consequences. Carbon performance and regional specificities moderate the relationships between marketing (Linares-Rodríguez et al., 2022) and investor pressure (Velte et al., 2020), and corporate carbon emission reporting. Further, the relationship of corporate carbon emission reporting with financial performance is moderated by carbon performance (Hassan & Romilly, 2018; Lewandowski, 2017), environmental innovation (Linda Kusumaning Wedari et al., 2022), and information asymmetry (Lemma et al., 2021; E. P. Y. Yu et al., 2021). Except for the moderating effect of carbon performance on the relationship between marketing and corporate

carbon emission reporting, none of the moderating factors are discussed within articles explicitly addressing Scope 3 carbon emissions.

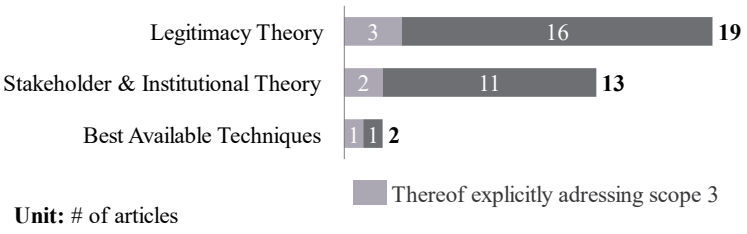
4 The literature on Scope 3 emissions

In the following chapter, we systematically lay out the results of the 62 articles that explicitly address Scope 3 emissions along the structure of our research framework.

4.1 Theoretical Lenses

We identified three theoretical lenses that researchers explicitly used to better understand the characteristics of carbon emission reporting itself as well as its antecedents, consequences, and moderators: Legitimacy theory, stakeholder and institutional theory, and best available techniques (BAT). Figure 10 illustrates the frequency of theoretical lenses used among the given literature. Other theories were solely applied for research on Scope 1 and 2 emissions and are therefore referred to under section 5 Agenda for future research only.

Paper 1 | Figure 10: Frequency of theoretical lenses used within relevant literature



4.1.1 Legitimacy Theory

The most frequently used theoretical lens is that of legitimacy theory. Legitimacy theory as first described by Dowling and Pfeffer (1975) proposes that if a disparity exists between the implied social values associated with an organization's activities and the generally acceptable behavior within a society, then an organization's legitimacy is in danger and faces legal, economic, or other social sanctions. Consequently, organizations' actions are targeted towardss avoiding or minimizing the risk of losing legitimacy (Suchman, 1995).

In the context of Scope 3 carbon emission reporting, scholars applied legitimacy theory to explain *why* corporations report their Scope 3 emissions to third-party organizations like the CDP or the general public. For example, Braam et al. (2016) argue that corporations that are responsible for activities that cause carbon emissions (Scope 1, 2, or 3) but do not disclose this to the public may be accused of hiding environmentally damaging behavior for their own benefit and thereby may lose legitimacy. To avoid such accusations, corporations may conduct Scope 3 carbon emission reporting. Ellram and Golicic (2016) and Kalu et al. (2016) applied legitimacy theory in a similar fashion to explain why corporations report Scope 3 emissions in pursuing environmentally responsible transportation practices and in voluntary carbon emission disclosures within the real estate sector, respectively.

One research group also used legitimacy theory as a theoretical explanation for the *extent* to which firms report their Scope 3 emissions. Specifically, Braam et al. (2016) found that corporations disclose only the minimum amount of information required to maintain legitimacy, in order to minimize potential sanctions or disadvantages from providing such transparency.

4.1.2 Stakeholder and Institutional Theory

Studies have also used stakeholder theory and institutional theory to understand why and how firms report their Scope 3 carbon emissions. Stakeholder theory, as outlined by Roberts (1992), posits that corporate behavior is driven by the different interests of its direct stakeholders, e.g., customers, suppliers, and investors, and the goal of fulfilling their interests as much as possible. Researchers have consistently used stakeholder theory to provide an explanatory perspective for corporate disclosure of ESG (Environmental Social Governance)-related information (Cormier et al., 2004). Relatedly, institutional theory proposes that firms are primarily governed by one or multiple higher institutions. Therefore, firms not only aim to fulfill the interests of those stakeholders that directly benefit from their own performance but

also to fulfill interests or requirements of higher institutional groups such as NGOs, governments, or other third parties (Meyer & Rowan, 1977; Suchman, 1995). We group these two theories because of a certain similarity in terms of their focus on external influences on firm behavior and the fact that researchers often applied both theories in parallel (Hahn et al., 2015; Mateo-Márquez et al., 2021).

With respect to corporate Scope 3 carbon emission reporting, researchers have employed stakeholder theory to explain firms' specific behavior around optimizing their disclosures in alignment with the respective addressed stakeholders. For example, Depoers et al. (2016) applied stakeholder theory to identify differences in reporting in CDP and annual reports. They argue that CDP reports and annual reports address different stakeholder groups with different priorities and firms therefore adjust their Scope 3 emission information as much as possible to align it with the expected priorities and interpretations of aforementioned stakeholders.

One research group employed institutional theory as a theoretical explanation for how firms can convince their suppliers via institutional pressures to provide data or information required to conduct corporate Scope 3 carbon emission reporting. Villena and Dhanorkar (2020) argue that institutional pressure, if applied to suppliers, can be a strong driver for transparency of supply chain (Scope 3) carbon emissions. They differentiate between the three classical types of institutional pressures: coercive, mimetic, and normative pressures. Coercive pressure is applied, for instance, when customers ask their suppliers to adhere to specific rules. In the case of supply chain decarbonization, asking the supplier to participate in the CDP supply chain program would be a typical example. Mimetic pressure comes from industry peers to comply with certain regulations and increases the motivation to remain competitive. Normative pressure comes from industry leaders and applies especially to firms with a strong urge to be thought of as industry leaders or with a customer base that entails firms with such an urge. They further found that the effectiveness of institutional pressure to provide more transparency on

Scope 3 carbon emissions varies due to different supplier priorities, individual incentives of the suppliers' managers, and other circumstances.

4.1.3 Best available techniques (BAT) concept

Researchers further applied the best available techniques (BAT) concept to evaluate how corporate carbon emission reporting is conducted. The European Union (EU) first introduced BAT as a theoretical concept to design institutional regulation that mandates firms to operate in a more environmentally friendly fashion. The BAT concept essentially entails that firms should apply "techniques with the lowest impact on the environment without compromising the economic health of the (industrial) enterprises", without explicitly stating what that specific technique is (Dijkmans, 2000). In theory, this should enable firms to adhere to regulation while constantly maintaining the most innovative processes and technologies. Of course, BAT is a legal concept rather than a theory in the typical sense of the social sciences.

Thus far, scholars do not consider BAT to be an effective concept for improving Scope 3 carbon emission reporting practices. For example, Huybrechts et al. (2018) analyzed the impact of the BAT concept along different value chains. They criticize that up- and downstream activities relative to the focal sector are not sufficiently considered. Therefore, the identified BAT may not be ideal for upstream or downstream activities or sectors. They further propose to consider relevant "cross-sector effects", initiate upstream and downstream partnerships, and determine a comprehensive "value chain BAT" as a general BAT for all sectors in order to improve BAT concept application as a means to drive carbon emission reporting and reduction along value chains (Huybrechts et al., 2018).

4.2 Antecedents

4.2.1 Regulation

4.2.1.1 Regulatory framework

As of today, corporate Scope 3 carbon emission reporting is not mandated within any national or international regulatory frameworks. Consequently, this type of corporate reporting is currently entirely voluntary (Blanco, 2021).

This voluntary nature hinders a widespread adoption of corporate Scope 3 emission reporting in practice. For example, Patchell (2018) argued that as long as it is voluntary, firms will only report Scope 3 emissions if they envision a tangible financial benefit. Tang and Demeritt (2018) found that regulatory pressure was the strongest factor for firms to perform carbon emission reporting according to the respective regulatory guidelines and explicitly suggest the hypothesis that if the regulatory framework included Scope 3 emission reporting, firms would comply accordingly. In line with Patchell's findings, they add that perceived financial and/or reputational benefits are not sufficiently large to outweigh the efforts and potential disadvantages of disclosing Scope 3 emissions. Hickmann (2017) seconds this by stating that firms need to receive a signal of upcoming regulatory changes in order to adopt novel carbon emission reporting and reduction practices.

Furthermore, low levels of experience with required corporate processes for Scope 3 emission reporting make current policymaking ineffective. For example, Meng et al. (2017) argue that a feedback loop exists between corporate emission reporting and policymaking. Therefore, firms need to inform policymakers on their processes and experiences so that policymakers can take those into account when designing new regulation. Ozawa-Meida et al. (2013) and das Virgens et al. (2020) conducted case studies in which they both concluded that their specific insights from their case studies should be considered by policymakers to improve

future regulation. Similarly, Klein-Banai and Theis (2013) analyzed 135 university emission reports and derived specific policy-related recommendations. Lai (2014) conducted a stakeholder survey in the building industry asking whether Scope 1, 2, or 3 carbon reporting should be mandatory. He found that the more experienced the stakeholders were with the topic, the higher the agreement to mandatory reporting was. However, their agreement was also higher for scopes 1 and 2 than for Scope 3.

4.2.2 Motivation

4.2.2.1 Marketing

Several studies found that corporate Scope 3 carbon emission reporting is used as a marketing tool. For example, Tang and Demeritt (2018) demonstrate that perceived image benefits are a strong motivational factor for firms to voluntarily disclose carbon emission information. They add that it contributes to a public perception of professionalism and strong leadership. Abreu et al. (2021) added nuance by suggesting that the expected image benefits from Scope 3 reporting vary by region and sector.

However, not impairing a firm's image can also be an important reason *not* to use Scope 3 reporting in marketing. For example, Linares-Rodríguez et al. (2022, p.1) argue that "companies are not willing to disclose information that sends a negative signal of their environmental actions to the stakeholders". Consequently, a firm's carbon performance, i.e., its carbon emissions over time and compared to its peers, has a moderating effect on using Scope 3 reporting for marketing purposes.

Researchers further found that corporate Scope 3 reporting is often used for greenwashing, i.e., purposely spinning the disclosure of information so that it leads to a better perceived image or idea of a firm than the actual behavior of the firm would justify. For example, Blanco (2021) conducted an analysis of voluntary climate change disclosures of global firms and found that firms purposely disclose positive climate-related information while withholding negative

information. Depoers et al. (2016) further suggest that managers adapt their strategy for voluntary carbon information disclosure based on the needs of the addressed stakeholder groups. They would interpret information with respect to the firm's image which, among other things, leads to firms disclosing different information in annual corporate reports and reports to the CDP.

4.2.2.2 Investor pressure

As is the case for many other corporate activities, pressure exerted by investors to disclose information is a key antecedent of corporate Scope 3 carbon emission reporting. For example, Busch, Johnson, and Pioch (2022) expect corporate Scope 3 emission reporting to ramp up as investors continue to request Scope 3 emission information. In a survey-based analysis, Tang and Demeritt (2018) collected several statements from corporate representatives who pointed out that investors increasingly request information concerning Scope 3 carbon emissions and potential reduction pathways. Similarly, Linares-Rodríguez et al. (2022) suggest that investors increasingly consider environmental criteria in their investment decisions and firms therefore tend to provide more transparency on their carbon emissions.

In support of this idea, investors increasingly use Scope 3 emission information as a proxy for firms' risks associated with their supply chain and potential climate regulation. One researcher explicitly identified this association in a quantitative analysis of climate change disclosures of global firms (Blanco, 2021). He argues that along with engaging suppliers on carbon footprint information, other risks such as physical, regulatory, or market impact risks can be identified.

4.2.2.3 Customer requirements

Scholars further consider adhering to customer requirements in the form of Scope 3 emission disclosure as another important driver towardss more widespread reporting. For example, Patchell (2018) points out that for a firm to determine its Scope 3 carbon emissions, the firm's

suppliers need to support it with data exchange and information sharing, i.e., they need to fulfill additional requirements of their customers. Dahlmann and Rohrich (2019) analyzed this in more detail and compared types of customer-supplier engagement along multiple dimensions (e.g., purpose, timeframe, information asymmetry). Their analysis supports Patchell's view on the pursued collaboration that suppliers show when addressing customer requirements on carbon emission information.

4.2.2.4 Corporate governance

Corporate governance is an important driver for climate-related behavior of a firm, including Scope 3 emission reporting. For example, Ben-Amar and McIlkenny (2015) found a positive association between board effectiveness and voluntary disclosure to the CDP. In addition, Hansen et al. (2022) found that despite having very similar value chains, some firms in the food industry do and some do not report Scope 3 emissions. They argue that this cannot be solely attributed to a lack of common methodologies but must also be due to a firm's governance and leadership's sense of urgency on sustainability.

The adoption of a corporate carbon management strategy can have a positive impact on corporate carbon emission reporting. For example, the results of Linares-Rodríguez et al. (2022) suggest a positive relationship between the adoption of a corporate carbon management strategy and emission reporting for scopes 1 and 2. They also investigated corporate Scope 3 reporting, but the corresponding results were not conclusive.

4.2.3 Ability

4.2.3.1 Reporting standards

As of today, the standardization of corporate carbon emission reporting, and Scope 3 emission reporting in particular, is primarily driven by NGOs, namely the GHG Protocol. Hickmann (2017, p.5) explicitly underlines this: "the GHG Protocol has filled a regulatory gap

in global climate policy-making by providing the means for individual companies to comprehensively calculate and communicate their emissions."

Two standards are relevant for corporate Scope 3 carbon emission reporting. For one, there are product carbon footprint (PCF) standards, i.e., standards that determine how the footprint of individual products or product groups needs to be calculated to enable suppliers to communicate the footprint of their products to their customers. For another, there exist corporate carbon footprint (CCF) standards, i.e., standards that determine how the footprint of a firm, split into scopes 1, 2, and 3, needs to be calculated to enable firms to report and communicate their emissions to the public.

Several researchers investigated existing standards for PCF and CCF, and many have criticized them as being incomplete, inaccurate, and difficult to execute in practice. For example, Patchell (2018) has created a comprehensive evaluation scheme for the GHG Protocol "Corporate Value Chain (Scope 3) Accounting and Reporting Standard", in which he evaluates the standard along six dimensions: Transaction cost, power, responsibility allocation, uncertainty, location contingency, and production costs. Overall, he doubts that current standards are sufficient to enable firms to fully report their Scope 3 emissions.

Many other researchers also find the current standards to be partially unclear and causing inaccurate corporate Scope 3 emission reporting, and therefore request more standardized approaches and solutions. For example, O. Robinson et al. (2015, p.8) investigated Scope 3 carbon emission reporting at a university and concluded that "methods for assessing Scope 3 emissions urgently need refining and standardizing". In a recent study within the food industry, Hansen et al. (2022, p.9) further argue that "Sector-specific guidance and reporting requirements for companies in the food system could distinguish an additional Scope 3 category". Similar findings were obtained by Wei et al. (2020), Feng et al. (2015), J. S. Li et al.

(2013), Guereca et al. (2013; Talbot & Boiral), Talbot and Boiral (2013), and Sykes et al. (2019) in their various case study analyses.

In addition, multiple other researchers propose more accurate calculation techniques compared to those in the current standards. For example, X. Yu et al. (2020) developed a specific framework for emissions accounting of industrial parks in China. Brander (2017) compared the accuracy of "attributional" (i.e., emissions determined via allocation key) and "consequential" (i.e., emissions determined via bottom-up calculation) calculation methods. He concluded that attributional calculations, as mostly used in standards, may not capture all emissions while consequential calculations are more accurate. Vasquez et al. (2015), Clabeaux et al. (2020), Kulkarni (2019), and O. J. Robinson et al. (2018) all conducted similar analyses on the advantages of a bottom-up approach for calculating a university's carbon footprint and confirmed Brander's view. Alvarez et al. (2019) analyzed the application of a compound hybrid analysis for the improvement of carbon footprint calculations as part of a case study of a Spanish timber firm. They found that their approach improves accuracy and efficiency, and reduces costs. Similar findings on the application of hybrid calculation methods were obtained by multiple other research teams (Alvarez et al., 2014; Brown et al., 2012; Lenzen & Murray, 2010; J. J. Li et al., 2021; Lin et al., 2019; Lin et al., 2013; Qi et al., 2018).

Researchers have also found evidence that corporations actively use the disadvantages and shortcomings of the current standards to their own advantage. For example, Depoers et al. (2016) found that managers adapt their disclosure strategy to address the preferences of different stakeholder groups and that the vagueness of standards allows them to do this. In support of this notion, Dragomir (2012, p.1) concluded that "given the sophistication of emissions data collection and estimation tools such as the Greenhouse Gas (GHG) Protocol, it comes as a surprise that [studied companies] have issued reports containing unexplained figures and methodological inconsistencies".

4.2.3.2 Organizational capabilities

Early research on corporate Scope 3 carbon emission reporting often argues that a lack of know-how and capabilities in corporations is a critical factor for limited in-practice application of Scope 3 reporting. For example, one research team found that a lack of knowledge on how to measure and report Scope 3 emissions was a key reason why firms did not disclose information to the CDP at all (Blanco et al., 2016). Isil and Sebastianelli (2020) further found that awareness levels for value chain carbon emissions are generally limited and are lower for firms' downstream compared to their upstream activities.

Researchers also pointed towardss the need for additional guidance from academia, NGOs, or regulators. For example, Downie and Stubbs (2013, p.156) suggested already in early research that "more comprehensive guidance on relevant emission sources by industry or sector would likely improve the completeness and relevance of inventories in accordance with the Greenhouse Gas Protocol". In support of that, Blanco et al. (2016) specifically point out that the execution of Scope 3 reporting can be more complicated in some industries than in others.

Researchers have also identified learning effects from the execution of Scope 3 reporting over time. For example, Matisoff et al. (2013) found evidence for a positive learning effect from participating in the CDP. However, they also point out that this can vary by segment or emission type. Isil and Sebastianelli (2020) identified a similar pattern and suggest that the more advanced general carbon reporting practices are, the better is the awareness of Scope 3 carbon emissions.

Furthermore, studies indicate that effective corporate Scope 3 reporting requires specific organizational structures and systems to be established. For example, Patchell (2018) outlines that a key contributor to transactions costs is coordination effort, which primarily entails setting up the organizational structure and internal communication needed to coordinate the execution of data management, stakeholder engagement, accounting, and reporting. Tang and Demeritt

(2018) add that the amount of additional organizational effort depends on sector and other previous experiences of a firm. For example, highly energy-intensive firms have an advantage because their operational units are already used to handling similar energy-related information and can therefore transfer their reporting structures more easily, while non-energy intensive firms often need to establish entirely new processes and departments from scratch.

Lastly, over the past years, carbon reporting has grown into a board-level topic with a strong bearing on the job of key executives. For example, Tang and Demeritt (2018) found that in many firms, a board-level sign-off of annual corporate emission reports is now required. They conclude that the topic receives increasingly more attention from top management, and we might therefore see an uptick in adoption. Furthermore, one study found that a growing number of firms have introduced incentives and employee awards for the advancement of a firm's knowledge and impact on climate change (Blanco, 2021).

4.2.3.3 Data quality

Many researchers identified data quality, or rather a lack thereof, as a key problem in corporate Scope 3 reporting. For example, Busch, Johnson, and Pioch (2022) comprehensively evaluated the data quality of corporations for Scope 1, 2, and 3 emissions separately and demonstrated that availability, comparability, and consistency of data remains problematic, particularly for Scope 3 carbon emission reporting. Similarly, Wegener et al. (2019) emphasize effects of low data quality as they suggest that it causes uncertainty, which in turn reduces the comparability of Scope 3 reports.

Scholars also point towardss the importance of data quality for the emission calculation procedure. For example, Ghaemi and Smith (2020) argue that a lack of high-quality data strongly hinders the accurate quantification of the full carbon emission profile. Other studies highlight the issue of double-counting as a critical problem for completeness and accuracy driven by misunderstandings on the responsibility for certain emissions (e.g., transportation

emissions), the application of varying standards or other reasons (Busch, Johnson, & Pioch, 2022; Patchell, 2018; O. J. Robinson et al., 2018). Furthermore, the use of secondary emission factors instead of original primary data from lifecycle assessment models further contributes to inaccurate Scope 3 emission reporting (Downie & Stubbs, 2012). This finding is reaffirmed by Busch, Johnson, and Pioch (2022) who underscore that data stemming directly from reporting companies is significantly more reliable than secondary data from survey data, third-party estimation methods, or global average emission factors.

Several researchers also acknowledge that obtaining high quality data for corporate Scope 3 emission reporting is very difficult. For example, Patchell (2018) points out that it requires high operational efforts, particularly driven by the data gathering process. Multiple research teams further emphasized that complex lifecycle analyses are needed to produce high-quality data (Cankaya & Pekey, 2019; Khoo et al., 2017; Villena & Dhanorkar, 2020). For example, Villena and Dhanorkar (2020) specifically outline that large operational efforts are needed to engage with a firm's supplier base to receive and evaluate data.

4.2.3.4 Transaction costs

The high organizational and operational efforts required for corporate Scope 3 carbon emission reporting create significant transaction costs. Several researchers emphasize this as a key issue (Dahlmann & Rohrich, 2019; Isil & Sebastianelli, 2020; Patchell, 2018). For example, Patchell (2018) provides a comprehensive view on the individual factors that drive transaction costs and defines five main contributors to transaction costs: Complexity, information quality, coordination, opportunism, and real costs of transactions. He mainly attributes the problem of high transaction costs to the efforts of engaging with stakeholders to measure and manage emissions, setting up the required organizational structure for coordination, and ensuring sufficient reporting quality. He describes transaction costs as the most critical antecedent

hindering a more successful implementation of corporate Scope 3 carbon emission reporting in practice.

4.3 Consequences

4.3.1 Environment

4.3.1.1 Carbon performance

Corporate Scope 3 carbon emission reporting is an important enabler for effective carbon emission reduction. For example, Rietbergen et al. (2015) found that accurate emission reporting is a critical prerequisite for subsequent target setting which is in turn needed to ensure effective emission reduction. This is reaffirmed by Downie and Stubbs (2013, p.156) who argue that "a lack of knowledge of Scope 3 emissions inhibits a firm's ability to pursue the most cost-effective carbon mitigation strategies". Furthermore, multiple researchers point out that accurate Scope 3 reporting creates the required transparency to pinpoint emission sources which leads to more effective steering of reduction actions (Garcia-Alaminos et al., 2022; Liu et al., 2021; Takayabu et al., 2019). In accordance with that, several researchers explicitly showed that Scope 3 reporting is critical for target setting, monitoring, and steering of reduction pathways (Meng et al., 2017; Ozawa-Meida et al., 2013; Sudmant et al., 2018; Villalba et al., 2013; Wiedmann et al., 2021).

Scholars further identified the currently voluntary nature of corporate Scope 3 emission reporting as an inhibitor for Scope 3 emission reduction. For example, Alvarez et al. (2019) claim that because it is voluntary, many firms currently do not report their Scope 3 emissions, which in turn slows down Scope 3 emission reduction.

In addition, poor Scope 3 carbon emission reporting can lead to "carbon leakage", i.e., actually occurring carbon emissions not being captured in reporting and thus not being accounted for. For example, Wei et al. (2020) consider opacity around reporting standards and

deliberate or accidental exclusion of certain activities as the key reasons for leakage of Scope 3 carbon emissions.

Furthermore, the relationship between Scope 3 emission reporting and Scope 3 emission reduction can also be interpreted as bidirectional. For example, Braam et al. (2016) indicate that firms' decisions to report Scope 3 emissions is influenced by their emission performance relative to their peers. They argue that, according to legitimacy theory, poor performers would need to report more comprehensively on Scope 3 emissions than high performers to reach the same level of legitimacy.

4.3.2 Performance

4.3.2.1 Compliance

Compliance is not yet established as a consequence of corporate Scope 3 carbon emission reporting. As of today, Scope 3 reporting is not mandatory anywhere and therefore a firm cannot be compliant with any regulatory framework in that regard. However, prior research has acknowledged compliance as a consequence of general corporate carbon emission reporting (Patchell, 2018).

4.3.2.2 Risk management

Researchers identified corporate Scope 3 carbon emission reporting as a supply chain risk management tool. Corporations' risk management often focuses on its supply chain and Scope 3 emissions are interpreted as an indicator of climate-related risks and opportunities along the supply chain (Dahlmann & Rohrich, 2019). For example, one researcher explicitly argues that "measuring supply chain carbon emissions can lead to the discovery of potentially hidden risks related to climate change" and emphasizes the potential consequences of severe weather conditions, floods, and droughts (Blanco, 2021, p.4). Nguyen et al. (2021) developed a machine

learning approach intended to predict corporate carbon footprints and thereby identify risks related to climate change.

The extent of associated risks can vary between developed and developing countries. In this regard, Blanco (2021) explains that the occurrence of such risks and available resources to withstand them can vary regionally. For instance, suppliers may be located in countries where such conditions may occur more frequently and consequently, customers of such suppliers are exposed to higher risk. In-depth transparency on Scope 3 emissions can allow firms to identify such suppliers and associated risks.

In addition to that, corporate Scope 3 emissions can approximate regulatory risk. Potentially changing regulation has been identified as an important new risk type for businesses in the era of climate change and firms employ various strategies to better understand their regulatory risk (Dahlmann & Rohrich, 2019). One researcher points out that the higher the emissions from a certain area in the supply chain, the higher the impact of potentially tightening regulation. Consequently, suppliers may not be able to supply certain goods or services anymore or even go bankrupt. He concludes with “firms that do not measure their Scope 3 may not realize the magnitude of their contribution to climate change and their potential physical and regulatory exposures to risks” (Blanco, 2021, p.14).

4.3.2.3 Financial performance

Corporate Scope 3 emission information is an important parameter for investors when making an investment decision. Blanco (2021) claims, as previously outlined, that investors interpret Scope 3 emissions as a proxy for regulatory and supply-chain-related risks and are therefore highly interested in this type of information. He points out that investors already use Scope 3 disclosures to inform their investment decision. Busch, Johnson, and Pioch (2022) further emphasize that improvements in the quality of available data are critical to providing investors with full transparency.

Scholars have not yet conducted relevant research on a direct relationship between corporate Scope 3 emission reporting and profitability. Patchell (2018) provides a line of reasoning to suggest that Scope 3 reporting is only financially beneficial if in line with customer environmental demands. His argumentation assumes that environmental reporting, if demanded by customers, drives a higher willingness to pay, i.e., a "green premium". However, this research does not contain empirical results on a direct relationship.

4.3.3 Stakeholders

4.3.3.1 Supplier engagement

As a result of corporate Scope 3 reporting, engagement with suppliers becomes increasingly collaborative, especially due to the need to exchange growing amounts of data. For example, Dahlmann and Rohrich (2019) found that engagement differs across various dimensions (e.g., purpose or information handling) and that firms apply three types of engagement: Basic, transactional, and collaborative engagement. In a case study of the UK food supply chain, Tidy et al. (2016) found that engagement became increasingly collaborative as a result of the pursuit of Scope 3 emission reporting and subsequent reduction. Consequently, there exists a bidirectional relationship between firms' Scope 3 carbon emission reporting and supplier engagement.

Various studies identified a need for dedicated approaches or strategies for supplier engagement. For example, Villena and Dhanorkar (2020) found that coercive pressures (i.e., rules and regulation) from buyers are the strongest driver for suppliers to increase carbon emission reporting. They further found that suppliers without climate change incentives are more vulnerable to coercive and mimetic pressure (i.e., imitating of or seeking superiority over competition) while suppliers with climate change incentives are more receptive to normative pressure (i.e., norms in and expectations of society). Dhanda et al. (2022, p.1) reaffirm these findings in their analysis on institutional and stakeholder consequences on carbon mitigation

strategies by stating that “our research indicates that different types of institutional pressures […] lead to different and, in certain situations, more active responses from firms. We find that coercive pressures are about equal or more effective than normative or mimetic pressures for adoption of mitigation strategies”.

The balance of negotiation power further influences the willingness of suppliers to provide information. For example, Patchell (2018) points out that firms with high negotiation power over their suppliers are more likely to convince them to share primary data than firms with lower negotiation power.

4.3.3.2 Customer relationship

In line with the findings on supplier engagement, customer relationships become more collaborative as well. As outlined in the section on antecedents, adhering to customer requirements is an important driver for Scope 3 carbon emission reporting. The different types of customer-supplier engagement, as outlined by Dahlmann and Rohrich (2019), apply to the consequence of customer relationships as well. Therefore, the relation between Scope 3 reporting and customer relationships can also be described as bidirectional. However, Lintukangas et al. (2022) found that Scope 3 reporting practices do not affect customer relationships as strongly as supplier relationships.

4.3.3.3 Public perception

There is no dedicated research on the particular impact of Scope 3 reporting on a firm’s public perception. Extant research so far only focused on general carbon reporting (e.g., Khan et al., 2022).

5 Agenda for future research

In this chapter, we build on our review to identify gaps in the literature on Scope 3 emissions and leverage studies on general carbon emission reporting to develop a comprehensive research

agenda for corporate Scope 3 reporting. We do so along the research framework for corporate carbon emission reporting shown in Figure 9. Table 2 illustrates the research agenda for theoretical lenses, Table 3 illustrates the research agenda for antecedents, and Table 4 illustrates the research agenda for consequences.

Paper 1 | Table 2: Research agenda for theoretical lenses

Theoretical Lens	**Exemplary References from Literature on General Carbon Emission Reporting**	**Exemplary Insights from References**	**Future Research Pathways**
Legitimacy Theory	D. Y. Li et al., 2018; L. Luo et al., 2018; Pellegrino & Lodhia, 2012	Carbon emission reporting is strongly driven by legitimation purposes and that firms apply legitimizing strategies	Apply legitimacy theory within different industrial or regional contexts to better understand *why* firms report Scope 3 emissions
	Albarrak et al., 2019; Stanny, 2013	Firms report different extents of emissions depending on communication channel (CDP, annual report, social media, etc.)	Apply legitimacy theory to better understand *to what extent* firms report Scope 3 emissions
	Bauckloh et al., 2022; D. Y. Li et al., 2018; Velte et al., 2020	Carbon reporting positively affects carbon performance	Apply legitimacy theory to analyze the link between Scope 3 reporting and Scope 3 emission reduction
Stakeholder & Institutional Theory	Cadez et al., 2019; Jaggi et al., 2018	Different managerial interpretations of institutional and stakeholder pressures affect decision for disclosure	Apply stakeholder and institutional theory to assess managers' decision making and strategy development in climate change mitigation
	Abreu et al., 2017; Jabbour et al., 2020	Degree of engagement with certain stakeholders influences how firms deal with climate change related issues	Apply stakeholder and institutional theory to develop theoretical understanding of firm's stakeholder relationships in the context of Scope 3 emissions
	Grauel & Gotthardt, 2016; Mateo-Márquez et al., 2021	National contexts (e.g., level of enforcement of environmental regulation) strongly influence voluntary disclosure and greenwashing activities	Apply stakeholder and institutional theory to investigate regional specifics
Best Available Techniques (BAT)	Evrard et al., 2016	Defined seven distinct steps to determine and apply BATs in general	Further investigate the potential role of developing and applying BATs for corporate Scope 3 emission reporting
All	Abreu et al., 2017; Le Ravalec et al., 2022; Lemma et al., 2019; Lemma et al., 2021; Moussa et al., 2020	Extended theoretical understanding of carbon reporting in various ways (e.g., developed model linking corporate commitment to climate change actions or suggest a completely new system for measuring a firms impact on global warming)	Apply other established theories, (e.g., agency theory, upper echelons theory, or resource dependence theory)

Paper 1 | Table 3: Research agenda for antecedents

Antecedent	**Exemplary References from Literature on General Carbon Emission Reporting**	**Exemplary Insights from References**	**Future Research Pathway**
Regulation: Regulatory Framework	Ana et al., 2019; Bauckloh et al., 2022; Grauel & Gotthardt, 2016; Hahn et al., 2015; Haque & Ntim, 2018; Kansal et al., 2018; Kim et al., 2022; Kozlovski & Bawah, 2015	Positive relationships between implementation of regulation and emission reporting	Measure consequences of regulation around Scope 3 emission reporting on a local, sectoral, or other level (once introduced)
	-	-	Apply qualitative research methods to assess how managers deal with uncertainty around regulation on Scope 3 reporting
	Allini et al., 2018; Kouloukoui et al., 2021; Mateo-Marquez et al., 2022; Muttakin et al., 2021; Muttakin et al., 2022; Patnaik, 2020; Scholtens & Kleinsmann, 2011; Velte et al., 2020; J. Z. Zhang et al., 2022	Regional aspects (common-law tradition, related environmental and social policies, culture, democratic values, level of economic development, etc.) influence relationship	Investigate moderating effects of regional specifics on relationship between regulation and corporate Scope 3 reporting
	Khan et al., 2022; Y. L. Zhang et al., 2020	Availability of human resources and established processes are critical for effective auditing	Assess capabilities and requirements for auditing of corporate Scope 3 reports
	Bauckloh et al., 2022; Kirsten, 2014; Qian et al., 2020; X. L. Yu et al., 2022	Most studies found positive relationships between regulation and carbon performance; Kirsten (2014) criticized "carbon leakage" via accounting loopholes	Investigate potential direct relationship between regulation and Scope 3 carbon performance
Motivation: Marketing	Coen et al., 2022; Cong et al., 2020; Guo et al., 2020	Firms with poor carbon performance often do not report Scope 3 to not impair image; however, not reporting at all may be worse than reporting poor performance	Assess if and how carbon performance moderates relationship between marketing and corporate Scope 3 reporting
	L. K. Wedari et al., 2021	Found evidence for greenwashing among poor environmental performers while such evidence could not be found among good environmental performers	Review "greenwashing" practices among corporate Scope 3 reporting
Motivation: Investor pressure	Albarrak et al., 2019; Herbohn et al., 2019	Investors increasingly request carbon risk information	Investigate role of investors in motivating firms to disclose Scope 3 (e.g., via quantitative analyses of actual investment cases and public announcements)

	Velte et al., 2020	Variations in shareholder rights, investor protection, tax law, and other factors may moderate this relationship	Analyze if and how regional specifics moderate relationship between investor pressure and corporate Scope 3 reporting
Motivation: Customer requirements	-	-	Explore what (non-)financial benefits customers associate with the reported information (e.g., via case studies in high-emission industries with a large share of Scope 3 emissions, e.g., the automotive industry)
Motivation: Corporate Governance	Ben-Amar et al., 2022; Bento & Gianfrate, 2020; Hsueh, 2019; Karim et al., 2021; Moussa et al., 2020; Reid & Toffel, 2009; Sullivan & Gouldson, 2017; Weinhofer & Hoffmann, 2010	Application of such tools positively influence corporate carbon reporting	Assess impact of corporate strategy tools (e.g., overarching decarbonization strategy, internal carbon pricing or governance on capital expenditure) on corporate Scope 3 reporting
	Adu et al., 2022; Ben-Amar et al., 2017; Bui et al., 2021; Nuber & Velte, 2021	Found positive relationships for general carbon reporting	Assess role of corporate leadership (e.g., via board gender diversity or board salary incentives) on corporate Scope 3 reporting
Ability: Reporting Standards	Nordenstam et al., 2018	Some aspects of GHG Protocol standard for Scope 1 could influence managerial decision-making in counterproductive ways	Run additional reviews on Scope 3 reporting standards beyond the review by Patchell (2018) (e.g., investigate or compare other standards, or dive deeper into how standard affects managerial decision-making)
	-	-	Conduct quantitative analyses on how adherence to different Scope 3 standards affects completeness, accuracy, and/or comparability of Scope 3 reports
Ability: Organizational Capabilities	Jabbour et al., 2020	Conducted specialist interviews and applied analytical approach called “mechanisms of responses” to design action-oriented framework for managers	Apply qualitative research on how required capabilities can be identified, assessed, and developed
	Jabbour et al., 2020; Weinhofer & Hoffmann, 2010; Y. L. Zhang et al., 2020	Point towardss need to develop additional know-how, instill organizational change through overarching corporate carbon management strategies, and prevent a lack of talent	Dive deeper into organizational implications of corporate Scope 3 reporting (e.g., via qualitative/case study research within corporate settings)
Ability: Data Quality	Diniz et al., 2021; Seles et al., 2018	Blockchain can significantly improve accuracy, traceability, and verification processes of underlying data; big data unlocks opportunities in carbon management	Better understand accuracy and data quality differences between primary data from suppliers and secondary emission factors/industry averages (e.g., via application of emerging technologies such as blockchain, artificial intelligence, or big data)

	Goldhammer et al., 2017; Qian et al., 2018; Seles et al., 2018; Shahgholian, 2019	Application of novel environmental management accounting tools improves corporate carbon management and disclosure quality	Conduct analyses on organizational data management tools and their effectiveness
	-	-	Apply qualitative research methods to assess how managers deal with uncertainty around Scope 3 emission data
	-	-	Analyze how comparability among Scope 3 reports can be improved (e.g., review if managers compare absolute Scope 3 figures or if they compare Scope 3 to scopes 1 and 2)
	-	-	Review if and how firms measure Scope 3 even if they do not report yet
	-	-	Explore potential solutions for improving data quality and mitigating associated operational efforts and costs (e.g., collaboration on data collection, regulatory changes, application of novel technologies such as artificial intelligence, etc.)
Ability: Transaction costs	Diniz et al., 2021	Blockchain can reduce costs associated with emission reporting	Identify pathways for transaction cost reduction (e.g., via application of emerging technologies such as blockchain, artificial intelligence, or big data)
	O. J. Robinson et al., 2018	Developed “cut-off criteria” system (incremental improvement of reporting quality vs incremental transaction cost) to find optimum between reporting quality and transaction cost	Analyze impact of incremental Scope 3 reporting quality improvements onto transaction costs

All	-	-	Conduct “citation mapping” to identify further promising avenues for future research

Paper 1 | Table 4: Research agenda for consequences

Consequence	**Exemplary References from Literature on General Carbon Emission Reporting**	**Exemplary Insights from References**	**Future Research Pathway**
Environment: Carbon Performance	Bang et al., 2019; Bauckloh et al., 2022; Greenblatt, 2015; C. Luo et al., 2020; Sun et al., 2022; Wu et al., 2010	Applied analytical approaches such as forecasting, development of new KPIs, benchmarking exercises, case studies in corporate settings, or impact analyses of recent events	Investigate if and how firms use information contained within Scope 3 reporting to generate insights that ultimately improve carbon performance
	Ioannou et al., 2016; Rietbergen et al., 2015	Targets are often not ambitious enough to drive sufficient carbon performance; high-quality reporting can improve target setting process	Assess how Scope 3 emission reports can help managers formulate carbon performance targets (especially aim to understand how effect sizes of reduction actions are measured and evaluated)
	Linda Kusumaning Wedari et al., 2022	Identified positive moderating effect from environmental innovation on relationship between general carbon performance and financial performance	Analyze potential moderating effect of environmental innovation on relationship between Scope 3 reporting and carbon performance
	Cong et al., 2020; Giannarakis et al., 2017; Velte et al., 2020; L. K. Wedari et al., 2021	Contradictory results: Most suggest that the better a firm's carbon performance, the more likely the firm is to extensively report and vice versa. On the other hand, Cong et al. (2020) found evidence that firms with poorer carbon performance tend to disclose emissions more extensively to mitigate the consequences of their poor performance	Assess the reverse effect of Scope 3 performance on Scope 3 carbon reporting
Performance: Compliance	Jung et al., 2018; Kouloukoui et al., 2021; Kouloukoui et al., 2019; Lemma et al., 2020; Sakhel, 2017	Consider compliance as a key consequence of general emission reporting; identified regulatory changes as a key risk perceived by managers	Assess compliance as a potential consequence of corporate Scope 3 carbon emission reporting (e.g., expert interviews)
Performance: Risk Management	-	-	Analyze how Scope 3 reporting can mitigate supply chain-related risks (supply shortages, supplier bankruptcy, etc.) using quantitative analyses/case studies in recently effected sectors like semiconductor industry promising
Performance: Financial Performance	Alsaifi et al., 2020; Gallego-Alvarez et al., 2014; Gerged et al., 2021; Lemma et al., 2019; Lemma et al., 2021; Lewandowski, 2017; Matsumura et al., 2014; Morrone et al., 2022; Palea &	Positive relationships between carbon reporting and profitability and stock price; for cost of capital, some suggest that investors penalize disclosure while others indicate that investors appreciate disclosure	Investigate direct relationship between Scope 3 reporting and financial performance - e.g., quantitative analyses based on Scope 3 data and financial indicators (profitability, stock price, cost of capital, etc.)

	Santhia, 2022; Tuesta et al., 2021; E. P. Y. Yu et al., 2021; Zhou et al., 2018		
	Busch, Bassen, et al., 2022; Ferrat, 2021; Hassan & Romilly, 2018; Lewandowski, 2017; Misani & Pogutz, 2015	No clear picture: Some indicate positive relationship while others suggest emission reduction affects financial performance negatively (For example, Lewandowski (2017) found U-shaped carbon performance curve while Ferrat (2021) found that short-term financial performance was negatively affected by improved carbon performance and that solely high-materiality firms derive improved financial performance in long run)	Investigate moderating effect of carbon performance on relationship between Scope 3 reporting and financial performance
	-	-	Analyze how carbon pricing effects financial performance (simulate carbon missions as actual cost in financial analysis)
	Lemma et al., 2021; E. P. Y. Yu et al., 2021	Reduced information asymmetry makes investors lower costs of capital	Assess how information asymmetry moderates relationship between Scope 3 reporting and financial performance
Stakeholders: Supplier Engagement	-	-	Apply qualitative research/case studies to explicitly investigate collaborative engagements of firms with suppliers to collect primary data and include PCFs in supplier selection processes
Stakeholders: Customer Relationship	Tang & Demeritt, 2018	Voluntary Scope 1/2 reporting considered as unique selling point	Investigate benefits of using PCFs at point of sale - industries in which PCF varies strongly by supplier (e.g., metals/mining) promising
Stakeholders: Public Perception	Albarrak et al., 2019; Khan et al., 2022	Higher Scope 1/2 reporting quality leads to better public reputation	Assess impact of Scope 3 reporting on public perception or media coverage
All	-	-	Conduct “citation mapping” to identify further promising avenues for future research

6 Discussion

The conversation around corporate Scope 3 carbon emission reporting within the academic literature on sustainable management experienced a significant uptick in recent years. In the following chapter, we aim to lay out patterns and gaps that we identified.

The studies displayed a few striking methodological commonalities and differences. First, the large majority (~80%) of quantitative studies used panel data instead of cross-sectional data. Thus, researchers deemed it important to analyze temporal developments rather than momentary statuses. Second, we identified a wide discrepancy among the sample sizes used for quantitative studies as almost as many studies used samples with less than 100 firms as with more than 500 firms. Conclusions drawn from studies with smaller sample sizes might have to be treated with more caution. Third, the literature comprises a relatively high share of case studies and low share of quantitative research. This suggests that we are early in the development of the field, where a lot of work is still theory-building rather than theory-testing, and that there may not be enough data available, so researchers are limited to more qualitative work.

Furthermore, operationalization (i.e., data collection, measurement and calculation procedures, etc.) of carbon emission reporting appears to be of upmost importance but still requires additional research regarding Scope 3 emissions. The issue of obtaining high quality data for Scope 3 reporting is emphasized by several studies specifically referring to key pain points such as double-counting, the use of lifecycle assessment models, and the accuracy of secondary and survey data (Busch, Johnson, & Pioch, 2022; Patchell, 2018; O. J. Robinson et al., 2018; Wegener et al., 2019). However, scholars have yet to investigate whether firms actually measure Scope 3 emissions internally even if they do not report them, and how firms use and compare Scope 3 emission figures in practice. Furthermore, future research shall also focus on exploring potential solutions for improving data quality and mitigating associated

operational efforts and costs (e.g., collaboration on data collection, regulatory changes, application of novel technologies such as blockchain, artificial intelligence, or big data, etc.).

The way firms manage uncertainty (regarding the comprehensiveness, reliability, and validity of Scope 3 emission reports) constitutes another critical area for additional research in this space. Overall, several researchers acknowledge this issue and point towardss low levels of comprehensiveness (Blanco et al., 2016; Busch, Johnson, & Pioch, 2022; Hansen et al., 2022). The high use of CDP data is most likely attributable to the fact that the CDP consistently applies the same questionnaire structure and therefore represents a trustworthy data source. Also, the high use of CDP data may have further led to the observation that the GHG Protocol is by far the most frequently used reporting standard. The high share of samples with heterogeneous application of reporting standards must be seen as problematic as it threatens comprehensiveness and comparability. The methodological approach of manually collecting data from annual reports or using global databases may be the root cause of that problem as it is not very robust because it theoretically allows the inclusion of firms with different standards in samples. Overall, poor data quality and high uncertainty may be the reason for the rather limited empirical research focus so far.

Additionally, we need to establish a better understanding of the motivations for Scope 3 reporting, conceivably via the explicit application of theoretical lenses. So far, theoretical lenses have been applied scarcely in Scope 3 emissions research. However, results from studies on scopes 1 and 2 indicate that they could help understand how managers deal with uncertainty and why they decide for or against Scope 3 reporting.

Overall, we strongly emphasize the need for additional research, especially for the consequences of Scope 3 carbon emission reporting. Particularly, we urge scholars to conduct additional research on carbon performance to better estimate the importance of Scope 3

reporting for subsequent carbon emission reduction as a means to advance supply chain decarbonization. Studies on Scope 1 and 2 emissions indicate promising results in this regard.

7 Practical implications

Our findings also have important implications for practitioners. First, our insights on operationalization and uncertainty management may influence how managers conduct Scope 3 emission reporting. For example, transaction costs and financial performance, especially investor reaction, are critical parameters in managers' decision making. Poor reporting may cause managers to miss the bigger picture of their firms' emission profile, and ultimately slow down supply chain decarbonization.

Second, our findings, especially on regulation, reporting standards, and firm capabilities, may help policymakers design future regulations. The extant literature makes it clear that the voluntary nature of Scope 3 reporting hinders wider adoption in practice. Hence, policymakers may want to re-design regulation, while considering what today's firms are capable of, to effectively promote Scope 3 reporting.

8 Limitations

Naturally, this literature review is subject to limitations. Most importantly, there are limitations inherent in the process of identifying relevant literature. While we aimed for a comprehensive search in the field of business and sustainable management, our review may have missed some relevant articles due to filtering by keywords or journals.

In addition, the terms "carbon reporting" and "carbon performance" are often used in a more general manner. Therefore, differentiation between scopes is not always entirely clear and can potentially mislead as statements about Scope 1 could be interpreted as if made about Scope 3. Therefore, we treated potentially affected articles with particular caution.

9 Contribution and conclusion

With respect to the academic understanding of corporate carbon emission reporting, we contribute to the literature in the form of providing a comprehensive research framework, laying out the extant research on corporate Scope 3 carbon emission reporting, breaking down its complexity, and enabling other researchers to efficiently advance the academic understanding in this field. Our research framework is compatible with but substantially extends prior frameworks into a more comprehensive version by integrating additional parameters and outlining critical relationships. The results of our review further provide an easy-to-understand and holistic structure that allows researchers to quickly absorb the key aspects of the academic literature on this topic. The identified patterns may help further stimulate the discussion on this important topic and pinpoint valuable insights.

We further contribute through our extensive agenda for future research. Beyond suggesting that researchers consider a wider range of theoretical approaches, our research agenda highlights various potential pathways for future research based on both qualitative and quantitative research. The provision of key insights from referenced work on Scope 1 and 2 emissions may be particularly helpful in that regard. As of today, scholars have seized only a fraction of the rich research opportunities that this field has to offer. Thus, we are hopeful that our review will enable researchers to make use of existing knowledge more effectively, build on it to contribute to the advancement of the field, and ultimately contribute to the actual decarbonization of supply chains.

References

Abreu, M. C. S. de, Freitas, A. R. P. de, & Reboucas, S. (2017). Conceptual model for corporate climate change strategy development: Empirical evidence from the energy sector. *Journal of Cleaner Production*, *165*, 382–392. https://doi.org/10.1016/j.jclepro.2017.07.133

Abreu, M. C. S. de, Webb, K., Araujo, F. S. M., & Cavalcante, J. P. L. (2021). From "business as usual" to tackling climate change: Exploring factors affecting low-carbon decision-making in the canadian oil and gas sector. *Energy Policy*, *148.* https://doi.org/10.1016/j.enpol.2020.111932

Adu, D. A., Flynn, A., & Grey, C. (2022). Carbon performance, financial performance and market value: The moderating effect of pay incentives. *Business Strategy and the Environment.* Advance online publication. https://doi.org/10.1002/BSE.3239

Albarrak, M. S., Elnahass, M., & Salama, A. (2019). The effect of carbon dissemination on cost of equity. *Business Strategy and the Environment*, *28*(6), 1179–1198. https://doi.org/10.1002/bse.2310

Allini, A., Giner, B., & Caldarelli, A. (2018). Opening the black box of accounting for greenhouse gas emissions: The different views of institutional bodies and firms. *Journal of Cleaner Production*, *172*, 2195–2205. https://doi.org/10.1016/j.jclepro.2017.11.194

Alsaifi, K., Elnahass, M., & Salama, A. (2020). Market responses to firms' voluntary carbon disclosure: Empirical evidence from the United Kingdom. *Journal of Cleaner Production*, *262.* https://doi.org/10.1016/j.jclepro.2020.121377

Alvarez, S., Blanquer, M., & Rubio, A. (2014). Carbon footprint using the Compound Method based on Financial Accounts. The case of the School of Forestry Engineering, Technical University of Madrid. *Journal of Cleaner Production*, *66*, 224–232. https://doi.org/10.1016/j.jclepro.2013.11.050

Alvarez, S., Tobarra, M. A., & Zafrilla, J. E. (2019). Corporate and Product Carbon Footprint under Compound Hybrid Analysis: Application to a Spanish Timber Company. *Journal of Industrial Ecology*, *23*(2), 496–507. https://doi.org/10.1111/jiec.12759

Ana, F., Pinheiro, M. D., Brito, J. de, & Mateus, R. (2019). Decarbonizing strategies of the retail sector following the Paris Agreement. *Energy Policy*, *135.* https://doi.org/10.1016/j.enpol.2019.110999

Bang, Y. Y., Lee, D. S., & Lim, S. R. (2019). Analysis of corporate CO2 and energy cost efficiency: The role of performance indicators and effective environmental reporting. *Energy Policy*, *133.* https://doi.org/10.1016/j.enpol.2019.110897

Bauckloh, T., Klein, C., Pioch, T., & Schiemann, F. (2022). Under Pressure? The Link Between Mandatory Climate Reporting and Firms' Carbon Performance. *Organization & Environment.* Advance online publication. https://doi.org/10.1177/10860266221083340

Ben-Amar, W., Chang, M., & McIlkenny, P. (2017). Board Gender Diversity and Corporate Response to Sustainability Initiatives: Evidence from the Carbon Disclosure Project. *Journal of Business Ethics*, *142*(2), 369–383. https://doi.org/10.1007/s10551-015-2759-1

Ben-Amar, W., Gomes, M., Khursheed, H., & Marsat, S. (2022). Climate change exposure and internal carbon pricing adoption. *Business Strategy and the Environment.* Advance online publication. https://doi.org/10.1002/bse.3051

Ben-Amar, W., & McIlkenny, P. (2015). Board Effectiveness and the Voluntary Disclosure of Climate Change Information. *Business Strategy and the Environment*, *24*(8), 704–719. https://doi.org/10.1002/bse.1840

Bento, N., & Gianfrate, G. (2020). Determinants of internal carbon pricing. *Energy Policy*, *143*. https://doi.org/10.1016/j.enpol.2020.111499

Blanco, C. (2021). Supply Chain Carbon Footprinting and Climate Change Disclosures of Global Firms. *Production and Operations Management*, *30*(9), 3143–3160. https://doi.org/10.1111/poms.13421

Blanco, C., Caro, F., & Corbett, C. J. (2016). The state of supply chain carbon footprinting: analysis of CDP disclosures by US firms. *Journal of Cleaner Production*, *135*, 1189–1197. https://doi.org/10.1016/j.jclepro.2016.06.132

Braam, G. J. M., Weerd, L. U. de, Hauck, M., & Huijbregts, M. A. J. (2016). Determinants of corporate environmental reporting: the importance of environmental performance and assurance. *Journal of Cleaner Production*, *129*, 724–734. https://doi.org/10.1016/j.jclepro.2016.03.039

Brander, M. (2017). Comparative analysis of attributional corporate greenhouse gas accounting, consequential life cycle assessment, and project/policy level accounting: A bioenergy case study. *Journal of Cleaner Production*, *167*, 1401–1414. https://doi.org/10.1016/j.jclepro.2017.02.097

Brown, L. H., Buettner, P. G., Canyon, D. V., Mac Crawford, J., & Judd, J. (2012). Estimating the life cycle greenhouse gas emissions of Australian ambulance services. *Journal of Cleaner Production*, *37*, 135–141. https://doi.org/10.1016/j.jclepro.2012.06.020

Bui, B., Houqe, M. N., & Zaman, M. (2021). Climate change mitigation: Carbon assurance and reporting integrity. *Business Strategy and the Environment*, *30*(8), 3839–3853. https://doi.org/10.1002/bse.2843

Busch, T [T.], Bassen, A., Lewandowski, S., & Sump, F. (2022). Corporate Carbon and Financial Performance Revisited. *Organization & Environment*, *35*(1), 154–171. https://doi.org/10.1177/1086026620935638

Busch, T [T.], Johnson, M., & Pioch, T. (2022). Corporate carbon performance data: Quo vadis? *Journal of Industrial Ecology*, *26*(1), 350–363. https://doi.org/10.1111/jiec.13008

Cadez, S., Czerny, A., & Letmathe, P. (2019). Stakeholder pressures and corporate climate change mitigation strategies. *Business Strategy and the Environment*, *28*(1), 1–14. https://doi.org/10.1002/bse.2070

Callahan, W., James Fava, S. A., Wickwire, S., Sottong, J., Stanway, J., & Ballentine, M. (2011). Corporate Value Chain (Scope 3) Accounting and Reporting Standard Supplement to the GHG Protocol Corporate Accounting and Reporting Standard GHG Protocol Team.

Cankaya, S., & Pekey, B. (2019). A comparative life cycle assessment for sustainable cement production in Turkey. *Journal of Environmental Management*, *249*. https://doi.org/10.1016/j.jenvman.2019.109362

CDP (2017). From Agreement to Action: Mobilizing suppliers towards a climate resilient world: CDP Global Supply Chain Report 2016. *Business for Social Responsibility (BSR) Consultancy*.

CDP (2022). Engaging the Chain: Driving Speed and Scale: CDP Global Supply Chain Report 2021. *Business for Social Responsibility (BSR) Consultancy*.

Clabeaux, R., Carbajales-Dale, M., Ladner, D., & Walker, T. (2020). Assessing the carbon footprint of a university campus using a life cycle assessment approach. *Journal of Cleaner Production*, *273*. https://doi.org/10.1016/j.jclepro.2020.122600

Coen, D., Herman, K., & Pegram, T. (2022). Are corporate climate efforts genuine? An empirical analysis of the climate 'talk-walk' hypothesis. *Business Strategy and the Environment*. Advance online publication. https://doi.org/10.1002/bse.3063

Cong, Y., Freedman, M., & Park, J. D. (2020). Mandated greenhouse gas emissions and required SEC climate change disclosures. *Journal of Cleaner Production*, *247*. https://doi.org/10.1016/j.jclepro.2019.119111

Cormier, D., Gordon, I. M., & Magnan, M. (2004). Corporate Environmental Disclosure: Contrasting Management's Perceptions with Reality. *Journal of Business Ethics*, *49*(2), 143–165. https://doi.org/10.1023/B:BUSI.0000015844.86206.B9

Dahlmann, F., & Rohrich, J. K. (2019). Sustainable supply chain management and partner engagement to manage climate change information. *Business Strategy and the Environment*, *28*(8), 1632–1647. https://doi.org/10.1002/bse.2392

das Virgens, T., Andrade, J., & Hidalgo, S. (2020). Carbon footprint of public agencies: The case of Brazilian prosecution service. *Journal of Cleaner Production*, *251*, 119551. https://doi.org/10.1016/j.jclepro.2019.119551

Depoers, F., Jeanjean, T., & Jerome, T. (2016). Voluntary Disclosure of Greenhouse Gas Emissions: Contrasting the Carbon Disclosure Project and Corporate Reports. *Journal of Business Ethics*, *134*(3), 445–461. https://doi.org/10.1007/s10551-014-2432-0

Dhanda, K. K., Sarkis, J., & Dhavale, D. G. (2022). Institutional and stakeholder effects on carbon mitigation strategies. *Business Strategy and the Environment*, *31*(3), 782–795. https://doi.org/10.1002/bse.2917

Dijkmans, R. (2000). Methodology for selection of best available techniques (BAT) at the sector level. *Journal of Cleaner Production*, *8*(1), 11–21. https://doi.org/10.1016/S0959-6526(99)00308-X

Diniz, E. H., Yamaguchi, A., dos Santos, T. R., Carvalho, P. de, Alego, A. S., & Carvalho, M. (2021). Greening inventories: Blockchain to improve the GHG Protocol Program in scope 2. *Journal of Cleaner Production*, *291*. https://doi.org/10.1016/j.jclepro.2021.125900

Dowling, J., & Pfeffer, J. (1975). Organizational legitimacy: Social values and organizational behavior. *Sociological Perspectives*, *18*(1), 122–136. https://doi.org/10.2307/1388226

Downie, J., & Stubbs, W. (2012). Corporate Carbon Strategies and Greenhouse Gas Emission Assessments: The Implications of Scope 3 Emission Factor Selection. *Business Strategy and the Environment*, *21*(6), 412–422. https://doi.org/10.1002/bse.1734

Downie, J., & Stubbs, W. (2013). Evaluation of Australian companies' scope 3 greenhouse gas emissions assessments. *Journal of Cleaner Production*, *56*, 156–163. https://doi.org/10.1016/j.jclepro.2011.09.010

Dragomir, V. D. (2012). The disclosure of industrial greenhouse gas emissions: a critical assessment of corporate sustainability reports. *Journal of Cleaner Production*, *29-30*, 222–237. https://doi.org/10.1016/j.jclepro.2012.01.024

Ellram, L. M., & Golicic, S. L. (2016). The role of legitimacy in pursuing environmentally responsible transportation practices. *Journal of Cleaner Production*, *139*, 597–611. https://doi.org/10.1016/j.jclepro.2016.08.077

Evrard, D., Laforest, V., Villot, J., & Gaucher, R. (2016). Best Available Technique assessment methods: a literature review from sector to installation level. *Journal of Cleaner Production*, *121*, 72–83. https://doi.org/10.1016/j.jclepro.2016.01.096

Feng, C., Gao, X. N., Wu, J., Tang, Y. T., He, J. F., Qi, Y. Q., & Zhang, Y. S. (2015). Greenhouse gas emissions investigation for towns in China: a case study of Xiaolan. *Journal of Cleaner Production*, *103*, 130–139. https://doi.org/10.1016/j.jclepro.2014.01.013

Ferrat, Y. (2021). Carbon emissions and firm performance: A matter of horizon, materiality and regional specificities. *Journal of Cleaner Production*, *329*. https://doi.org/10.1016/j.jclepro.2021.129743

Gallego-Alvarez, I., Garcia-Sanchez, I. M., & Vieira, C. D. (2014). Climate Change and Financial Performance in Times of Crisis. *Business Strategy and the Environment*, *23*(6), 361–374. https://doi.org/10.1002/bse.1786

Garcia-Alaminos, A., Gilles, E., Monsalve, F., & Zafrilla, J. (2022). Measuring a university?S environmental performance: A standardized proposal for carbon footprint assessment. *Journal of Cleaner Production*, *357.* https://doi.org/10.1016/j.jclepro.2022.131783

Gerged, A. M., Matthews, L., & Elheddad, M. (2021). Mandatory disclosure, greenhouse gas emissions and the cost of equity capital: Uk evidence of a U-shaped relationship. *Business Strategy and the Environment*, *30*(2), 908–930. https://doi.org/10.1002/bse.2661

Ghaemi, Z., & Smith, A. D. (2020). A review on the quantification of life cycle greenhouse gas emissions at urban scale. *Journal of Cleaner Production*, *252.* https://doi.org/10.1016/j.jclepro.2019.119634

Giannarakis, G., Zafeiriou, E., & Sariannidis, N. (2017). The Impact of Carbon Performance on Climate Change Disclosure. *Business Strategy and the Environment*, *26*(8), 1078–1094. https://doi.org/10.1002/bse.1962

Goldhammer, B., Busse, C., & Busch, T [T.] (2017). Estimating Corporate Carbon Footprints with Externally Available Data. *Journal of Industrial Ecology*, *21*(5), 1165–1179. https://doi.org/10.1111/jiec.12522

Graf-Vlachy, L., Oliver, A. G., Banfield, R., König, A., & Bundy, J. (2020). Media Coverage of Firms: Background, Integration, and Directions for Future Research. *Journal of Management*, *46*(1), 36–69. https://doi.org/10.1177/0149206319864155

Grauel, J., & Gotthardt, D. (2016). The relevance of national contexts for carbon disclosure decisions of stock-listed companies: a multilevel analysis. *Journal of Cleaner Production*, *133*, 1204–1217. https://doi.org/10.1016/j.jclepro.2016.05.182

Greenblatt, J. B. (2015). Modeling California policy impacts on greenhouse gas emissions. *Energy Policy*, *78*, 158–172. https://doi.org/10.1016/j.enpol.2014.12.024

Guereca, L. P., Torres, N., & Noyola, A. (2013). Carbon Footprint as a basis for a cleaner research institute in Mexico. *Journal of Cleaner Production*, *47*, 396–403. https://doi.org/10.1016/j.jclepro.2013.01.030

Guo, T., Zha, G. L., Lee, C. L., & Tang, Q. L. (2020). Does corporate green ranking reflect carbon-mitigation performance? *Journal of Cleaner Production*, *277.* https://doi.org/10.1016/j.jclepro.2020.123601

Hahn, R., Reimsbach, D., & Schiemann, F. (2015). Organizations, Climate Change, and Transparency: Reviewing the Literature on Carbon Disclosure. *Organization & Environment*, *28*(1), 80–102. https://doi.org/10.1177/1086026615575542

Hansen, A. D., Kuramochi, T., & Wicke, B. (2022). The status of corporate greenhouse gas emissions reporting in the food sector: An evaluation of food and beverage manufacturers. *Journal of Cleaner Production*, *361.* https://doi.org/10.1016/j.jclepro.2022.132279

Haque, F., & Ntim, C. G. (2018). Environmental Policy, Sustainable Development, Governance Mechanisms and Environmental Performance. *Business Strategy and the Environment*, *27*(3), 415–435. https://doi.org/10.1002/bse.2007

Hassan, O. A. G., & Romilly, P. (2018). Relations between corporate economic performance, environmental disclosure and greenhouse gas emissions: New insights. *Business Strategy and the Environment*, *27*(7), 893–909. https://doi.org/10.1002/bse.2040

Herbohn, K., Gao, R., & Clarkson, P. (2019). Evidence on Whether Banks Consider Carbon Risk in Their Lending Decisions. *Journal of Business Ethics*, *158*(1), 155–175. https://doi.org/10.1007/s10551-017-3711-3

Hickmann, T. (2017). Voluntary global business initiatives and the international climate negotiations: A case study of the Greenhouse Gas Protocol. *Journal of Cleaner Production*, *169*, 94–104. https://doi.org/10.1016/j.jclepro.2017.06.183

Hsueh, L. (2019). Opening up the firm: What explains participation and effort in voluntary carbon disclosure by global businesses? An analysis of internal firm factors and dynamics. *Business Strategy and the Environment*, *28*(7), 1302–1322. https://doi.org/10.1002/bse.2317

Huybrechts, D., Derden, A., van den Abeele, L., Aa, S. V., & Smets, T. (2018). Best available techniques and the value chain perspective. *Journal of Cleaner Production*, *174*, 847–856. https://doi.org/10.1016/j.jclepro.2017.10.346

Ioannou, I., Li, S. X., & Serafeim, G. (2016). The Effect of Target Difficulty on Target Completion: The Case of Reducing Carbon Emissions. *Accounting Review*, *91*(5), 1467–1492. https://doi.org/10.2308/accr-51307

Isil, O., & Sebastianelli, R. (2020). Arcs of carbon awareness in the value chain and their antecedents. *Business Strategy and the Environment*, *29*(2), 503–518. https://doi.org/10.1002/bse.2383

Jabbour, A., Vazquez-Brust, D., Jabbour, C. J. C., & Ribeiro, D. A. (2020). The interplay between stakeholders, resources and capabilities in climate change strategy: Converting barriers into cooperation. *Business Strategy and the Environment*, *29*(3), 1362–1386. https://doi.org/10.1002/bse.2438

Jaggi, B., Allini, A., Macchioni, R., & Zagaria, C. (2018). The Factors Motivating Voluntary Disclosure of Carbon Information: Evidence Based on Italian Listed Companies. *Organization & Environment*, *31*(2), 178–202. https://doi.org/10.1177/1086026617705282

Jung, J., Herbohn, K., & Clarkson, P. (2018). Carbon Risk, Carbon Risk Awareness and the Cost of Debt Financing. *Journal of Business Ethics*, *150*(4), 1151–1171. https://doi.org/10.1007/s10551-016-3207-6

Kalu, J. U., Buang, A., & Aliagha, G. U. (2016). Determinants of voluntary carbon disclosure in the corporate real estate sector of Malaysia. *Journal of Environmental Management*, *182*, 519–524. https://doi.org/10.1016/j.jenvman.2016.08.011

Kansal, M., Joshi, M., Babu, S., & Sharma, S. (2018). Reporting of Corporate Social Responsibility in Central Public Sector Enterprises: A Study of Post Mandatory Regime in India. *Journal of Business Ethics*, *151*(3), 813–831. https://doi.org/10.1007/s10551-016-3253-0

Karim, A. E., Albitar, K., & Elmarzouky, M. (2021). A novel measure of corporate carbon emission disclosure, the effect of capital expenditures and corporate governance. *Journal of Environmental Management*, *290.* https://doi.org/10.1016/j.jenvman.2021.112581

Khan, H. Z., Houqe, M. N., & Ielemia, I. K. (2022). Organic versus cosmetic efforts of the quality of carbon reporting by top New Zealand firms. Does market reward or penalise? *Business Strategy and the Environment.* Advance online publication. https://doi.org/10.1002/bse.3169

Khoo, J. Z., Haque, N., Woodbridge, G., McDonald, R., & Bhattacharya, S. (2017). A life cycle assessment of a new laterite processing technology. *Journal of Cleaner Production*, *142*, 1765–1777. https://doi.org/10.1016/j.jclepro.2016.11.111

Kim, J. B., Wang, C., & Wu, F. (2022). The real effects of risk disclosures: Evidence from climate change reporting in 10-Ks. *Review of Accounting Studies.* Advance online publication. https://doi.org/10.1007/s11142-022-09687-z

Kirsten, S. (2014). Renewable Energy Sources Act and Trading of Emission Certificates: A national and a supranational tool direct energy turnover to renewable electricity-supply in Germany. *Energy Policy*, *64*, 302–312. https://doi.org/10.1016/j.enpol.2013.08.030

Klein-Banai, C., & Theis, T. L. (2013). Quantitative analysis of factors affecting greenhouse gas emissions at institutions of higher education. *Journal of Cleaner Production*, *48*, 29–38. https://doi.org/10.1016/j.jclepro.2011.06.004

Kouloukoui, D., Marcellis-Warin, N. de, Armellini, F., Warin, T., & Torres, E. A. (2021). Factors influencing the perception of exposure to climate risks: Evidence from the world's largest carbon-intensive industries. *Journal of Cleaner Production*, *306.* https://doi.org/10.1016/j.jclepro.2021.127160

Kouloukoui, D., Marinho, M. M. D., Gomes, S. M. D., 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.* https://doi.org/10.1016/j.jclepro.2019.117935

Kozlovski, E., & Bawah, U. (2015). A financial decision support framework for the appraisal of renewable energy infrastructures in developing economies. *International Journal of Energy Management*, *9*(2), 176–203. https://doi.org/10.1108/IJESM-03-2014-0008

Kulkarni, S. D. (2019). A bottom up approach to evaluate the carbon footprints of a higher educational institute in India for sustainable existence. *Journal of Cleaner Production*, *231*, 633–641. https://doi.org/10.1016/j.jclepro.2019.05.194

Lai, J. H. K. (2014). Mandatory reporting of greenhouse gas emissions from buildings: Stakeholders' opinions in Hong Kong. *Energy Policy*, *75*, 278–288. https://doi.org/10.1016/j.enpol.2014.10.004

Le Ravalec, M., Rambaud, A., & Blum, V. (2022). Taking climate change seriously: Time to credibly communicate on corporate climate performance. *Ecological Economics*, *200*, 107542. https://doi.org/10.1016/J.ECOLECON.2022.107542

Lee, S. Y. (2012). Corporate Carbon Strategies in Responding to Climate Change. *Business Strategy and the Environment*, *21*(1), 33–48. https://doi.org/10.1002/BSE.711

Lemma, T. T., Feedman, M., Mlilo, M., & Park, J. D. (2019). Corporate carbon risk, voluntary disclosure, and cost of capital: South African evidence. *Business Strategy and the Environment*, *28*(1), 111–126. https://doi.org/10.1002/bse.2242

Lemma, T. T., Lulseged, A., & Tavakolifar, M. (2021). Corporate commitment to climate change action, carbon risk exposure, and a firm's debt financing policy. *Business Strategy and the Environment*, *30*(8), 3919–3936. https://doi.org/10.1002/bse.2849

Lemma, T. T., Shabestari, M. A., Freedman, M., & Mlilo, M. (2020). Corporate carbon risk exposure, voluntary disclosure, and financial reporting quality. *Business Strategy and the Environment*, *29*(5), 2130–2143. https://doi.org/10.1002/bse.2499

Lenzen, M., & Murray, J. (2010). Conceptualising environmental responsibility. *Ecological Economics*, *70*(2), 261–270. https://doi.org/10.1016/j.ecolecon.2010.04.005

Lewandowski, S. (2017). Corporate Carbon and Financial Performance: The Role of Emission Reductions. *Business Strategy and the Environment*, *26*(8), 1196–1211. https://doi.org/10.1002/bse.1978

Li, D. Y., Huang, M., Ren, S. G., Chen, X. H., & Ning, L. T. (2018). Environmental Legitimacy, Green Innovation, and Corporate Carbon Disclosure: Evidence from CDP China 100. *Journal of Business Ethics*, *150*(4), 1089–1104. https://doi.org/10.1007/s10551-016-3187-6

Li, J. J., Tian, Y. J., Zhang, Y. L., & Xie, K. C. (2021). Spatializing environmental footprint by integrating geographic information system into life cycle assessment: A review and practice recommendations. *Journal of Cleaner Production*, *323.* https://doi.org/10.1016/j.jclepro.2021.129113

Li, J. S., Chen, G. Q., Lai, T. M., Ahmad, B., Chen, Z. M., Shao, L., & Ji, X. (2013). Embodied greenhouse gas emission by Macao. *Energy Policy*, *59*, 819–833. https://doi.org/10.1016/j.enpol.2013.04.042

Lin, J. Y., Li, H. M., Huang, W., Xu, W. T., & Cheng, S. H. (2019). A Carbon Footprint of High-Speed Railways in China: A Case Study of the Beijing-Shanghai Line. *Journal of Industrial Ecology*, *23*(4), 869–878. https://doi.org/10.1111/jiec.12824

Lin, J. Y., Liu, Y., Meng, F. X., Cui, S. H., & Xu, L. L. (2013). Using hybrid method to evaluate carbon footprint of Xiamen City, China. *Energy Policy*, *58*, 220–227. https://doi.org/10.1016/j.enpol.2013.03.007

Linares-Rodríguez, M. C., Gambetta, N., & García-Benau, M. A. (2022). Carbon management strategy effects on the disclosure and efficiency of carbon emissions: A study of Colombian companies' context and inherent characteristics. *Journal of Cleaner Production*, 132850. https://doi.org/10.1016/J.JCLEPRO.2022.132850

Lintukangas, K., Arminen, H., Kahkonen, A. K., & Karttunen, E. (2022). Determinants of Supply Chain Engagement in Carbon Management. *Journal of Business Ethics.* Advance online publication. https://doi.org/10.1007/s10551-022-05199-7

Liu, Y. Y., Wang, Y. Q., Lyu, P., Hu, S. E., Yang, L., & Gao, G. (2021). Rethinking the carbon dioxide emissions of road sector: Integrating advanced vehicle technologies and construction supply chains mitigation options under decarbonization plans. *Journal of Cleaner Production*, *321.* https://doi.org/10.1016/j.jclepro.2021.128769

Luo, C., Posen, I. D., Hoornweg, D., & MacLean, H. L. (2020). Modelling future patterns of urbanization, residential energy use and greenhouse gas emissions in Dar es Salaam with the Shared Socio-Economic Pathways. *Journal of Cleaner Production*, *254.* https://doi.org/10.1016/j.jclepro.2020.119998

Luo, L., Tang, Q. L., & Peng, J. (2018). The direct and moderating effects of power distance on carbon transparency: An international investigation of cultural value and corporate social responsibility. *Business Strategy and the Environment*, *27*(8), 1546–1557. https://doi.org/10.1002/bse.2213

Mateo-Marquez, A. J., Gonzalez-Gonzalez, J. M., & Zamora-Ramirez, C. (2022). An international empirical study of greenwashing and voluntary carbon disclosure. *Journal of Cleaner Production*, *363.* https://doi.org/10.1016/j.jclepro.2022.132567

Mateo-Márquez, A. J., González-González, J. M., & Zamora-Ramírez, C. (2021). The influence of countries' climate change-related institutional profile on voluntary environmental disclosures. *Business Strategy and the Environment*, *30*(2), 1357–1373. https://doi.org/10.1002/BSE.2690

Matisoff, D. C., Noonan, D. S., & O'Brien, J. J. (2013). Convergence in Environmental Reporting: Assessing the Carbon Disclosure Project. *Business Strategy and the Environment*, *22*(5), 285–305. https://doi.org/10.1002/bse.1741

Matsumura, E. M., Prakash, R., & Vera-Munoz, S. C. (2014). Firm-Value Effects of Carbon Emissions and Carbon Disclosures. *Accounting Review*, *89*(2), 695–724. https://doi.org/10.2308/accr-50629

Meng, F. X., Liu, G. Y., Yang, Z. F., Hao, Y., Zhang, Y. R., Su, M. R., & Ulgiati, S. (2017). Structural analysis of embodied greenhouse gas emissions from key urban materials: A case study of Xiamen City, China. *Journal of Cleaner Production*, *163*, 212–223. https://doi.org/10.1016/j.jclepro.2016.11.108

Meyer, J. W., & Rowan, B. (1977). Institutionalized Organizations: Formal Structure as Myth and Ceremony. *American Journal of Sociology*, *83*(2), 340–363. https://doi.org/10.1086/226550

Misani, N., & Pogutz, S. (2015). Unraveling the effects of environmental outcomes and processes on financial performance: A non-linear approach. *Ecological Economics*, *109*, 150–160. https://doi.org/10.1016/j.ecolecon.2014.11.010

Morrone, D., Schena, R., Conte, D., Bussoli, C., & Russo, A. (2022). Between saying and doing, in the end there is the cost of capital: Evidence from the energy sector. *Business Strategy and the Environment*, *31*(1), 390–402. https://doi.org/10.1002/bse.2900

Moussa, T., Allam, A., Elbanna, S., & Bani-Mustafa, A. (2020). Can board environmental orientation improve US firms' carbon performance? The mediating role of carbon strategy. *Business Strategy and the Environment*, *29*(1), 72–86. https://doi.org/10.1002/bse.2351

Muttakin, M. B., Mihret, D. G., & Rana, T. (2021). Electoral system, corporate political donation, and carbon emission intensity: Cross-country evidence. *Business Strategy and the Environment*, *30*(4), 1767–1779. https://doi.org/10.1002/bse.2714

Muttakin, M. B., Rana, T., & Mihret, D. G. (2022). Democracy, national culture and greenhouse gas emissions: An international study. *Business Strategy and the Environment.* Advance online publication. https://doi.org/10.1002/bse.3059

Nguyen, Q., Diaz-Rainey, I., & Kuruppuarachchi, D. (2021). Predicting corporate carbon footprints for climate fi nance risk analyses: A machine learning approach. *Energy Economics*, *95.* https://doi.org/10.1016/j.eneco.2021.105129

Nordenstam, L., Ilic, D. D., & Odlund, L. (2018). Corporate greenhouse gas inventories, guarantees of origin and combined heat and power production - Analysis of impacts on total carbon dioxide emissions. *Journal of Cleaner Production*, *186*, 203–214. https://doi.org/10.1016/j.jclepro.2018.03.034

Nuber, C., & Velte, P. (2021). Board gender diversity and carbon emissions: European evidence on curvilinear relationships and critical mass. *Business Strategy and the Environment*, *30*(4), 1958–1992. https://doi.org/10.1002/bse.2727

Ozawa-Meida, L., Brockway, P., Letten, K., Davies, J., & Fleming, P. (2013). Measuring carbon performance in a UK University through a consumption-based carbon footprint: De Montfort University case study. *Journal of Cleaner Production*, *56*, 185–198. https://doi.org/10.1016/j.jclepro.2011.09.028

Palea, V., & Santhia, C. (2022). The financial impact of carbon risk and mitigation strategies: Insights from the automotive industry. *Journal of Cleaner Production*, *344.* https://doi.org/10.1016/j.jclepro.2022.131001

Patchell, J. (2018). Can the implications of the GHG Protocol's scope 3 standard be realized? *Journal of Cleaner Production*, *185*, 941–958. https://doi.org/10.1016/j.jclepro.2018.03.003

Patnaik, S. (2020). Emissions permit allocation and strategic firm behavior: Evidence from the oil sector in the European Union emissions trading scheme. *Business Strategy and the Environment*, *29*(3), 976–995. https://doi.org/10.1002/bse.2411

Pellegrino, C., & Lodhia, S. (2012). Climate change accounting and the Australian mining industry: Exploring the links between corporate disclosure and the generation of legitimacy. *Journal of Cleaner Production*, *36*, 68–82. https://doi.org/10.1016/j.jclepro.2012.02.022

Qi, C. C., Wang, Q. S., Ma, X. T., Ye, L. P., Yang, D. L., & Hong, J. L. (2018). Inventory, environmental impact, and economic burden of GHG emission at the city level: Case study of Jinan, China. *Journal of Cleaner Production*, *192*, 236–243. https://doi.org/10.1016/j.jclepro.2018.04.259

Qian, W., Horisch, J., & Schaltegger, S. (2018). Environmental management accounting and its effects on carbon management and disclosure quality. *Journal of Cleaner Production*, *174*, 1608–1619. https://doi.org/10.1016/j.jclepro.2017.11.092

Qian, W., Suryani, A. W., & Xing, K. (2020). Does carbon performance matter to market returns during climate policy changes? Evidence from Australia. *Journal of Cleaner Production*, *259*. https://doi.org/10.1016/j.jclepro.2020.121040

Reid, E. M., & Toffel, M. W. (2009). Responding to Public and Private Politics: Corporate Disclosures of Climate Change Strategies. *Strategic Management Journal*, *30*(11), 1157–1178. https://doi.org/10.1002/smj.796

Rietbergen, M. G., van Rheede, A., & Blok, K. (2015). The target-setting process in the CO2 Performance Ladder: does it lead to ambitious goals for carbon dioxide emission reduction? *Journal of Cleaner Production*, *103*, 549–561. https://doi.org/10.1016/j.jclepro.2014.09.046

Roberts, R. W. (1992). Determinants of corporate social responsibility disclosure: An application of stakeholder theory. *Accounting, Organizations and Society*, *17*(6), 595–612. https://doi.org/10.1016/0361-3682(92)90015-K

Robinson, O., Kemp, S., & Williams, I. (2015). Carbon management at universities: a reality check. *Journal of Cleaner Production*, *106*, 109–118. https://doi.org/10.1016/j.jclepro.2014.06.095

Robinson, O. J., Tewkesbury, A., Kemp, S., & Williams, I. D. (2018). Towards a universal carbon footprint standard: A case study of carbon management at universities. *Journal of Cleaner Production*, *172*, 4435–4455. https://doi.org/10.1016/j.jclepro.2017.02.147

Rousseau, D. M., Manning, J., & Denyer, D. (2008). *Evidence in Management and Organizational Science: Assembling the Field's Full Weight of Scientific Knowledge through Syntheses.* https://doi.org/10.2139/ssrn.1309606

Sakhel, A. (2017). Corporate climate risk management: Are European companies prepared? *Journal of Cleaner Production*, *165*, 103–118. https://doi.org/10.1016/j.jclepro.2017.07.056

Schaedler, L., Graf-Vlachy, L., & König, A. (2022). Strategic leadership in organizational crises: A review and research agenda. *Long Range Planning*, *55*(2). https://doi.org/10.1016/j.lrp.2021.102156

Scholtens, B., & Kleinsmann, R. (2011). Incentives for subcontractors to adopt CO2 emission reporting and reduction techniques. *Energy Policy*, *39*(3), 1877–1883. https://doi.org/10.1016/J.ENPOL.2011.01.032

Seles, B., Jabbour, A., Jabbour, C. J. C., Fiorini, P. D., Mohd-Yusoff, Y., & Thome, A. M. T. (2018). Business opportunities and challenges as the two sides of the climate change: Corporate responses and potential implications for big data management towardss a low carbon society. *Journal of Cleaner Production*, *189*, 763–774. https://doi.org/10.1016/j.jclepro.2018.04.113

Shahgholian, A. (2019). Unpacking the relationship between environmental profile and financial profile; literature review towards methodological best practice. *Journal of Cleaner Production*, *233*, 181–196. https://doi.org/10.1016/j.jclepro.2019.05.365

Stanny, E. (2013). Voluntary Disclosures of Emissions by US Firms. *Business Strategy and the Environment*, *22*(3), 145–158. https://doi.org/10.1002/bse.1732

Suchman, M. C. (1995). Managing Legitimacy: Strategic and Institutional Approaches. *Academy of Management Review*, *20*(3), 571. https://doi.org/10.2307/258788

Sudmant, A., Gouldson, A., Millward-Hopkins, J., Scott, K., & Barrett, J. (2018). Producer cities and consumer cities: Using production- and consumption-based carbon accounts to guide climate action in China, the UK, and the US. *Journal of Cleaner Production*, *176*, 654–662. https://doi.org/10.1016/j.jclepro.2017.12.139

Sullivan, R., & Gouldson, A. (2017). The Governance of Corporate Responses to Climate Change: An International Comparison. *Business Strategy and the Environment*, *26*(4), 413–425. https://doi.org/10.1002/bse.1925

Sun, L [Lu], Kaufman, M. F., Sirk, E. A., Durga, S., Mahowald, N. M., & You, F. (2022). COVID-19 impact on an academic Institution's greenhouse gas inventory: The case of Cornell University. *Journal of Cleaner Production*, *363*, 132440. https://doi.org/10.1016/J.JCLEPRO.2022.132440

Sykes, A. J., Topp, C. F. E., & Rees, R. M. (2019). Understanding uncertainty in the carbon footprint of beef production. *Journal of Cleaner Production*, *234*, 423–435. https://doi.org/10.1016/j.jclepro.2019.06.171

Takayabu, H., Kagawa, S., Fujii, H., Managi, S., & Eguchi, S. (2019). Impacts of productive efficiency improvement in the global metal industry on CO2 emissions. *Journal of Environmental Management*, *248*. https://doi.org/10.1016/j.jenvman.2019.109261

Talbot, D., & Boiral, O. (2013). Can we trust corporates GHG inventories? An investigation among Canada's large final emitters. *Energy Policy*, *63*, 1075–1085. https://doi.org/10.1016/j.enpol.2013.09.054

Tang, S., & Demeritt, D. (2018). Climate Change and Mandatory Carbon Reporting: Impacts on Business Process and Performance. *Business Strategy and the Environment*, *27*(4), 437–455. https://doi.org/10.1002/bse.1985

Tidy, M., Wang, X. J., & Hall, M. (2016). The role of Supplier Relationship Management in reducing Greenhouse Gas emissions from food supply chains: supplier engagement in the UK supermarket sector. *Journal of Cleaner Production*, *112*, 3294–3305. https://doi.org/10.1016/j.jclepro.2015.10.065

Tuesta, Y. N., Soler, C. C., & Feliu, V. R. (2021). Carbon management accounting and financial performance: Evidence from the European Union emission trading system. *Business Strategy and the Environment*, *30*(2), 1270–1282. https://doi.org/10.1002/bse.2683

Vasquez, L., Iriarte, A., Almeida, M., & Villalobos, P. (2015). Evaluation of greenhouse gas emissions and proposals for their reduction at a university campus in Chile. *Journal of Cleaner Production*, *108*, 924–930. https://doi.org/10.1016/j.jclepro.2015.06.073

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*. https://doi.org/10.1016/j.jclepro.2020.120063

Villalba, G., Tarnay, L., Campbell, E., & Gabarrell, X. (2013). A life-cycle carbon footprint of Yosemite National Park. *Energy Policy*, *62*, 1336–1343. https://doi.org/10.1016/j.enpol.2013.07.024

Villena, V. H., & Dhanorkar, S. (2020). How institutional pressures and managerial incentives elicit carbon transparency in global supply chains. *Journal of Operations Management*, *66*(6), 697–734. https://doi.org/10.1002/joom.1088

Webster, J., & Watson, R. T. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, *26*(2), xiii–xxiii. http://www.jstor.org/stable/4132319

Wedari, L. K [L. K.], Jubb, C [C.], & Moradi-Motlagh, A [A.] (2021). Corporate climate-related voluntary disclosures: Does potential greenwash exist among Australian high emitters reports? *Business Strategy and the Environment*, *30*(8), 3721–3739. https://doi.org/10.1002/bse.2836

Wedari, L. K [Linda Kusumaning], Moradi-Motlagh, A [Amir], & Jubb, C [Christine] (2022). The moderating effect of innovation on the relationship between environmental and financial performance: Evidence from high emitters in Australia. *Business Strategy and the Environment.* Advance online publication. https://doi.org/10.1002/BSE.3167

Wegener, M., Labelle, R., & Jerman, L. (2019). Unpacking carbon accounting numbers: A study of the commensurability and comparability of corporate greenhouse gas emission disclosures. *Journal of Cleaner Production*, *211*, 652–664. https://doi.org/10.1016/j.jclepro.2018.11.156

Wei, W. D., Zhang, P. F., Yao, M. T., Xue, M., Miao, J. W., Liu, B., & Wang, F. (2020). Multi-scope electricity-related carbon emissions accounting: A case study of Shanghai. *Journal of Cleaner Production*, *252.* https://doi.org/10.1016/j.jclepro.2019.119789

Weinhofer, G., & Busch, T [Timo] (2013). Corporate Strategies for Managing Climate Risks. *Business Strategy and the Environment*, *22*(2), 121–144. https://doi.org/10.1002/BSE.1744

Weinhofer, G., & Hoffmann, V. H. (2010). Mitigating climate change – how do corporate strategies differ? *Business Strategy and the Environment*, *19*(2), 77–89. https://doi.org/10.1002/BSE.618

Wiedmann, T., Chen, G. W., Owen, A., Lenzen, M., Doust, M., Barrett, J., & Steele, K. (2021). Three-scope carbon emission inventories of global cities. *Journal of Industrial Ecology*, *25*(3), 735–750. https://doi.org/10.1111/jiec.13063

Wu, X. C., Priyadarsini, R., & Eang, L. S. (2010). Benchmarking energy use and greenhouse gas emissions in Singapore's hotel industry. *Energy Policy*, *38*(8), 4520–4527. https://doi.org/10.1016/j.enpol.2010.04.006

Yu, E. P. Y., Tanda, A., Luu, B. V., & Chai, D. I. H. (2021). Environmental transparency and investors' risk perception: Cross-country evidence on multinational corporations' sustainability practices and cost of equity. *Business Strategy and the Environment*, *30*(8), 3975–4000. https://doi.org/10.1002/bse.2852

Yu, X., Zheng, H. R., Sun, L [L.], & Shan, Y. L. (2020). An emissions accounting framework for industrial parks in China. *Journal of Cleaner Production*, *244.* https://doi.org/10.1016/j.jclepro.2019.118712

Yu, X. L., Shi, J. W., Wan, K., & Chang, T. Y. (2022). Carbon trading market policies and corporate environmental performance in China. *Journal of Cleaner Production*, *371.* https://doi.org/10.1016/j.jclepro.2022.133683

Zhang, J. Z., Liu, Y., Zhou, M. F., Chen, B. Y., Liu, Y. W., Cheng, B. D., Xue, J. J., & Zhang, W. (2022). Regulatory effect of improving environmental information disclosure under environmental tax in China: From the perspectives of temporal and industrial heterogeneity. *Energy Policy*, *164.* https://doi.org/10.1016/j.enpol.2021.112760

Zhang, Y. L., Gu, L. Y., & Guo, X. (2020). Carbon audit evaluation system and its application in the iron and steel enterprises in China. *Journal of Cleaner Production*, *248.* https://doi.org/10.1016/j.jclepro.2019.119204

Zhou, Z. F., Zhang, T., Wen, K., Zeng, H. X., & Chen, X. H. (2018). Carbon risk, cost of debt financing and the moderation effect of media attention: Evidence from Chinese companies operating in high-carbon industries. *Business Strategy and the Environment*, *27*(8), 1131–1144. https://doi.org/10.1002/bse.2056

3 Research Paper 2

Incumbent Responses to Anticipated Discontinuous Regulatory Change: The Case of Scope 3 CO_2 Reporting in the Steel Industry

Abstract

Regulatory change can be highly discontinuous for organizations. Yet, despite the cumulative knowledge of the discontinuous change and institutionalism literatures, our understanding of incumbent behavior in response to anticipated discontinuous regulatory change is limited. To address this issue, we conducted qualitative analyses of data on the European steel industry, which is facing prospective discontinuous regulatory change on Scope 3 reporting. Our findings offer new insights into this understudied field by elaborating on incumbents' expectations for the future, their ensuing motivations, and their taken or planned actions. We find evidence for heterogenous adaptation behavior that manifests in three motivational patterns. These patterns are a result of incumbents' varying expectations of future circumstances, opportunities, and risks, and they lead to different actions incumbents plan or take in response to the anticipated discontinuous regulatory change. Our study advances the understanding of regulatory change as a distinct form of discontinuous change, sheds light on incumbent behavior at an early stage of a discontinuous change prior to its actual occurrence, and highlights that, in contrast to other forms of discontinuous change, a successful adaptation to discontinuous regulatory change can also have negative effects on incumbents. Finally, our study opens up numerous pathways for future research.

Keywords: Discontinuous change, discontinuous regulatory change, incumbent response behavior, Scope 3 emissions, Scope 3 reporting

1 Introduction

Regulatory change can be highly discontinuous for organizations. For instance, in 2016, the European Union passed the General Data Protection Regulation (GDPR) as a novel regulatory framework for personal data protection, which came into force on May 25th 2018 (European Commission, 2023). For many firms, this regulatory change impacted their daily operations with immediate effect and often induced drastic changes to their value creation processes, thus being discontinuous to the affected firms (Anderson & Tushman, 1990; Christensen & Bower, 1996). To comply with GDPR, firms using personal consumer data needed to integrate a new consumer consent query, which often led to reduced consumer interaction (Johnson et al., 2023; Peukert et al., 2022). The online advertising industry, for example, struggled with the new regulation and suffered losses in advertisement performance and sales (Wang et al., 2023). In addition, Jia et al. (2021) found that, after GDPR was implemented, investments in new and emerging technology firms in Europe dropped significantly in comparison to the US and other regions.

Researchers have long investigated the question of how incumbent firms respond to discontinuous change. Initially, scholars assumed that incumbents would somewhat uniformly and systematically fail to adapt to discontinuous changes (Christensen & Bower, 1996). Later scholars discovered and explained that incumbent firms behave highly heterogeneously in response to the same discontinuous change (Eggers & Park, 2018; Kammerlander et al., 2018; König et al., 2012). In a comprehensive review of the literature, Eggers and Park (2018) emphasized that different types of discontinuous technological changes can induce different behavioral responses. Scholars further detailed, for example, the influence of resource rigidity and routine rigidity (Gilbert, 2005; König et al., 2021), managerial sensemaking (Raffaelli et al., 2019; Weber et al., 2019), and varying organizational types and characteristics

(Kammerlander et al., 2018; König et al., 2013; König et al., 2012; Szewczyk et al., 2022) on incumbents' responses towards discontinuous change.

Scholars of institutionalism have also contributed to the understanding of how organizations react to change. In her fundamental work, Oliver (1991) outlined five types of strategic responses to institutional pressures, i.e., demands from institutions or stakeholders, that are distinguished into three forms - coercive (regulatory), normative, and mimetic (Scott, 2008) - and developed a theory predicting firm behavior in response to changes in such pressures. Other scholars extended this conversation by identifying institutional complexity, i.e., a state in which a firm experiences multiple, partly contradicting institutional pressures simultaneously, as a dynamically changing influence that firms experience differently (Greenwood et al., 2011), by investigating the influence of intra-organizational political processes (Pache & Santos, 2010), and by studying patterns of compliance with such pressures (Dhalla & Oliver, 2013; Malesky & Taussig, 2016; Raaijmakers et al., 2014). More recently, Weber et al. (2019) integrated Institutional Theory and the conversation on incumbent response to discontinuous change by explicating institution-infused patterns of managerial sensemaking of such change.

However, this cumulative body of research does not provide a sufficient understanding of incumbent responses to discontinuous regulatory change for three main reasons. First, it primarily focuses on discontinuous change in the form of technological change and innovation. Regulatory changes, however, do not necessarily open up new pathways of creating and capturing value for a business, as is the case for many other forms of discontinuous change (Christensen & Bower, 1996; Kammerlander et al., 2018), but instead can have explicit objectives that are detrimental or restrictive to firms' value creation processes. Second, while most discontinuous changes are introduced and then diffuse over time as stakeholders react to them, discontinuous regulatory change is usually discussed and iteratively developed among stakeholders *before* any law is enacted, but then comes into force with full effect for all parties

at once. Due to its implicit assumption of a diffusion process, prior research has mainly assessed incumbent behavior during or after a discontinuous change (Anderson & Tushman, 1990; Eggers & Park, 2018; Kumaraswamy et al., 2018). For discontinuous regulatory change, however, the timespan prior to its actual occurrence is of upmost importance (Malesky & Taussig, 2016). Third, although institutionalist literature has begun to address regulatory change, it tends to consider regulatory change as rather incremental and does not thoroughly include the crucial aspect of potential discontinuity (Greenwood et al., 2011; Raaijmakers et al., 2014).

These limitations of the extant literature are problematic for multiple reasons. First, existing theoretical explanations are not directly applicable to incumbent responses to discontinuous regulatory changes, which may lead to imprecise or outright incorrect conclusions about incumbents' behaviors related to potential regulatory changes. Second, the extant literature does little to account for firm behavior in preparation for a prospective discontinuous change. As a result, we lack a thorough theoretical understanding of situations in which a potential regulatory change is discussed but its exact scope, timing, and implementation are still unclear. Third, practitioner accounts suggest that many firms simply struggle with adaptation to and compliance with regulatory change (Dhalla & Oliver, 2013; Malesky & Taussig, 2016; Raaijmakers et al., 2014), making it practically important to create a deeper understanding of incumbents' reactions to such change. Lastly, our shortcomings in understanding discontinuous regulatory changes also limit policymakers' ability to craft and implement effective regulation. Hence, we ask the overarching theoretical question: *How do incumbent firms act in the face of anticipated discontinuous regulatory change?*

In this article, we aim to shine light on this issue by developing theory in the empirical context of prospectively new regulation on corporate Scope 3 CO_2 reporting in the steel industry. We conduct a qualitative analysis (Gioia et al., 2013) of 21 in-depth interviews with

managers and experts within and around the industry, as well as secondary data, to identify characteristics of incumbent behavior and subsequently develop a process theory (Langley, 1999) to illuminate relationships between characteristics. Our research setting is suitable as the steel industry is a highly polluting industry for which changes in regulation on corporate Scope 3 CO_2 reporting are frequently demanded, but the time and scope of such changes will coming into effect remains highly uncertain (European Commission's Joint Research Centre, 2022; European Steel Association, 2020).

Our findings offer new insights into the understudied field of firm-level adaptation behavior to discontinuous regulatory change. More specifically, we elaborate on incumbents' expectations for the future of their industry, which motivations emerge from these expectations, and which actions they have already taken or plan to take in response. We illustrate how incumbents' varying expectations of future circumstances, opportunities, and risks influence their motivation to adapt, and ultimately determine what actions they take or plan to take to prepare for the anticipated discontinuous regulatory change.

We make three critical contributions to the discontinuous change and institutionalism literatures. First, we advance the understanding of regulatory change as a distinct form of discontinuous change by illustrating incumbent behavior specific to discontinuous regulatory change. In this way, we extend the conversation on discontinuous change to a novel type of change. Second, we shed light on incumbent behavior at an early stage of a discontinuous change prior to its actual occurrence. In so doing, we allow for further nuance in our understanding of heterogeneous incumbent behavior in response to a discontinuous change, and we open avenues for future research. Third, we discover that, in contrast to other forms of discontinuous change, a successful adaptation to a discontinuous regulatory change can have negative effects on incumbent firms (e.g., on their image or competitive position), which, in turn, influences their response behavior. With that discovery, we widen the understanding of

why incumbents do or do not adapt to a discontinuous change and open up new research pathways in the field of incumbent adaptation to discontinuous change.

2 Theoretical Background

2.1 Incumbent behavior in response to discontinuous change

A critical challenge for incumbent firms has long been assessing and responding to discontinuous change, i.e., disruptions that drastically change traditional pathways of value creation, innovation, and organizational processes (Anderson & Tushman, 1990; Christensen & Bower, 1996; Gilbert, 2005). Scholars in this field of research have identified a plethora of barriers to adaptation and behavioral patterns of incumbent firms in response to discontinuous change, and firmly established that different incumbent firms can behave heterogeneously in response to the same discontinuous change (Eggers & Park, 2018; Kammerlander et al., 2018; König et al., 2012).

For one, scholars linked incumbent response behavior to different organizational and managerial characteristics. For example, scholars developed and revised theory on the influence of opportunity and threat perceptions on incumbent inertia in response to discontinuous change (Gilbert, 2005; König et al., 2021). They found that inertia is comprised of resource rigidity and routine rigidity, and that differences in managers' perceptions have varying effects on incumbents' inertia. Relatedly, Raffaelli et al. (2019) analyzed how managers' cognitive and emotional framing influence their response, and pointed towardss the need for managers to become flexible in their ability to frame a discontinuous change. Furthermore, Kammerlander and Ganter (2015) found that specific noneconomic goals of CEOs of family-owned businesses influence if and how the firm responds to a discontinuous change. Eggers and Park (2018) pointed out that larger firms are more likely to possess relevant resources and are better able to acquire new knowledge needed to adapt to a discontinuous change.

For another, prior research posits that there exist different types of discontinuous changes and that their characteristics induce different responses by incumbents. For example, in a comprehensive literature review, Eggers and Park (2018) laid out the characteristics of different discontinuous changes and subsequently explained the interdependencies between antecedents of incumbent responses (e.g., firm size, top management characteristics, organizational structure) and these discontinuous changes.

Notably, discontinuous *regulatory* changes are understudied in this literature stream. In the recent review by Eggers and Park (2018), regulatory change is not considered as a central representation of change and only very few scholars treat regulatory change as a discontinuity. Similarly, Kumaraswamy et al. (2018) mostly illustrate regulatory changes as a regulator's reaction towards a discontinuous innovation, but not as the core discontinuity. In a rare example, Haveman et al. (2001) assessed the impact of discontinuous regulatory changes in two separate industries on organizational domains (i.e., the spectrum of products and services a firm can provide), CEO succession, and financial performance. They found that such regulatory changes induced shifts in organizational domains and executive leadership, which both subsequently affected financial performance.

2.2 Institutionalist perspective on firm response to regulatory change

The institutionalist literature has also concerned itself with how organizations react to different types of change, which are all understood to manifest as institutional pressures that may change over time. In this literature, regulation, in the form of coercive pressure, is one of three fundamental pillars (Scott, 2008). In her fundamental work, Oliver (1991) defined five distinct strategic responses - acquiesce, compromise, avoid, defy, and manipulate - that incumbent firms use in response to such coercive pressures and developed a theory predicting firm response behavior.

Other scholars built on this conceptual groundwork and identified institutional complexity as a driver for heterogeneity in incumbent response. For example, Greenwood et al. (2011) found that institutional complexity is a dynamically changing state and that firms, based on their organizational characteristics and position in their field, experience it to different degrees. Such differences in experiences subsequently led to differences in response behavior. Relatedly, Raaijmakers et al. (2014) found that institutional complexity leads decision-makers to delay compliance with a coercive institutional demand to actively reduce the institutional complexity. In contrast, Luo et al. (2016) investigated firms' corporate social responsibility reporting as a response to institutional complexity and found that firms that experienced higher complexity responded with earlier (but lower quality) adaptation to the change.

Prior work further found patterns related to firms' compliance with regulatory changes. For example, Dhalla and Oliver (2013) found that strong industry identity, i.e., a collective understanding of the key industry characteristics among incumbents, often led to non-compliance with certain coercive pressures. Malesky and Taussig's (2016) work suggests that the more a firm is engaged with policymakers during the regulatory design process, the more likely the firm is to comply with a regulatory change once it is enacted.

Furthermore, work integrating the discontinuous change literature and institutionalism has already led to valuable contributions to both literature streams. In a recent study, Weber et al. (2019) leveraged institutionalist perspectives to better understand organizations' responses to discontinuous innovation in the context of new business models in the emerging "sharing economy" and identified distinct patterns of managerial sensemaking that drive heterogeneity in incumbent response and inertia to discontinuous change. Notably, in their comprehensive historical review of institutional theory, Glynn and D'Aunno (2022) further emphasize the importance of such integrative research and call for further related work.

2.3 Incumbent behavior prior to a discontinuous regulatory change

Despite the rich knowledge on firms' adaptation to discontinuous change and organizations' reaction to change more general, there is a limited understanding of incumbent behavior prior to the occurrence of a discontinuous regulatory change. There are at least three reasons for this. First, extant literature mainly investigates discontinuous innovations (i.e., changes that constitute technological changes, innovative forms of value creation, or new business models), but does not thoroughly assess discontinuous regulatory changes. However, regulatory changes are particularly critical as they differ from discontinuous innovations in that a regulatory change does not necessarily enable new pathways of creating and capturing value for a business (Christensen & Bower, 1996; Kammerlander et al., 2018), but instead may be exclusively restrictive and thus detrimental to firms' current value creation processes (e.g., by mandating reduced environmental pollution or increased employee safety). Although some atypical discontinuous (de)regulatory changes might exhibit different characteristics, e.g., the explicit legalization of certain technologies or innovations such as ridesharing (Deerfield & Elert, 2023) or autonomous driving (Skeete, 2018), most do not and therefore require specific attention as they may pose significant challenges to incumbent firms.

Second, while most discontinuous changes are introduced - a technology is invented, for example - and then diffuse over time with all stakeholders reacting to it, discontinuous regulatory change is usually discussed and iteratively developed among stakeholders *before* a new law is passed and then, often after a certain grace period, comes into force with immediate effect for all parties. Due to this assumption of a diffusion process, or an "era of ferment" (Anderson & Tushman, 1990, p. 606), prior research primarily focused on incumbent behavior during or after a discontinuous change has taken place. Scholars emphasize that the era of ferment is often characterized by uncertainty which differs for different types of technological change and that this timespan strongly influences how firms adapt to the discontinuous change

(Anderson & Tushman, 1990; Christensen & Bower, 1996; Eggers & Park, 2018; Kumaraswamy et al., 2018). For discontinuous regulatory change, however, the timespan prior to its occurrence is of upmost importance as scope, timing, and implementation of a discontinuous regulatory change are shaped essentially exclusively during this period (Malesky & Taussig, 2016). In another rare example, Lamdin (2001) assessed the impact of regulatory changes using an event study approach. In doing so, however, he was not able to investigate the aforementioned timespan prior to the occurrence of the regulatory changes.

Third, although the institutionalist literature considers regulatory change, specifically in the form of coercive pressure, it does not thoroughly account for its potentially discontinuous nature, instead often considering regulatory change as rather incremental. For example, Raaijmakers et al. (2014) studied incremental regulatory changes within the childcare sector in the Netherlands, and Dhalla and Oliver (2013) studied the effects of incrementally stricter banking regulation in Canada.

This state of the literature poses severe problems for our theoretical understanding of the focal phenomenon, warranting additional research. First, the extant theoretical foundations and conceptual understandings within the literature stream of discontinuous change are insufficient to fully explain incumbent responses to discontinuous regulatory changes. For example, this may lead to imprecise or outright incorrect conclusions about incumbents' expectations of risks and opportunities associated with potential regulatory changes. Second, the extant literature does not specifically account for firm behavior in preparation for a prospective discontinuous regulatory change. As a result, we lack a thorough understanding of situations in which a potential regulatory change is discussed but its exact scope, timing, and implementation are still unclear. Third, practitioner accounts suggest that many firms simply struggle with adaptation to and compliance with regulatory changes (Dhalla & Oliver, 2013; Malesky & Taussig, 2016; Raaijmakers et al., 2014). This is particularly important as regulatory action is expected to be a

primary driver for change in many fields, especially related to global issues like climate change or artificial intelligence (Council of the European Union, 2023; US EPA, 2022), which incumbents need to respond to. Lastly, the shortcomings in our understanding of discontinuous regulatory changes are problematic for policymakers because they inhibit their ability to craft and implement effective regulation and to productively engage with incumbents during this process. Hence, we ask the research question: *How do incumbent firms act in the face of anticipated discontinuous regulatory change?*.

3 Method

3.1 Research setting

We studied anticipated regulation around corporate Scope 3 CO_2 emission reporting in the European steel industry as an exploratory case study (Siggelkow, 2007; Yin, 1994) to develop theory in response to the above research question (Christensen, 2006; Eisenhardt, 1989). The practice of corporate Scope 3 reporting is widely expected to become part of mandatory regulation in the future (Euractiv, 2022; Lloyd et al., 2022). However, as of today, it is not part of any enforced regulatory framework and most firms have not adopted this practice voluntarily (Hettler & Graf-Vlachy, 2023). The steel industry is a particularly suitable case study setting as it is a traditional industry with fairly homogenous incumbents that are facing a potentially large change due to the shift towardss “green steel” (European Commission’s Joint Research Centre, 2022), in which drastic regulatory changes are frequently called for (European Steel Association, 2020). Thus, the introduction of mandatory Scope 3 reporting into a regulatory framework in the European steel industry represents a regulatory change that is both discontinuous and simultaneously widely anticipated.

We collected data through interviews and complemented it with archival documents. First, we conducted interviews with managers and experts in and around the steel industry. Our

respondents comprised managers and directors from various departments of steelmaking firms as well as industry experts and managers working for steelmakers' suppliers and customers, industry associations, and industry service providers. The interviews were conducted and recorded via video-calls, usually lasted around 30-45 minutes, and were subsequently transcribed for further analysis. Second, we consulted various relevant archival documents such as annual reports, sustainability reports, press articles, and independent industry reports.

We stopped the data collection process once theoretical saturation was reached and additional data collection only lead to marginally new insights (Glaser & Strauss, 2017). Table 1 provides an overview of the interview respondents as well as the archival documents used in this study.

Paper 2 | Table 1: Overview of data sources

Interviews (21 total)

Organization	Participant # and Role
Steelmaker A	1) Director Transformation & Regulation
	2) Procurement Manager Alloys
Steelmaker B	3) Sustainability Manager
	4) Manager Digital Transformation
Steelmaker C	5) Head of Value Chain Emissions
Steelmaker D	6) Director Corporate Strategy
Steelmaker E	7) Vice President Sustainability
Steelmaker F	8) Director Production Process
Steelmaker G	9) Global Procurement Manager
Steelmaker H	10) Head of Production
Steelmaker I	11) Project Leader Procurement
Steel Consumer A	12) Sustainability Manager Metals
Steel Consumer B	13) Manager Strategic Sustainability
Steel Consumer C	14) ESG Manager
Raw Material Supplier A	15) CEO
Raw Material Supplier B	16) CEO
Raw Material Supplier C	17) Commercial Director
Industry Association A	18) Standards Manager
Industry Association B	19) Head of Corporate Sustainability
Service Provider A	20) Founder & Director
Service Provider B	21) Founder & Director

Archival Documents (74 total)

Type	Number
Primary Data	
Annual Reports	28
Sustainability Reports	15
Company Websites	11
Secondary Data	
Press Articles	14
Industry Reports	6

3.2 Data analysis

We analyzed our data using the Gioia methodology (Gioia et al., 2013; Nag et al., 2007), i.e., we developed categorizations using constant comparison techniques (Glaser & Strauss,

2017; Strauss & Corbin, 1990). First, we read through all interview transcripts and coded all relevant phrases. Then, we applied an interpretative approach (Miles et al., 2014) to group these coded phrases into *first-order categories*. We proceeded to cluster the first-order categories into *second-order themes* to develop a structure at a higher theoretical level. This step was particularly important to shift from concrete first-order categories to more abstract second-order themes, which is needed to allow for generalizability of the results. Then, we allocated the second-order themes to *overarching dimensions* to provide a high-level structure on our evidence on incumbent behavior prior to discontinuous regulatory changes. Throughout, we used archival documents to triangulate our findings and cross-check for plausibility (Jick, 1979; Miles et al., 2014) as well as to refine our results beyond the interview responses. Table 2 shows the emerging data structure with exemplary evidence. We translated quotes from non-English-speaking interview respondents.

Paper 2 | Table 2: Data structure and exemplary quotes

Overarching Dimensions	2nd-Order Themes	1st-Order Categories	Exemplary Quotes
Expectations for the future context	Expected opportunities	Reach CO_2 emission reduction targets	"[…] because it was a conscious decision to explicitly set targets for this [Scope 3 emissions] and reporting builds the basis for achieving these targets." (Participant 4)
		Allow for sales of superior products with lower carbon footprints	"So actually, the only supplier where we would ask explicitly for their Scope 3 emissions, are the ones that we believe have good marketing potential in terms of green steel. And then it's the green steel premium potential, green steel premium that will incentivize the steel industry to provide more transparency." (Participant 12)
		Fulfill investor expectations	"[…] today the biggest driver [for Scope 3 reporting] I would say are the targets we have to announce for SBTi, which is let's say an extremely important point for our investors, especially over the next years. [...] And now this year we are working also on the SBTi and SBTi has already announced some very complex methodology for inclusion, which includes reporting of Scope 3." (Participant 5)
		Enhance supply chain management	"I can see advantages in procurement so that processes in the supply chain are improved which may result in both, better CO_2 and cost efficiency." (Participant 1)
		Improve employee satisfaction	"And the value that we've heard from steel makers often is that it's relating to how their employees feel about them, feel about the job they're doing." (Participant 18)
	Expected circumstances	Acknowledge that regulatory change is needed and will eventually come	"And because there is a lot of money involved, I am fully convinced that there will be regulatory boundary conditions in the future. Similar to what we already know from emission trading in the EU, there the calculations are also determined by regulatory provisions." (Participant 1)
		Expect that Scope 3 reporting will become an established standard business process	"Essentially how it's been pushed from our customers is 'you're out if you don't have it', so it's going to be mandatory. Further down the line, I imagine it will be very similar for us. A contract will go out for tender and it will be mandatory to the award of the contract to provide that data." (Participant 9)
	Expected risks	Be forced to disclose poor environmental performance	"If there are no regulatory or for the entire industry applicable provisions, then it [doing Scope 3 reporting] is a clear competitive disadvantage. […] Of course, if I disclose my Scope 3 and the others don't, then it's a disadvantage." (Participant 10)

		Increase operational workload	"But of course, these kinds of regulations create a lot of work, especially if you are not prepared. […] Also, all supply chain aspects create a lot of work to collect and consolidate the data. And more broadly speaking, all the preparation and resources that need to be provided. In that regard, we are sometimes also hindered by our corporate slowness." (Participant 4)
		Face regulatory restrictions to operate	"And there is a risk that someday Scope 3 figures are capped. This would cause real competitive disadvantages. I mean that regulation states that only materials under certain thresholds are allowed to be imported." (Participant 1)
		Lose procurement bargaining power with suppliers	"[…] it can be detrimental to the business relationship with some suppliers because they may judge these targets or ambitions as unachievable, or they may try to take advantage of the situation and ask for price increases." (Participant 5)
		Reveal secret corporate information to competitors	"On the other hand, you would make many aspects transparent: How you work, where and how much recycling or new materials you are using. You would give away insights into your data and your business model. That may certainly be a risk." (Participant 4)
Motivation for today's behavior	Incentives for early movers	Ensure readiness once details of regulatory change are announced	"We are active, we already have Scope 3 reporting, we have a target. Such regulation would not have a direct effect then. […] when it comes to Scope 3 calculations, we have sufficient primary data, I am confident this covers all potential regulatory frameworks." (Participant 3)
		Fulfill first customer requirements	"It's [Scope 3 reporting] being driven largely by our customers. You know, they're requiring full CO_2 product carbon footprints, which does obviously include our Scope 3 emissions. So, it's now very much at the forefront of what we want to do." (Participant 2)
		Develop short-term competitive advantage	"[…] if one steelmaker is able to transparently explain their Scope 3 emissions and another is not, then it's a clear competitive advantage for the first." (Participant 14)
		Build image of industry leader for sustainability	"We want to ensure that we are seen as the leaders within our industry and being the industry's first to be on the forefront of battling climate change." (Participant 7)
		Comply with other sustainability related initiatives (e.g., Science Based Targets)	"[…] that's the reason why or some of the reasons why we've signed up for the Science Based Targets, and that requires to have Scope 3 emission targets and reporting as well." (Participant 7)
	Reasons for hesitation	Remain inactive until scope and methodologies of	"[…] because the methodology is not clear yet, which method to use for measurement. There are competing methodologies for the product carbon footprint, what to include, what the system boundaries are, and so on. This is often referred to as a reason for not doing it yet.

		regulatory change are more mature	And therefore, they prefer to wait until there is one clear established methodology and standard." (Participant 21)
		Emphasize shortage of resources for additional workload	"A lot of people I speak to personally don't know where to start, don't have the resources to provide us with the information. I think where our customer base is able to provide this information, their resources are much greater than ours." (Participant 2)
		Emphasize lack of required knowledge	"I can imagine that, for many, the uncertainty around this topic is very high. With that I mean they don't know how to approach it, they lack the expertise in-house and they are not willing to purchase it externally. And then they say: 'The regulator does not force me yet, so actually I don't have to act.'" (Participant 17)
		Emphasize unavailability of required data	"I am sure we would be happy to report this but, as a matter of fact, the data basis simply does not allow for that yet. That is the pivotal reason why we are now starting this IT project with the ferroalloys." (Participant 2)
	Disincentives preventing implementation	Avoid damage to competitive position due to perception of higher CO_2 footprint	"If you disclose your Scope 3 emissions and your competitors aren't, it can appear like you have a greater environmental footprint." (Participant 18)
		Save costs and prioritize daily business	"You have to understand that it [Scope 3 reporting] costs money, it costs time of people. […] the steel industry had some good years, but we are coming into a recession now. So again, the cost will have the biggest influence and the steel producers know very well that image alone doesn't sell steel." (Participant 15)
Actions planned or taken until today	Foundational preparatory actions	Build sustainability culture	"[...] the issues of environmental management and sustainability fully arrived in our culture in all departments and are constantly emphasized by our senior management." (Participant 2)
		Increase budget and FTEs	"Yeah, we just recently, well beginning of last year, we started up a 4-person team working on supplier sustainability, so that's specifically to address this topic." (Participant 7)
		Build and transfer knowledge	"There are efforts to develop our employees in this direction. We have internal websites and meetings, we hold conferences and trainings. I personally held such trainings before already." (Participant 6)
		Develop data and IT infrastructure	"At the moment, the majority of work comes stems from collecting the data and building a database, which as we both well know is quite difficult." (Participant 2)
		Request primary data from suppliers	"We engage with our strategic suppliers on this [primary data] and already have first contractual agreements in place that guarantee delivery of such CO_2 figures." (Participant 3)

Advanced early mover activities	Provide initial data to first customers	"When I speak of front-runners, I mean steel suppliers that already have algorithms in place, often even 3rd party verified, to calculate and submit their product carbon footprints to us." (Participant 12)
	Use sustainability KPIs to steer corporate strategy	"Then we are using climate targets as one of our main metrics for strategy execution. […] So, it has been put on par with the financial KPIs within our reporting structures and visualizations within our organization, it's on the same level." (Participant 7)
	Include sustainability KPIs in employee incentives	"I mean we do include our climate targets in personal incentives. So that's where it becomes very, very personal to everyone." (Participant 7)
	Pursue long-term partnerships with best suppliers	"Yes, for example we recently started the <initiative name> initiative with <steelmaker name>, which aims at enabling more sustainable steel production in the long run and this also includes Scope 3 reporting." (Participant 16)
	Announce long-term reduction targets (e.g., SBTi)	"The SBTi is also a driver for this [Scope 3 reporting]. And everyone or most key players have already committed to this." (Participant 3)
Sector monitoring	Conduct benchmarking studies to compare own emission performance with competitors	"[…] we benchmark with our competitors or the market in general, and for Scope 3 specifically, we have to say that for us it makes up the largest share of our emissions" (Participant 8)
	Participate in industry associations to follow latest developments	"Yes, we take part in industry associations, e.g., the "WV Stahl" or the industry association for steel tubes. It is important to be there because there such topics are being discussed, especially also from a political perspective." (Participant 11)
Lobbying	Publicly campaign for "level playing field" for all participants across the industry	"We always have to consider that we need a level playing field. That means, we need to use the same criteria globally in order to reach the goals of the Paris agreement. We want to push for that." (Participant 1)
	Interact with policymakers to affect scope of regulatory change	"We have of course our government affairs team who is in contact for all types of regulations. We are also involved through Eurofer, so the European Steel Association, there we are also giving our opinions for how to account CO_2, what should be the thresholds and so on." (Participant 5)

	Engage with stakeholders to maximize chances of receiving governmental subsidies	"One result of lobbying is that a certain steelmaker now receives 4 billion in subsidies, 2 from the EU and 2 from the German government, simply because they provided their viewpoints on what will and what will not work in terms of decarbonization to politics." (Participant 21)

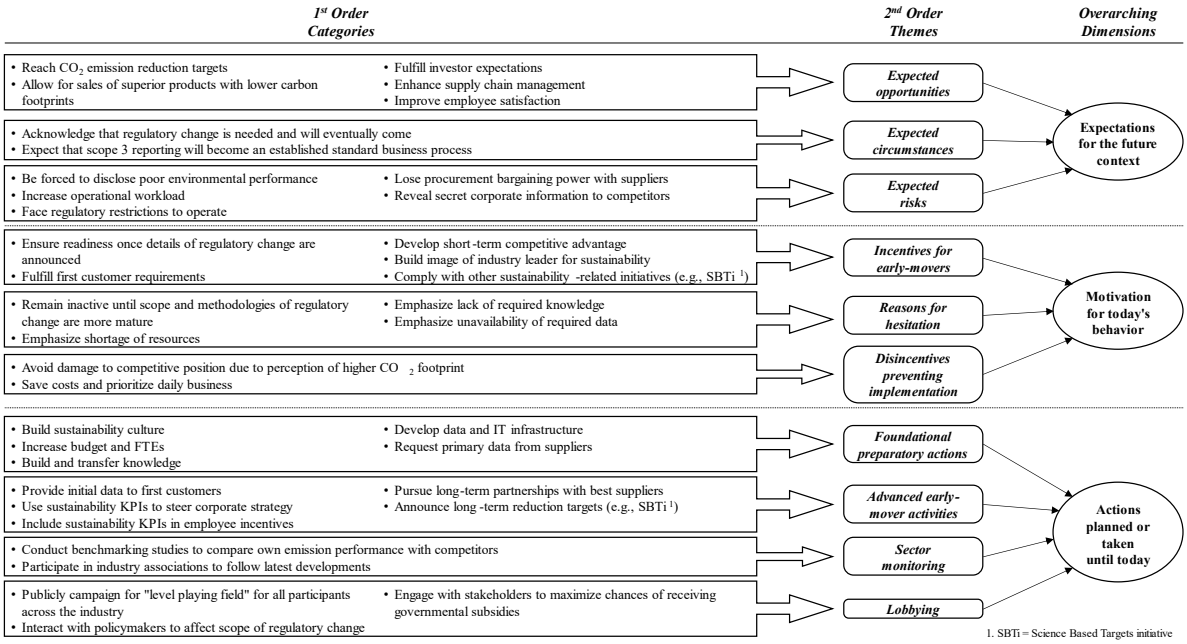
Building on the established data structure, we developed process theory (Langley, 1999) on how incumbents motivation is influenced by their expectations for the future and how their motivation drives their planned or taken actions. We then linked these aspects using the "grounded theory strategy" of process theory (Langley, 1999, p. 699) to recognize relationships among the categories and themes, and identify behavioral patterns or strategies. In doing so, we follow Langley's approach of "making sense whatever way we can" (Langley, 1999, p. 708), integrating interview and secondary data to arrive at evidence-based theory.

Throughout our theory development process, we repeatedly integrated extant literature. During the initial phase of data analysis, we "consult[ed] with existing literature, with suspension of judgement to allow discovery of new insights" (Gioia et al., 2013, p. 26). Once we established the data structure and identified direct relationships, we further "enfolded" (Eisenhardt, 1989, p. 544) the existing knowledge from prior studies by comparing existing work with our emerging categorization and process theory. This allowed us to further refine the articulation of our theory (Gioia et al., 2013). Overall, our methodological approach is profoundly similar to that of previous work at the intersection of discontinuous change and institutionalism (Weber et al., 2019).

4 Incumbent behavior prior to a discontinuous regulatory change

In our data, we identified three distinct patterns of motivation that give rise to the incumbents' behavior and that build the core of our theory. We further found linkages between the incumbents' patterns of motivation and their preceding expectations for the future, and, ultimately how these patterns drive incumbents' planned or taken actions in preparation for the anticipated discontinuous regulatory change. Figure 1 shows our data structure.

Paper 2 | Figure 1: Data structure



4.1 Incumbents' motivation, expectation, and action

In this sub-chapter, we lay out the nuances of the incumbents' patterns of motivation, their expectations for the future, and their planned or taken actions.

4.1.1 Incumbents' motivation for today's behavior

4.1.1.1 Incentives for early movers

The data suggest multiple incentivizing factors that motivate incumbents to become "early movers" (i.e., be among the first to react to a certain change, innovation, or technology) in the field of corporate Scope 3 reporting. First, some incumbents emphasized their intention to be ready for any regulatory change once it is announced to minimize its potentially disruptive impact. Second, many incumbents were motivated by business opportunities associated with Scope 3 reporting in the form of fulfilling first customer requirements (i.e., being able to respond to first customer requests, such as the automotive industry asking for Scope 3 data when purchasing steel), developing short-term competitive advantages (i.e., being among the first in the industry that implement Scope 3 reporting and thereby acquiring skills that

competitors do not have), or building an image of being the industry leader for sustainability. Third, incumbents were also motivated by a desire to comply with other sustainability-related initiatives such as the Science Based Targets initiative (SBTi). The SBTi is the largest global framework for firms to determine emission reduction targets and requires firms to conduct Scope 3 reporting and define Scope 3 reduction targets (World Resources Institute, 2023). As a result, firms that intend to announce emission reduction targets based on SBTi need to voluntarily conduct Scope 3 reporting. For example, Participant 3 stated:

> *And SBTi requires this [Scope 3 reporting] anyways, which is why we are very active in this space already.*

Aspects of these motivational factors can partially also be found in extant literature. For example, Kammerlander and Ganter (2015) found that certain noneconomic goals (e.g., power and control, transgenerational value, or the maintenance of family reputation) of family business CEOs influence the firm's adaptation to discontinuous innovation. They found evidence for heterogeneity in firms' responses, which they partly attributed to differences in the CEOs' noneconomic goals. Their findings support the possibility that a firm's motivation of becoming sustainability leaders influences their adaptation to this discontinuous regulatory change. In addition to that, Greenwood et al. (2011) and Pache and Santos (2010) outlined that firms, due to differences in their organizational characteristics and position in their competitive landscape, respond differently to institutional complexity. As prospective regulatory change induces a dynamic change in institutional complexity, these findings may also partially explain why some firms see business opportunities in the context of Scope 3 reporting while others do not.

4.1.1.2 Reasons for hesitation

Our results show multiple reasons for incumbents to hesitate on adopting corporate Scope 3 reporting. On the one hand, our respondents pointed to a low level of maturity of future

regulation, especially highlighting deficient methodologies to calculate and report Scope 3 emissions. Thus, some intended to remain inactive until future regulation would be more mature. For example, Participant 17 articulated:

> *Our industry is still far behind on this [Scope 3 reporting], especially because there is no common process for calculating those CO2 emissions, on which basis, what is included, what is excluded. Therefore, many firms, us as well, are hesitant and not confident to provide any data.*

Prior scholars have already pointed out that incumbents sometimes hesitate to respond to a discontinuous change. For example, Raaijmakers et al. (2014) found that firms delay compliance to a coercive demand to reduce the experienced institutional complexity. Other scholars pointed towardss reasons that drive variations in incumbent inertia in response to the same discontinuous change, e.g., differences in managerial perceptions of opportunities and threats (Eggers & Park, 2018; Gilbert, 2005; König et al., 2021). In this context, remaining inactive until the regulatory change is more mature could thus be seen as incumbents' way of reducing institutional complexity.

On the other hand, incumbents often were incapable of conducting Scope 3 reporting. Our data suggested shortages of resources (e.g., personnel, budget, or other resources to accommodate the additional workload), lack of required knowledge (i.e., insufficiently trained or educated personnel to conduct Scope 3 reporting), and general unavailability of data (e.g., missing data needed to calculate a firm's Scope 3 emissions) as the main reasons. In support of a similar relationship, Dooley (2018, p. 78) claimed that innovations "were not previously implemented due to a failure to change organizational processes", which he attributed to routine rigidity. In this context, slowness to change procurement processes to include the collection of required emission data is an example of such routine rigidity that in turn may lead to the unavailability of data. Other studies highlighted the influence of different managerial opportunity and threat perceptions on resource rigidity and routine rigidity (Gilbert, 2005;

König et al., 2021). Similar differences in managerial perceptions may also apply in this context and lead to the identified shortage of resources, lack of knowledge, and unavailability of data. The issue of path dependency may similarly contribute to incumbents' inertia in adopting the required capabilities (Keller et al., 2022).

4.1.1.3 Disincentives preventing implementations

Our findings further suggest two critical disincentives that outright discourage incumbents from implementing corporate Scope 3 reporting. First, incumbents want to avoid damage to their competitive position due to a potentially unfavorable perception of their CO_2 footprint. Participant 16 specifically suggested that some steelmakers deliberately avoid disclosing their poor environmental performance:

> *If I know that I have a bad CO2 footprint, then I don't have an interest in determining and disclosing it, but instead would rather try to avoid that.*

Second, incumbents intend to reduce costs and therefore prioritize daily business activities over activities needed for Scope 3 reporting. For example, Participant 15 emphasized the steelmakers' cost pressure, especially in a period of prospective recession.:

> *You have to understand that it [Scope 3 reporting] costs money, it costs time of people. […] the steel industry had some good years, but we are coming into a recession now. So again, the cost will have the biggest influence and the steel producers know very well that image alone doesn't sell steel.*

4.1.2 Incumbents' expectations for the future industry context

4.1.2.1 Expected opportunities

Our respondents pointed to several opportunities that they expect in a future in which Scope 3 reporting is mandatory. First, the incumbents believed that it would help them reach their CO_2 emission reduction targets. For example, Participant 14 compared Scope 3 reporting to financial reporting in its functionality for steering a company:

As I said earlier, Scope 3 reporting must function in an automated manner similar to financial reporting. […] Then the operational steering of climate impact becomes easier and reaching the targets can be ensured.

Second, our respondents indicated that Scope 3 reporting may support product sales. Specifically, Scope 3 reporting may allow incumbents to credibly prove to their customers that their product has a lower carbon footprint than their competitors'. Consequently it allows them to better sell such products. Prior studies found evidence for similar commercial expectations from adapting to discontinuous changes. For example, Martinez (2022) integrated research on incumbent response to discontinuous change with business model innovation. The scholar elaborated on the changes to business models in response to discontinuous changes, which, similar to what we find in our research context, may include the ability to sell new or superior products.

Third, the data suggest that Scope 3 reporting will provide steelmakers with an opportunity to fulfil important investor expectations. Investors are widely expected to review a steelmakers' SBTi targets and their associated Scope 3 emission reports more diligently in the future (Bendig et al., 2023). Related to our findings, prior work has similarly identified the importance of managing investor expectations through adaptation to discontinuous changes. For example, König et al. (2013) elaborates on how the family - as the main investor of a family-owned business - affects the firm's adoption of discontinuous technologies.

Fourth, our results indicate that incumbents hope to enhance their supply chain management through Scope 3 reporting. Our respondents believed that Scope 3 reporting allows steelmakers to improve procurement efficiency, better understand risks within their supply chain, and make more informed decisions.

Lastly, our respondents suggested that, in the future, employees will place more emphasis on working for a sustainable company. Therefore, incumbents associate conducting Scope 3

reporting with the opportunity of improving employee satisfaction and increasing employer attractiveness.

4.1.2.2 Expected circumstances

Our respondents expressed two main expectations for future circumstances within the industry. These circumstances are neither opportunities nor risks, but instead describe general conditions that do not entail direct positive or negative potential consequences for individual firms. First, most of our respondents acknowledged that a regulatory change is needed to mitigate the steel industry's impact on climate change and that it will eventually come.

Second, most of our respondents believed that Scope 3 reporting will become an established standard business process. They emphasized that Scope 3 reporting will be common practice in the future and that a lack of adherence will effectively exclude firms from the industry. For example, Participant 2 spoke of "you're out if you don't have it".

4.1.2.3 Expected risks

Our results indicate several risks that incumbents expect to arise in a future with mandatory Scope 3 reporting. First, some incumbents feared that they will be forced to disclose poor environmental performance which they would not disclose otherwise. For example, Participant 10 specifically suggested that, unless they are forced by regulation, steelmakers would avoid disclosing their poor environmental performance:

> *If there are no regulatory or for the entire industry applicable provisions, then it [Scope 3 reporting] is a clear competitive disadvantage. […] Of course, if I disclose my Scope 3 and the others don't, then it's a disadvantage.*

Second, many incumbents believed that new regulation associated with Scope 3 reporting will cause significant operational workload in their organization, possibly to a level that overwhelms the organization. For example, Participant 6 referred to "building a second controlling department which works not in € but in CO_2".

Third, incumbents were afraid that a regulatory change may generally restrict their freedom to operate. For example, Participant 1 suggested that regulation might enforce “certain thresholds”, which would limit the steelmakers’ supplier choice.

Fourth, our data suggest that incumbents may lose procurement bargaining power against suppliers due to mandatory Scope 3 reporting. For example, Participant 5 argued that

Lastly, our findings suggest that incumbents associate Scope 3 reporting with the risk of involuntarily revealing sensitive information. On the one hand, some less carbon-intensive suppliers may use Scope 3 information, such as a steelmaker’s current emissions and emission target commitments, to their advantage and raise prices, knowing that their customers will have to continue to purchase from them to meet their targets. On the other hand, Scope 3 reporting may reveal information about specific process materials, recycling rates, or other details of the business model.

4.1.3 Incumbents’ planned or taken actions until today

4.1.3.1 Foundational preparatory actions

Our findings indicated several activities that can be characterized as foundational. These activities build the basic capabilities to perform Scope 3 reporting. First, several respondents referred to the importance of building a sustainability culture within the organization. Relatedly, in a previous study, Dooley (2018) argued that an organization’s cultural norms need to change for successfully adapting a discontinuous innovation. This supports the notion that “building a sustainability culture” is a foundational preparatory action.

Second, our results indicated multiple actions intended to establish basic capabilities for Scope 3 reporting. This includes providing budgets and staff (i.e., granting financial and human resources needed to establish Scope 3 reporting capabilities), building and transferring knowledge (i.e., providing educational material to employees, running training and upskilling

sessions, appointing internal topic champions to encourage interpersonal teaching, etc.), and developing data and IT infrastructure (i.e., collecting data and aggregating databases, developing digital tools, integrating newly developed data and tools into existing IT landscape, etc.). Prior research identified similar activities in response to discontinuous changes. For example, Gilbert (2005) and König et al. (2021) assessed the impact of resource rigidity on incumbent inertia and identified the provision of financial and human resources as an important element in an incumbent's response behavior to a discontinuous change. Steinhauser et al. (2020) reviewed the role of digital complementary assets in the adaptation of a discontinuous innovation in the healthcare sector and found that they have a strong effect.

Lastly, our findings indicate frequent interactions between incumbents and their suppliers. Firms need to collect data from their suppliers, i.e., the product carbon footprint (PCF) of the purchased product, to accurately conduct Scope 3 reporting. Only if such primary data from suppliers is not available, firms may use secondary emissions factors (e.g., global average PCFs), although this is strongly discouraged by leading calculation standards (GHG Protocol, 2011). Collecting primary data is foundational because it allows incumbents to compare suppliers with one another, which is not possible based purely on secondary data. Consequently, it enables emission reduction measures by choosing the supplier with a lower footprint. For example, the Participant 3 elaborated on their supplier engagement and specified that they have "contractual agreements in place" to legally ensure the delivery of primary data.

4.1.3.2 Advanced early mover activities

Our findings show that incumbents plan or take actions that can be described as activities that only advanced industry participants, or "early movers", would perform. These activities explicitly exceed foundational preparatory actions. First, many of our respondents suggested that providing initial data to first customers is a key activity to move a firm beyond foundational

preparatory actions. Incumbents may provide their PCF including Scope 3 information to their customers, either directly at the point of sale or upon request by their customers.

Second, our findings indicated two distinct ways of how some incumbents use sustainability KPIs including Scope 3 emission data in their daily business activities. First, incumbents want to make their climate targets a core priority and therefore use sustainability KPIs to design and steer their corporate strategy. Second, incumbents incorporate sustainability KPIs into remuneration schemes to motivate their employees to contribute to the firms' progress in that regard.

Third, our respondents elaborated on the development of long-term partnerships between steelmakers and suppliers. Such partnerships are intended to allow joint improvements of sustainability capabilities including Scope 3 reporting for both suppliers and customers. For example, Participant 16 specifically mentioned a recently started initiative:

> *Yes, for example we recently started the <initiative name> initiative with <steelmaker name>, which aims at enabling more sustainable steel production in the long run and this also includes Scope 3 reporting.*

Lastly, some incumbents also publicly announce long-term reduction targets. Usually, these reduction targets are based on the SBTi and therefore include specific Scope 3 targets as well. For example, in their latest sustainability report of 2022, steelmaker E announced a reinforcement of their emission reduction targets:

> *As a part of the new sustainability strategy, we launched more ambitious goals for our sustainability. […] Our approved SBTi target requires a 42% CO2 emission reduction across all scopes by 2030 compared to the 2016 baseline.*

4.1.3.3 Sector monitoring

Our data further indicate two distinct incumbent activities to monitor their sector's status and progress with respect to Scope 3 reporting. For one, our respondents suggested that

incumbents conduct benchmarking studies to understand their competitors' Scope 3 emission performance and estimate their relative position in the competitive landscape. For another, many of our respondents mentioned their participation in industry associations as a means to follow the latest industry developments. It allows incumbents to engage and exchange information with each other, which in turn can be used for advising policymakers on regulatory plans. Incumbent managers suggested that participating may also be used to simply extract new information and remain informed about the latest developments concerning potential regulatory changes.

4.1.3.4 Lobbying

Our results further show evidence of different kinds of lobbying by incumbents. First, incumbents publicly campaign for a "level playing field". They highlight the importance of a fair regulatory framework that ensures that all industry participants are treated equally. Since Scope 3 reporting is currently not part of any regulatory framework, this can be interpreted as a call to make it mandatory - but across the entire global industry.

Second, the data indicate that incumbents interact with policymakers to affect the scope of potential regulatory changes. Most incumbents have dedicated teams focused on lobbying and positioning a firms' standpoint within policymakers' discussions in various forums. For example, Participant 5 mentions their "government affairs team" and how they articulate their opinions on aspects like emission thresholds. Participant 21 even spoke of a newly founded position of "Chief Lobbyist" for whom "a new office was just opened in Berlin".

Lastly, our respondents suggested that incumbents also engage with political stakeholders to secure governmental subsidies. For example, Participant 6 emphasized that incumbents in the steel industry are currently facing a severe transformational challenge, of which Scope 3

reporting is one element that requires substantial financial investment. Therefore, incumbents lobby for governmental subsidies in this regard:

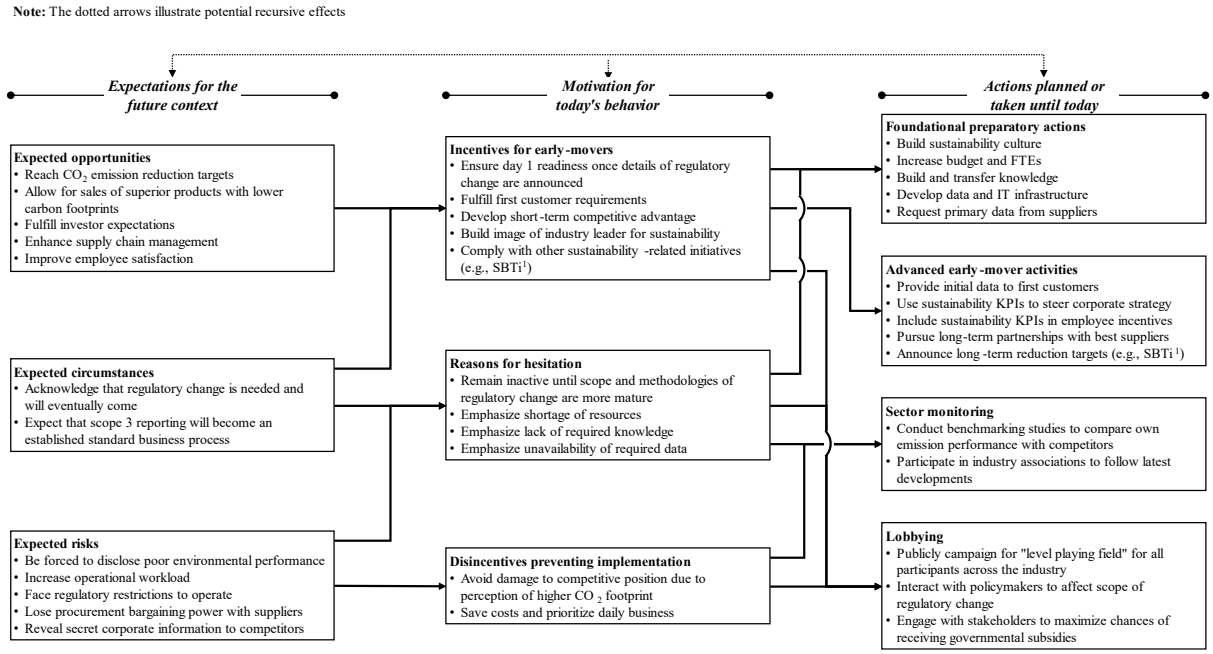
> *We are in a constant stakeholder approach with various ministries, states, etc. There, subsidies are being allocated and since we are not able to manage this monumental transformation challenge on our own, resources from the public authorities are needed.*

Our findings relate closely to the extant literature on lobbying. Many scholars have investigated how lobbying benefits firms and enhances their performance, and that it is often seen as a risk mitigation tool intended to influence governments and policymakers. (Hadani et al., 2017; Hillman et al., 2004). In our empirical context, interacting with policymakers to affect the scope of regulatory changes, and engaging with stakeholders to maximize the chances of receiving governmental subsidies may be considered risk mitigation. Furthermore, Abdurakhmonov et al. (2022) investigated the breadth of lobbying activities and argue that a wider span of lobbying activities improves lobbying effectiveness. Our data provide evidence for such a broach span of lobbying activities, as we identified not only activities related to direct interactions with policymakers, but also with the public, industry associations, and other stakeholders, suggesting that incumbents in the steel industry may have justified hopes of relatively high lobbying effectiveness.

4.2 Incumbents' expectations for the future influencing their motivation today

In this sub-chapter, we describe how incumbents' expectations for the future influence their motivation today. Figure 2, which can be understood as Figure 1 "set in motion", illustrates our emerging process model, with solid arrows indicating direct relationships between expectations, motivations, and actions, and dotted arrows illustrating potential recursive effects.

Paper 2 | Figure 2: Process model of incumbents' behavior prior to a discontinuous regulatory change



4.2.1 Incentives for early movers as a consequence of expected circumstances and expected opportunities

Our findings indicate various direct relationships between expected circumstances and incentives for early movers, and between expected opportunities and incentives for early movers. First, the data suggest that the expected opportunity of reaching CO_2 emission targets induces the motivation to build an image of being the industry leader for sustainability by moving early on Scope 3 reporting. For example, Participant 7 connected their ambition to reach emission reduction targets with their motivation to be sustainability leaders:

> *So, let's say that the operating environment is expecting us, as we are within the energy intensive industries, that we are reducing our carbon footprint. […] And of course, we want to ensure that we are seen as the leaders within our industry and being the industry's first to be on the forefront of battling climate change.*

Steelmaker E further espoused this relationship in their latest sustainability report. In this report, they confirm to be on track with their emission reduction targets whilst improving their

Scope 3 reporting capabilities. In their statement, they even admitted that improving Scope 3 reporting accuracy has led to a higher total carbon footprint figure, which shows the firmness of their intention to become a sustainability leader:

> *The number of different emission sources to be included in Scope 3 calculation can be quite big: we have over a dozen of separate sources of Scope 3 emissions which need to be calculated per each production site. A bit ironically, the better and more thorough our climate reporting has become, the higher the emissions have become because we have been filling the missing gaps. But we are in a good position to lower our emissions in line with the Science Based Targets initiative.*

This behavior may be grounded in a "who we are not as an organization" approach (Stanske et al., 2020). With this statement, Steelmaker E might intend to underline that they are not a firm that withholds any possibly negative information in response to a discontinuous change.

Second, our findings indicate that the opportunity to allow for sales of superior products with lower carbon footprints sparks the motivation to fulfill first customer requirements. Scope 3 reporting allows incumbents to prove to customers that their product has a lower PCF and therefore may support product sales. Thus, the earlier the incumbent establishes Scope 3 reporting capabilities, the earlier the incumbent can benefit from that opportunity. For example, Participant 6 explicated:

> *Yes, of course, it has become a criterion for the purchasing decision. Time, price, quality, and the fourth is now to be low carbon. That means that we are preferably chosen by our customers if we are able to show to them that we are low carbon.*

This relationship may entail recursive effects. On the one hand, the opportunity to allow for sales of superior products in the future sparks the motivation to fulfill first customer requirements today. On the other hand, the more customers communicate carbon requirements today, the more relevant a firm may consider the opportunity for the future.

Third, our results provide evidence that the opportunity to fulfill investor expectations motivates incumbents to move early on Scope 3 reporting to comply with other sustainability-related initiatives. For example, Participant 5specifically outlined that SBTi-aligned targets are "an extremely important point for our investors" and that they are therefore currently working on the SBTi's "complex methodology for inclusion". This mirrors similar direct relationships found in prior research. For example, Flammer et al. (2021) investigated the impact of shareholder activism on voluntary disclosure of climate change risks. They found that "environmental shareholder activism increases the voluntary disclosure of climate change risks" (Flammer et al., 2021, p. 18). Relatedly, Bueno-Garcia et al. (2021) analyzed the impact of different shareholders on a firm's environmental proactivity and found that especially for foreign shareholders, firms are willing to modify their environmental practices.

Fourth, we found that incumbents' acknowledgements that regulatory change is needed and will eventually come motivates them to move early to be ready once the regulatory change comes into effect. For example, the Participant 3 expressed that, because of their current Scope 3 reporting activities, "such regulation would not have a direct effect then".

Lastly, many incumbents were convinced that Scope 3 reporting will become an established standard business process, and therefore believed that moving early would allow them to build a competitive advantage. However, that of course means that such a competitive advantage would be temporary and only exist in the short term. For example, Participant 12 first mentioned preferential treatment by customers:

> *Today, those steel producers that can transparently show their product carbon footprint including Scope 3 are treated advantageously.*

Later in the same interview, he elaborated on his expectation for the future about this effect fading:

> *I believe in the future, it [Scope 3 reporting] will be increasingly less differentiated, meaning that it will become a standard procedure to report Scope 3 emissions.*

This relationship may partly be explained by the concept of "futurescapes" (Rindova & Martins, 2022). According to this concept, firms develop a narrative about a discontinuous future, in this case a future in which Scope 3 reporting is well established, and use this narrative to justify changes to their organization today.

4.2.2 Reasons for hesitation as a consequence of expected circumstances and expected risks

Our results show linkages between expected circumstances and reasons for hesitation, and between expected risks and reasons for hesitation. First, the data suggest that the expected circumstance of Scope 3 reporting as an established standard business process induces incumbents to remain inactive until scope and methodologies of the regulatory change are more mature. For example, Participant 21 stated:

> *[…] because the methodology is not clear yet, which method to use for measurement. There are competing methodologies for the product carbon footprint - what to include, what the system boundaries are, and so on. This is often referred to as a reason for not doing it yet. And therefore, they [steelmakers] prefer to wait until there is one clear established methodology and standard.*

Second, the responses indicated that the expected risk of increased operational workload makes incumbents emphasize their lack of resources and unavailability of data as reasons for hesitation. For example, the Digital Transformation Manager of Steelmaker B elaborated on the aspects of lengthy data collection processes and required resources:

> *But of course, these kinds of regulations create a lot of work. […] Also, all supply chain aspects create a lot of work to collect and consolidate the data. And more broadly speaking, all the preparation and resources that need to be provided. In that regard, we are sometimes also hindered by our corporate slowness.*

4.2.3 Disincentives preventing implementation as a consequence of expected risks

We further identified relationships between expected risks and disincentives preventing implementation. First, the risk of being forced to disclose poor environmental performance creates a disincentive that makes incumbents avoid the adoption of Scope 3 reporting. Incumbents who fear that their carbon footprint is higher than their competitors' worry that they will be forced to disclose that in the future, which might impair their public image. Voluntary disclosure of their total carbon footprint including Scope 3 would thus create unnecessary damage to their competitive position today, especially if competitors do not yet disclose their Scope 3 emissions. Therefore, many incumbents seek to eschew Scope 3 reporting until it is mandated. For example, Participant 8 specifically stated that, although they would be able to disclose Scope 3 emissions, they will not do so until regulation is in place because of their concern of damaging their competitive position:

> *We consciously left [Scope 3 emissions] out of our reporting. The reason is that we benchmark with our competitors or the market in general, and for Scope 3 specifically, we have to say that for us it makes up the largest share of our emissions. And of course, we do not want to let ourselves be viewed worse than needed. […] Therefore, as long as it is not mandatory, we will not publish it.*

Second, the risk of increased workload in the future creates the disincentive of saving costs and prioritizing daily business today. The increased workload in the future requires human and financial resources, which some incumbents want to avoid by not adopting Scope 3 reporting until it is mandated.

4.3 Incumbents' planned or taken actions driven by their motivation today

In this sub-chapter, we laid out how the incumbents' motivational patterns drive their planned or taken actions until today.

4.3.1 Foundational preparatory actions driven by incentives for early movers and reasons for hesitation

Our data suggest that incentives for early movers and reasons for hesitation drive incumbents to plan or take foundational preparatory actions. First, the incentive for early movers to fulfill first customer requirements induces incumbents to request primary data from their suppliers. For example, Participant 18 explained that steel-consuming industries pressure their steelmakers to get clarity on upstream emissions:

> *The other thing that we're seeing is significant pressure from customers. So, there's all sorts of customers in steel markets, but automotives and construction particularly will have upstream Scope 3 net zero targets […] that's driving steelmaker behavior to understand their own upstream emissions and not only understand it but reduce it as well.*

Second, the unavailability of required data as a reason for hesitation drives incumbents to initiate the development of corresponding data and IT infrastructure. For example, Participant 2 explained how their current data does not allow for Scope 3 reporting and that they now initiate an IT project to remedy this issue:

> *I am sure we would be happy to report this but, as a matter of fact, the data basis simply does not allow for that yet. That is the pivotal reason why we are now starting this IT project with the ferroalloys.*

4.3.2 Advanced early mover activities driven by incentives for early movers

The results indicated that, perhaps unsurprisingly, incentives for early movers directly drive advanced early mover activities. First, the motivational patterns of fulfilling first customer requirements and developing short-term competitive advantages drive the provision of initial data to first customers. For example, Steelmaker D specifically stated in its latest whitepaper on green steel that they already provide Scope 3 data to some of their customers due to customer demand, creating a competitive advantage:

> *The data and emission values of Scope 1, Scope 2, and Scope 3 must be recorded properly and will be passed on to customers by <Steelmaker D>. [...] Since data of this kind is requested ever more frequently and may even been mandated in future, the corresponding databases could also prove to be a competitive advantage for <Steelmaker D>.*

Previous studies provide evidence for similar relationships. For example, Kammerlander et al. (2018) investigated how German book and magazine publishing companies responded to digitalization. They found that most firms developed digital products and services primarily to fulfill new customer demands.

Second, the incentive of building an image of being the industry leader for sustainability drives incumbents to announce long-term carbon reduction targets. For example, Steelmaker B explicated this relationship by elaborating on their "pioneering role" in correspondence to their reduction target announcement in their latest sustainability report:

> *This is why we had our greenhouse gas reduction targets validated by the renowned Science Based Targets initiative (SBTi) in the reporting year. [...] Our decarbonization roadmap underscores our pioneering role in the industry for greater climate protection and sustainable transformation.*

4.3.3 Sector monitoring driven by reasons for hesitation and disincentives preventing implementation

The findings provide evidence that reasons for hesitation and disincentives preventing implementation drive incumbents to perform sector monitoring. First, the disincentive to avoid damage to one's competitive position due to the perception of a higher CO_2 footprint drives incumbents to conduct benchmarking studies. This is because benchmarking studies are needed to confirm or disprove their hypothesis about the presumed effect of disclosing their Scope 3 emissions. This relationship most likely entails recursive effects because the benchmarking results in turn determine the extent of the disincentive and may even alter incumbents' motivation if benchmarking results indicate that the incumbent actually performs better than originally anticipated.

Second, the reason for hesitation of remaining inactive until scope and methodologies of regulatory change are more mature drives incumbents to participate in industry associations.

Incumbents want to know how the industry develops, how industry associations inform policymakers, and how policymakers in turn use that information to design regulation. For example, Participant 5 first acknowledged that the current drafts of future regulatory frameworks lack clarity and then added that Steelmaker C participates in industry associations to follow the discussions on the concretization of future regulation:

> *They [current drafts of future regulatory frameworks] are not very clear. First, we need to see them in the final forms. […] We work with them either through discussions in Eurofer or through other discussions like the German Steel Association with the green steel definition. So, my colleagues are participating, and we join these groups to see where the discussions on regulation are going.*

This relationship may also entail recursive effects as participation in industry associations influences the motivation to remain hesitant and possibly even alters that motivation.

4.3.4 Lobbying driven by incentives for early movers, reasons for hesitation, and disincentives preventing implementation

Our results indicated that incentives for early movers, reasons for hesitation, and disincentives preventing implementation all drive lobbying efforts. First, the incentive of building an image of industry leadership for sustainability drives incumbents to publicly campaign for a "level playing field" and to try to influence policymakers. For example, Participant 7 elaborated on their intention to promote a level playing field in the entire European industry and their request to the regulator to use all means necessary:

> *Well, we try and advocate always for a level playing field as much as possible and that, you know, in our case means that we are always promoting the full scope of emissions, including always the Scope 3 and that all kinds of policy instruments are being utilized.*

Early movers may also be inclined to engage in that type of lobbying due to the incentive to develop short-term competitive advantages because if a strict regulatory change is announced, they would gain an initial advantage due to their pre-existing capabilities for Scope 3 reporting.

Second, the reason for hesitation of remaining inactive until scope and methodologies of the regulatory change are more mature drives incumbents to interact with policymakers to affect the scope of the regulatory change. A striking example for this relationship was a self-developed standard for green steel, which includes guidelines for Scope 3 reporting, that Steelmaker C recently published. Therein, Steelmaker C emphasized the need for equal rules for all participants and asks policymakers to consider their viewpoints when designing future regulation:

> *We have spent a lot of time thinking about how to do this in a fair way that incentivizes all steelmakers to reduce emissions and ultimately achieve net zero. […] These clear definitions will also help inform targeted policy. […] This system could therefore be used by policymakers and customers to incentivize producers to further decarbonize.*

Prior research suggests that these relationships might also entail recursive effects. Malesky and Taussig (2016) argue that the more a firm is engaged with policymakers during the regulatory design process, the more likely the firm is to comply with a regulatory change once it is enacted. Thus, lobbying activities might influence incumbents' decision to become compliant and even motivate them to become compliant while it is still voluntary, thus influencing how long they remain inactive.

Lastly, the disincentive to avoid damage to one's competitive position due to the perception of a higher CO_2 footprint makes incumbents engage with policymakers to affect the scope of future regulatory changes. For example, Participant 12 explained that some industry players who were afraid to be ostracized and thus attempted to shun regulation:

> *Many firms are certainly afraid to be placed in a certain corner if they have to disclose this type of information. […] Yes, I believe it is a well-tried method of the industry to seek for closeness with associations, with policymakers, in order to have a certain impact on regulation, maybe even to inhibit certain things.*

Our findings correspond to work in the literature on lobbying. For example, in a study on the Pharmaceutical industry, Barber and Diestre (2019) outline a fundamental trade-off for incumbents between the content quality of a regulatory change and the speed of policymakers' decision for the regulatory change. They argue that a firm's competitive position with respect to the prospective regulatory change influences which of the two aspects the firm actively pushes for. This finding supports the notion that some incumbents actively push for Scope 3 reporting to be integrated into regulation soon (i.e., likely those who believe to benefit from mandatory Scope 3 reporting) while others urge policymakers to further detail the prospective regulatory change before enacting it or maybe even try to prevent policymakers from enacting mandatory Scope 3 reporting at all (i.e., likely those who believe to have a disadvantage from mandatory Scope 3 reporting).

5 Discussion

One the one hand, our findings echo many themes from prior research. The spectrum of motivational patterns, expectations for the future, and planned or taken actions clearly illustrate well-known patterns of heterogeneity in incumbent responses to discontinuous change in terms of inertia, timing of response, and differences in managerial sensemaking (Bigelow et al., 2019; Gilbert, 2005; König et al., 2021; Raffaelli et al., 2019; Weber et al., 2019). Furthermore, it reflects key institutionalist notions around institutional complexity and compliance (Dhalla & Oliver, 2013; Greenwood et al., 2011; Malesky & Taussig, 2016; Raaijmakers et al., 2014).

On the other hand, however, our results also present important new insights for the literature streams of discontinuous change and institutionalism. In the following chapter, we summarize these theoretical and practical implications of our research.

5.1 Theoretical implications

We make three critical contributions to the conversation around regulation in the context of discontinuous change and institutionalism. First, we add to the academic knowledge on discontinuous change by laying out the details of discontinuous regulatory change as a specific type of discontinuous change and we develop a theory on incumbent response behavior. In the discontinuous change literature, regulatory change is rarely viewed as a relevant discontinuity (Barczak, 2016; Christensen et al., 2018; Markides, 2006) and institutionalism accounts for regulatory change largely as a factor influencing institutional complexity, which in turn is, in most cases, examined as a rather incrementally changing element (Luo et al., 2016; Motherway et al., 2018; Raaijmakers et al., 2014). In contrast, we portray discontinuous regulatory change as key discontinuity in its own right that triggers heterogeneous responses by incumbents, and we further develop a theory around organizations' expectations, motivations, and actions that may be reapplied to other types of discontinuous changes. In particular, we discuss specifics of discontinuous regulatory changes such as the aspect that, in contrast to discontinuous innovations, they do not necessarily open new pathways of creating and capturing value for a business, but instead can be purely detrimental to a firm's value creation process (e.g., by damaging a firm's competitive position due to the perception of a higher CO_2 footprint).

Second, we extend the academic knowledge of discontinuous change and institutionalism by focusing on the timespan prior to the occurrence of a discontinuous change. Existing research primarily focused on the era of ferment after a discontinuous change is introduced (Bergek et al., 2013; Danneels, 2004; Kammerlander et al., 2018), usually in the form of a technology or innovation, but not prior to that. Institutionalist perspectives illuminate the aspect of compliance (Malesky & Taussig, 2016; Raaijmakers et al., 2014), focusing primarily on the timespan after a regulatory change is enacted. In the case of a discontinuous regulatory change, the critical period is the time before the regulatory change takes effect. For example, incumbent behavior

in the form of foundational preparatory actions and sector monitoring is a critical element for the adaptation to a discontinuous regulatory change and takes place in that very timespan. Consequently, our work adds to the understanding of the period prior to the introduction of a discontinuous change and further opens pathways for additional research in this field.

Third, in contrast to other forms of discontinuous change, we unveil that a successful adaptation to a discontinuous regulatory change can also have negative effects on incumbent firms, which, in turn, influences their response behavior. If an incumbent has very poor carbon performance, for instance, a successful adoption of the discontinuous regulatory change (i.e., accurately conducting Scope 3 reporting) can have a negative effect on the incumbent's public image or competitive position due to other stakeholders' awareness of the firm's high CO_2 footprint (Albarrak et al., 2019; Hettler & Graf-Vlachy, 2023; Khan et al., 2022). This effect usually cannot be found with the adoption of other forms of discontinuous change such as technological innovations, instead most scholars highlight the firms' struggles with the adoption process and what factors influence the firms' ability to adapt successfully (Eggers & Park, 2018; Kammerlander et al., 2018; König et al., 2021; Raffaelli et al., 2019). Our results further suggest that incumbents' awareness of their Scope 3 carbon performance in comparison to their peers prior to any Scope 3 reporting activity influences their motivation to either feel incentivized to move early or feel disincentivized and avoid adaptation. This may also lead incumbents to either support or oppose the discontinuous regulatory change within their lobbying activities as well as their supplier and customer engagements.

5.2 Practical implications

Our work also holds important practical implications for individual managers, firms, and policymakers. Incumbent managers might wish to be aware of how their expectations for the future may influence their motivation today and subsequently, how their motivations influence their preparatory actions. Such awareness may enable them to alter or control their own

sensemaking of the discontinuous regulatory change and ultimately make more informed decisions, as proposed in prior work (Raffaelli et al., 2019). Firms may leverage our findings to reassess their perceptions and subsequently reevaluate their sustainability strategy and the role corporate Scope 3 reporting may play in it. For instance, understanding that Scope 3 reporting may entail tangible business opportunities could change their perspective on voluntary reporting. Policymakers might want to take our findings as an impetus to reflect on ongoing lobbying influence and how they collaborate with industry participants to optimize the regulatory design process and ultimately shape regulation towardss climate mitigation more effectively. Specifically, policymakers may use our research to better understand incumbents' anticipations and motivations surrounding regulatory change. We are optimistic that our theoretical findings should transfer to other prospective discontinuous regulatory changes such as new laws surrounding ethical sourcing and supply chains (Boersma, 2018; Burchielli et al., 2009; Huber & Steininger, 2022) or data security and user protection surrounding applications of artificial intelligence (Candelon et al., 2021; Hannigan et al., 2022; Li et al., 2023). Consequently, we suggest that practitioners from all industries may benefit from our insights.

6 Limitations and future research

Naturally, our research is subject to certain limitations and opens up new research pathways. First, as is typical for qualitative research, this study was performed in a single-industry context with a single prospective discontinuous regulatory change. This might limit the generalizability of the developed theory. Further, we are aware that "single case studies often yield more complicated and over-determined theories than multiple cases" (Eisenhardt, 2021, p. 151), but are confident that our case provides strong evidence for our theory. Nevertheless, we encourage future scholars to replicate our work in other suitable research settings as well. Second, although the chosen point in time to analyze the steel industry on prospective regulation for Scope 3 reporting appears well-suited for the purpose of this paper, observations made at an even earlier

or later point in time might have revealed different results. Lastly, collecting data that provides evidence for relationships that might create a negative perception of our respondents' organizations (e.g., disincentives preventing implementation) is a particularly challenging task. This is because our respondents may not feel comfortable sharing information that might harm their organization, which we aimed to prevent by ensuring interviewees' confidentiality, creating an atmosphere that allowed interviewees to speak freely, and reminding interviewees that they might also refuse to answer if they would prefer not to.

Our work opens up numerous new research pathways. First, future researchers might wish to replicate this study in the context of different industrial settings or in response to different prospective discontinuous regulatory changes, as has been done for other theories in this space (König et al., 2021). This would allow scholars to validate and possibly extend our theory, and thereby further contribute to our understanding of incumbent responses to prospective discontinuous regulatory changes. Second, longitudinal studies of incumbent behavior prior to discontinuous change could extend our understanding of behavior over time and the long-term consequences of incumbent preparatory actions. Third, the newly identified possibility that a successful adaptation towards a discontinuous regulatory change can have exclusively negative effects on the incumbent firm warrants additional research as to if and how this discovery applies to other forms of discontinuous changes. To this end, researchers may want to analyze incumbent behavior prior to the introduction of other discontinuous regulatory changes with focus on the possibility that a successful adaptation to the respective discontinuous regulatory change may have adverse effects on the incumbent, influencing its response behavior. Fourth, further studies should investigate the timespan prior to a discontinuous change more deeply. To do so, scholars may reassess incumbent behavior prior to the introduction of certain technological changes or innovations. Specifically, future researchers may wish to integrate the fields of discontinuous change and lobbying more closely to better understand lobbying

behavior in the context of prospective discontinuous change and how incumbents may use lobbying activities to support or oppose certain prospective discontinuous changes.

Overall, our study offers new insights into incumbent response behavior towards discontinuous regulatory change and explores the role of varying expectations and motivations as the explanatory factors for subsequent actions. Given the importance of regulatory change in the context of climate change and other societal issues, we hope that our work stimulates the conversation around discontinuous regulatory change and triggers rich future research that further extends to our collective understanding in this space.

References

Abdurakhmonov, M., Ridge, J. W., Hill, A. D., & Loncarich, H. (2022). Strategic Risk and Lobbying: Investigating Lobbying Breadth as Risk Management. *Journal of Management*, *48*(5), 1103–1130. https://doi.org/10.1177/01492063211011762

Albarrak, M. S., Elnahass, M., & Salama, A. (2019). The effect of carbon dissemination on cost of equity. *Business Strategy and the Environment*, *28*(6), 1179–1198. https://doi.org/10.1002/bse.2310

Anderson, P., & Tushman, M. L. (1990). Technological Discontinuities and Dominant Designs: A Cyclical Model of Technological Change. *Administrative Science Quarterly*, *35*(4), 604. https://doi.org/10.2307/2393511

Barber, B., & Diestre, L. (2019). Pushing for speed or scope? Pharmaceutical lobbying and Food and Drug Administration drug review. *Atlanta Competitive Advantage Conference 2010*, *40*(8), 1194–1218. https://doi.org/10.1002/smj.3021

Barczak, G. (2016). Innovation Research: What's Next? *Journal of Product Innovation Management*, *33*(6), 650. https://doi.org/10.1111/jpim.12344

Bendig, D., Wagner, A., & Lau, K. (2023). Does it pay to be science-based green? The impact of science-based emission-reduction targets on corporate financial performance. *Journal of Industrial Ecology*, *27*(1), 125–140. https://doi.org/10.1111/jiec.13341

Bergek, A., Berggren, C., Magnusson, T., & Hobday, M. (2013). Technological discontinuities and the challenge for incumbent firms: Destruction, disruption or creative accumulation? *Research Policy*, *42*(6-7), 1210–1224. https://doi.org/10.1016/j.respol.2013.02.009

Bigelow, L., Nickerson, J. A., & Park, W. Y. (2019). When and how to shift gears: Dynamic trade-offs among adjustment, opportunity, and transaction costs in response to an innovation shock. *Strategic Management Journal*, *40*(3), 377–407. https://doi.org/10.1002/smj.2996

Boersma, M. (2018). Between norms and practice: Civil society perspectives on the legitimacy of multistakeholder initiatives to eliminate child labor. *Business Strategy and the Environment*, *27*(5), 612–620. https://doi.org/10.1002/bse.2066

Bueno-Garcia, M., Ortiz-Perez, A., & Mellado-Garcia, E. (2021). Shareholders' environmental profile and its impact on firm's environmental proactivity: An institutional approach. *Business Strategy and the Environment*, *30*(1), 374–387. https://doi.org/10.1002/bse.2626

Burchielli, R., Delaney, A., Tate, J., & Coventry, K. (2009). The FairWear Campaign: An Ethical Network in the Australian Garment Industry. *Journal of Business Ethics*, *90*(S4), 575–588. https://doi.org/10.1007/s10551-010-0593-z

Candelon, F., Di Carlo, R. C., Bondt, M. de, & Evgeniou, T. (2021). *ai* Regulation Is Coming How to prepare for the inevitable. *Harvard Business Review*, *99*(5), 102.

Christensen, C. M. (2006). The Ongoing Process of Building a Theory of Disruption. *Journal of Product Innovation Management*, *23*(1), 39–55. https://doi.org/10.1111/j.1540-5885.2005.00180.x

Christensen, C. M., & Bower, J. L. (1996). Customer power, strategic investment, and the failure of leading firms. *Strategic Management Journal*, *24*(4), 69–86. https://doi.org/10.1002/(sici)1097-0266(199603)17:3<197::aid-smj804>3.3.co;2-l

Christensen, C. M., McDonald, R., Altman, E. J., & Palmer, J. E. (2018). Disruptive Innovation: An Intellectual History and Directions for Future Research. *Journal of Management Studies*, *55*(7), 1043–1078. https://doi.org/10.1111/joms.12349

Council of the European Union. (2023). *Climate change: what the EU is doing.* European Union. https://www.consilium.europa.eu/en/policies/climate-change/

Danneels, E. (2004). Disruptive Technology Reconsidered: A Critique and Research Agenda. *Journal of Product Innovation Management*, *21*(4), 246–258. https://doi.org/10.1111/j.0737-6782.2004.00076.x

Deerfield, A., & Elert, N. (2023). Entrepreneurship and Regulatory Voids: The Case of Ridesharing. *Entrepreneurship Theory and Practice*, *47*(5), 1568–1593. https://doi.org/10.1177/10422587221093300

Dhalla, R., & Oliver, C. (2013). Industry Identity in an Oligopolistic Market and Firms' Responses to Institutional Pressures. *Organization Studies*, *34*(12), 1803–1834. https://doi.org/10.1177/0170840613483809

Dooley, K. (2018). Routine Rigidity and Environmental Sustainability: Why Rational Innovations are Regularly Ignored. *Business Strategy and the Environment*, *27*(1), 70–81. https://doi.org/10.1002/bse.1984

Eggers, J. P., & Park, K. F. (2018). Incumbent adaptation to technological change: The past, present, and future of research on heterogeneous incumbent response. *Academy of Management Annals*, *12*(1), 257–389. https://doi.org/10.5465/annals.2016.0051

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *Academy of Management Review*, *14*(4), 532. https://doi.org/10.2307/258557

Eisenhardt, K. M. (2021). What is the Eisenhardt Method, really? *Strategic Organization*, *19*(1), 147–160. https://doi.org/10.1177/1476127020982866

Euractiv. (2022). *EU urged to align corporate climate reporting rules with global standards.* Euractiv. https://www.euractiv.com/section/economy-jobs/news/eu-urged-to-align-corporate-climate-reporting-rules-with-global-standards/

European Commission. (2023). *Data protection in the EU*. https://commission.europa.eu/law/law-topic/data-protection/data-protection-eu_en

European Commission's Joint Research Centre. (2022). *EU climate targets: how to decarbonise the steel industry.* European Commission. https://joint-research-centre.ec.europa.eu/jrc-news/eu-climate-targets-how-decarbonise-steel-industry-2022-06-15_en

European Steel Association. (2020). *We are ready – are you? Making a success of the EU Green Deal*. https://www.eurofer.eu/assets/publications/position-papers/a-green-deal-on-steel-update/2020-10-14-EUROFER-Policy-paper-A-Green-Deal-on-Steel_V5.pdf

Flammer, C., Toffel, M. W., & Viswanathan, K. (2021). Shareholder activism and firms' voluntary disclosure of climate change risks. *Atlanta Competitive Advantage Conference 2010*, *42*(10), 1850–1879. https://doi.org/10.1002/smj.3313

GHG Protocol. (2011). *Corporate Value Chain (Scope 3) Standard.* GHG Protocol. https://ghgprotocol.org/corporate-value-chain-scope-3-standard

Gilbert, C. G. (2005). Unbundling the structure of inertia: Resource versus routine rigidity. *Academy of Management Journal*, *48*(5), 741–763. https://doi.org/10.5465/AMJ.2005.18803920

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology. *Organizational Research Methods*, *16*(1), 15–31. https://doi.org/10.1177/1094428112452151

Glaser, B. G., & Strauss, A. L. (2017). Discovery of grounded theory: Strategies for qualitative research. *Discovery of Grounded Theory: Strategies for Qualitative Research*, 1–271. https://doi.org/10.4324/9780203793206

Glynn, M. A., & D'Aunno, T. (2022). An Intellectual History of Institutional Theory: Looking Back to Move Forward. *Academy of Management Annals*, *17*(1), 301–330. https://doi.org/10.5465/annals.2020.0341

Greenwood, R., Raynard, M., Kodeih, F., Micelotta, E. R., & Lounsbury, M. (2011). Institutional complexity and organizational responses. *Academy of Management Annals*, *5*(1), 317–371. https://doi.org/10.1080/19416520.2011.590299

Hadani, M., Bonardi, J.-P., & Dahan, N. M. (2017). Corporate political activity, public policy uncertainty, and firm outcomes: A meta-analysis. *Strategic Organization*, *15*(3), 338–366. https://doi.org/10.1177/1476127016651001

Hannigan, T. R., Briggs, A. R., Valadao, R., Seidel, M.-D. L., & Jennings, P. D. (2022). A new tool for policymakers: Mapping cultural possibilities in an emerging AI entrepreneurial ecosystem. *Research Policy*, *51*(9), 104315. https://doi.org/10.1016/j.respol.2021.104315

Haveman, H. A., Russo, M. V., & Meyer, A. D. (2001). Organizational environments in flux: The impact of regulatory punctuations on organizational domains, CEO succession, and performance. *Organization Science*, *12*(3), 253–273. https://doi.org/10.1287/orsc.12.3.253.10104

Hettler, M., & Graf-Vlachy, L. (2023). Corporate scope 3 carbon emission reporting as an enabler of supply chain decarbonization: A systematic review and comprehensive research agenda. *Business Strategy and the Environment*, *n/a*(n/a), 1–20. https://doi.org/10.1002/bse.3486

Hillman, A. J., Keim, G. D., & Schuler, D. (2004). Corporate Political Activity: A Review and Research Agenda. *Journal of Management*, *30*(6), 837–857. https://doi.org/10.1016/j.jm.2004.06.003

Huber, S. T., & Steininger, K. W. (2022). Critical sustainability issues in the production of wind and solar electricity generation as well as storage facilities and possible solutions. *Journal of Cleaner Production*, *339*, 130720. https://doi.org/10.1016/j.jclepro.2022.130720

Jia, J., Jin, G. Z., & Wagman, L. (2021). The Short-Run Effects of the General Data Protection Regulation on Technology Venture Investment. *Marketing Science*, *40*(4), 661–684. https://doi.org/10.1287/mksc.2020.1271

Jick, T. D. (1979). Mixing Qualitative and Quantitative Methods: Triangulation in Action. *Administrative Science Quarterly*, *24*(4), 602. https://doi.org/10.2307/2392366

Johnson, G. A., Shriver, S. K., & Goldberg, S. G. (2023). Privacy and Market Concentration: Intended and Unintended Consequences of the GDPR. *Management Science*, *69*(10), 5695–5721. https://doi.org/10.1287/mnsc.2023.4709

Kammerlander, N., & Ganter, M. (2015). An Attention-Based View of Family Firm Adaptation to Discontinuous Technological Change: Exploring the Role of Family CEOs' Noneconomic Goals. *Journal of Product Innovation Management*, *32*(3), 361–383. https://doi.org/10.1111/jpim.12205

Kammerlander, N., König, A., & Richards, M. (2018). Why Do Incumbents Respond Heterogeneously to Disruptive Innovations? The Interplay of Domain Identity and Role Identity. *Journal of Management Studies*, *55*(7), 1122–1165. https://doi.org/10.1111/joms.12345

Keller, A., Konlechner, S., Güttel, W. H., & Reischauer, G. (2022). Overcoming path-dependent dynamic capabilities. *Strategic Organization*, 147612702211258. https://doi.org/10.1177/14761270221125807

Khan, H. Z., Houqe, M. N., & Ielemia, I. K. (2022). Organic versus cosmetic efforts of the quality of carbon reporting by top New Zealand firms. Does market reward or penalise? *Business Strategy and the Environment.* Advance online publication. https://doi.org/10.1002/bse.3169

König, A., Graf-Vlachy, L., & Schöberl, M. (2021). Opportunity/Threat Perception and Inertia in Response to Discontinuous Change: Replicating and Extending Gilbert (2005). *Journal of Management*, *47*(3). https://doi.org/10.1177/0149206320908630

König, A., Kammerlander, N., & Enders, A. (2013). The family innovator's dilemma: How family influence affects the adoption of discontinuous technologies by incumbent firms.

Academy of Management Review, *38*(3), 418–441. https://doi.org/10.5465/amr.2011.0162

König, A., Schulte, M., & Enders, A. (2012). Inertia in response to non-paradigmatic change: The case of meta-organizations. *Research Policy*, *41*(8), 1325–1343. https://doi.org/10.1016/j.respol.2012.03.006

Kumaraswamy, A., Garud, R., & Ansari, S. (2018). Perspectives on Disruptive Innovations. *Journal of Management Studies*, *55*(7), 1025–1042. https://doi.org/10.1111/joms.12399

Lamdin, D. J. (2001). Implementing and interpreting event studies of regulatory changes. *Journal of Economics and Business*, *53*(2-3), 171–183. https://doi.org/10.1016/S0148-6195(01)00035-2

Langley, A. (1999). Strategies for Theorizing from Process Data. *Academy of Management Review*, *24*(4), 691–710. https://doi.org/10.5465/AMR.1999.2553248

Li, S., Liu, Y., & Feng, J. (2023). Who Should Own the Data? The Impact of Data Ownership Shift from the Service Provider to Consumers. *Journal of Management Information Systems*, *40*(2), 366–400. https://doi.org/10.1080/07421222.2023.2196775

Lloyd, S. M., Hadziosmanovic, M., Rahimi, K., & Bhatia, P. (2022). Trends Show Companies Are Ready for Scope 3 Reporting with US Climate Disclosure Rule. *Environmental Research Letters*, *13*(10). https://doi.org/10.1088/1748-9326/AAE19A

Luo, X. R., Wang, D., & Zhang, J. (2016). Whose Call to Answer: Institutional Complexity and Firms' CSR Reporting Academy of Management Journal Whose Call to Answer: Institutional Complexity and Firms' CSR Reporting. *Academy of Management Journal*, *61*(1), 321–344. https://doi.org/10.5465/AMJ.2014.0847

Malesky, E., & Taussig, M. (2016). The Danger of Not Listening to Firms: Government Responsiveness and the Goal of Regulatory Compliance. *Academy of Management Journal*, *60*(5), 1741–1770. https://doi.org/10.5465/AMJ.2015.0722

Markides, C. (2006). Disruptive Innovation: In Need of Better Theory. *Journal of Product Innovation Management*, *23*(1), 19–25. https://doi.org/10.1111/j.1540-5885.2005.00177.x

Martinez, F. (2022). Organizational change in response to environmental complexity: Insights from the business model innovation literature. *Business Strategy and the Environment*, *31*(5), 2299–2314. https://doi.org/10.1002/bse.3022

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative Data Analysis: A Methods Sourcebook.* (3rd Edition). Sage Publications Inc. https://eric.ed.gov/?id=ED565763

Motherway, D., Pazzaglia, F., & Sonpar, K. (2018). Failures in Regulator-Led Deinstitutionalization of Questionable Business Practices. *Journal of Business Ethics*, *149*(3), 627–641. https://doi.org/10.1007/s10551-016-3082-1

Nag, R., Corley, K. G., & Gioia, D. A. (2007). The Intersection of Organizational Identity, Knowledge, and Practice: Attempting Strategic Change via Knowledge Grafting. *The Academy of Management Journal*, *50*(4), 821–847. http://www.jstor.org/stable/20159892

Oliver, C. (1991). Strategic Responses to Institutional Processes. *Academy of Management Review*, *16*(1), 145. https://doi.org/10.2307/258610

Pache, A.-C., & Santos, F. (2010). When worlds collide: The internal dynamics of organizational responses to conflicting institutional demands. *Academy of Management Review*, *35*(3), 455–476. https://doi.org/10.5465/AMR.2010.51142368

Peukert, C., Bechtold, S., Batikas, M., & Kretschmer, T. (2022). Regulatory Spillovers and Data Governance: Evidence from the GDPR. *Marketing Science*, *41*(4), 746–768. https://doi.org/10.1287/mksc.2021.1339

Raaijmakers, A. G., Vermeulen, P. A., Meeus, M. T., & Zietsma, C. (2014). I Need Time! Exploring Pathways to Compliance under Institutional Complexity. *Academy of Management Journal*, *58*(1), 85–110. https://doi.org/10.5465/AMJ.2011.0276

Raffaelli, R., Glynn, M. A., & Tushman, M. (2019). Frame flexibility: The role of cognitive and emotional framing in innovation adoption by incumbent firms. *Strategic Management Journal*, *40*(7), 1013–1039. https://doi.org/10.1002/smj.3011

Rindova, V. P., & Martins, L. L. (2022). Futurescapes: Imagination and temporal reorganization in the design of strategic narratives. *Strategic Organization*, *20*(1), 200–224. https://doi.org/10.1177/1476127021989787

Scott, W. R. (2008). *Institutions and organizations: Ideas, Interests and Identities* (3rd Edition). Sage Publications Inc.

Siggelkow, N. (2007). Persuasion With Case Studies. *Academy of Management Journal*, *50*(1), 20–24. https://doi.org/10.5465/amj.2007.24160882

Skeete, J.-P. (2018). Level 5 autonomy: The new face of disruption in road transport. *Technological Forecasting and Social Change*, *134*, 22–34. https://doi.org/10.1016/j.techfore.2018.05.003

Stanske, S., Rauch, M., & Canato, A. (2020). Anti-identity strategizing: The dynamic interplay of "who we are" and "who we are not". *Strategic Organization*, *18*(1), 136–170. https://doi.org/10.1177/1476127019855753

Steinhauser, S., Doblinger, C., & Huesig, S. (2020). The Relative Role of Digital Complementary Assets and Regulation in Discontinuous Telemedicine Innovation in European Hospitals. *Journal of Management Information Systems*, *37*(4), 1155–1183. https://doi.org/10.1080/07421222.2020.1831778

Strauss, A., & Corbin, J. M. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. *Basics of qualitative research: Grounded theory procedures and techniques*. SAGE Publications, Inc.

Szewczyk, J., Kurzhals, C., Graf-Vlachy, L., Kammerlander, N., & König, A. (2022). The family innovator's dilemma revisited: Examining the association between family influence and incumbents' adoption of discontinuous technologies. *Journal of Family Business Strategy*, *13*(4), 100516. https://doi.org/10.1016/j.jfbs.2022.100516

US EPA. (2022). *Climate Change Regulatory Actions and Initiatives*. https://www.epa.gov/climate-change/climate-change-regulatory-actions-and-initiatives

Wang, P., Jiang, L., & Yang, J. (2023). The Early Impact of GDPR Compliance on Display Advertising: The Case of an Ad Publisher. *Journal of Marketing Research*, Article 00222437231171848. Advance online publication. https://doi.org/10.1177/00222437231171848

Weber, F., Lehmann, J., Graf-Vlachy, L., & König, A. (2019). Institution-Infused Sensemaking of Discontinuous Innovations: The Case of the Sharing Economy. *Journal of Product Innovation Management*, *36*(5), 632–660. https://doi.org/10.1111/jpim.12499

World Resources Institute. (2023, September 15). *Science Based Targets initiative (SBTi): Driving ambitious climate action in the private sector by enabling companies to set science-based emissions reduction targets.* https://www.wri.org/initiatives/science-based-targets

Yin, R. K. (1994). *Case Study Research Design and Methods: Applied Social Research and Methods Series* (2nd Edition). Sage Publications Inc. http://www.sciepub.com/reference/59519

4 Research Paper 3

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5 Discussion

The purpose of this dissertation is to analyze factors influencing firms' adoption and response behavior towards corporate Scope 3 reporting as an enabler of supply chain decarbonization. Across three research papers, this dissertation diligently lays out a plethora of influencing factors, provides a series of findings that detail these factors' conditions and relationship, and explains how theoretical foundations support these findings. In the first research paper, this dissertation holistically structures what the academic community already knows about Scope 3 reporting and what still needs to be researched along a novel research framework. In the second research paper, this dissertation develops theory on how firms respond to anticipated discontinuous regulatory change in the context of prospectively mandatory Scope 3 reporting. In the third research paper, this dissertation leverages the findings from research papers 1 and 2 to inform practitioners on the underlying reasons why many firms do not report Scope 3 emissions and on the adverse consequences of no or low-quality Scope 3 reporting, and to enable practitioners to develop their Scope 3 reporting capabilities.

Chapter 5 discusses this dissertation's key findings, theoretical and practical implications, declares its limitations, provides avenues for further research, and closes this dissertation with concluding remarks.

5.1 Theoretical Implications

This dissertation provides a holistic structure and collective overview of the currently available and unavailable knowledge on corporate Scope 3 reporting that is novel to the extant literature. The high level of fragmentation of the Scope 3 reporting literature is likely to be a consequence of the many nuances and relationships that Scope 3 reporting entails, as is indicated by the large number of elements included in the research framework illustrated in Paper 1 | Figure 9. Many scholars studied individual elements described within that research

framework, and therefore, providing a comprehensive literature review adds significant value to the academic community as it helps scholars easily identify and digest the most relevant work on a certain aspect of Scope 3 reporting. Further, this dissertation also illustrates what the academic community does not yet know about Scope 3 reporting and thereby enables future scholars to effectively extend that conversation.

Prior studies on Scope 3 reporting show several commonalities and differences, and the field appears to be at an early stage of its academic development. Notably, two out of three reviewed articles have been published from 2018 onwards and three journals (*Journal of Cleaner Production, Business Strategy and the Environment,* and *Energy Policy*) published more than 75% of the articles. Thus, the conversation around Scope 3 reporting is quite young and takes place in a somewhat narrow set of outlets. With respect to research methodology, approximately 56% of the articles perform quantitative analyses, 23% employ case study approaches, and 12% engage in alternative forms of qualitative analysis. A mere 5% of the articles conduct literature reviews, and 4% focus on conceptual analyses. Hahn et al. (2015) found a similar methodological distribution in their previous literature review on general emission reporting, except for case study utilization, which is significantly higher in this dissertation's sample. This is typical for the early development stage of this field of research as a lot of scholarly work still revolves around theory building rather than theory testing. Similarly, the high use of CDP data as the underlying data source and the GHG Protocol as the underlying standard used for emission data indicates that not many robust alternatives have been established yet.

The quality of Scope 3 reporting varies drastically due to high levels of uncertainty concerning data quality, reporting standards, and regulation. First, the quality of the data underlying the calculation of Scope 3 reports is often problematic due to unavailability of primary data, the use of inaccurate secondary data, and procedural issues such as differences in

lifecycle assessment models, and double counting (Busch et al., 2022; Patchell, 2018; O. J. Robinson et al., 2018; Wegener et al., 2019). Second, using different reporting standards to calculate Scope 3 reports makes these reports only partially comparable as different standards might ask users to include or exclude different specifics possibly leading to diverging results (Blanco et al., 2016; Hansen et al., 2022; O. Robinson et al., 2015). As of today, there is no regulatory or industry-specific guidance on which reporting standard to use. As a result, firms choose their Scope 3 reporting standard individually, which ultimately leads to uncertainty concerning comprehensiveness and comparability of firms' Scope 3 reports. Thus, the high share of samples with heterogenous application of reporting standards identified among the reviewed articles is highly problematic because it indicates that scholars conducted analyses with data that may not be directly comparable, questioning the accuracy and validity of their results. Overall, in the context of corporate Scope 3 reporting, firms are faced with high degrees of uncertainty in a dynamically changing environment, which triggers heterogenous response behavior (Eggers & Park, 2018; Greenwood et al., 2011; Weber et al., 2019).

Building on this realization, this dissertation also contributes to a better understanding of heterogenous firm behavior in the context of rapidly evolving global issues such as climate change, in which drastic regulatory changes are highly anticipated. Regulation is one of the key antecedents of corporate Scope 3 reporting. The currently voluntary nature of Scope 3 reporting strongly hinders a more widespread adoption and prospectively mandatory Scope 3 reporting would significantly increase adoption through compliance (Hickmann, 2017; Patchell, 2018; Tang & Demeritt, 2018). Such a regulatory change would be discontinuous to most firms as they currently often do not conduct Scope 3 reporting at all. Consequently, the theory and process model illustrated in Paper 2 | Figure 2 may partially be transferred to other dynamically changing environments in which discontinuous regulatory changes are anticipated to establish a better understanding of firm behavior in these contexts as well. For example, the rapid

development of artificial intelligence may very well induce policymakers to introduce discontinuous regulatory changes concerning data security and user protection (Candelon et al., 2021; Hannigan et al., 2022; Li et al., 2023).

Simultaneously, this dissertation fuels the vibrant fields of discontinuous change and institutionalism by extending the conversation towardss discontinuous regulatory change as a distinct form of discontinuous change. In the extant discontinuous change literature, regulatory change is usually not considered as the core discontinuity (Barczak, 2016; Christensen et al., 2018; Kumaraswamy et al., 2018; Markides, 2006) and institutionalism evaluates regulatory change as a rather incrementally changing element of institutional complexity (Luo et al., 2016; Motherway et al., 2018; Raaijmakers et al., 2014). In this dissertation, however, I position regulatory change as the major discontinuity which drives heterogenous response behavior and develop additional theory around firms' respective expectations, motivations, and actions. Prior studies around discontinuous innovations specifically emphasized that managerial sensemaking (Weber et al., 2019), and managers ' opportunity and threat perception (Gilbert, 2005; König et al., 2021) contribute to firms' heterogeneous response behavior. These aspects certainly play a role in this dissertation's theory on discontinuous regulatory change as well. However, other elements of this dissertation's theory on discontinuous regulatory change are novel to the extant literature. For example, an important differentiating factor of discontinuous regulatory change is that, in contrast to other forms of discontinuous change, it does not always provide new pathways of creating and capturing value for a firm, but instead can also be detrimental to a firm's value creation process. As a result, a successful adaptation to a discontinuous regulatory change (e.g., accurately conducting Scope 3 reporting) can also have negative effects on incumbent firms (e.g., damaging a firm's competitive position due to the perception of a higher CO2 footprint).

The discovery that a successful adaptation to a discontinuous regulatory change can also have negative effects on incumbent firms is novel to the extant literature and adds further explanation for heterogenous firm response behavior. This effect has not been identified among other forms of discontinuous change, in which scholars usually highlight firms' strenuousness with successfully adapting and what factors contribute to that strenuousness (Eggers & Park, 2018; Kammerlander et al., 2018; König et al., 2021; Raffaelli et al., 2019). If firms are aware of the potentially negative effects associated with successfully adapting to a discontinuous regulatory change, they are naturally less inclined to move early and rather avoid adaptation. This awareness may further influence firms' lobbying activities and how they approach their suppliers, customers, and other stakeholders.

Furthermore, this dissertation explicitly emphasizes the importance of the previously understudied timespan prior to the occurrence of a discontinuous change and expands the theoretical understanding of firm behavior in that timespan. Prior studies mainly assessed the phase after the occurrence of a discontinuous change (Bergek et al., 2013; Danneels, 2004; Kammerlander et al., 2018; Weber et al., 2019), predominantly in the form of a technology or innovation, and analyzed firms' compliance after a regulatory change is enacted (Malesky & Taussig, 2016; Raaijmakers et al., 2014). For discontinuous regulatory changes, however, the timespan prior to their occurrence is particularly important because their scope and conditions are exclusively designed during that phase and firms not only monitor this design phase but also try to influence it, which is specifically laid out under the process model illustrated in Paper 2 | Figure 2. Further, this dissertation explains why some firms already conduct Scope 3 reporting voluntarily, while others do not. The reviewed scholarly work concerning the remaining antecedents of Scope 3 reporting next to regulation, all contribute to the understanding of voluntary compliance in this context. Consequently, this dissertation provides

a theory for voluntary compliance with a novel procedure (e.g., Scope 3 reporting) that is anticipated to become mandatory in the future.

Overall, this dissertation contributes to the theoretical understanding of Scope 3 reporting as an enabler of supply chain decarbonization. The review of the extant literature on Scope 3 reporting, especially with respect to its environmental consequences, underscores the importance of Scope 3 reporting for achieving Scope 3 emissions reductions through baselining, target setting, monitoring, and steering of reduction actions (Downie & Stubbs, 2013; Garcia-Alaminos et al., 2022; Rietbergen et al., 2015; Wiedmann et al., 2021). Further, the data collected through an extensive series of interviews also suggests that Scope 3 reporting is needed to achieve supply chain decarbonization. Lastly, in a very recently published article, Dahlmann et al. (2023) posit that, in the long term, Scope 3 reporting contributes to Scope 3 emission reduction, and thus to supply chain decarbonization.

5.2 Practical Implications

This dissertation holds considerable practical implications relevant for individual managers, firms, and policymakers.

This dissertation increases managers' awareness for a variety of aspects that can enhance their understanding of Scope 3 reporting. Managers can now easily navigate and digest the rather fragmented extant academic literature on corporate Scope 3 reporting, which allows them to build knowledge more effectively. Also, managers are now aware of the aspects and relationships of Scope 3 reporting that have not yet been researched, which allows them to differentiate for which they can rely on literature and for which they may need to make assumptions. Further, in the third research paper, this dissertation explicitly lays out three practical reasons why firms do not report Scope 3 emissions, which most likely many managers can identify with. This helps managers evaluate their firms current Scope 3 reporting

capabilities, and the subsequent elaborations on why and how they should conduct Scope 3 reporting become easier to understand and more suitable to their individual situations.

To go one step further, this dissertation also provides managers with actionable recommendations on how to implement and improve their Scope 3 reporting. In the third research paper, this dissertation elaborates on five actions that managers can apply to address the reasons why their firms do not report Scope 3 emissions. Simultaneously, these actions allow managers to generate additional strategic benefits which make these actions particularly helpful and attractive. Lastly, this dissertation offers a roadmap towardss high quality Scope 3 reporting to further ease the implementation process.

More broadly, this dissertation also allows managers to improve their ability to steer their firms and manage uncertainty. The novel theory on discontinuous regulatory change invites managers to reflect on their expectations for the future and how these correspond to their motivations and actions today. This may further encourage them to reassess their sensemaking and derive future decisions based on their own interpretations more consciously, as suggested in previous studies (Raffaelli et al., 2019; Weber et al., 2019).

For firms, this dissertation underscores the importance of Scope 3 reporting and encourages them to provide the resources needed to implement high quality Scope 3 reporting. First, it shines light on the adverse consequences of not reporting Scope 3 emissions. Second, the data collected through the interview series suggests that Scope 3 reporting can entail tangible business opportunities, build competitive advantage, and prepares firms for the future. Third, this dissertation provides the novel perspective that Scope 3 is not merely an ESG activity but also a strategic management tool. As a result of the above reasons, firms may now attribute a higher value towards conducting Scope 3 reporting and therefore increase its prioritization among budgeted activities.

Lastly, this dissertation helps policymakers design future regulations. The holistic research framework for the extant literature on Scope 3 reporting allows policymakers, like managers, to easily access the available academic knowledge on Scope 3 reporting and to fully grasp its complexities. Furthermore, policymakers may use the results of this dissertation to better understand firm behavior in the context of prospective regulatory change, and to reflect on ongoing lobbying work and how they collaborate with industry participants to further improve the regulatory design process. The results of this dissertation make clear that the currently voluntary nature of Scope 3 reporting strongly hinders a more widespread adaptation. Consequently, this dissertation may also encourage policymakers to draft and implement new regulations to further promote Scope 3 reporting in practice while considering the limits of what today's firms may be capable of. More broadly, these implications may also transfer to other prospective discontinuous regulatory changes, such as new laws for ethical supply chains (Boersma, 2018; Burchielli et al., 2009; Huber & Steininger, 2022) and responsible application of artificial intelligence (Candelon et al., 2021; Hannigan et al., 2022; Li et al., 2023).

5.3 Limitations and Avenues for Further Research

Naturally, this dissertation's theoretical und practical implications need to be discussed under consideration of their main limitations and stimulate various pathways for future research.

This dissertation entails several methodological limitations. First, despite aiming for a literature review that is fully comprehensive, the literature review conducted for this dissertation may have missed possibly relevant articles in the academic literature due to the filtering by journals and keywords. Second, the qualitative research presented in Research Paper 2 was conducted in a single case study context, which may restrict the generalizability of the developed theory. However, I am convinced that my case study provides sufficient evidence to support the developed theory. Third, the quantitative analyses underlying Research Paper 3

draws from broad global databases. Therefore, the results of those analyses are limited to those firms for which data was consistently available and do not include circumstances of firms for which data was not available.

This dissertation further entails limitations inherent to the point in time that it was produced. First, new articles relevant for the topic of corporate Scope 3 reporting may have been published in the meantime after the literature review's publication. Therefore, this dissertation may not include the most recently published relevant articles. Second, the data from the series of in-depth interviews conducted with managers from the European steel industry reflects the participants' opinions at the time of the interview. Although the chosen point in time to analyze the European steel industry appears well-suited for the purpose of this dissertation, the participants' opinions may have changed after the interviews took place or may have been different at an earlier point in time. Such differences may not be reflected in the results of this dissertation.

Finally, this dissertation entails limitations due to the natural circumstances of the interview participants that contributed to this dissertation's data collection. Collecting data that provides evidence for relationships that might create a negative perception of the participants' firms (e.g., disincentives preventing implementation) was particularly challenging. This is because participants may not feel comfortable sharing information that might cast their employer in a poor light. Although the interviewer ensured full confidentiality and aimed to create an atmosphere that allowed interviewees to speak freely, some participants may not have disclosed all relevant details. This must be considered when interpreting this dissertation's findings.

This dissertation also provides future scholars with numerous pathways for additional research. First, Research Paper 1 entails an extensive chapter that diligently lays out which theoretical lenses, antecedents, and consequences of Scope 3 reporting have not yet been

researched, and further offers suggestions on how to approach these literature gaps whilst leveraging existing research on Scope 1 and 2 reporting. For example, prior research on Scope 1 and 2 reporting found that blockchain technology can significantly improve accuracy and data quality of carbon reporting. Similar research for Scope 3 reporting may derive highly insightful results and would address a very important aspect of it. Also, future scholars may update the literature review presented in Research Paper 1 if a significant amount of additional scholarly work arises in the future that warrants further structuring.

Second, this dissertation provides scholars of the discontinuous change and institutionalism literature with a variety of future research opportunities. Future scholars may aim to replicate this dissertation's qualitative research approach on discontinuous regulatory change in the European Steel industry in a different industrial setting or different discontinuous regulatory change. This would allow them to validate and possibly extend this dissertation's theory and further widen the academic understanding of the important area of discontinuous regulatory change. Second, researchers may conduct longitudinal studies of incumbent behavior prior to different discontinuous changes to extend our understanding of behavior over time and specifically analyze the long-term consequences of incumbent preparatory actions. Further, future studies may analyze if and how the newly discovered phenomenon of possibly negative effects of a successful adaptation towards a discontinuous regulatory change also applies to other forms of discontinuous change, and how the awareness of this phenomenon affects firms' behavior. Also, researchers may aim to investigate the timespan prior to the occurrence of a discontinuous change in more detail. To do so, they may aim to integrate the fields of discontinuous change and lobbying more closely to reassess firm behavior prior to the introduction of certain technologies or innovations and evaluate how firms use lobbying activities to influence the discontinuous change.

Lastly, this dissertation lays ground for further practitioner-oriented work. The results of this dissertation have shown that practitioners need additional guidance to make progress in their Scope 3 reporting. Research Paper 3 of this dissertation provides a strong example for how academic research can inform practitioners. In a similar fashion, Dahlmann et al. (2024) informed practitioners of the "organizing-performing paradox" of Scope 3 reporting and explained how they should interpret Scope 3 reports based on how many reports a firm has already produced in the past. Therefore, further practitioner-oriented work based on empirical research in the field is needed to better inform firms, managers, and policymakers on how to leverage academic findings in practice and to create a closer relationship between academia and practice.

5.4 Conclusion

Reflecting more broadly on the results of this dissertation leads to four main conclusions, that are all particularly meaningful in times of global disruptive trends like climate change and artificial intelligence. First, this dissertation advances the academic understanding of corporate Scope 3 reporting. It provides a novel holistic research framework and explicitly lays out what is already known and what remains to be researched, and further details how firms behave in response to anticipated mandatory Scope 3 reporting. Second, this dissertation advances the academic understanding of discontinuous change and firm response behavior. It illustrates discontinuous regulatory change as a distinct type of discontinuous change, provides a novel theory on firm response behavior towards anticipated discontinuous regulatory change, and provides future scholars with opportunities to further expand the knowledge in this vibrant field. Third, this dissertation enables practitioners to leverage academic knowledge in practice. It provides a plethora of theoretical findings and repeatedly informs firms, managers, and policymakers on how to best integrate those with their daily business activities. Fourth, and ultimately, this dissertation progresses the issue of global supply chain decarbonization via a

more widespread adoption of Scope 3 reporting in practice. Its findings on the various factors influencing firms' adoption and response behavior widen the theoretical understanding of Scope 3 reporting, allow future scholars to further expand that academic knowledge, and enable practitioners to develop and improve their Scope 3 reporting capabilities in practice, which leads to a more widespread adoption of Scope 3 reporting, and ultimately, to enhanced global supply chain decarbonization.

5.5 References of Discussion

Barczak, G. (2016). Innovation Research: What's Next? *Journal of Product Innovation Management*, *33*(6), 650. https://doi.org/10.1111/jpim.12344

Bergek, A., Berggren, C., Magnusson, T., & Hobday, M. (2013). Technological discontinuities and the challenge for incumbent firms: Destruction, disruption or creative accumulation? *Research Policy*, *42*(6-7), 1210–1224. https://doi.org/10.1016/j.respol.2013.02.009

Blanco, C., Caro, F., & Corbett, C. J. (2016). The state of supply chain carbon footprinting: analysis of CDP disclosures by US firms. *Journal of Cleaner Production*, *135*, 1189–1197. https://doi.org/10.1016/j.jclepro.2016.06.132

Boersma, M. (2018). Between norms and practice: Civil society perspectives on the legitimacy of multistakeholder initiatives to eliminate child labor. *Business Strategy and the Environment*, *27*(5), 612–620. https://doi.org/10.1002/bse.2066

Burchielli, R., Delaney, A., Tate, J., & Coventry, K. (2009). The FairWear Campaign: An Ethical Network in the Australian Garment Industry. *Journal of Business Ethics*, *90*(S4), 575–588. https://doi.org/10.1007/s10551-010-0593-z

Busch, T., Johnson, M., & Pioch, T. (2022). Corporate carbon performance data: Quo vadis? *Journal of Industrial Ecology*, *26*(1), 350–363. https://doi.org/10.1111/jiec.13008

Candelon, F., Di Carlo, R. C., Bondt, M. de, & Evgeniou, T. (2021). *ai* Regulation Is Coming How to prepare for the inevitable. *Harvard Business Review*, *99*(5), 102.

Christensen, C. M., McDonald, R., Altman, E. J., & Palmer, J. E. (2018). Disruptive Innovation: An Intellectual History and Directions for Future Research. *Journal of Management Studies*, *55*(7), 1043–1078. https://doi.org/10.1111/joms.12349

Dahlmann, F., Brammer, S., & Roehrich, J. (2023). Navigating the “performing-organizing” paradox: Tensions between supply chain transparency, coordination, and scope 3 GHG emissions performance. *International Journal of Operations & Production Management*, *43*(11), 1757–1780. https://doi.org/10.1108/IJOPM-09-2022-0622

Dahlmann, F., Roehrich, J., & Brammer, S. (2024). Managing Scope 3 Emissions in Your Supply Chains: Why Firms Must Take a Step Back to Move Forwards. *California Management Review Insights*. https://cmr.berkeley.edu/2024/01/managing-scope-3-emissions-in-your-supply-chains-why-firms-must-take-a-step-back-to-move-forwards/

Danneels, E. (2004). Disruptive Technology Reconsidered: A Critique and Research Agenda. *Journal of Product Innovation Management*, *21*(4), 246–258. https://doi.org/10.1111/j.0737-6782.2004.00076.x

Downie, J., & Stubbs, W. (2013). Evaluation of Australian companies’ scope 3 greenhouse gas emissions assessments. *Journal of Cleaner Production*, *56*, 156–163. https://doi.org/10.1016/j.jclepro.2011.09.010

Eggers, J. P., & Park, K. F. (2018). Incumbent adaptation to technological change: The past, present, and future of research on heterogeneous incumbent response. *Academy of Management Annals*, *12*(1), 257–389. https://doi.org/10.5465/annals.2016.0051

Garcia-Alaminos, A., Gilles, E., Monsalve, F., & Zafrilla, J. (2022). Measuring a university?S environmental performance: A standardized proposal for carbon footprint assessment. *Journal of Cleaner Production*, *357.* https://doi.org/10.1016/j.jclepro.2022.131783

Gilbert, C. G. (2005). Unbundling the structure of inertia: Resource versus routine rigidity. *Academy of Management Journal*, *48*(5), 741–763. https://doi.org/10.5465/AMJ.2005.18803920

Greenwood, R., Raynard, M., Kodeih, F., Micelotta, E. R., & Lounsbury, M. (2011). Institutional complexity and organizational responses. *Academy of Management Annals*, *5*(1), 317–371. https://doi.org/10.1080/19416520.2011.590299

Hahn, R., Reimsbach, D., & Schiemann, F. (2015). Organizations, Climate Change, and Transparency: Reviewing the Literature on Carbon Disclosure. *Organization & Environment*, *28*(1), 80–102. https://doi.org/10.1177/1086026615575542

Hannigan, T. R., Briggs, A. R., Valadao, R., Seidel, M.-D. L., & Jennings, P. D. (2022). A new tool for policymakers: Mapping cultural possibilities in an emerging AI entrepreneurial ecosystem. *Research Policy*, *51*(9), 104315. https://doi.org/10.1016/j.respol.2021.104315

Hansen, A. D., Kuramochi, T., & Wicke, B. (2022). The status of corporate greenhouse gas emissions reporting in the food sector: An evaluation of food and beverage manufacturers. *Journal of Cleaner Production*, *361*. https://doi.org/10.1016/j.jclepro.2022.132279

Hickmann, T. (2017). Voluntary global business initiatives and the international climate negotiations: A case study of the Greenhouse Gas Protocol. *Journal of Cleaner Production*, *169*, 94–104. https://doi.org/10.1016/j.jclepro.2017.06.183

Huber, S. T., & Steininger, K. W. (2022). Critical sustainability issues in the production of wind and solar electricity generation as well as storage facilities and possible solutions. *Journal of Cleaner Production*, *339*, 130720. https://doi.org/10.1016/j.jclepro.2022.130720

Kammerlander, N., König, A., & Richards, M. (2018). Why Do Incumbents Respond Heterogeneously to Disruptive Innovations? The Interplay of Domain Identity and Role Identity. *Journal of Management Studies*, *55*(7), 1122–1165. https://doi.org/10.1111/joms.12345

König, A., Graf-Vlachy, L., & Schöberl, M. (2021). Opportunity/Threat Perception and Inertia in Response to Discontinuous Change: Replicating and Extending Gilbert (2005). *Journal of Management*, *47*(3). https://doi.org/10.1177/0149206320908630

Kumaraswamy, A., Garud, R., & Ansari, S. (2018). Perspectives on Disruptive Innovations. *Journal of Management Studies*, *55*(7), 1025–1042. https://doi.org/10.1111/joms.12399

Li, S., Liu, Y., & Feng, J. (2023). Who Should Own the Data? The Impact of Data Ownership Shift from the Service Provider to Consumers. *Journal of Management Information Systems*, *40*(2), 366–400. https://doi.org/10.1080/07421222.2023.2196775

Luo, X. R., Wang, D., & Zhang, J. (2016). Whose Call to Answer: Institutional Complexity and Firms' CSR Reporting Academy of Management Journal Whose Call to Answer: Institutional Complexity and Firms' CSR Reporting. *Academy of Management Journal*, *61*(1), 321–344. https://doi.org/10.5465/AMJ.2014.0847

Malesky, E., & Taussig, M. (2016). The Danger of Not Listening to Firms: Government Responsiveness and the Goal of Regulatory Compliance. *Academy of Management Journal*, *60*(5), 1741–1770. https://doi.org/10.5465/AMJ.2015.0722

Markides, C. (2006). Disruptive Innovation: In Need of Better Theory. *Journal of Product Innovation Management*, *23*(1), 19–25. https://doi.org/10.1111/j.1540-5885.2005.00177.x

Motherway, D., Pazzaglia, F., & Sonpar, K. (2018). Failures in Regulator-Led Deinstitutionalization of Questionable Business Practices. *Journal of Business Ethics*, *149*(3), 627–641. https://doi.org/10.1007/s10551-016-3082-1

Patchell, J. (2018). Can the implications of the GHG Protocol's scope 3 standard be realized? *Journal of Cleaner Production*, *185*, 941–958. https://doi.org/10.1016/j.jclepro.2018.03.003

Raaijmakers, A. G., Vermeulen, P. A., Meeus, M. T., & Zietsma, C. (2014). I Need Time! Exploring Pathways to Compliance under Institutional Complexity. *Academy of Management Journal*, *58*(1), 85–110. https://doi.org/10.5465/AMJ.2011.0276

Raffaelli, R., Glynn, M. A., & Tushman, M. (2019). Frame flexibility: The role of cognitive and emotional framing in innovation adoption by incumbent firms. *Strategic Management Journal*, *40*(7), 1013–1039. https://doi.org/10.1002/smj.3011

Rietbergen, M. G., van Rheede, A., & Blok, K. (2015). The target-setting process in the CO2 Performance Ladder: does it lead to ambitious goals for carbon dioxide emission reduction? *Journal of Cleaner Production*, *103*, 549–561. https://doi.org/10.1016/j.jclepro.2014.09.046

Robinson, O., Kemp, S., & Williams, I. (2015). Carbon management at universities: a reality check. *Journal of Cleaner Production*, *106*, 109–118. https://doi.org/10.1016/j.jclepro.2014.06.095

Robinson, O. J., Tewkesbury, A., Kemp, S., & Williams, I. D. (2018). Towards a universal carbon footprint standard: A case study of carbon management at universities. *Journal of Cleaner Production*, *172*, 4435–4455. https://doi.org/10.1016/j.jclepro.2017.02.147

Tang, S., & Demeritt, D. (2018). Climate Change and Mandatory Carbon Reporting: Impacts on Business Process and Performance. *Business Strategy and the Environment*, *27*(4), 437–455. https://doi.org/10.1002/bse.1985

Weber, F., Lehmann, J., Graf-Vlachy, L., & König, A. (2019). Institution-Infused Sensemaking of Discontinuous Innovations: The Case of the Sharing Economy. *Journal of Product Innovation Management*, *36*(5), 632–660. https://doi.org/10.1111/jpim.12499

Wegener, M., Labelle, R., & Jerman, L. (2019). Unpacking carbon accounting numbers: A study of the commensurability and comparability of corporate greenhouse gas emission disclosures. *Journal of Cleaner Production*, *211*, 652–664. https://doi.org/10.1016/j.jclepro.2018.11.156

Wiedmann, T., Chen, G. W., Owen, A., Lenzen, M., Doust, M., Barrett, J., & Steele, K. (2021). Three-scope carbon emission inventories of global cities. *Journal of Industrial Ecology*, *25*(3), 735–750. https://doi.org/10.1111/jiec.13063