Università degli Studi di Palermo

AREA RICERCA E TRASFERIMENTO TECNOLOGICO
SETTORE DOTTORATI E CONTRATTI PER LA RICERCA
U. O. DOTTORATI DI RICERCA

Ph.D. Program Title: **MECHANICAL, MANUFACTURING, MANAGEMENT AND AEROSPACE INNOVATION**

Department: **Management Engineering Department**

Scientific Disciplinary Sector– **IEGE-01/A- INGEGNERIA ECONOMICO-GESTIONALE**

Navigating stakeholder complexity: How social media platforms, NGO-company interactions, and stakeholder coordination shape transparency in environmental disclosure

Ph.D. CANDIDATE
GIUSEPPE CRAPA

THE COORDINATOR
PROF. GIOVANNA LO NIGRO

SUPERVISORS
PROF. PAOLO ROMA
PROF. MANFREDI BRUCCOLERI

INDUSTRY ADVISOR
MR. ALBERTO BAESSO

CYCLE - XXXVIII

ACADEMIC YEAR 2025-2026

Finanziato dall'Unione europea NextGenerationEU | Ministero dell'Università e della Ricerca | Italiadomani | Università degli Studi di Palermo

PREFACE

This thesis is submitted for the degree of Doctor of Philosophy at the University of Palermo (Italy). The supervisors of this work are Professor Paolo Roma and Manfredi Bruccoleri of the same university.

This thesis builds upon the findings presented in three research papers that I conducted throughout my Ph.D. studies. The papers are as follows:

- **Crapa, G.,** Latino, M. E., & Roma, P. (2024). The performance of green communication across social media: Evidence from large-scale retail industry in Italy. *Corporate Social Responsibility and Environmental Management*, 31(1), 493–513.

- **Crapa, G.,** Roma, P., & Bruccoleri, M. (2025). The influence of NGO-corporate relationship on environmental disclosure: Evidence from the fashion industry. *Corporate Social Responsibility and Environmental Management*, 32(2), 2104-2127.

- **Crapa, G.,** & Villena, H., V. (2025). Environmental Product Declarations: Challenges and Opportunities in the European Lighting Sector. The paper has been presented at the Academy of Management as well as at the Production and Operations Management Society conferences. It has been recently submitted to the Journal of Operations Management.

The previous versions of these articles have been submitted for participation in Italian and international conferences:

- Crapa, G., Roma, P., & Bruccoleri, M. (2023). "The influence of NGO-corporate relationships on environmental sustainability disclosure". *Proceedings of the 30th EurOMA Conference, July 3-5, Leuven, Belgium. Proceedings of XXXIV Riunione Scientifica Annuale AiIG (Associazione italiana di Ingegneria Gestionale), October 11-12, Lecco, Italy*

- Crapa, G., Roma, P., & Bruccoleri, M. (2024). "Understanding antecedents and consequences of Environmental Product Declarations implementation within a product strategy". *Proceedings of the 31th EurOMA Conference, June 29-July 3, Barcelona, Spain.*

- Crapa, G., & Villena, H., V. (2025). "Environmental Product Declarations: Challenges and Opportunities in the European Lighting Sector." *Proceedings of the 35th POMS Conference, May 8-May 12, Atlanta, Georgia, USA.*
  Proceedings of the 85th AoM Conference, July 25-July 29, Copenhagen, Denmark.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my heartfelt gratitude to Professor Paolo Roma and Professor Manfredi Bruccoleri, my research supervisors, for their invaluable guidance throughout my three-years Ph.D. program. Their role went far beyond that of academic advisors. They were true mentors who supported me during challenging times. They were always available for discussions related to my research activities, and their insightful perspectives consistently inspired me. Without their expert guidance I would not have achieved any important results. They also encouraged me to spend a visiting period in the United States, which helped me to develop a more international profile.

I extend my sincere gratitude to Professor Veronica H. Villena from the W.P. Carey School of Business, Arizona State University, with whom I had the privilege of collaborating in presence for 11 months during my visiting period at the Department of Supply Chain Management. I deeply appreciated the opportunity to work with her on our research project and greatly benefited from the Ph.D. seminars she recommended. Professor Villena is not only an outstanding scholar but also provided invaluable support in helping me to adapt to the American academic and professional environment.

I am also deeply grateful to WayPoint s.r.l., which co-financed my PhD program. In particular, I wish to thank Mr. Alberto Baesso, Innovation Manager, who served as my industry supervisor. He played a pivotal role in helping me bridge the gap between academia and industry, providing opportunities to conduct research within the company and to represent it in national and international organizations. These experiences were fundamental in enhancing the soft skills that complemented my academic training and in fostering a strong network of industry experts, which proved especially crucial for conducting interviews for the third research project of this thesis.

Furthermore, I would like to express my gratitude to the professors and colleagues with whom I had the pleasure of collaborating. Specifically, I wish to thank Rosalinda Iachetta, more than a colleague; a constant presence throughout my Ph.D. journey, who provided moments of relief and friendship during the inevitable periods of stress and uncertainty. I am also grateful to Federica Filippone, who has recently entered into my life and brought new energy and positivity during the final stage of my doctoral program.

Lastly, and most importantly, I am profoundly grateful to my family for their support throughout every phase of my life and in all the decisions I have made. This thesis is dedicated to them, as they have been instrumental in all my achievements.

Thesis prepared with the financial support of the European Union – Next Generation EU, and co-funded by Way Point s.r.l. with the scholarship code: PNRR.WAYPOINT.

Ottobre 2025

Giuseppe Crapa

Table of Contents

PREFACE ..... **I**
ACKNOWLEDGEMENTS ..... **III**
TABLES ..... **VIII**
FIGURES ..... **IX**
Chapter 1 ..... **1**
INTRODUCTION **1**
1.1 General introduction **1**
1.2 Literature review and research questions of the thesis **2**
1.3 Methodologies **6**
1.4 Thesis outline **8**
Chapter 2
RESEARCH STREAM 1: "The performance of green communication across social media: Evidence from large-scale retail industry in Italy **9**
2.1 INTRODUCTION **9**
2.2 LITERATURE REVIEW **11**
2.2.1. The effect of green versus non-green communication 11
2.2.2. Factors influencing the performance of green communication 14
2.2.2.1. The moderating role of the type of social media platforms *14*
2.2.2.2. The moderating role of media richness *15*
2.2.2.3. How the moderating role of media richness depends on social media platforms *16*
2.3 METHODOLOGY **18**
2.3.1 Main independent variables 19
2.3.2 Control variables 21
2.4 ANALYSIS AND FINDINGS **21**
2.4.1 Robustness check 27
2.5 Research Stream 1: THEORETICAL CONTRIBUTIONS AND MANAGERIAL IMPLICATIONS **28**
2.5.1 From Chapter 2 (Dimension 1 - Green Communication Effectiveness) to Chapter 3 (Dimension 2 – Stakeholder Governance Relationships) 33
Chapter 3
RESEARCH STREAM 2: "The influence of NGO-corporate relationship on environmental disclosure: Evidence from the fashion industry" **34**
3.1 INTRODUCTION **34**
3.2 THEORETICAL BACKGROUND **38**

3.2.1 NGO-corporate relationships and ED under the Stakeholder Theory lens.....38
3.2.2 Collaborative versus conflictual NGO-corporate relationship: impact on environmental disclosure.....39
3.2.3 NGOs-corporate relationship and the risk of greenwashing practices.....40
3.3 METHODOLOGY.....**43**
3.3.1 Research design.....43
3.3.2 Data collection and analysis.....45
3.3.2.1 Semi-structured interviews with Greenpeace and secondary data collection.....*45*
3.3.2.3. NGO–Corporate relationship and the risk of greenwashing.....*49*
3.4 FINDINGS AND DISCUSSION.....**50**
3.4.1 NGO's strategies to push companies towards commitment.....50
3.4.2 NGO-corporate relationship and company behavior.....55
3.4.3. Linking the type of NGO-corporate relationship and the risk of greenwashing.....61
3.4.3.1. Content analysis on the risk of greenwashing.....*61*
3.4.3.2. Content analysis on the risk of greenwashing.....*63*
3.4.3.3. Everlasting conflictual NGO-corporate relationship.....*65*
3.5 Research Stream 2: THEORETICAL CONTRIBUTIONS AND MANAGERIAL IMPLICATIONS.....**66**
3.5.1. From the Stakeholder Governance Relationships dimension (Chapter 3) to the Operational Coordination Among Multiple Stakeholders dimension (Chapter 4).....69
Chapter 4.....**71**
RESEARCH STREAM 3: "Environmental Product Declarations: Challenges and Opportunities in the European Lighting Sector".....**71**
4.1 INTRODUCTION.....**71**
4.2 THEORETICAL FRAMEWORK.....**74**
4.2.1 Information processing theory (IPT).....75
4.2.2 Multi-stakeholder initiatives (MSIs).....77
4.3 RESEARCH METHODOLOGY.....**79**
4.4 STUDY SETTING: THE LIGHTING INDUSTRY.....**82**
4.4.1 The EPD generation process.....82
4.5 FINDINGS.....**84**
4.5.1. Developing capabilities to gather both primary and secondary data [dim.1 in Fig. 4].....85
4.5.1.1 Establishing a collaborative structure for primary data collection.....*85*
4.5.1.2 Identifying ways to model data and address data gaps.....*86*

4.5.2 Inefficiencies in EPD verification and registration [dimension 2 in Fig. 4] 88
4.5.2.1 Verifiers are an important bottleneck *88*
4.5.2.2 Program operators' systems not up to date *88*
4.5.3 Stakeholders pursuing self-interests [dimension 3 in Fig. 4] 89
4.5.3.1 Program operators' conflicting self-interests *89*
4.5.3.2 Database providers' resistance *91*
4.5.3.3 Manufacturers safeguard their individual rather than collective interests *92*
4.5.4 Developing industry-wide EPD standards [dimension 4 in Fig. 4] 93
4.5.4.1 Harmonizing practices across the lighting industry *93*
4.5.4.2. Striving to transform collective initiatives into global initiatives *95*
4.5.5 Multi-stakeholder Initiatives working in isolation [dimension 5 in Fig. 4] 96
4.5.5.1 Overlooking the voices of key stakeholders *96*
4.5.5.2 Multi-stakeholders are working in silos *97*
4.6 A GROUNDED THEORETICAL MODEL FOR MANAGING EPDs GENERATION **98**
4.7 Research Stream 3: THEORETICAL CONTRIBUTIONS AND MANAGERIAL IMPLICATIONS **100**
Chapter 5
CONCLUSIONS **106**
5.1 Final Takeaways **106**
5.2. Directions for future research **108**
REFERENCES **110**
APPENDIX **127**

TABLES

Table 1. Descriptive Statistics....19

Table 2. Correlation Matrix....22

Table 3. OLS regressions for the entire sample with different measures of the dependent variable....23

T**able 4.** OLS regressions for Facebook sample with different measures of the dependent variable....25

Table 5. OLS regressions for Instagram sample with different measures of the dependent variable....26

Table 6. OLS regressions for Twitter sample with different measures of the dependent variable....26

Table 7. OLS regressions for Instagram, Facebook, and Twitter samples with aggregate measure as dependent variable....28

Table 8. Profiles of companies....44

Table 9. Assignment of disclosure level to standardized judgments - Detox Catwalk 2016. 47

Table 10. Legend for criterion: Transparency 2016-2018 and Transparency 2018-2021....48

Table 11. Assignment of disclosure level to standardized judgments - Destination Zero 2018. 48

Table 12. Assignment of disclosure level to standardized judgments- Fashion Fairytale 2021....48

Table 13. GRI standards. 50

Table 14. Report 2016 – Key events of Detox Campaign for each company during the first joining phase of the campaign 2011-2014....51

Table 15. Assignment of the environmental disclosure level for the short-term 2011-2016. 56

Table 16. Assignment of the environmental disclosure level for the intermediate period 2016-2018....56

Table 17. Assignment of the environmental disclosure level for the long-term 2018-2021. 57

Table 18. Aggregated assessments for short-, intermediate-, and long-term....58

Table 19. Example of the type of relationship and the level of environmental disclosure 59

Table 20. Transparency and standardization upon companies' sustainability reports. 62

Table 21. Description of Respondents....81

FIGURES

Figure 1. Flowchart of the activities performed for data collection and coding. Data sources in italic font ..... **Errore. Il segnalibro non è definito.**

Figure 2. The trajectory of environmental disclosure quality over time based on the type of NGO-corporate relationship. 60

Figure 3. Environmental Product Declaration Ecosystem for the European Lighting Sector.....83

Figure 4. Data structure 84

Figure 5. A grounded theoretical model of managing EPD related challenges and opportunities 98

Chapter 1
INTRODUCTION

1.1 General introduction

Over recent decades, global awareness of the need for environmental protection and sustainable economic development has grown significantly. This heightened environmental consciousness has emerged alongside a confluence of factors that have intensified societal concern over corporate sustainability performance such as the increasingly visible effects of climate change, rising income inequality, human rights violations in global supply chains, and high-profile corporate environmental scandals. In response, policymakers and governments worldwide have committed to identifying new pathways for achieving the United Nations Sustainable Development Goals (SDGs). At the same time, stakeholder groups—including investors, employees, NGOs, and customers—are exerting growing pressure on companies to improve their environmental, social, and governance (ESG) performance (Crapa et al., 2025). Consequently, an increasing number of citizens and firms have recognized their active role in addressing environmental degradation (Jira and Toffel, 2013; Mol, 2015). In turn, firms are now expected not only to take concrete action on ESG issues but also to communicate these efforts transparently through comprehensive and credible disclosures, enabling stakeholders to assess and verify their commitments (Jira and Toffel, 2013).

Considering this context, the central focus of this thesis is transparency in environmental disclosure which is critical for firms' competitiveness and long-term survival. Environmental disclosure refers to the extent of information available about a firm's environmental impacts and practices (Bellamy et al., 2020). It can have an impact to diverse outcomes beyond market performance (Grewal et al., 2019; Jacobs et al., 2010) such as corporate environmental reputation (Cho et al., 2012), executive turnover (Meng et al., 2013), financial performance (Albertini, 2013), and even executive excess compensation (Li et al., 2019). Regardless of whether these effects are positive or negative, stakeholder expectations for transparency in environmental performance have intensified under increasing regulatory, reputational, and competitive pressures (Jira and Toffel, 2013). This trend is reflected in regulatory shifts such as EU's Corporate Sustainability Reporting Directive (CSRD) mandatory requirement for publicly traded firms to disclose climate-related risks (Directive (EU) 2022/2464, 2022). Today, sustainability reporting has become part of business as usual for almost all of the

world's largest 250 companies, and a large majority of the top 100 companies in each country, territory or jurisdiction (KPMG, 2025).

This thesis examines corporate transparency in environmental disclosure across multiple communication channels and tools—including sustainability reports, eco-labels, and social media—at both the organizational and product levels. It explores the opportunities and challenges associated with these practices, with particular attention to the interplay between voluntary disclosure, stakeholder engagement, and the risk of strategic or misleading communication.

1.2 Literature review and research questions of the thesis

The extent of a firm's environmental disclosure depends on two key factors: its capacity to gather and process environmental data from internal and external sources, and its motivation to share this information with stakeholders (Bellamy et al., 2020). Firms may voluntarily disclose information to advance corporate social responsibility (CSR) goals, strengthen legitimacy, or preempt stricter regulations. However, disclosure is not always comprehensive. Companies may strategically limit or shape disclosures to reduce scrutiny (Marquis et al., 2016), obscure unfavorable information (Fabrizio and Kim, 2019), and influence stakeholder perceptions (Carlos and Lewis, 2018). In particular, stakeholder pressure can prompt short-term reactions in which firms report false or misleading information about their environmental initiatives and outcomes—a practice known as greenwashing (Lee, 2019). Awareness of false environmental claims is increasing globally, with growing scrutiny of both corporate and governmental communications on environmental and climate strategies. Yet, despite this heightened awareness, greenwashing remains widespread (Adamkiewicz et al., 2022). Additionally, advances in communication technologies have broadened the channels available for environmental disclosure. Alongside traditional sustainability reports, firms now use websites, social media platforms, digital dashboards, and interactive stakeholder dialogues to share environmental information (Giacomini et al., 2021; Rocca et al., 2021). This multi-channel approach has the potential to enhance transparency, authenticity, and engagement—but only if it avoids the pitfalls of greenwashing and selective disclosure.

These trends reveal a broad tension in contemporary environmental transparency. Societal expectations for credible, detailed information are increasing, but the channels and processes through which this information is communicated, and operationalized

remain fragmented and uneven. In light of those observations, this doctoral thesis adopts an integrative perspective to address the overarching questions (OQs):

OQ1: How do different stakeholders influence and shape corporate environmental transparency at both organizational and product levels across multiple communication channels?

OQ2: Under what conditions can credible and scalable environmental transparency be achieved?

These questions point out that environmental transparency is not a single activity but the result of interrelated communication, governance, and operational processes. Accordingly, the thesis examines three dimensions that collectively shape corporate environmental transparency: "green" communication effectiveness, governance relationships, and operational coordination. Each dimension corresponds to one of the three empirical studies that form this thesis; however, they build on one another, thereby reinforcing the integrative narrative of the work.

The first stream focuses on message performance in the public digital arena, examining when and how green posts published in social media platform gains traction with audiences compared to non-green content, and how platform characteristics and media richness of shared content moderate this effect. Prior research has explored how organizations leverage social media for sustainability communication, documenting implications for corporate communication effectiveness and user engagement with environmental causes (Bellucci and Manetti, 2017; Castelló et al., 2013; Dunn and Harness, 2018). Yet, a notable gap has been found in understanding the performance of green versus non-green communication across different social media. Specifically, it is still unclear whether and under which conditions green communication may be more effective than non-green communication in terms of consumers' response across different social media. The first part of this thesis (Chapter 2) aims to address this gap by comparing green versus non-green communication across social media and unraveling critical factors that can influence the efficacy of green (vs. non-green) content in stimulating response from social media users. Given the growing influence of social media and the increasing attention to environmental sustainability, it is essential to understand how users react to and interact with green versus non-green content. In this context, the thesis specifically addresses the following research questions:

RQ (1): Can green communication be more effective than non-green communication in terms of consumers' response in social media?

RQ (2): Does any possible difference in consumers' response between green and non-green communication hinge upon the type of social media platform and the degree of media richness?

Examining how different social media platforms (e.g., Facebook, Instagram, Twitter—now named X) and content formats (e.g., text, images, videos) influence user engagement can offer valuable insights for marketers. These insights could guide the selection of green communication strategies that are best suited to each platform, with the goals of raising environmental awareness and achieving potential environmental and economic benefits.

The dimension of green communication effectiveness, the focus of first study of the thesis, establishes a baseline by showing that environmental messages can capture audience attention and engagement, although the extent of engagement depends on the social media post format and platform used. However, green communication effectiveness alone is insufficient for assessing corporate environmental transparency, as messages can be compelling yet misleading. This observation introduces the second dimension, which is investigated in Chapter 3 of this thesis.

The second stream, focusing on corporate-stakeholder relationships, extends the lens to the stakeholder governance relationships behind environmental claims. It analyzes how collaborative versus conflictual relationships between corporations and Non-Governmental Organizations (NGOs), along with NGOs' campaign design choices, can drive or undermine substantive ED practices. Here, the enquiry of OQ1 and OQ2 shifts from understanding how audiences respond to green communication to investigating how firms are motivated or pressured to disclose. This second research stream thus broadens the stakeholder perspective by examining additional critical actors, with particular emphasis on NGOs and their influence on corporate environmental transparency. In this thesis, NGO-corporate collaboration is defined as a systematic form or forums of dialog such as roundtables with NGOs and other stakeholders and common projects with concrete actions and goals (Kourula and Halme, 2008). While NGO-corporate collaboration can build trust and support long-term sustainability goals, conflictual NGO–corporate relationships may be more effective in driving public environmental disclosure. For example, under persistent NGO pressure and media scrutiny, firms may feel compelled to highlight environmental achievements in sustainability reports (Luo et al., 2017). Conversely, when a collaborative relationship is in place, firms might feel less pressure to publicly disclose information, focusing instead

on meeting the internal objectives set within the partnership. Therefore, it becomes particularly relevant to explore how NGO activism—whether conflictual or collaborative—affects a firm's environmental commitment, especially with regard to the quality and transparency of environmental disclosure. Specifically, how the type of relationship between NGOs and corporations may influence the quality of ED on the one hand, and how NGOs may unintentionally lead companies to adopt greenwashing practices on the other hand, are not yet fully explored issues. To fill this gap, the aim is to find an answer to the following research questions:

RQ (3): How does the type of relationship between an NGO and a corporation (i.e., collaborative versus conflictual) during the campaign carried out by the NGO influence corporation's efforts in terms of ED and their evolution over time?

RQ (4): How do communication strategy, activism, and pressure exerted by an NGO influence the participation rate of companies in the campaign and unintentionally lead participating companies to exhibit false commitment?

RQ (5): How does an everlasting conflictual NGO-corporate relationship carried out by the NGO influence the risk of greenwashing practices?

This dimension (Stakeholder Governance Relationships) complements dimension 1 (Communication Effectiveness) by showing that disclosure practices are inseparable from the governance relationships through which firms are supported, pressured, or sanctioned by stakeholders.

The third dimension of this thesis, *operational coordination*, shifts focus from the motivations behind green communication to the technical and organizational challenges of developing quantitative and externally verified environmental information at the product level. This dimension (Study three in chapter four) also addresses the risk of greenwashing, but from the product-level perspective, focusing on Environmental Product Declarations (EPDs). Specifically, users are increasingly skeptical toward product claims, such as "green" and "environmentally friendly", due to the proliferation of such misleading claims in recent years (Szabo and Webster, 2021). To reduce such concerns, regulators now require manufacturers to disclose products' environmental impacts using scientific and quantitative methods (Lewis et al., 2023). As a response, some manufacturers have opted to develop EPDs. EPDs are independently verified labels that provide quantitative environmental information for a product across its entire life cycle—including emissions related to raw materials and product components, manufacturing and transportation phases, product usage, and end-of-life management

(International Organization for Standardization [ISO], ISO 14025, 2006). EPDs enable buying companies to make informed purchasing decisions. Most research on operations management has mainly focused on transparency in environmental disclosure at the organizational or inter-organizational levels (Schnackenberg and Tomlinson, 2016). A few studies have begun to address the complexities of product-level transparency, often focusing on eco-labels and their influence on consumer purchasing decisions (e.g., Darnall et al., 2018; Gosselt et al., 2019). The third study of this thesis contributes to this research stream by focusing on EPDs, a type of environmental label tool used in business-to-business contexts (i.e., a contractor and a manufacturer). The research investigate the challenges that manufacturers face during EPD development in light of the rapidly growing demand for such declarations. To address these issues, the thesis tries to address the following two research questions:

RQ (6): What are the challenges in developing EPDs and how manufacturers manage them?

RQ (7): How does coordination between manufacturers and external stakeholders (e.g., program operators, industry associations, and databases providers) facilitate the management of and streamline the EPD process?

Issues such as data constraints, methodological fragmentation, and the lack of international harmonization complicate the comparability and credibility of EPDs. Addressing these challenges requires firms not only to build internal technical expertise and information processing capabilities but, also, to coordinate closely and collaborate with external stakeholders, including industry partners, suppliers, designers, and certification schemes. Through such collaboration, companies develop the capabilities necessary to develop quantitative and science-based product environmental information.

1.3 Methodologies

In this thesis, both qualitative and quantitative research methodologies have been implemented. The empirical analyses are based on primary data collection, which was collected and analyzed through the usage of different methodologies.

In the research article presented in Chapter 2, a quantitative approach was adopted, relying on econometric analysis to test four hypotheses. Two Italian retailers—Conad and Coop—were selected not only for their economic relevance but also for their commitment to environmental sustainability as a core business philosophy. Both had published annual sustainability reports detailing their environmental impact and the

green initiatives undertaken to reduce it (Conad, 2021; Coop, 2021). Data collection was conducted using a web-scraping tool, which retrieved all posts published by the two retailers on the official pages of each of the three selected social media platforms (i.e., Facebook, Instagram and Twitter-nowadays named X). The collection period spanned from the launch of each retailer's official page on each platform until the end of February 2020, a cutoff chosen to avoid distortions caused by the onset of the COVID-19 pandemic. For each post, information was recorded on the publication date, the content, the content format (i.e., text, images, videos, or combinations thereof), and user engagement metrics, including likes, comments, and shares (or retweets, where applicable). After collection, posts were assigned identification numbers, and a random sample of 350 posts was drawn for each retailer–platform pair. This procedure resulted in a total of 2,100 posts (700 per platform, equally divided between Coop and Conad). The sample size was deemed acceptable by subject-matter experts, being both sufficiently large and representative of the retailers' activity across the three platforms. This approach is consistent with previous research on sustainability communication (e.g., Calic and Mosakowski, 2016).

For the paper presented in Chapter 3, a qualitative longitudinal analysis was conducted to investigate the relationships between Greenpeace and 24 fashion industry firms targeted by the *Detox* campaign over a 10-year period. Launched in 2011 and concluded in 2021, the *Detox* campaign aimed to raise environmental awareness and promote greater responsibility within the fashion sector. Greenpeace was selected as the focal NGO due to its global influence and its strict policy of not accepting funds from corporate partners, thereby eliminating the risk of sponsorship bias in campaign outcomes. Data collection involved three semi-structured interviews with Greenpeace's Global Corporate Leader of the Detox Campaign (GCLDC). To triangulate the data, a comprehensive review of secondary sources (i.e., all official campaign documents) was conducted, along with an in-depth analysis of the annual sustainability reports published by all participating companies throughout the campaign's duration.

The last paper, presented in Chapter 4, employs a grounded research methodology, given limited knowledge on managing information flows both within and beyond organizational boundaries for Environmental Product Declaration development. To ensure rigor in the study's design and implementation, the systematic three-step approach outlined by Gioia et al., (2013) was adopted. The research was conducted as a multiple case study involving different stakeholders. This approach encompassed all major stakeholders in the lighting sector ecosystem, and archival data (i.e., industry

white papers, meeting minutes, published EPDs) were used to triangulate the findings.

1.4 Thesis outline

This work is structured in five chapters as follows.

Chapter 1 outlines the different literature streams addressed in this thesis. It presents the literature gaps and research questions, highlights the relevance of the arguments, and describes the research methodologies adopted.

Chapter 2 presents the first research stream which is based on the research article by Crapa et al., (2024), "The performance of green communication across social media: Evidence from large-scale retail industry in Italy". This study, through econometric analysis and robustness checks, shows that while green content generally stimulates larger response than non-green content, its effect varies across social media, with the highest effect being observed on Instagram (at least for likes) and the lowest on Twitter (at least for comments). Moreover, the extent to which the positive effect of green content increases as media richness increases (i.e., moving from only text to text plus photo, and then to text plus video) is also contingent upon the social media platform.

Chapter 3 presents the second research stream which is based on the research article by Crapa et al., (2025), "The influence of NGO-corporate relationship on environmental disclosure: Evidence from the fashion industry". This article provides five propositions by studying the relationships between Greenpeace and 24 firms operating in the fashion industry through a qualitative longitudinal analysis. The findings suggest that company behavior toward ED and the odds of greenwashing practices are affected by type of relationship established with NGOs.

Chapter 4 presents the third research stream which is based on the research article by Crapa and Villena (2025) (submitted to JOM), "Environmental Product Declarations: Challenges and Opportunities in the European Lighting Sector". This study investigates the major challenges that manufacturers face in developing EPDs and how they are overcoming them. A multiple case study has been conducted with major players in the European lighting ecosystem—five manufacturers, two program operators, two multistakeholder groups, and one database and software provider. The research reveals the complexities in developing EPDs and the associated opportunities.

Chapter 5 is the final chapter of this thesis where the overall conclusions are drawn. Finally, directions for future research are provided.

Chapter 2
RESEARCH STREAM 1:
"The performance of green communication across social media: Evidence from large-scale retail industry in Italy

2.1 INTRODUCTION

In contemporary discourse, green marketing is conceptualized as a comprehensive strategic framework encompassing the systematic integration of environmental considerations into marketing activities designed to facilitate exchanges that satisfy consumer needs while minimizing adverse environmental impact (Dangelico and Vocalelli, 2017). Current debates frame green marketing as a source of competitive advantage, highlighting its potential to enhance consumers' perceived benefits, strengthen product appeal, and improve overall business performance (Dangelico and Pontrandolfo, 2015; Ottman et al., 2006; Walker and Wan, 2012). Within this context, the implementation of a robust corporate social responsibility (CSR) strategy—and particularly a green communication strategy—is seen as fundamental in building trust and reputation among stakeholders by signaling the environmental values embedded in an organization's culture (Banerjee, 2002; Bellucci et al., 2019; Brown and Starkey, 1994; Giacomini et al., 2022).

Social media platforms have become pivotal CSR communication channels, fostering interactive dialogues between companies and their stakeholders and enabling simultaneous engagement with diverse audiences such as consumers, investors, and activists (Kaplan and Haenlein, 2010). Increasingly, companies are using these platforms to showcase environmental initiatives and promote sustainable consumption practices—a trend commonly referred to as green communication (Giacomini et al., 2020; Giacomini et al., 2021; Reilly and Hynan, 2014; Rocca et al., 2021). Through social media, firms can disseminate messages related either to eco-friendly products/services or to sustainability-oriented corporate initiatives, relying on communication approaches that often differ from those applied to non-green messages (Groening et al., 2018).

While a growing body of research has investigated the effectiveness of green communication in shaping corporate strategies and fostering user engagement (Bellucci and Manetti, 2017; Castelló et al., 2013, 2016; Dunn and Harness, 2018; Korschun and Du, 2013; Perks et al., 2017; Reilly and Hynan, 2014), surprisingly little attention has been paid to how green versus non-green content performs across different social media platforms. In other words, it remains unclear whether green communication consistently

outperforms non-green communication in driving user engagement, and under what conditions this occurs. The present study seeks to address this gap by examining the relative effectiveness of green and non-green communication on social media, while exploring two factors that may strongly influence outcomes: the type of platform and the degree of media richness. Because platforms such as Facebook, Instagram, and Twitter differ in community dynamics and functionalities, they may naturally shape the reception of different types of content (Roma and Aloini, 2019; Smith et al., 2012). Media richness, which reflects a medium's ability to convey information effectively (Daft and Lengel, 1986; Dennis and Kinney, 1998; Osei-Frimpong and McLean, 2018; Reilly and Hynan, 2014), can be observed in content formats such as text, images, or videos. Prior studies demonstrate that richness influences brand-related communication outcomes, particularly on social media (Roma and Aloini, 2019), suggesting it may also affect how audiences engage with green versus non-green content. Since the degree of media richness has been shown to play a crucial role in the performance of brand-related communication, especially in social media (e.g., Roma and Aloini, 2019), it may also exert an influence in the green versus nongreen content comparison. In a nutshell, our paper aims to answer the following research questions (RQs):

RQ1. *Can green communication be more effective than non-green communication in terms of consumers' response in social media?*

RQ2. *Does any possible difference in consumers' response between green and non-green communication hinge upon the type of social media platform and the degree of media richness?*

Addressing these questions is crucial for advancing knowledge on sustainable communication in the social media landscape (e.g., Dunn and Harness, 2018; Korschun and Du, 2013; Perks, et al., 2017; Reilly and Hynan, 2014). Given the dual relevance of sustainability concerns and social media's growing influence, identifying how users interact with green versus non-green content—depending on both the platform and the format (e.g., text, photos, or videos)—can provide marketers with strategic insights into tailoring green communication campaigns that maximize engagement and generate positive environmental and economic impacts. Importantly, recognizing the heterogeneity among social media platforms, in terms of goals, architectures, supported content formats, and evolving social norms (Roma and Aloini, 2019; Smith et al., 2012), is essential for understanding how these differences shape audience responses. Clarifying these dynamics helps firms make more informed decisions on where and how

to allocate resources across platforms (Smith et al., 2012), select the most suitable platform for a given objective (Gensler et al., 2013), and choose the appropriate content format to capture user attention (Voorveld et al., 2012).

The empirical analysis was conducted on two of the largest retail chains in the Italian market, Coop Italia and Conad, by collecting data from posts published on their Facebook, Instagram, and Twitter (now known as X) accounts. Findings indicate that green communication generally elicits higher engagement—measured in likes, comments, and shares—than non-green communication. However, the effect varies by platform, with the strongest outcomes observed on Instagram (particularly for likes) and the weakest on Twitter (notably for comments). In addition, the relationship between green content and media richness is not uniformly positive. Higher richness (e.g., video compared to text or images) does not always enhance effectiveness, as the moderating role of media richness depends strongly on the platform where the content is disseminated.

2.2 LITERATURE REVIEW

2.2.1. The effect of green versus non-green communication

The academic debate on social media as a tool for green communication has intensified in recent years. One key research stream links green marketing to competitive advantage and market differentiation (Arnaud, 2017; York, 2009), emphasizing its role in enhancing consumer-perceived benefits, improving product attractiveness, and boosting corporate performance (Dangelico and Pontrandolfo, 2015; Ottman et al., 2006; Walker and Wan, 2012; Yang et al., 2022). Genuine commitment to sustainability is widely recognized as a major source of competitive advantage (Beverland and Farrelly, 2010; Delmas and Burbano, 2011; Delmas and Grant, 2014; Porter and Kramer, 2011). Elements considered crucial for effective green communication include the credibility of information provided (Parkman and Krause, 2018), transparency (Aung and Chang, 2014; Badia-Melis et al., 2015), and sustained involvement in environmental initiatives (Araujo and Kollat, 2018; Giacomini et al., 2021).

Social media channels give companies opportunities to better capture consumer expectations, address criticism, strengthen trust, and improve corporate reputation and social legitimacy (Dunn and Harness, 2018; Korschun and Du, 2013; Perks et al., 2017). As a result, more campaigns are being designed to communicate environmental

commitment in innovative ways (Hao et al., 2018; Kapoor et al., 2021; Reilly and Hynan, 2014). Through user interaction with products and services, social media foster positive word-of-mouth, brand loyalty, dialogic accounting practices, and stronger purchase intentions (Acuti et al., 2019; Bellucci et al., 2019; Ko and Megehee, 2012; Nekmahmud et al., 2022). In this context, several studies highlight the critical role of social platforms in informing audiences about sustainability initiatives, facilitating bidirectional dialogue (Bellucci and Manetti, 2017; Cooper and Owen, 2007; Giacomini et al., 2022; Khanal et al., 2021; Rocca et al., 2021), and shaping consumer attitudes and behaviors toward green products and services (Ghali et al., 2016; Han et al., 2018; Pizzi et al., 2021). Nevertheless, hesitation persists among some firms due to the perceived risk of accusations of greenwashing—misrepresenting or exaggerating environmental achievements(Falchi et al., 2022; Peloza et al., 2012; Zhang et al., 2018).

At first sight, marketing and sustainability may appear difficult to reconcile. Conventional marketing has traditionally encouraged consumption growth, assuming resource abundance and focusing on fulfilling ever-expanding (Csikszentmihalyi, 2000; Swim et al., 2011). Sustainability, by contrast, views resources as finite and advocates for their renewal in line with circular principles (McDonough and Braungart, 2002). Furthermore, despite consumers often expressing pro-environmental attitudes in surveys, their behavior has not always aligned with these declarations (Auger and Devinney, 2007; Campbell et al., 2020; Gatersleben et al., 2002; Hatanaka, 2020; Hojnik et al., 2020; Trudel and Cotte, 2009).

This gap between attitudes and actions has been a persistent challenge for policymakers, environmental organizations, and businesses promoting sustainable consumption (Johnstone and Tan, 2015; Prothero et al., 2011). However, contemporary developments suggest that consumer needs and sustainability can coexist rather than conflict (Daub and Ergenzinger, 2005; Chowdhury and Quaddus, 2021; Wang et al., 2019). Marketing is increasingly positioned as a mechanism to promote sustainable lifestyles, which is essential in addressing the urgency of climate change (Mont et al., 2014; Veleva, 2021). Firms are expected to showcase sustainable production practices and encourage responsible consumption through strategies aligned with socially responsible marketing (Laczniak and Murphy, 2006). Compared with the past, when consumerist values were dominant, environmental awareness has expanded considerably (Bortree et al., 2013; Luchs et al., 2012; Severo et al., 2021; Sun et al., 2019). More consumers now evaluate companies' environmental and social commitments when making purchase decisions (Hamzah and Tanwir, 2021; Marquina

and Morales, 2012). Therefore, the current scenario sees not only a trend of firms addressing green issues in their campaigns, but also an equally keen interest and involvement from stakeholders, who play a crucial role for organizations in the development of a CSR strategy (Bellucci and Manetti, 2017; Cooper and Owen, 2007; Lee, 2011; Madsen and Ulhøi, 2001).

At the individual level, various theoretical perspectives explain why consumers support environmental causes. Some scholars, emphasizing prosocial motives, rely on the norm activation model (NAM) (Schwartz, 1977), which posits that personal or moral norms strongly influence prosocial actions. Numerous studies confirm that such norms play a crucial role in explaining pro-environmental behavior (Bamberg and Möser, 2007; Biel and Thøgersen, 2007; Hunecke et al., 2001; Kang, 2022). These norms arise from an interplay of cognitive, emotional, and social factors (Bierhoff, 2005). Cognitive elements, such as environmental knowledge and awareness, are particularly significant in shaping moral responsibility toward pro-environmental action (Confente and Scarpi, 2021). For instance, purchasing decisions may reflect the degree of concern about the environmental consequences of consumption (Follows and Jobber, 2000). This line of reasoning suggests that rising environmental awareness increases the likelihood that consumers will positively engage with green content on social media, thereby contributing to the diffusion of environmental values.

Other scholars, adopting the theory of planned behavior (TPB) (Ajzen, 1991), highlight self-interest motivations. TPB-based approaches argue that altruistic actions can simultaneously produce personal satisfaction, thereby framing ego-centered motivations as central to environmental behavior (Prakash and Pathak, 2017; Steenhaut and Van Kenhove, 2006; Yarimoglu and Gunay, 2020). In this view, consumers may interact with green content on social media partly to reinforce a green self-identity or to be publicly recognized as environmentally conscious (Freestone and McGoldrick, 2008; Mancha and Yoder, 2015).

Despite their different emphases, NAM and TPB both support the expectation of pro-environmental behavior in a variety of contexts. Prior literature suggests that such behavior is best understood as a combination of self-oriented and other-oriented motivations, encompassing concern for society, future generations, and the natural environment (Bamberg and Möser, 2007). Growing attention to sustainability from consumers and stakeholders, combined with the increasing effectiveness of social media in disseminating environmental communication (Bellucci and Manetti, 2017; Ghali et

al., 2016; Han et al., 2018; Pizzi et al., 2021), supports the expectation that green content generates stronger engagement than non-green content.

H1. *On social media, firm-generated green content performs better than firm-generated non-green content in terms of consumer responses (e.g., likes, comments, shares).*

2.2.2. Factors influencing the performance of green communication

2.2.2.1. The moderating role of the type of social media platforms

Extant research has highlighted marked distinctions among social media platforms (e.g., Facebook, Twitter, Instagram), particularly regarding user intensity and underlying motivations for engagement (Chen, 2015; Hollenbaugh and Ferris, 2014; Pourazad *et al.*, 2023; Whiting and Williams, 2013). These platforms attract audiences that now number in the hundreds of millions, though their popularity is not static and shifts over time. For example, Twitter (recently renamed X) once occupied a dominant role in the social media landscape, yet more recently Instagram and TikTok have gained stronger traction among users (Alhabash et al., 2014; Wong, 2023). While Facebook continues to retain a substantial base of younger adults, adolescents increasingly prefer Instagram (Dibb and Foster, 2021; Mackson et al., 2019) and TikTok (Cheong and Lloyd, 2023). Currently, Instagram is widely recognized as one of the platforms most frequently used by Generation Z, who often place it ahead of TikTok in terms of preference (Newberry, 2023; Williamson, 2022). Beyond popularity trends, each platform cultivates its own social norms, behavioral expectations, and functionalities, which shape how users interact with firms' communications (Roma and Aloini, 2019). This suggests that analyzing variations in user responses across different platforms can generate valuable insights for tailoring communication strategies aimed at encouraging sustainable consumer engagement (Colleoni, 2013; Roma and Aloini, 2019).

Adopting a cross-platform perspective (e.g., Roma and Aloini, 2019; Roma and Vasi, 2019), this study contends that platform characteristics play a decisive role in determining the effectiveness of green content. Existing literature identifies Facebook and Instagram as particularly influential channels for green advertising and sustainability-related communication (Šikić, 2021). Instagram, in particular, stands out due to its visual orientation and its emphasis on high-quality, creative imagery. The platform provides diverse tools for photo and video editing, which firms increasingly leverage to craft persuasive storytelling and enhance emotional resonance (Herman, 2014; Rietveld et al., 2020). This emotional appeal is especially important in

sustainability communication, as it facilitates user receptiveness to green initiatives and can inspire pro-environmental behaviors (Guadagno et al., 2013). Moreover, the presence of a more fertile ground for green communication especially on Instagram is also driven by the type of users active within the Instagram community, that is dominated by younger cohorts such as Generation Z. There exists indeed evidence that younger generations are much more informed about sustainable living than previous generations (Arora and Manchanda, 2022; Bedard and Tolmie, 2018). As a matter of fact, nowadays, many influential sustainability advocates and "green influencers" have chosen Instagram as their primary platform (Jalali and Khalid, 2021). In contrast, we argue that the practice of creating emotional content on Twitter is still rather limited or at least is not as customary as in the other social media platform, because short textual descriptions, that is, tweets, are still the most common format for communication (Bigné et al., 2019). The platform's relatively limited emphasis on emotional content may constrain the persuasive power of green communication and dampen user responses to such initiatives. Drawing on these insights, the following hypothesis is proposed:

H2. *The positive performance gap between green and non-green content (in terms of consumers' response) differs across social media platforms, with Instagram showing the highest gap and Twitter showing the lowest gap.*

2.2.2.2. The moderating role of media richness

Social media platforms are widely acknowledged as highly effective instruments for fostering consumer engagement, often outperforming traditional communication channels in terms of efficiency and reach (Hollebeek et al., 2014; Kaplan and Haenlein, 2010). In this regard, prior literature has suggested that different types and formats of content shared may yield different levels of efficacy in engaging consumers (e.g., (Ji et al., 2019; Lock and Araujo, 2020; Roma and Aloini, 2019; Yin and Zhang, 2020). Much of this body of literature is grounded in Media Richness Theory (MRT) (Daft and Lengel, 1986; Dennis and Kinney, 1998) and Social Presence Theory (SPT) (Osei-Frimpong and McLean, 2018; Short et al., 1976), both of which suggest that communication channels vary in their capacity to convey information effectively and to create a sense of personal presence during interactions. In recent years, richer media formats have increasingly been deployed as a strategy in environmental communication and activism to capture attention and intensify public engagement. Activists frequently rely on visual documentation—such as live protest recordings or imagery illustrating the

devastating consequences of climate change and environmental degradation—to convey urgency (Jones, 2022). Within the sphere of green communication, the objective is often to provide tangible demonstrations that environmental challenges (e.g., waste, pollution, climate risks) are immediate and consequential (Calculli et al., 2021; Sun et al., 2019). The underlying assumption is that the stronger the emotions triggered by such content, the greater the probability of viral diffusion (Dobele et al., 2007; Guadagno et al., 2013). Empirical studies reinforce this perspective. For instance, Kao and Du (2020) demonstrate that advertisements designed to evoke positive moral or social emotions exert stronger influence on consumers, aligning with broader findings that emotions can meaningfully shape consumer attitudes and choices (Pornpitakpan et al., 2017; Swim et al., 2011; Ursavas and Hesapci-Sanaktekin, 2013). Although this communication approach is naturally adopted by environmental agencies, it is also more frequently pursued by sustainability-oriented firms in communicating their green initiatives (Reilly and Hynan, 2014). Indeed, absent emotionally rich content, audiences may fail to grasp the urgency or significance of environmental issues (Kao and Du, 2020). Rich media formats—such as videos, imagery, and sound—are particularly effective in stimulating emotional reactions and fostering engagement, making them especially suitable for environmental campaigns that rely on vivid stimuli to influence consumer perceptions (Ji et al., 2019). Visual and auditory cues attached to sustainability messages can illustrate risks, humanize ecological problems, and demonstrate their consequences in ways that text alone cannot achieve (Smith and Joffe, 2009). Consequently, it is reasonable to posit that rich media are more critical for green messaging than for non-green messaging. This reasoning leads to the expectation that the positive performance gap between green and non-green content in social media increases as the media richness increases, that is, when the content moves from text-only, to text and photo/image, and then to text and video. Accordingly, we formulate:

H3. *The positive performance gap between green and non-green content in social media increases as the media richness increases, that is, as the content shifts from text-only, to text and photo/image, and then to text and video.*

2.2.2.3. How the moderating role of media richness depends on social media platforms

The third hypothesis above states that the use of richer media (e.g., videos) should favor more green communication than non-green communication, thereby amplifying the performance advantage of the former. Nonetheless, this effect may vary across social media platforms. As discussed earlier, each platform exhibits distinct community-

related characteristics (e.g., user base, behavioral norms, and interaction rules) and technology-related features (e.g., functionalities and interface design) (Hughes et al., 2012; Petrocchi et al., 2015; Roma and Aloini, 2019). These variations shape platform-specific user habits and preferences regarding content formats, which in turn influence both firms and consumers in their choice of communication media (Alhabash and Ma, 2017). Instagram, for instance, does not allow text-only posts; content must include either images or videos accompanied by text. Although the platform supports short videos, it has historically been associated with visual imagery, particularly photographs (Pittman and Reich, 2016; Yu and Egger, 2021). This long-standing cultural emphasis on photos can lead to a greater appreciation and diffusion of images over videos, despite the latter being technically richer media. Thus, richer content such as video does not automatically guarantee stronger engagement or improved outcomes for green communication on Instagram. Twitter (recently renamed X), by contrast, emerged as a microblogging site, designed to enable rapid dissemination of concise information. Although it has progressively integrated richer and more visual formats, its foundational identity continues to privilege text-based interaction (Bigné et al., 2019). Consequently, users may be less responsive to visually rich media on this platform, limiting the relative advantage of richer content for green communication. On Facebook, instead, no specific culture has been originally established emphasizing the role of a media over another one. That is, different types of content, for example, text only, images, videos, are typically utilized in this platform (Bessi et al., 2016; Escobar-Rodríguez and Bonsón-Fernández, 2017; Kim et al., 2015). In recent years, however, evidence points to an increasing orientation toward richer content, especially video, with features such as live streaming and stories gaining rapid popularity among users (Gupta, 2013; Roma and Aloini, 2019; Vilnai-Yavetz and Tifferet, 2015). Given these platform dynamics, Facebook appears particularly conducive to the enhanced effectiveness of richer media formats. Integrating these arguments with the rationale underlying Hypothesis (H3), it can be posited that richer content is typically more useful for green communication than for non-green communication. Therefore, combining the two arguments, we expect that the positive performance gap between green and non-green content in social media increases as media richness increases to a greater extent on Facebook than on Instagram and Twitter.

H4. *The increase of the performance gap between green and non-green content as the media richness increases is more likely to occur on Facebook than on Instagram and Twitter.*

2.3 METHODOLOGY

The study examines the Italian large-scale retail sector as the empirical setting to test the proposed hypotheses. Specifically, it evaluates the green communication strategies and initiatives of two leading retailers in this market: Conad and Coop. This sector was selected due to the significant environmental impact of large-scale retailing, which includes energy consumption, product and resource waste, and pollution from logistics activities. Both brands operate under a cooperative business model that groups multiple legally independent retailers, and have a prominent presence mainly in the national context. These companies were selected not only for their economic significance but also because sustainability has been integrated into their business philosophy. Each publishes an annual sustainability report detailing environmental impacts and initiatives undertaken to mitigate these effects (Conad, 2021; Coop, 2021). Furthermore, both retailers actively use social media platforms—Facebook, Instagram, and Twitter—to communicate their green initiatives on a daily basis. Data were collected using a web scraping tool, capturing all posts from the official social media pages of both companies from their page inception until the end of February 2020. This timeframe was chosen to exclude distortions caused by the COVID-19 pandemic. For each post, information on publication date, content, format (text, image, video, or combinations), and user engagement—including likes, comments, and shares (or retweets, where applicable)—was extracted. From this dataset, a random sample of 350 posts per retailer-platform pair was selected, resulting in a total of **2,100 posts** (700 per platform: 350 from Coop and 350 from Conad).

To ensure careful evaluation, five experts reviewed each selected post, examining its content and format. Therefore, it was necessary to reduce this heavy workload by limiting the number of posts retrieved from each social media platform. Specifically, while the total number of posts made available by each retailer in each social media platform from the inception of the page until the end of February 2020 was more than a thousand in most of the cases, a random subsample of 700 posts from each social media platform, equally divided between Coop (350 posts) and Conad (350 posts), for a total of 2,100 posts was considered acceptable by the experts to evaluate. At the same time, this number is sufficiently large and representative of the posts of the two retailers in the three considered social media. Our approach is consistent with similar studies examining sustainability issues (e.g., Calic and Mosakowski, 2016). Specifically, the choice of having equal number of posts for all three platforms is to avoid that the imbalance in the posts among different platforms would affect our results.

Table 1 reports the descriptive statistics for all variables in our sample across the different social media platforms under study. Posts received an average of 484 likes on Facebook, 190 on Instagram, and 7 on Twitter, indicating substantial differences in audience response across platforms. The average number of comments was 24 on Facebook, 3 on Instagram, and approximately 6 on Twitter, while average shares were 41 on Facebook and 26 on Twitter (sharing is not available on Instagram). These results highlight the distinct engagement patterns characteristic of each social media platform.

Table 1. Descriptive Statistics

	Facebook				Instagram				Twitter			
	Mean	Std. Dev	Min	Max	Mean	Std. Dev	Min	Max	Mean	Std. Dev	Min	Max
Likes	483.5	1045.0	0	16746	190.3	882.8	1	17686	7.3	35.5	0	897
Comments	23.82	65.6	0	651	3.0	5.4	0	57	5.8	10.9	0	126
Shares	40.5	161.0	0	2010	-	-	-	-	25.9	51.2	0	589
Green	0.19	0.39	0	1	0.08	0.28	0	1	0.15	0.36	0	1
Company	0.50	0.50	0	1	0.50	0.50	0	1	0.50	0.50	0	1
Holidays	0.08	0.26	0	1	0.05	0.22	0	1	0.04	0.19	0	1
Text+Photo	0.75	0.43	0	1	0.85	0.35	0	1	0.55	0.50	0	1
Text+Video	0.25	0.43	0	1	0.14	0.35	0	1	0.21	0.41	0	1
Year 2020	0.02	0.14	0	1	0.03	0.17	0	1	0.26	0.44	0	1
Year 2019	0.12	0.33	0	1	0.15	0.36	0	1	0.34	0.47	0	1
Year 2018	0.19	0.39	0	1	0.16	0.36	0	1	0.17	0.38	0	1
Year 2017	0.20	0.40	0	1	0.18	0.39	0	1	0.20	0.40	0	1
Year 2016	0.17	0.37	0	1	0.25	0.43	0	1	0.01	0.09	0	1
Year 2015	0.21	0.41	0	1	0.19	0.40	0	1	0.01	0.09	0	1
Year 2014	0.08	0.28	0	1	-	-	-	-	-	-	-	-
Year 2013	0.00	0.08	0	1	0.00	0.08	0	1	-	-	-	-
Year 2012	-	-	-	-	0.01	0.11	0	1	-	-	-	-

2.3.1 Main independent variables

To assess the presence of green features in each post, five experienced professionals with several years of work in national-level environmental associations were engaged. They independently evaluated all selected posts across the three social media platforms. While the experts were informed about the general scope of the research, they were not made aware of the specific hypotheses to avoid influencing their evaluations. To further reduce variability related to the interpretation of posts, the experts were instructed to follow the definitions provided by the U.S. Bureau of Labor Statistics (http://www.bls.gov/green/). According to this classification, posts concerning products or processes that reduce pollution or natural resource consumption, promote energy efficiency and renewable energy, facilitate recycling, enable cleaner environments (e.g., spaces, air, water, ecosystems), or improve hygiene, safety, and health conditions for people, animals, or plants were coded as having green features. For each post, experts indicated the presence (1) or absence (0) of any green feature. Upon

completion of the coding phase, Cronbach's α was computed to assess inter-rater reliability for each social media platform (Calic and Mosakowski, 2016). Reliability scores were never lower than 0.875, substantially exceeding the commonly accepted threshold of 0.70. In cases of disagreement among experts, the majority rule (three out of five) was applied. The resulting variable, Green, is a dummy variable equal to 1 when a post exhibited green features and 0 otherwise. As shown in Table 1, the share of posts with green content was broadly comparable across platforms, with 19% on Facebook, 8% on Instagram, and 15% on Twitter.

To test Hypothesis H2, the regression models included the interaction between Green and the dummy variables capturing the social media platform on which the post was published. With three platforms, two dummy variables were required, using Facebook as the baseline. The variables Instagram and Twitter take the value 1 if the post appeared on Instagram or Twitter, respectively (0 otherwise). In addition to their interactions with Green, these dummies were included in level form to control for direct platform effects on consumer reactions (likes, comments, shares). The dataset includes an equal number of posts (700) from each platform. To test Hypothesis H3, interactions between Green and the dummy variables indicating the post format were included to capture media richness. Three formats were present in the sample: (1) text only (observed only on Twitter), (2) text plus photo/image, and (3) text plus video. No posts contained only images or only videos. Following Media Richness Theory (MRT) and Social Response Theory (SRT), text plus video represents the richest format, followed by text plus photo/image, and then plain text. For the full sample and for the Twitter-only sample, "text only" served as the baseline category, with two dummies—Text + Photo and Text + Video—taking the value 1 when the corresponding format was used (0 otherwise. For the Facebook-only and Instagram-only samples, where no text-only posts were present, "text plus photo/image" served as the baseline, and only the dummy Text + Video was included. As with platform dummies, the format variables were included both in level form and in interaction with Green to control for direct format effects on consumer reactions. Table 1 reports that on Facebook 75% of posts used the Text + Photo format and 25% used Text + Video. On Instagram, 85% of posts used Text + Photo and 15% used Text + Video. On Twitter, 55% of posts used Text + Photo, 21% used Text + Video, and the remaining 24% used text only.

2.3.2 Control variables

In addition to the direct effects of social media platforms (captured through the dummies Instagram and Twitter) and media richness (captured through the dummies Text + Photo and Text + Video), the models include several control variables. A retailer fixed effect is introduced through a dummy variable (Company) taking the value 1 when the post was published by Conad and 0 when it was published by Coop. Time-related effects are controlled for through year dummies (Year) covering the period 2012–2020, and through a dummy variable (Holidays) that takes the value 1 when a post was published during official national holidays and 0 otherwise.

The inclusion of the Holidays variable is motivated by prior evidence indicating a significant increase in social media activity during holidays, as users tend to enhance the festive atmosphere and share experiences online (Smith et al., 2012). Because the implications of this heightened holiday engagement—both from companies and users—on responses to green versus non-green communication were uncertain, this aspect was explicitly controlled for in the analysis.

Table 1 also presents the descriptive statistics for all control variables. It is worth noting that the distribution of posts between Conad and Coop is, by construction, identical across the three social media platforms.

2.4 ANALYSIS AND FINDINGS

Table 2 reports the correlation matrix for the entire sample, which shows no serious degree of correlation among variables. To test the hypotheses, two complementary approaches were employed. First, the dependent variables were subjected to a logarithmic transformation, and robust OLS regression models were estimated using the entire sample. This procedure made it possible to test the first three hypotheses (H1, H2, H3) by introducing the interaction terms in a stepwise fashion. Second, three sets of robust OLS regression models were estimated, each based on a subsample consisting of posts retrieved from a single social media platform. This procedure allowed for both the robustness of the results for the first three hypotheses to be verified and the fourth hypothesis (H4) to be examined. More specifically, the use of separate subsamples made it possible to analyze: *i)* how the effect of the variable *Green* on consumers' response changes across different social media platforms (which helps further investigate hypotheses *H1* and *H2*); *ii)* how the moderating role of media richness on such effect may hinge upon the social media platform where the focal post is publicized (which helps further investigate hypotheses *H3* and *H4*).

Table 2. Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Green															
(2) Company	-0.109*														
(3) Holidays	-0.014	-0.010													
(4) Text+Photo	-0.123*	-0.224*	-0.022												
(5) Text+Video	0.169*	0.216*	0.058*	-0.799*											
(6) Instagram	-0.120*	0.000	-0.006	0.214*	-0.098*										
(7) Twitter	0.028	-0.000	-0.059*	-0.269*	0.016	-0.500*									
(8) Year 2020	-0.024	-0.216*	0.006	-0.035	-0.059*	-0.167*	0.367*								
(9) Year 2019	0.150*	-0.146*	-0.020	-0.113*	0.110*	-0.092*	0.238*	-0.175*							
(10) Year 2018	-0.009	0.055*	0.015	-0.106*	0.204*	-0.027	-0.004	-0.159*	-0.236*						
(11) Year 2017	-0.006	0.125*	-0.018	-0.168*	0.041	-0.023	0.013	-0.168*	-0.251*	-0.227*					
(12) Year 2016	-0.057*	0.133*	0.015	0.188*	-0.132*	0.222*	-0.271*	-0.140*	0.208*	-0.188*	-0.200*				
(13) Year 2015	-0.064*	0.108*	-0.011	0.228*	-0.176*	0.124*	-0.266*	-0.137*	-0.204*	-0.185*	-0.197*	-0.163*			
(14) Year 2014	-0.028	-0.124*	0.035	0.080*	-0.056*	-0.120*	-0.120*	-0.058*	-0.087*	-0.079*	-0.084*	-0.069*	-0.068*		
(15) Year 2013	-0.027	-0.066*	0.016	0.041	-0.033	0.016	-0.046*	-0.023	-0.034	-0.030	-0.032	-0.027	-0.026	-0.011	
(16) Year 2012	0.015	-0.066*	-0.016	0.041	-0.033	0.093*	-0.046*	-0.023	-0.034	-0.030	-0.032	-0.027	-0.026	-0.011	-0.004

The significance level is set equal to 0.05.

Table 3 reports the results under the first approach, i.e., considering the entire sample. In this case, given that shares are not enabled on Instagram, *Likes* and *Comments* were used as measures of performance of a post. For both dependent variables, Table 3 reports the results with no interactions (columns indicated as *H1*), with the interaction terms between the variable *Green* and the social media dummies (columns indicated as *H2*), and with the interaction terms between the variable *Green* and the content format dummies (columns indicated as *H3*), respectively. First, it is possible to point out that the control variables exhibit the expected sign and significance. Specifically, Facebook exhibits the highest consumer response in terms of likes and comments (the coefficients of both *Instagram* and *Twitter* dummies are indeed negative and significant across the columns). Moreover, the coefficients of both *Text+Photo* and *Text+Video* dummies are mostly positive and significant across the columns, implying in line with MRT and SPT theories that content richer than plain text generates higher consumer response in terms of likes and comments (Roma and Aloini, 2019; Rosenkrans, 2009). The only exception is the effect of the dummy *Text+Photo* on comments, which is not significant.

Table 3. OLS regressions for the entire sample with different measures of the dependent variable

	Ln Likes			Ln Comments		
	H1	H2	H3	H1	H2	H3
Green	0.427***	0.397**	0.422*	0.322***	0.591***	0.105
	(0.070)	(0.138)	(0.200)	(0.071)	(0.136)	(0.193)
Green x Instagram	-	0.289^{+}	-	-	0.045	-
		(0.160)			(0.189)	
Green x Twitter	-	-0.081	-	-	-0.751***	-
		(0.163)			(0.157)	
Green x Text+Photo	-	-	-0.114	-	-	0.044
			(0.218)			(0.209)
Green x Text+Video	-	-	0.227	-	-	0.576*
			(0.229)			(0.241)
Instagram	-0.981***	-1.009***	-0.978***	-0.927***	-0.903***	-0.921***
	(0.073)	(0.080)	(0.073)	(0.070)	(0.075)	(0.069)
Twitter	-4.585***	-4.566***	-4.567***	-0.997***	-0.852***	-0.970***
	(0.090)	(0.098)	(0.091)	(0.075)	(0.081)	(0.075)
Text+Photo	0.420***	0.431***	0.442***	0.002	0.047	0.016
	(0.083)	(0.083)	(0.084)	(0.072)	(0.071)	(0.075)
Text+Video	0.234*	0.243*	0.187^{+}	0.409***	0.423***	0.313***
	(0.097)	(0.098)	(0.103)	(0.088)	(0.087)	(0.093)
Company	0.162**	0.161**	0.154*	0.825***	0.829***	0.812***
	(0.061)	(0.061)	(0.061)	(0.056)	(0.056)	(0.056)
Holidays	0.155	0.159	0.153	-0.007	-0.005	-0.009
	(0.111)	(0.111)	(0.111)	(0.105)	(0.107)	(0.105)
Year dummies	Included	Included	Included	Included	Included	Included
Constant	2.494***	2.459***	-0.929***	1.035***	0.891**	1.059***
	(0.327)	(0.339)	(0.164)	(0.267)	(0.281)	(0.261)
N	2100	2100	2100	2100	2100	2100
Prob >F	.000	.000	.000	.000	.000	.000
R^2	0.704	0.704	0.704	0.329	0.339	0.339

Robust standard errors in parentheses - $^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Moving to the variables of interest, first from columns indicated as *H1*, it is possible to notice that the coefficient of the variable *Green* is positive and largely significant (particularly in the models with no interactions). That is, firm-generated content exhibiting green features results in higher consumer response in terms of likes and comment, as compared with content exhibiting no green features. This provides support to the hypothesis H1. Second, from columns indicated as H2 the social media platform where a green versus non-green post is publicized seems to matter. Note that in a model where the interaction terms *Green x Instagram* and *Green x Twitter* are introduced, the term *Green* measures the effect of green content for Facebook, whereas the interaction terms (*Green x Instagram* and *Green x Twitter*) will capture whether the positive effect of green content will be higher or lower for Instagram or Twitter, respectively, as compared with Facebook. From columns indicated as H2, it is possible to observe that the coefficient of the *Green* variable is positive

and significant, whereas the coefficient of the interaction between *Green* and *Instagram* dummies is positive and significant for *Likes*, but not for *Comments*. This implies that, at least in terms of likes, the positive effect of green content is higher on Instagram than on the baseline social media platform, i.e., Facebook, whereas no difference arises between the two platforms regarding the effect on comments. In contrast, the coefficient of the interaction between *Green* and *Twitter* is negative and significant for *Comments*, while being insignificant for likes. Therefore, the effect of green content in terms of comments is lower on Twitter than on Facebook, whereas no significant difference is shown to emerge in terms of likes. Overall, the hypothesis on the moderating role of social media is thus confirmed with some platforms shown higher beneficial effect of green content than others, i.e., Instagram versus Facebook and Twitter for likes, and Instagram and Facebook versus Twitter for comments.

From columns indicated as *H3*, no evidence emerges of a positive moderating role of media richness on the relationship between green content and consumer response in terms of likes. As a matter of fact, the coefficient of the interaction terms involving the dummies *Text+Photo* and *Text+Video* are not significant, which implies that the positive effect of green content on consumers' likes is not higher as media richness increases. A positive and significant coefficient is observed only for the interaction term between the dummies *Green* and *Text+Video* when *Comments* is the dependent variable. This implies that the effect of green (versus non green) content on comments is the highest when communicated via video. Apart from this result, the hypothesis *H3* does not seem to be supported in general. Nevertheless, using the second approach (i.e., running robust OLS regressions with separate subsamples) the analysis explores whether the lack of significance may be attributed to the moderating role of media richness depending on the social media platform where the post is published.

Tables 4, 5, and 6 report the results for the subsamples of posts on Facebook, Instagram, and Twitter, respectively. For Facebook and Twitter, the model also include *Shares* as the dependent variable. As can be observed, the hypothesis *H1* is confirmed across the three social media as the variable *Green* is largely significant across the models, except for cases related to comments and shares on Twitter. At the same time, this different result observed on Twitter also suggests that the social media platform where the given post is publicized matters. More interestingly, from Tables 4, 5, and 6 it can also be observed that the moderating role of media richness on the relationship between the presence of green content and consumer response depends on the social media platform where the

advertisement is posted. Indeed, on Facebook the coefficient of the interaction terms between the dummies *Green* and *Text+Video* is positive and strongly significant, suggesting that in this social network the positive effect of the presence of green features on the consumers' response increases as media richness increases (i.e., moving from photos to videos). In contrast, on Instagram the positive effect of the presence of green features on the consumers' response is unchanged as media richness increases. That is, photos/images and videos exhibit the same moderating effect on the relationship between green communication and consumers' response, as measured by likes and comments. Finally, quite surprisingly, on Twitter the positive effect of the presence of green features on consumers' response is higher for only text communication than for communication featuring text plus photos/images, while being not significantly different between only text communication and 'text plus video' communication. That is, on Twitter the highest benefit of green features occurs for either low or high media richness. This evidence does not support the hypothesis *H3*, yet it supports our hypothesis *H4*. Indeed, the increase of the consumers' response gap between green and non-green content as the media richness increases is more likely observed on Facebook than on Instagram and Twitter.

Table 4. OLS regressions for Facebook sample with different measures of the dependent variable

	Ln Likes		Ln Comments		Ln Shares	
	H1-H2	H3-H4	H1-H2	H3-H4	H1-H2	H3-H4
Green	0.710***	0.338*	0.701***	0.230^{+}	0.855***	0.417^{+}
	(0.134)	(0.155)	(0.139)	(0.141)	(0.197)	(0.229)
Green x Text+Video	-	0.908**	-	1.149***	-	1.070**
		(0.271)		(0.297)		(0.411)
Text+Video	-0.305*	-0.548***	0.171	-0.136	1.555***	1.268***
	(0.128)	(0.137)	(0.139)	(0.152)	(0.177)	(0.187)
Company	1.619***	1.608***	0.928***	0.914***	0.114***	0.101
	(0.101)	(0.101)	(0.108)	(0.107)	(0.131)	(0.131)
Holidays	-0.084	-0.096	-0.117	-0.133	-0.422^{+}	-0.437^{+}
	(0.190)	(0.189)	(0.182)	(0.180)	(0.221)	(0.226)
Year dummies	Included	Included	Included	Included	Included	Included
Constant	4.025***	4.085***	1.482***	1.558***	0.151	0.222
	(0.416)	(0.437)	(0.333)	(0.356)	(0.563)	(0.555)
N	700	700	700	700	700	700
Prob >F	.000	.000	.000	.000	.000	.000
R^2	0.371	0.382	0.176	0.196	0.265	0.276

Robust standard errors in parentheses - $^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Table 5. OLS regressions for Instagram sample with different measures of the dependent variable

	Ln Likes		Ln Comments	
	H1-H2	H3-H4	H1-H2	H3-H4
Green	0.340***	0.245*	0.348**	0.397**
	(0.089)	(0.096)	(0.107)	(0.136)
Green x Text+Video	-	0.330	-	-0.169
		(0.218)		(0.204)
Text+Video	0.183*	0.143	0.252*	0.272*
	(0.092)	(0.095)	(0.114)	(0.121)
Company	-0.731***	-0.745***	-0.250***	-0.243***
	(0.069)	(0.069)	(0.067)	(0.068)
Holidays	-0.344**	-0.341**	-0.270*	-0.271*
	(0.110)	(0.110)	(0.133)	(0.133)
Year dummies	Included	Included	Included	Included
Constant	2.485***	1.995***	0.519^{+}	0.519^{+}
	(0.102)	(0.117)	(0.289)	(0.290)
N	700	700	700	700
Prob >F	.000	.000	.000	.000
R^2	0.746	0.747	0.402	0.403

Robust standard errors in parentheses - $^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Table 6. OLS regressions for Twitter sample with different measures of the dependent variable

	Ln Likes		Ln Comments		Ln Shares	
	H1-H2	H3-H4	H1-H2	H3-H4	H1-H2	H3-H4
Green	0.190*	0.312^{+}	0.031	0.297*	0.074	0.388**
	(0.079)	(0.177)	(0.049)	(0.127)	(0.071)	(0.142)
Green x Text+Photo	-	-0.210	-	-0.369**	-	-0.396*
		(0.201)		(0.140)		(0.165)
Green x Text+Video	-	0.015	-	-0.177	-	-0.301
		(0.238)		(0.171)		(0.221)
Text+Photo	0.236**	0.264**	0.154**	0.199***	0.362***	0.407***
	(0.086)	(0.092)	(0.053)	(0.055)	(0.079)	(0.086)
Text+Video	0.451***	0.444**	0.373***	0.388***	0.637***	0.669***
	(0.119)	(0.128)	(0.087)	(0.093)	(0.125)	(0.134)
Company	-0.229^{+}	-0.236^{+}	2.469***	2.462***	2.465***	2.460***
	(0.136)	(0.135)	(0.103)	(0.102)	(0.134)	(0.134)
Holidays	0.320*	0.313*	0.145^{+}	0.140	0.243	0.241
	(0.150)	(0.151)	(0.084)	(0.085)	(0.158)	(0.157)
Year dummies	Included	Included	Included	Included	Included	Included
Constant	2.177***	2.183***	-0.139**	-1.141**	1.516***	1.506***
	(0.284)	(0.280)	(0.053)	(0.055)	(0.306)	(0.298)
N	700	700	700	700	700	700
Prob >F	.000	.000	.000	.000	.000	.000
R^2	0.439	0.440	0.774	0.776	0.595	0.596

Robust standard errors in parentheses - $^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

2.4.1 Robustness check

In the main analysis, three different measures of consumers' response in social media were considered: likes, comments, and shares. These three dependent variables were analysed separately as it is not immediate to come up with an aggregate measure that would consider them jointly. Indeed, likes, comments and shares have very different meaning and value in terms of consumers' response. One intuitive way to obtain a reasonable aggregate measure is to weight the importance of likes, comments, and shares, and essentially sum the resulting weighted measures. The key point is therefore to compute the weights. In this section, this approach is adopted to test the robustness of the findings when the three measures are combined into a single aggregated dependent variable.

To compute the weights, the *geometric average* aggregation rule suggested by several scholars (Crawford, 1987; Golany and Kress, 1993) was applied as a useful method for determining weights. For example, for Facebook, the average values of likes, comments, and shares were first calculated, and pairwise comparisons were carried out by comparing the number of likes, on average 484, with the number of comments, on average 24, thus obtaining that one comment is proportional to 20 likes. Then, the number of likes was compared with the number of shares, on average 40, obtaining that one share is proportional to 12 likes. Finally, the number of shares is 1.67 times the number of comments on Facebook. At this point, the matrix of alternatives was constructed to enable to calculate the geometric mean for each row. After normalization, the relative weights were obtained as follows: Likes = 3%, Comments = 61%, and Shares = 36%. These weights are consistent with the relative importance attributed by Facebook's algorithm to different types of engagement (Swani and Labrecque, 2020). Applying the same procedure to Twitter's data produced weights of 50% for Comments, 39% for Likes, and 11% for Retweets. For Instagram, where sharing is not possible, the resulting weights were 98% for Comments and 2% for Likes. Based on these weights, an aggregate dependent variable was computed, hereafter referred to as *Performance.*

Table 7 reports the results of the regression analyses considering the aggregate variable *Performance*, for the subsamples of posts on Facebook, Instagram, and Twitter, respectively. The results indicate that hypothesis H1 is confirmed across the three social media as the variable *Green* is largely significant across the models. Moreover, from Table 8 it is once again confirmed that the moderating role of media richness on the effect of green communication on consumers' response depends on the social media platform where the content is posted. Indeed, on Facebook the coefficient of the interaction terms between the

dummies *Green* and *Text+Video* is positive and strongly significant, suggesting that in this social network, the positive effect of the presence of green features on the consumers' response increases as media richness increases (i.e., moving from photos to videos). In contrast, on Instagram, the positive effect of the presence of green features on the consumers' response is unchanged as media richness increases. Finally, on Twitter the highest benefit of green features occurs for either low or high media richness. Overall, this suggests that the results are robust to the use of the aggregate measure of consumers' response.

Table 7. OLS regressions for Instagram, Facebook, and Twitter samples with aggregate measure as dependent variable

Ln Performance	Facebook		Instagram		Twitter	
	H1-H2	H3-H4	H1-H2	H3-H4	H1-H2	H3-H4
Green	0.564***	0.143^{+}	0.320***	0.228*	0.106^{+}	0.340*
	(0.094)	(0.085)	(0.084)	(0.090)	(0.064)	(0.142)
Green x Text+Photo						-0.315*
						(0.164)
Green x Text+Video		1.028***		0.320		-0.178
		(0.202)		(0.210)		(0.189)
Text+Photo					0.263***	0.300***
					(0.071)	(0.076)
Text+Video	0.283**	0.007	0.151^{+}	0.113	0.528***	0.545***
	(0.081)	(0.070)	(0.088)	(0.092)	(0.108)	(0.116)
Company	-0.156**	-0.168**	-0.823***	-0.837***	1.423***	1.417***
	(0.058)	(0.057)	(0.064)	(0.065)	(0.118)	(0.117)
Holidays	-0.142	-0.156^{+}	-0.316**	-0.313**	0.287**	0.283**
	(0.092)	(0.093)	(0.103)	(0.103)	(0.109)	(0.109)
Year dummies	Included	Included	Included	Included	Included	Included
Constant	0.341***	0.344***	1.080***	1.100***	1.575***	1.571***
	(0.060)	(0.058)	(0.102)	(0.093)	(0.244)	(0.238)
N	700	700	700	700	700	700
Prob >F	.000	.000	.000	.000	.000	.000
R^2	0.211	0.263	0.759	0.760	0.377	0.379

Robust standard errors in parentheses - $^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

2.5 Research Stream 1: THEORETICAL CONTRIBUTIONS AND MANAGERIAL IMPLICATIONS

This study examined whether the presence of green features in social media communication has a beneficial effect on consumers' response in terms of likes, comments, and shares. In addition, the analysis explored how this effect varies depending on the social media platform where communication is posted and on the richness of the format employed (text, images, or videos). This study offers important theoretical contributions for four streams of literature. First, the results contribute to the

stream of literature on social media usage for green communication. In this respect, a consolidated body of literature has documented a positive role of social media as a tool for firms and institutions to communicate their green initiatives (e.g., Castelló et al., 2013, 2016; Colleoni, 2013; Dunn and Harness, 2018; Korschun and Du, 2013; Perks et al., 2017; Reilly and Hynan, 2014). In particular, by grounding on stakeholder and legitimacy theories, several studies in this stream have contributed to explain which corporate communication approaches adopted in online social media is more effective in driving a convergence between corporations' sustainability agenda and stakeholders' social expectations, thus increasing corporate legitimacy in the eyes of consumers, stakeholders, and society as a whole (Colleoni, 2013; Korschun and Du, 2013). It is suggested that legitimacy is achieved through social media when the company is able to establish dialogues with users without imposing institutional conditions (Castelló et al., 2016). By re-interpreting our findings under the lens of stakeholder theory, this study contributes to the recent debate on the use of social media to build corporate legitimacy in the eyes of consumers. In this respect, the authors indeed reveal that green communication is a more suitable strategy than non-green communication to stimulate higher involvement from consumers in social media. As such, green communication in social media proves to be an effective tool at firms' disposal to build corporate legitimacy, at least in the eyes of consumers. Moreover, we have identified important boundary conditions that favor the efficacy of green performance in building such legitimacy, namely the type of social media and the degree of media richness.

Second, the results advance the extant knowledge available in the literature on consumers' engagement in social media (Hollebeek et al., 2014; Kaplan and Haenlein, 2010; Osei-Frimpong and McLean, 2018). Previous research has identified social media as a powerful instrument to engage consumers in a timely and direct manner and at higher levels of efficiency than can be achieved with more traditional communication tools (Hollebeek et al., 2014; Kaplan and Haenlein, 2010; Lim and Rasul, 2022; Osei-Frimpong and McLean, 2018; Rietveld et al., 2020). In particular, a number of antecedents that could influence consumer engagement (CE) on social media have been pinpointed, including the characteristics of brands (Algharabat et al., 2020), the efforts of marketers and their customer orientation (Agnihotri, 2020), message characteristics and format (Ashley and Tuten, 2015; Li and Xie, 2020; Shahbaznezhad et al., 2021). This work advances this stream from a theoretical perspective by showing that green communication can be an additional powerful tool for engaging consumers to the extent that it can be even superior to conventional nongreen communication. Accordingly, it

becomes important for future research in this literature to include green communication among the effective tools for firms to propel consumer engagement.

Third, it advances the stream of literature on the role of social media on firm-generated or user-generated content (e.g., Colicev et al., 2019; Kumar et al., 2016; Roma and Aloini, 2019), providing a cross-platform comparison perspective. This literature has underscored that the characteristics of communication vary across different social media as the latter typically differ both in terms of community-related aspects (e.g., community participants, social norms, rules) and in terms of technology-related features (e.g., different functionalities). This study opens up a new angle on this issue by revealing that, because of the aforementioned different characteristics, the effect of green content on consumer response depends on the given social media platform where the content is publicized. For instance, social media platforms such as Instagram characterized by younger, and thus more environmentally friendly users (Arora and Manchanda, 2022; Jalali and Khalid, 2021), are more likely to stimulate larger consumer response to green content. In contrast, platforms such as Twitter, typically characterized by short communication formats (e.g., Bigné et al., 2019), do not seem to be particularly favorable for green content.

Finally, it contributes to the literature on the role of media richness and social presence in determining the performance of communication (e.g., Kaplan and Haenlein, 2010; Klein, 2003; Osei-Frimpong and McLean, 2018; Roma and Aloini, 2019; Sabate et al., 2014). Grounding on Media Richness Theory (MRT) and Social Presence Theory (SPT), prior studies propose that media that can stimulate different sensory characteristics, such as videos, should be more effective instruments for user engagement than media exhibiting a lower degree of richness, such as plain text (Bonsón et al., 2015; Ji et al., 2019; Lock and Araujo, 2020; Roma and Aloini, 2019; Rosenkrans, 2009). The results instead reveal a more nuanced picture where an increase in the degree of media richness is not necessarily more beneficial to green than non-green communication. Specifically, the extent to which the predictions of MRT and SPT apply depends once again on the characteristics of social media. In some social media platforms (e.g., Facebook), the expected positive moderating role of media richness on the relationship between green communication and consumers' response is observed. However, in other social media platforms, the social norms (and the enabling technological functionalities) developed over the years may promote the use of communication formats that are not necessarily those exhibiting the highest media richness. Under these formats, the consumer response to green content may be larger or

at least comparable to that of richer formats. For instance, Instagram has traditionally promoted photos as the social norm in this community. Hence, we observe that no difference in the effect of the presence of green features emerges between photos and videos. Similarly, Twitter has always promoted short text communication, which may explain why this less rich format generates higher consumer response than photos and the same level of response as videos. Therefore, our study offers new food-for-thought in this fourth stream of literature by pinpointing the type of social media as one important boundary condition for the role of media richness in consumer response to (green) firm-generated content.

In addition to the above considerations, a further caveat concerns the convergence of social-network features and corporate consolidation, which may blur the lines between platforms. In recent years, especially Facebook and Instagram have largely "homogenized" their formats – for example, story-style posts, live video, filters and recommendation tabs are now common across platforms. This convergence means that user interactions on Facebook and Instagram may be more similar than their original designs suggest, potentially attenuating the differences observed in user engagement. A possible explanation is Facebook's acquisition of Instagram (completed in 2012), which occurred shortly before the data collection period of this study. That takeover – which Facebook described as creating "increased ties" between the services (techcrunch.com) – could have led to more integrated content strategies or user flows on the two platforms. In other words, Instagram and Facebook may have shared tools, campaign designs or audience targeting under common ownership, which complicates attributing engagement outcomes purely to platform effects. Nevertheless, important distinctions remain that support separate analysis of Facebook and Instagram. For example, until very recently Instagram did not have a native "share" function for resharing feed posts (only introducing a "repost" feature in 2025), whereas Facebook long allowed users to directly reshare content. Likewise, the user bases differ sharply. Instagram is used predominantly by younger audiences, whereas Facebook's highest usage is among adults in their 30s and 40s. These enduring demographic and functional differences suggest that, despite the trend toward feature convergence and shared ownership, Facebook and Instagram continue to operate in meaningfully distinct segments of the market.

The findings presented, also, offer useful insights for firms engaged in environmental sustainability on how to design and manage their interactions with consumers in social media. First, this study has shown that in recent years green

communication has been able to stimulate larger consumers' response in social media than non-green content. This clearly suggests that companies engaging in green initiatives should consider investing in green communication campaigns in social media to increase the visibility of these initiatives, improve the interaction with consumers and stakeholders in general, and enhance the efficacy of their CSR strategy. The caveat is, however, not to fall into greenwashing practices that would instead have negative effects on the company's credibility in the long run. At the same time, the findings offer tailored suggestions to firms for each social media platform. Indeed, due their intrinsic characteristics, some social media represent a more fertile ground for communicating green content. Firms should factor in these characteristics, and possibly fine tune their green communication strategy to the specific context. For instance, on Instagram, and to some extent on Facebook, users are more prone to embrace firm (communication) commitment to environmental sustainability, and thus firms should take advantage of the type of users active in these social media platforms for their communication. Other social media such as Twitter may require more attention to the type of users and social norms, and thus firms should carefully design the green content to be at least as effective as non-green communication.

Moreover, firms pursuing environmental sustainability should consider the type of format (and its degree of richness and social presence) through which to communicate the green content. In this respect, this study informs these firms that higher benefits in terms of consumer response associated with green content as media richness (and social presence) increases will occur only in some social media platforms. Therefore, the characteristics of social media matter not only in shaping the relationship between green content and consumer response, but also in shaping the moderating role of media richness in such a relationship. Indeed, higher benefits for green content emerge for videos as compared to photos only on Facebook. On Instagram no significant differences emerge, whereas on Twitter the positive moderating role of media richness occurs only partially, as the consumer response to green content is higher when moving from photos to videos, but not when moving from only text to photos. This implies that firms would need to consider the characteristics of different social media platforms (e.g., social norms, rules, technical functionalities) where the green content will be posted when deciding the most appropriate format for their communication.

Being the first study explicitly examining the performance of green versus non-green content across different social media, this work is not without limitations, which however offer opportunities for future research. First, the analysis focuses on two

leading players in a single industry within the Italian market. Broader investigations covering multiple industries, global companies, or cross-industry comparisons could enhance the generalizability of the findings. Second, while the study considered three prominent platforms, the social media landscape is rapidly evolving. Platforms such as TikTok and Snapchat, with distinct user bases and formats, are becoming increasingly relevant for firms pursuing sustainability communication. Extending research to these platforms would yield further insights into how the effectiveness of green content varies across media.

2.5.1 From Chapter 2 (Dimension 1 - Green Communication Effectiveness) to Chapter 3 (Dimension 2 – Stakeholder Governance Relationships)

The finding that green content outperforms non-green content on some social media indicates that firms have powerful incentives to adopt environmental communication strategies on those platforms. However, social media platforms amplify both authentic environmental commitments and misleading claims with equal efficiency. Chapter 3 addresses partially this tension by investigating the second dimension of the integrative framework—stakeholder's governance relationships. It focuses on how external stakeholder pressure shapes whether firms respond to incentives for disclosure with substantive environmental improvements or with strategic misrepresentation. This study examines research questions RQ3, RQ4, and RQ5 through a longitudinal qualitative analysis of twenty-four fashion firms' engagement with Greenpeace's Detox campaign over a ten-year period, distinguishing between collaborative and conflictual NGO-corporate relationships and their differential impacts on environmental disclosure trajectories and greenwashing propensity.

Chapter 3
RESEARCH STREAM 2: "The influence of NGO-corporate relationship on environmental disclosure: Evidence from the fashion industry"

3.1 INTRODUCTION

The intensifying impacts of climate change have amplified societal concern regarding corporate sustainability performance. In response, a wide range of stakeholders—such as investors, employees, non-governmental organizations (NGOs), and consumers—exert mounting pressure on firms to accelerate progress across environmental, social, and governance (ESG) dimensions. Within this context, sustainability reports (SRs) have assumed a central role as instruments through which organizations disclose and justify their ESG policies and practices to diverse stakeholder groups (Gray et al., 1997). However, producing reports that are comprehensive, relevant, and balanced presents significant challenges, as it requires an in-depth understanding of stakeholder expectations. Such understanding is most effectively achieved through direct engagement. Accordingly, firms are increasingly fostering collaboration with stakeholders, particularly NGOs, to strengthen and legitimize their ESG initiatives (Fontana, 2018; Schepers, 2006).

Non-governmental organizations (NGOs) have increasingly gained recognition and influence at the international policy level as key representatives of civil society (Teegen et al., 2004). Their growing participation in United Nations (UN) conferences, meetings, and related events underscores this trend (Teegen et al., 2004). Alongside this enhanced visibility, NGOs have assumed greater responsibility and legitimacy both as corporate watchdogs and as agents of sustainable development. They possess the capacity to shape corporate behavior either negatively—through protest and public campaigns—or positively—through partnership and cooperation. Indeed, in recent years, some of the most significant shifts in corporate sustainability practices across various industries have been attributed to NGO-driven campaigns (Gunther, 2015).

Historically, the relationship between NGOs and the private sector was largely adversarial; however, this dynamic has progressively evolved with the emergence of more collaborative approaches between these once opposing actors (Murphy and Bendell, 1997). In the analysis of this interaction, pivotal research has identified various forms of collaboration, such as dialogue and certifications (Macdonald and Chrisp, 2005; Rondinelli and London, 2003) research cooperation, and common projects/programs (Kourula and Halme, 2008). In this thesis, the term NGO-corporate

collaboration is defined as “a systematic form or forums of dialogue such as roundtables with NGOs and other stakeholders” and “common projects” with concrete actions and goals (Kourula and Halme, 2008). There are several examples of successful collaborations between NGOs and companies that yielded a positive impact in terms of environmental sustainability. However, a conflictual NGO-corporate relationship may be more fruitful when it comes to sustainability reporting because, for instance, a company pestered by NGO activism and consequently exposed to media pressure, may perceive the urgency to showcase the achievement of environmental goals by publishing sustainability reports (Luo et al., 2017). Conversely, a collaborative relationship might lead to diminished urgency of the “obligation” to publicly share all information since the company's main interest is to achieve the objectives for which the collaboration was established, and thus fulfil the requirements agreed with the NGO partner. Therefore, it appears to be of great interest to understand how activism campaigns carried out by NGOs, in collaboration with or against certain firms, affect the environmental commitment of the latter, especially concerning the quality of environmental disclosure (ED).

NGO campaigns, coupled with the resulting public scrutiny from customers and investors, exert mounting pressure on firms to enhance their environmental performance. While NGOs often seek to discourage deceptive communication practices, such pressure may prompt companies to respond reactively by disclosing false or misleading information regarding their environmental initiatives and outcomes—a practice commonly referred to as greenwashing (Lee, 2019). Growing awareness of such misleading claims has emerged worldwide, involving both corporations and governments in their communication of environmental and climate strategies. Despite this increased vigilance, greenwashing remains widespread, particularly within sectors such as the clothing industry (Adamkiewicz et al., 2022). In this regard, it is important to assess whether and how the type of relationship established between NGOs and corporations (i.e., collaborative versus conflictual) can lead companies to be less transparent in the information they disclose, thus raising the odds of greenwashing malpractice adoption. For instance, partnerships between NGOs and companies may reduce the propensity to greenwash, as joint initiatives or NGO oversight can strengthen stakeholder trust in corporate environmental practices. Conversely, adversarial relationships may incentivize firms to adopt less transparent communication strategies. When publicly criticized by NGOs for failing to adhere to sound environmental practices, companies may attempt to counteract reputational damage by signaling

environmental commitment through disclosure, thereby creating a risk of presenting distorted or exaggerated information.

The academic investigation of NGO influence on corporate policies and operations related to sustainable development remains a relatively nascent field. To date, most research has primarily focused on the role of governments as key drivers of ESG practices, often examined through the lens of institutional theory (e.g., Aaronson, 2005; Albareda et al., 2007). Parallel streams of research have explored various determinants of firms' environmental disclosure (ED), including environmental performance (Clarkson et al., 2008; Sutantoputra, 2022), stakeholder pressure (Sutantoputra, 2022), organizational characteristics such as size and industry sector (Cormier and Magnan, 2004; Nikolaeva and Bicho, 2011), financial performance (Cormier and Magnan, 2004; Fortanier et al., 2011), and media exposure (Nikolaeva and Bicho, 2011). Despite these contributions, limited attention has been paid to the role of NGOs, particularly in distinguishing between conflictual and collaborative interactions with corporations, in driving environmental and social improvements. More specifically, the extent to which the nature of NGO–corporate relationships shape the quality of ED, and the ways in which NGO activism may inadvertently incentivize greenwashing practices, remain underexplored areas of inquiry. To fill this gap, the aim is to find an answer to the following research questions (RQs):

RQ (3). *How does the type of relationship between an NGO and a corporation (i.e., collaborative versus conflictual) during the campaign carried out by the NGO influence corporation's efforts in terms of ED and their evolution over time?*

RQ (4). *How do communication strategy, activism, and pressure exerted by an NGO influence the participation rate of companies in the campaign and unintentionally lead participating companies to exhibit false commitment?*

RQ (5). *How does an everlasting conflictual NGO-corporate relationship carried out by the NGO increase the risk of greenwashing practices?*

To address these research questions, a qualitative longitudinal analysis was conducted. The study examined the interactions between Greenpeace and 24 fashion industry firms targeted by the *Detox* campaign over a ten-year period. Launched in 2011 and concluded in 2021, the *Detox* campaign sought to raise environmental awareness and promote accountability within the fashion sector. Greenpeace was selected as the focal NGO not only for its global prominence but also because of its policy of rejecting

financial contributions from corporate partners, thereby minimizing the risk of sponsorship bias in campaign outcomes. Data were collected through multiple sources. Three semi-structured interviews were carried out with Greenpeace's Global Manager of the Detox Campaign (GMDC). In addition, all official campaign documents were systematically reviewed, and the sustainability reports produced by the targeted companies over the period under study were analyzed in detail.

This study contributes to Stakeholder Theory and the expanding literature on environmental disclosure (ED) by demonstrating that the nature of NGO–corporate relationships significantly shapes the evolution of ED quality over time. The findings indicate that conflictual relationships tend to enhance ED quality in the short and medium term, whereas collaborative relationships are associated with initially lower levels of disclosure. In the long run, however, the distinction between relationship types diminishes, as most firms converge toward a medium level of disclosure. Furthermore, the study underscores the effectiveness of visual rhetoric (e.g., images, typography, and textual framing) and social activism as communication strategies employed by NGOs to exert pressure on companies and mobilize participation in environmental campaigns. At the same time, the analysis cautions that excessive NGO pressure may increase the likelihood of greenwashing among firms with initially weak environmental performance that opt to join such initiatives. The risk of greenwashing is also pronounced for companies that lack genuine environmental commitment and maintain adversarial relationships with NGOs.

This study develops research propositions that can inform future research while offering practical insights into the roles, strategies, and influence of NGOs on corporate behavior, thereby elucidating the complex dynamics of environmental disclosure and greenwashing. The findings suggest that NGOs may enhance corporate engagement in sustainability campaigns by employing systematic activism to stimulate short- to medium-term responses. For long-term impact, however, NGOs may need to complement activism with advocacy for stricter governmental regulation, as firms frequently converge toward compliance with prevailing standards rather than exceeding them. Moreover, the analysis highlights the importance of considering initial disparities in corporate environmental performance when designing campaigns. Excessive pressure on firms with weaker performance may inadvertently increase the likelihood of greenwashing practices. From the corporate perspective, companies are advised to maintain transparency regarding any disagreements with campaign requirements in order to preserve credibility and mitigate the risk of public skepticism.

3.2 THEORETICAL BACKGROUND

3.2.1 NGO-corporate relationships and ED under the Stakeholder Theory lens

NGOs play a pivotal role in ED and reporting, frequently acting as intermediaries between corporations and local communities. The Stakeholder Theory has been widely adopted by several studies to analyze how NGOs shape corporate ED practices. NGOs have increasingly positioned themselves as influential stakeholders by demanding higher levels of transparency and accountability in environmental management. To exert influence, NGOs adopt multiple strategies. They often launch public campaigns and organize peaceful protests, including demonstrations and symbolic actions aimed at raising public awareness and placing pressure on firms to adopt more sustainable behaviors (Brander et al., 2023; Greenpeace, 2023). Research further suggests that creative and visual communication tools—such as videos, posters, and sticker-based campaigns—can have strong psychological effects, thereby enhancing stakeholder engagement and advocacy (Boiral, 2016; Dhanani, 2019). Such initiatives can expose companies to reputational risks, motivating them to strengthen their disclosure practices (Doh and Guay, 2006). In addition, NGOs act as watchdogs by monitoring firms' environmental performance and urging them to disclose impacts and sustainability initiatives. Eesley and Lenox (2006) demonstrated that when environmental NGOs possess greater power and legitimacy, companies are more likely to respond favorably to requests for improved transparency. NGOs also engage in collaborative efforts with corporations to improve environmental performance and reporting.

Collaboration between business organizations and NGOs often facilitate new knowledge creation and promote synergistic solutions (Savitz, 2013). According to Amran et al. (2014), collaborations with NGOs foster organizational learning through cultural change and teamwork, which in turn strengthens incentives for firms to engage in sustainability reporting. Moreover, NGOs sometimes play a role in assessing the sustainability of multinational supply chains (Gualandris et al., 2015). A further contribution lies in NGOs providing independent verification and certification, which adds credibility to disclosed information. Certification initiatives such as the Forest Stewardship Council (FSC) illustrate how NGOs validate corporate claims regarding sustainable practices (Overdevest, 2010). Evidence also suggests that social and environmental NGOs advocate strongly for mandated and externally verified reporting standards (O'Dwyer et al., 2005). Another important function of NGOs is translating complex environmental data into accessible formats, thereby improving stakeholder

engagement and holding companies accountable (Fransen and Kolk, 2007). For instance, the Carbon Disclosure Project (CDP) collects and disseminates corporate data on greenhouse gas emissions and climate strategies. Companies that participate in the CDP are more likely to improve their environmental performance, partly due to the external pressure and public scrutiny the NGO facilitates (Kolk et al., 2008; Villena and Dhanorkar, 2020). Finally, NGOs frequently engage in multi-stakeholder collaborations with governments and international organizations, contributing to the strengthening of environmental reporting frameworks and ensuring that corporate disclosures are aligned with societal expectations and regulatory standards (Kolk et al., 2008).

3.2.2 Collaborative versus conflictual NGO-corporate relationship: impact on environmental disclosure

Building on the theoretical foundations of the study, the analysis highlights the main dynamics and strategies that characterize NGO–corporate relationships, providing insights for the third research question (RQ3) of this thesis. The literature identifies a broad spectrum of strategies NGOs employ to influence companies toward more sustainable practices. These interactions generally take the form of either collaborative or conflictual NGO-corporate relationship. Collaboration has been defined as a process through which actors with different perspectives on a problem engage constructively to explore their differences and search for solutions that transcend their individual viewpoints (Gray, 1999). Collaborative strategies may vary in intensity and are often institutionalized in partnerships. In such arrangements, NGOs may offer companies advice or guidance to strengthen corporate social responsibility (CSR) initiatives, while at the same time assuring consumers that purchased products comply with sustainability standards. This dynamic enhances both credibility and legitimacy, as it leverages the trust that NGOs command among stakeholders (Rivera-Santos and Rufín, 2010; Rondinelli and London, 2003). However, collaboration is not without challenges. In cases where partnerships are financially supported by corporations, a dependency relationship may arise, potentially compromising NGO independence. Such dependencies can lead to deviations from intended objectives, and any perceived misconduct risks damaging the NGO's legitimacy and credibility (Stafford et al., 2000).

In contrast, adversarial or conflictual strategies typically involve anti-corporate campaigns, watchdog activities, and litigation (Utting, 2005). Through these means, NGOs seek to hold companies accountable, pressuring them to comply with societal expectations and regulatory requirements. Beyond this, conflictual engagement can also

serve to shape broader norms and expectations concerning corporate responsibility, environmental stewardship, and the role of government regulation (Gray, 1999).

Building on these considerations, this study contributes to the literature by examining how the nature of NGO–corporate relationships shapes the quality of environmental disclosure (ED). In particular, it investigates whether adversarial, rather than collaborative, relationships exert stronger influence on campaign engagement and firms' disclosure practices. When subjected to social pressure, companies may respond by signaling positively to stakeholders through ED, using disclosure as evidence of their commitment and progress. This perspective is rooted in Stakeholder Theory. Hummel and Schlick (2016) argue that organizations facing legitimacy threats from stakeholders—such as in conflictual relationships—may attempt either to reshape stakeholder perceptions or to align their value systems with those held by the broader community. Conversely, collaborative relationships may generate a weaker sense of obligation to disclose publicly. In such cases, the primary corporate objective is to fulfill the agreed-upon goals of the partnership, often by meeting the NGO's specific requirements rather than providing comprehensive disclosure. Furthermore, close collaborations may shift firms' attention toward managing the public dimension of the relationship, potentially at the expense of developing substantive ESG initiatives (Peloza and Falkenberg, 2009).

3.2.3 NGOs-corporate relationship and the risk of greenwashing practices

Incorporating stakeholder needs into organizational strategies represents a fundamental aspect of effective management and is commonly conceptualized as stakeholder engagement (Ferrón-Vílchez et al., 2021). This notion, described by Sharma and Vredenburg (1998, p. 735) as "the ability to establish trust-based collaborative relationships with a wide variety of stakeholders," underscores the central role of trust and collaboration in advancing organizational objectives. Firms employ a range of engagement mechanisms to capture stakeholders' environmental concerns and expectations. Such practices promote a strategic and iterative process through which stakeholders can take part in corporate environmental decision-making (Garcés-Ayerbe et al., 2019). Active involvement of stakeholders enables organizations to align more closely with stakeholder expectations (Ferrón-Vílchez et al., 2021), ultimately enhancing the quality of decision-making and supporting more sustainable outcomes.

Nevertheless, the incorporation of stakeholder interests into environmental strategies may produce divergent outcomes. On one side, firms may respond to

stakeholder demands with proactive initiatives, adopting advanced environmental practices that demonstrate a substantive commitment to sustainability (Ferrón-Vílchez et al., 2021; Murillo-Luna et al., 2008). On the other side, pressures related to legitimacy concerns can drive companies to employ SR primarily as a tool for maintaining a favorable public image (Holder-Webb et al., 2009), often with the aim of minimizing reputational risks (Hahn and Lülfs, 2014). In such instances, some firms may resort to greenwashing, using SR to portray environmental, social, and governance (ESG) performance as more advanced than it actually is, thereby misrepresenting their true practices (Seele and Gatti, 2017).

Proactive greenwashing arises when firms deliberately overstate their environmental initiatives to strengthen their reputation and secure a competitive edge (Lyon and Montgomery, 2015; Marquis et al., 2016). Stakeholder pressure can also result in reactive responses, where the risk of greenwashing is higher. Under such conditions, companies may distort or embellish their environmental performance to deflect external scrutiny, a practice particularly common in industries with high environmental impact (Cho and Patten, 2007). Reactive greenwashing is often a consequence of firms responding symbolically to stakeholder demands without implementing substantive improvements. While such practices may temporarily safeguard corporate image, they risk eventual exposure, thereby undermining credibility and jeopardizing trust-based stakeholder relationships.

Delmas and Burbano (2011) identified four drivers that tempt organizations to greenwash. Firstly, they examined the “external non-market drivers”, highlights the role of regulatory, normative, and cognitive factors in influencing corporate practices. The regulatory environment shapes the accessibility and reliability of environmental information available to consumers, investors, and managers, thereby indirectly affecting the other drivers of greenwashing. NGOs, often operating in tandem with the media, play a critical watchdog role (Lee, 2019). Through campaigns and the dissemination of information on misleading practices, NGOs aim to ensure that corporate ESG commitments are implemented in practice rather than merely declared. As public opinion, consumer awareness, and investor interest in environmental issues increase, activist organizations gain greater influence and exert stronger pressure on firms (Nøjgaard, 2023).

The second set of drivers identified by Delmas and Burbano (2011) relates to “external market drivers”, which stem from the expectations of consumers, investors, and competitors—particularly in firms with lower environmental awareness. When

companies perceive stronger consumer or investor pressure, the risk of greenwashing rises. This effect is further reinforced in contexts of high visibility and close stakeholder proximity (Chen and Chang, 2013; Schons and Steinmeier, 2016). Competitive dynamics also play a crucial role: firms often mimic practices of industry peers perceived as more legitimate or successful, a pattern that extends to the adoption of greenwashing strategies (Walker and Wan, 2012). In addition, Delmas and Burbano (2011) identify "organizational drivers", which include firm-specific characteristics, incentive structures, and the effectiveness of internal communication, as well as "individual drivers", as the fourth, referring to cognitive and psychological factors at the managerial level.

Montgomery et al., (2023) identify three phases in the evolution of greenwashing research: Greenwashing 1.0 called "Static Communication"; Greenwashing 2.0 called "Dynamic Management"; and Greenwashing 3.0 called "Narratives about the Future". Greenwashing 1.0 is characterized by a narrow focus on single environmental issues, typically directed at a limited set of stakeholders—most often consumers—while involving minimal participation from intermediaries such as NGOs, which could otherwise provide independent oversight. The transition to Greenwashing 2.0 reflects a shift in corporate sustainability strategies, as firms began acknowledging the diversity of stakeholder interests and the cognitive challenges stakeholders may face in interpreting sustainability messages. This stage broadens the scope of issues addressed, extending beyond consumers and engaging multiple stakeholders, while increasing interaction with intermediaries that enhance accountability and scrutiny. The most advanced stage, Greenwashing 3.0, highlights how misleading claims may undermine companies' access to financial resources, particularly from investors. This phase introduces the idea of "future-washing," whereby firms construct narratives about long-term sustainability goals without necessarily offering verifiable evidence of current practices.

The present study draws on the framework developed by Delmas and Burbano (2011), alongside Montgomery et al. 's (2023) greenwashing evolution model (with particular emphasis on Greenwashing 1.0 and 2.0), to analyze the findings related to the fourth and fifth research questions (RQ4 and RQ5), which address greenwashing risks. Within this perspective, collaborative relationships with NGOs may lower the likelihood of greenwashing, as consumers and investors (market drivers) are more inclined to trust corporate environmental practices when NGOs act as advisors (non-market drivers). In contrast, when firms face adversarial relationships with NGOs, the incentive to engage in greenwashing increases. Under such conditions, companies may attempt to quickly improve stakeholder perceptions by selectively disclosing only positive information or by

projecting an image that exceeds their actual ESG performance, thereby manipulating stakeholder views (Hahn and Lülfs, 2014; Holder-Webb et al., 2009).

3.3 METHODOLOGY

3.3.1 Research design

This study represents a first attempt to examine how the type of NGO–corporate relationship may influence the quality of environmental disclosure (ED) and how NGOs may affect the likelihood of greenwashing practices. An exploratory approach was adopted, specifically a qualitative research design, for several reasons. First, qualitative research allows for in-depth analysis of complex real-world phenomena and facilitates the development of inductive theory (Eisenhardt and Graebner, 2007). Second, the flexibility of this approach enables the collection of rich data through interviews, direct observation, and the review of archival sources, supporting cross-validation and enhancing the reliability of findings (Voss, 2002).

The study focuses on a single industry—the fashion sector—which has been under significant public scrutiny in recent years due to environmental scandals and unsustainable practices. Key environmental challenges in this sector include massive water consumption, high carbon dioxide emissions, extensive textile waste, and the use of hazardous chemicals that pose risks to both ecosystems and human health. For instance, a single European textile-finishing company may use over 466 grams of chemicals per kilogram of textile (Niinimäki et al., 2020). These issues have heightened social pressure on firms to improve ESG performance and to use sustainability reporting (SR) to communicate their efforts. Simultaneously, the sector has witnessed increasing greenwashing scandals, such as labeling polyester products as “recycled” despite the material being non-reusable at the end of its lifecycle (The Guardian, 2022). Given these dynamics, the fashion industry provides a suitable context for investigating multinational companies’ ED practices and greenwashing risks.

This study presents a qualitative longitudinal analysis of the relationships between Greenpeace and 24 multinational firms operating in the fashion industry that were targeted by the campaign Detox, carried out by Greenpeace for more than 10 years to raise environmental awareness and responsibility. The relationship between Greenpeace and a single company is the unit of analysis, so the dyads between an NGO and the various corporate companies are the subject of the study.

Greenpeace actively encourages major fashion brands to collaborate with their suppliers to make production chains more sustainable, aiming to reduce the sector’s

substantial environmental footprint. Launched in 2011 and concluding in 2021, the Detox campaign sought to eliminate chemical substances from garments that are hazardous to humans and ecosystems (Greenpeace, 2018). Companies were assessed according to their progress toward the Detox 2020 deadline for eliminating hazardous chemicals throughout their supply chains, including the adoption of monitoring tools for wastewater chemicals. During the first phase of the campaign (2011–2016), companies were classified into four categories based on credible steps taken: "Avant-Garde" for firms performing well on at least two criteria with no critical failures; "Faux Pas" for firms with critical failures on two or more criteria; "Evolution Mode" for intermediate performance; and "Toxic Addicted" for companies showing no credible commitment or refusing participation. Five companies were classified as "Toxic Addicted," while of the remaining 19, three were "Avant-Garde," twelve "Evolution Mode," and four "Faux Pas" (see Table 8). Initially, these 19 companies had varying degrees of conflictual relationships with Greenpeace. Upon committing to the campaign, they transitioned to collaborative interactions, engaging in systematic dialogue to achieve campaign objectives. In contrast, the five companies that did not join the campaign established an everlasting conflictual relationship with Greenpeace and were repeatedly accused of lack of interest in the environmental issues promoted by the Detox campaign.

Table 8. Profiles of companies

Category-Catwalk 2016	Company	Segment	Country
Avant Garde	Inditex	Fast Fashion	Spain
	Benetton	Fast Fashion	Italy
	H&M	Fast Fashion	Sweden
Evolution Mode	C&A	Fast Fashion	Belgium
	Fast Retailing (Uniqlo)	Fast Fashion	Japan
	G-star	Fast Fashion	Netherlands
	Mango	Fast Fashion	Spain
	Miroglio	Fast Fashion	Italy
	Valentino	Luxury	Italy
	Adidas	Sport	Germany
	Burberry	Luxury	UK
	Levi's	Fast Fashion	U.S.
	Primark	Fast Fashion	Ireland
	Puma	Sport	Germany
	M&S	Fast Fashion	UK
Faux Pas	Esprit	Fast Fashion	China
	Victoria Secret (Limited brand)	Fast Fashion	U.S.
	Li-Ning	Sport	China
	Nike	Sport	U.S.
Toxic Addicted	Dolce & Gabbana	Luxury	Italy
	GAP	Fast Fashion	U.S.
	Metersbonwe	Fast Fashion	China
	Calvin Klein (PVH)	Fast Fashion	U.S.
	Versace	Luxury	Italy

3.3.2 Data collection and analysis

3.3.2.1 Semi-structured interviews with Greenpeace and secondary data collection

Semi-structured interview protocols were used in this study to strengthen reliability and validity of the qualitative data (Yin, 1994). This approach allowed flexibility to probe participants for additional insights and fostered open discussion of sensitive issues, while ensuring that all interviews addressed key aspects of environmental sustainability. Three semi-structured interviews were conducted, each lasting approximately two hours, with Greenpeace's GMDC. The first interview, carried out in July 2022, focused on topics such as the themes addressed during the campaign, the companies involved, the nature and evolution of NGO–corporate relationships, and the quantitative parameters used for monitoring progress in the Detox campaign. The second interview, held in September 2022, concentrated on greenwashing-related issues, including risks emerging from sustainability reports, potential cases of greenwashing within the Detox campaign or other initiatives, and the degree of attention given by the NGO to greenwashing risks when engaging with companies. A third follow-up interview was conducted in July 2023 to validate and further refine the findings. In addition, multiple secondary sources were analyzed, including campaign documentation and the sustainability reports of all participating companies (when available). Figure 1 outlines the step-by-step process of data collection and coding applied in the study.

A flexible coding process was adopted. Initially, codes were derived from the first interview, after which a desk-based analysis was performed, drawing on three Greenpeace monitoring reports that tracked companies' progress over time: *Detox Catwalk (2016), Destination Zero (2018), and Self Regulation: A Fashion Fairy-tale (2021)*. This descriptive first-cycle coding facilitated the synthesis of data from interview transcripts and reports (Miles et al., 2014). A subsequent cycle of coding involved the development of inferential pattern codes to uncover emerging themes and support the formulation of research propositions.

NGO–corporate relationship and environmental disclosure Detox Catwalk 2016 - First leg of the campaign (2011-2016)

For the "*Detox Catwalk 2016*" report, a content analysis was conducted to assess companies' performance in terms of environmental disclosure (ED). This procedure was not required for the subsequent reports (2018 and 2021), as Greenpeace evaluated brands using standardized criteria rather than narrative judgments, as in 2016. The results of the content analysis are presented in **Tables A.1, A.2**, and **A.3** (see

Appendix), each corresponding to one of the criteria employed by Greenpeace to assess brand performance.

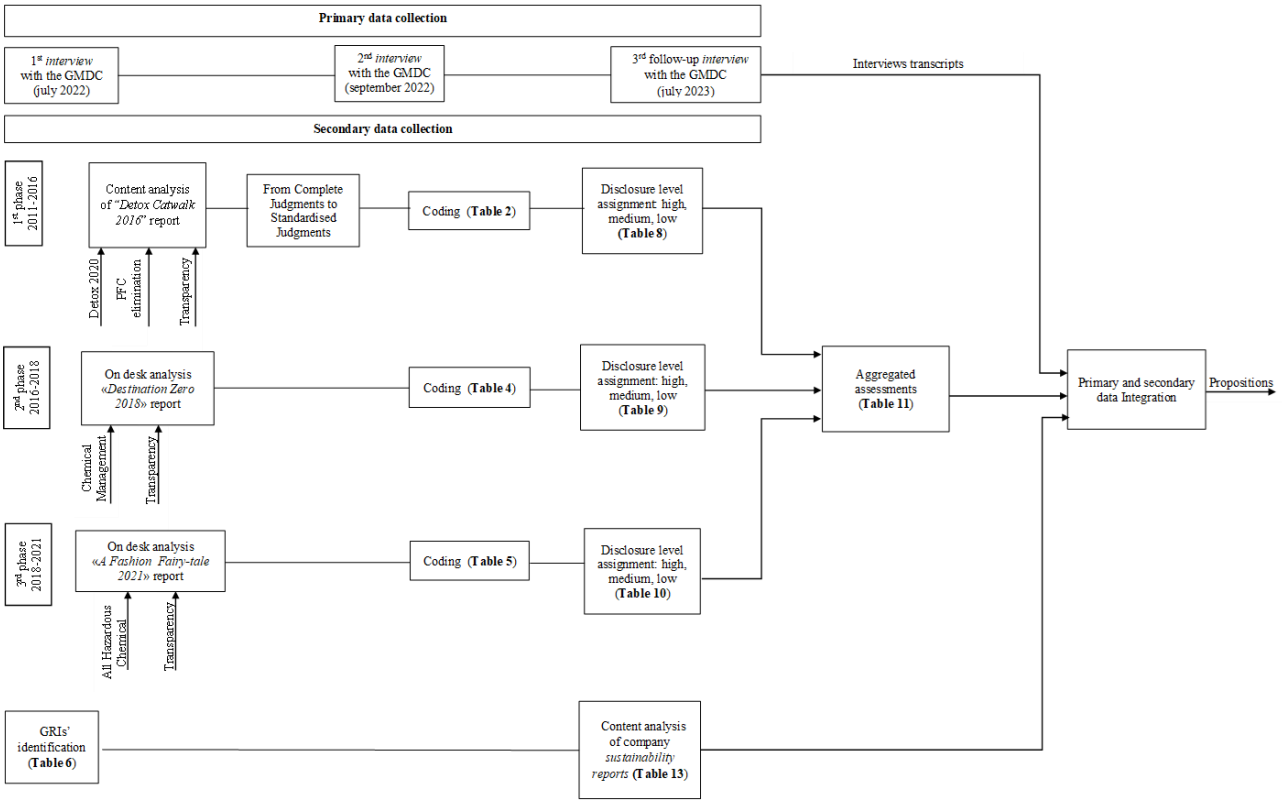
The first criterion, named *Detox 2020*, assessed a company's chemical management system and the methodology required to draw up the *Manufacturing Restricted Substances List* (MRSL), a list used to identify hazardous chemicals used in production by suppliers and prioritize them for elimination before 2020. The entries *Chemical Management* and *All Hazardous Chemical* replace this criterion in the 2018 and 2021 reports, respectively.

The second criterion, *PFC elimination*, assessed the progress made in the elimination of any use and discharge of one of the groups of widely used hazardous chemicals for polyfluorinated compounds (PFC). In the 2018 report, this item is referred to as *Substitution*, whereas Greenpeace no longer used this criterion in the 2021 report.

Finally, the third criterion, *Transparency*, assessed whether the company ensured that its suppliers regularly published data on discharges of hazardous chemicals from their wet processes and whether the company disclosed the list of its suppliers (including second-tier suppliers, where wet processes are typically conducted).

Figure 1. Flowchart of the activities performed for data collection and coding.

Data sources in italic font



For each of the three criteria, three *Standardized Judgments* (SJs) were defined (see **Table 9**). Subsequently, relying on the *Complete Judgment* (CJs), (i.e., the full excerpt of the text found in the report Detox Catwalk, including all aspects (not just ED) considered by Greenpeace to evaluate each brand for a given criterion), the SJs were assigned to the companies. Afterwards, each SJ was subsequently classified into a *Disclosure Level*: Low, Medium, or High to each of the SJs previously identified. This judgment indicates the quantity and quality of environmental information shared by companies, according to the associative modalities exemplified in **Table 9.**

Table 9. Assignment of disclosure level to standardized judgments - Detox Catwalk 2016.

Legend – Detox Catwalk 2016			
DETOX 2020	PFC ELIMINATION	TRASPARENCY	DISCLOSURE LEVEL
Individual MRSL	Communication of progress on the "PFC elimination" objective and case study's publication useful for substitution	The list of suppliers (all levels) and the list of data are complete	High
Basic ZDHC MRSL+ additions	Communication of progress on the "PFC elimination" objective without the case study's publication useful for substitution	The list of suppliers (all levels) is complete, but the list of data is incomplete or vice versa	Medium
Basic ZDHC MRSL	Communication of progress on the "PFC elimination" objective not complete and without the case study's publication useful for substitution	The list of suppliers (all levels) and the list of data are both incomplete	Low

Destination Zero 2018 and Fashion Fairytale 2021 – Second and third legs of the campaign (2016-2018 and 2018-2021)

Content analysis was not conducted for the ED assessments after 2016 (i.e., in the 2018 and 2021 reports), as the data provided were already directly traceable to the SJs identified in the 2016 analysis. The only exception concerned the criterion of *Transparency*, which was constructed using two elements: the supplier tier disclosed and the percentage of suppliers reporting wastewater discharge data. The interpretative framework for this criterion is presented in **Table 10**. To ensure consistency with the SJs, these two elements were combined into a single judgment. For example, if a company presented "*Wastewater data published >80*" and *"Tier 1,2, and 3"*, then this information was consolidated into the judgment "*The list of suppliers (with all levels) and the list of data are complete*".

Table 10. Legend for criterion: Transparency 2016-2018 and Transparency 2018-2021

Shared suppliers' data	Wastewater data published >80%	Data list complete
	Wastewater data published 50-80%	Data list incomplete
	Wastewater data published <50%	
Shared suppliers' levels	Tier 1, 2, and 3	Supplier list is complete
	Tier 1 and 2	Supplier list is incomplete
	Tier 1	

The salient information has been aggregated in tables **A.4, A.5** (reported in the Appendix) for each evaluation period. **Table 11** presents the 3-levels of SJs defined for the 2 criteria (*Chemical management* and *Transparency*) used for the second leg of the Detox campaign, "Destination Zero 2018", as well as the 3-levels of Disclosure: Low, Medium, or High assigned to each of the SJs previously identified.

Table 11. Assignment of disclosure level to standardized judgments - Destination Zero 2018.

Legend – Destination Zero 2018		
CHEMICAL MANAGEMENT	TRASPARENCY	DISCLOSURE LEVEL
Individual MRSL	The list of suppliers (all levels) and the list of data are complete	High
Basic ZDHC MRSL+ additions	The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa	Medium
Basic ZDHC MRSL	The list of suppliers (all levels) and the list of data are both incomplete	Low

In the same way, **Table 12** shows the 3-levels of SJs for the 2 criteria (All Hazardous Chemical and Transparency) used for the third leg of the Detox campaign, "Fashion Fairytale 2021", as well as the 3-levels of Disclosure assigned to each of the SJs previously identified.

Table 12. Assignment of disclosure level to standardized judgments- Fashion Fairytale 2021.

Legend – Fashion Fairytale 2021		
ALL HAZARDOUS CHEMICAL	TRASPARENCY	DISCLOSURE LEVEL
Individual MRSL	The list of suppliers (all levels) and the list of data are complete	High
Basic ZDHC MRSL+ additions	The list of suppliers (all levels) is complete, but the list of data is incomplete	Medium
Basic ZDHC MRSL	The list of suppliers (all levels) and the list of data are both incomplete	Low

3.3.2.3. NGO–Corporate relationship and the risk of greenwashing

Greenwashing is defined by Greenpeace as "*making people believe that your company is doing more to protect the environment than it actually is*" (Greenpeace, 2021). Building on this definition, the Detox campaign regarded as greenwashing those advertising practices that (a) make false or misleading claims about a company's environmental actions and (b) promote deceptive pro-environmental solutions. This study adopts Greenpeace's conceptualization of greenwashing.

As previously mentioned, a second interview with Greenpeace's GMDC was conducted in September 2022 specifically on this issue. The interview was transcribed and coded. The initial coding process focused on broad themes, including greenwashing practices in sustainability reporting (SR) and the evaluation of information reliability, examples of greenwashing both during and after the Detox campaign, and Greenpeace's considerations regarding greenwashing when determining the type of NGO–corporate relationship to pursue. This inductive first-cycle coding facilitated the summarization of data segments from the recordings (Miles et al., 2014). Moreover, to triangulate and support the interview data, an on-desk analysis of the documents most oriented toward this practice was carried out. Specifically, reports, websites, and sustainability documentation of the five companies identified as having made no credible environmental commitment—classified as "Toxic Addicted" in the Detox Catwalk 2016 report—were examined (see **Table 8**). The interview and the literature review (e.g., Delmas and Burbano, 2011; Ruiz-Blanco et al., 2022) confirmed that there is no universally accepted methodology to assess the reliability of sustainability reports or to eliminate the risk of greenwashing. Nevertheless, the perspective of Greenpeace's GMDC provided valuable insights into the organization's modus operandi for identifying potential greenwashing. As the GMDC explained: "*We start from the premise that production chains are often very complex, and to assess complexity, you need to have a systematic approach. […], use more 'systemic' parameters, such as transparency and traceability. If a company has a good traceability system that includes its production network, suppliers, sub-suppliers, and can simply trace the supply chain, then this is a good starting point because it suggests that the company, if it decides to make more sustainability commitments, will be able to monitor and govern the change that we have asked.*" (GMDC of Greenpeace). In line with this approach, the analysis focused on the degree of transparency and traceability of information in sustainability reports published up to 2020. The presence and level of detail of selected GRI (Global Reporting Initiative) standards were used as the main evaluation criteria, since previous

studies (Adams, 2004; Ruiz-Blanco et al., 2022) have highlighted that adherence to GRI standards enables companies to produce comparable and credible ESG disclosures, thereby enhancing transparency. Moreover, companies not applying GRI standards have been found to be more prone to greenwashing than those that do (Ruiz-Blanco et al., 2022). To ensure continuity with the previous stages of the analysis, a specific subset of GRI standards was selected. These standards best reflect Greenpeace's environmental priorities concerning supply chains, hazardous chemical management, and wastewater. The selected GRI standards are summarized in **Table 13**.

Table 13. GRI standards.

Standard	Reporting requirements
GRI 102-9	A description of the organization's supply chain, including its main elements as they relate to the organization's activities, primary brands, products, and services.
GRI 303-1	Information about the company management of water resources and related impacts. A special focus on its connection with suppliers.
GRI 303-4	Information about the total water discharge divided into all areas (discharge basins). Substances potentially hazardous to water bodies released during discharge. Focus on discharge limits and percentage of suppliers with significant impacts on water resources.
GRI 308-2	Environmental assessment of suppliers found to have a significant and potentially negative environmental impact.

3.4 FINDINGS AND DISCUSSION

3.4.1 NGO's strategies to push companies towards commitment

The timeline of key Detox campaign events during the joining phase (2011–2014) is reported in **Table 14**. In this period, Greenpeace employed both "peaceful protest" and "creative communication" strategies (Greenpeace USA, 2013). These approaches pursued two objectives simultaneously: raising awareness of global environmental challenges and promoting solutions consistent with a green and peaceful future. The campaign combined written communication (e.g., press releases) with visual rhetoric (e.g., videos, posters, placards) and performance-based rhetoric (e.g., social activism through striptease protests or sticker campaigns) to exert pressure on companies to adhere to the initiative (Greenpeace, 2018). Such non-verbal communication techniques proved highly persuasive and likely played a decisive role in encouraging many firms to join the campaign. By deploying these strategies and leveraging organizational legitimacy, Greenpeace mobilized activists, consumers, and media support. This, in turn, shaped public opinion by portraying companies' environmental practices as violations of social norms and pollution-related expectations, thereby generating legitimacy threats for targeted firms. As a result, companies were more inclined to respond promptly to the campaign's demands in order to safeguard their reputations and

meet public expectations. Indeed, when Greenpeace organized specific visual actions—such as encouraging supporters to display Detox tattoos (Table 14, see letter B), launching logo redesign competitions to expose "toxic" practices (Table 14, see letter C), or initiating company-specific visual actions (Table 14, see item i)—most of the targeted companies joined the campaign shortly thereafter, committing to the Detox 2020 goal (marked as X in Table 14). Overall, through visual rhetoric and social activism, Greenpeace effectively disseminated its message, mobilized stakeholders, and drove corporate engagement in the Detox campaign.

Table 14. Report 2016 – Key events of Detox Campaign for each company during the first joining phase of the campaign 2011-2014

Company	2011	2012	2013	2014
Inditex		November: **(i)** Global public action against Zara". More than 700 people, in over 80 cities, in 20 countries around the world protested, staged street theatre, and conducted "mannequin" walk-outs to demand Zara commit to eliminating the use of all hazardous chemicals throughout its supply chain. **F-X** December: **G**		
Benetton		November: **F**	January: **X**	
H&M	July: **A-B** August**: D** September: (**i**) Activists rebrand H&M in 12 countries attached "DETOX our water" and "DETOX the future" stickers onto local H&M shop windows! **X**	March: **E** November: **F**	April: **H**	January: **I**
C&A	November: **B, X**	November: **F** December: **G**		January: **I**
Fast Retailing (Uniqlo)	August: **D**		January: **X**	
G-star	August: **D**	March: **E**	January: **X**	
Mango		November: **F** December: **X**		
Miroglio				September: **X**
Valentino			February: **X**	

<table>
<tr><td rowspan="2">Adidas</td><td>July: A-B,
-(i) striptease outside Adidas's shops worldwide
August: C-D-X</td><td>March: E</td><td>April: H</td><td rowspan="2">January: I,
- Greenpeace volunteers around the world entered Adidas stores to remind that the company is washing its hands, that it's time to stop hiding behind paper promises and commit to Detox.
May: N,
- Activists around the world join together to take action, asking Adidas to keep the football beautiful by eliminating hazardous chemicals. Activities took place in 10 countries and more than 35 cities.
June:
Greenpeace spun a hashtag #detox #allin or nothing.
-X (11 June) agrees to end the greenwash and return to its Detox pledge</td></tr>
<tr><td colspan="3">Greenwashing</td></tr>
<tr><td>Burberry</td><td></td><td></td><td></td><td>January: I,
- Greenpeace supporters and customers participated in three-day social media storm on Twitter, Facebook, and Instagram to convince the brand to join Detox.
Greenpeace volunteers visited Burberry stores from Beijing to Mexico City to protest, X (28 January)</td></tr>
<tr><td>Levi’s</td><td></td><td>November: F
December: (i) Greenpeace activists staged a vertical catwalk action on a giant red carpet banner reading "Levi's, it's Time to Detox"</td><td></td><td></td></tr>
</table>

		in front of the Levi's store in the biggest mall in Copenhagen, Denmark. - **(i)** "Street artists support Detox" posters and street art were promoted across the globe. In Taiwan alone, over 200 pieces of street art were put up, alongside 90 pieces of clean graffiti around eight Levi's stores. - **(i)** Activists and volunteers also took to the street in over 20 countries to take the message directly to the brand's customers and to speak with the staff working in their stores, who sent the message back to Levi's HQ, **-G**, **X**		
Primark				January: **I** February: **X**
Puma	July: **A-B-X** August: **D**	March: **E**		January: **I** May: **N** November: **X**, The company announced its renovated commitment to Detox. In addition to setting out a plan to eliminate PFCs from 100% of its products, it also showed how it intends to publish the discharge data of 80% of its global suppliers by the end of 2020.
	Greenwashing			
M&S		September: **(i)** striptease outside M&S's stores worldwide October: **X** November: **F**		
Esprit		September: **(i)** striptease outside Esprit's stores worldwide October: **X** November: **F**		
Victoria Secret (Limited brand)		November: **F**	January: **X**	
Li-Ning	July: **A-B** August: **D** November: **X**	March: **E**		January: **I**
	Greenwashing			
Nike	July: **A-B** **-(i)** striptease outside Nike's stores worldwide August: **C-D-X**	March: **E** December: **G**		January: **I** May: **N**
	Greenwashing			
Dolce &				February: **L-M**

Gabbana				
GAP	August: **D**	November: **F** December: **G**	April: **H**, Greenpeace reached out to GAP executives asking them to narrow the gap between their words and the truth when it comes to Detox. Consumers and activists around the world joined together to call on GAP to clean up its act.	January: **I** March: GAP opened its first store in Taiwan. Activists decided to mark the occasion by reminding GAP of its unresolved toxic problems in front of the new store.
Metersbonwe	July: **A-B**	November: **F**		
Calvin Klein (PVH)	July: **A-B** August: **D**	March: **E** November: **F** December**: G**		
Versace				February: **L**, -Greenpeace Italia volunteers displayed a banner in the Galleria Vittorio Emanuele, during Fashion Week, calling for Detox. - **M**

Legend:

- X: company commitment to achieve the target of Detox campaign until 2020.
- A: In the 2011 "Dirty Laundry" report, the company is denounced by Greenpeace because of the emission of hazardous chemicals by its supplier in China. THE CAMPAIGN STARTS.
- B: Large retail mannequins joined the 'Detox' challenge and appeared in iconic locations around the world. In addition, some people started showing their 'Detox' tattoos.
- C: Greenpeace launched a design competition offering everyone the chance to redesign company logos to better reflect their truly toxic practices.
- D: Company's products were analyzed by Greenpeace and hazardous chemicals were found in them.
- E: Investigation by Greenpeace showing that this brand's products release toxic substances even when washing them.
- F: "Toxic threads, the big fashion stitch-up", an investigation revealing links between textile production plants using toxic chemicals and water pollution, was also extended to these companies.
- G: Greenpeace investigated textile production plants in Mexico (first investigation outside of China) and found a wide range of hazardous substances in the wastewater discharged from two plants. These companies have these plants as their supplier.
- H: An investigation revealed a relationship between the company and a polluting supplier in Indonesia, so more transparency was demanded.
- I: A new investigation by Greenpeace has found a wide range of hazardous chemicals in children's clothing and footwear from these companies.
- L: Greenpeace launched "A Little Story about a Fashionable Lie" report revealing the toxic truth behind luxury fashion, finding hazardous chemicals in the clothes of these brands.
- M: Greenpeace activists from Mexico to Moscow join the Naked King (protest in front of stores) to tell luxury fashion brands to commit to toxic-free fashion. They flooded these brands with online messages.
- N: The German division of Greenpeace published "A red card for sportswear brands" revealing the presence of a number of hazardous chemicals in the boots, gloves, and jerseys produced by these brands in the run-up to the 2014 World Cup.

Consistent with the evidence discussed above, several studies have demonstrated that images and videos exert a strong psychological impact and represent an effective medium for communicating messages (e.g., Boiral, 2016; Dhanani, 2019). Nevertheless, prior research has primarily examined the use of visuals in corporate annual reports to

convey specific narratives (e.g., Boiral, 2016; Cooper and Slack, 2015; Dhanani, 2019). Far less is known about how stakeholders employ non-verbal communication, and even less about its use in interactions between companies and stakeholders, particularly in the NGO context. Existing literature highlights that stories can elicit emotional responses, making them more persuasive than purely rational arguments, especially for audiences predisposed to react emotionally (e.g., Fisher, 1984; Hong et al., 2022). Both visual communication and the rhetoric of performance capitalize on this mechanism by using visuals and movement to immediately transmit emotionally charged messages (*pathos*) to target audiences and stakeholders (Hong et al., 2022). By integrating emotional appeals with logical reasoning and ethical credibility, visual rhetoric and social activism—in the form of performance-based rhetoric—emerge as effective non-verbal communication strategies for NGOs to exert pressure on companies and persuade them to actively engage in campaigns. This reasoning leads to the formulation of the first proposition:

P1. *The use of visual rhetoric (e.g., videos) and the rhetoric of performance (e.g., social activism in the form of a striptease or a sticker campaign) by an NGO in the initial stages of a campaign raise the odds of attracting commitment from targeted companies.*

3.4.2 NGO-corporate relationship and company behavior

For the Detox Catwalk 2016 (i.e., the first leg of the campaign 2011-2016), the overall assessment of the ED results for each brand, encompassing all three criteria simultaneously is reported in **Table 15**. The presence of three criteria simplified the construction of the overall assessment because the two-out-of-three rule was used to determine the assignment, except when the highest level across the three criteria was high and the lowest was low. For instance, in case of high-high-medium assessment in the three criteria, the overall assessment resulted high. On the other hand, in case of high-high-low, high-medium-low, and high-low-low assessments, the overall assessment resulted medium.

Table 15. Assignment of the environmental disclosure level for the short-term 2011-2016.

'Detox Catwalk 2016' criteria				
Company	Detox 2020	PFC elimination	Transparency	Disclosure Level
Adidas	Low	High	High	Medium
Benetton	High	Medium	Medium	Medium
Burberry	Medium	Medium	Low	Medium
C&A	Low	Medium	High	Medium
Esprit	Low	Medium	Low	Low
Fast Retailing (Uniplo)	High	High	Low	Medium
G-star	Medium	High	Low	Medium
H&M	High	Medium	Medium	Medium
Inditex	High	High	High	High
Levi's	Medium	High	High	High
Li-Ning	Low	Low	Low	Low
Limited Brands (Victoria Secret)	Low	Low	Low	Low
Mango	High	High	Low	Medium
M&S	Low	Low	Medium	Low
Miroglio	High	Low	Low	Medium
Nike	Medium	Low	Medium	Medium
Primark	Low	High	Low	Medium
Puma	Low	Low	Medium	Low
Valentino	High	High	Low	Medium

For the Destination Zero 2018 (i.e., the second leg of the campaign 2016-2018), the overall assessment of the ED results for each brand, encompassing all two criteria simultaneously is reported in **Table 16**.

Table 16. Assignment of the environmental disclosure level for the intermediate period 2016-2018.

'Destination Zero 2018' criteria			
Company	Chemical Management	Transparency	Disclosure Level
Adidas	Medium	High	Medium-High
Benetton	High	High	High
Burberry	Medium	Low	Low-Medium
C&A	Low	High	Medium
Esprit	Low	Medium	Low-Medium
Fast Retailing (Uniplo)	High	Medium	Medium-High
G-star	Low	High	Medium
H&M	High	Medium	Medium-High
Inditex	High	Medium	Medium-High
Levi's	Medium	High	Medium-High
Li-Ning	Low	Medium	Low-Medium
Limited Brands (Victoria Secret)	Medium	Medium	Medium
Mango	High	Low	Medium
M&S	Medium	Low	Low-Medium
Miroglio	High	High	High
Nike	Low	Medium	Low-Medium
Primark	Medium	Medium	Medium
Puma	Low	High	Medium
Valentino	High	High	High

For the *Fashion Fairytale 2021* (i.e., the third leg of the campaign 2018-2021), the results are reported in **Table 17**.

Table 17. Assignment of the environmental disclosure level for the long-term 2018-2021.

"Fashion Fairytale 2021" criteria			
Company	All Hazardous Chemical	Transparency	Disclosure Level
Adidas	Low	Low	Low
Benetton	Medium	Medium	Medium
Burberry	Medium	Medium	Medium
C&A	Medium	High	Medium-High
Esprit	Low	Medium	Low-Medium
Fast Retailing (Uniplo)	Medium	Low	Low-Medium
G-star	Medium	Medium	Medium
H&M	Medium	High	Medium-High
Inditex	High	Low	Medium
Levi's	Low	Medium	Low-Medium
Li-Ning	Low	Low	Low
Limited Brands (Victoria Secret)	Low	Medium	Low-Medium
Mango	High	Low	Medium
M&S	Low	Low	Low
Miroglio	Low	Low	Low
Nike	Medium	Low	Low-Medium
Primark	Low	Low	Low
Puma	Medium	Medium	Medium
Valentino	High	Medium	Medium-High

For the second and third legs, the methodology adopted for the aggregate evaluation of disclosure levels differed from that applied in the initial stage of the campaign, as Greenpeace reduced the assessment criteria from three to two. When the two criteria were aligned (e.g., high–high) or completely divergent (e.g., low–high), the overall evaluation was straightforward (i.e., high in the first case, medium in the second). In contrast, for intermediate ratings (e.g., medium–high or low–medium), both levels were retained (e.g., medium–high → medium–high), since the study is qualitative in nature and aims to preserve the richness of the information rather than to assign a precise numerical score. Finally, **Table 18** presents the aggregate disclosure levels achieved by the brands across the three periods under consideration. The table allows for the identification of brands that have consistently demonstrated strong commitment to disseminating information on environmental practices related to the Detox campaign, as well as those positioned in the lower tier, showing comparatively limited attention to environmental disclosure.

Table 18. Aggregated assessments for short-, intermediate-, and long-term

Company	Disclosure 2016	Disclosure 2018	Disclosure 2021
Adidas	Medium	Medium-High	Low
Benetton	Medium	High	Medium
Burberry	Medium	Low-Medium	Medium
C&A	Medium	Medium	Medium-High
Esprit	Low	Low-Medium	Low-Medium
Fast Retailing (Uniplo)	Medium	Medium-High	Low-Medium
G-star	Medium	Medium	Medium
H&M	Medium	Medium-High	Medium-High
Inditex	High	Medium-High	Medium
Levi's	High	Medium-High	Low-Medium
Li-Ning	Low	Low-Medium	Low
Limited Brands (Victoria Secret)	Low	Medium	Low-Medium
Mango	Medium	Medium	Medium
M&S	Low	Low-Medium	Low
Miroglio	Medium	High	Low
Nike	Medium	Low-Medium	Low-Medium
Primark	Medium	Medium	Low
Puma	Low	Medium	Medium
Valentino	Medium	High	Medium-High

Table 18 shows that 14 companies out of 19 settled at a medium level in terms of ED results in the final period of the Detox campaign, irrespective of the type of relationship established with the NGO. This finding suggests that, despite Greenpeace's various initiatives, the long-term behavior of these companies has not undergone substantial change. Greenpeace also questioned whether firms would continue to implement and report their commitments—such as disclosing supply chains and publishing progress reports and wastewater data from production facilities—once the pressure of an active campaign subsided (Greenpeace, 2021). To investigate this, the NGO conducted a so-called "blind check," systematically collecting and analyzing publicly available information from corporate websites and reports to assess company actions in the absence of direct external scrutiny. The results revealed that while many brands published a Detox progress report in 2020, nearly one third had not issued an update since 2019, and in the cases of Inditex, Mango, and Esprit, the most recent dedicated report dated back to 2018 (Greenpeace, 2021). Furthermore, approximately one third of the monitored brands failed to include detailed wastewater data or analyses in their latest reports, suggesting that the issue may have lost priority within their disclosure practices.

Adopting the lens of Stakeholder Theory may be useful to understand this behavior. According to this theory, how companies choose to address sustainability concerns can be understood as a response to demands from stakeholders (Wheeler et al., 2003). Indeed, companies consider stakeholders' sustainability expectations when deciding

whether and how to adopt sustainability strategies and share ESG content (Darnall et al., 2018; Huq et al., 2016; Tsoi, 2010). In this context, several companies appear to have responded to NGO demands in the short to medium term primarily for opportunistic reasons, particularly when their legitimacy was perceived to be under greater threat from this stakeholder. By the final stage of the campaign, however, disclosure levels tended to converge at a medium level, reflecting sufficient effort to demonstrate compliance with prevailing regulations and norms, rather than a differentiated response based on the nature of the NGO relationship (collaborative or conflictual). This pattern suggests that many companies were not genuinely engaged with the environmental issues raised, but rather sought to meet the minimum requirements necessary to maintain stability and legitimacy. As emphasized by Greenpeace GMDC:″ […] *There will always be companies that will not take any action unless they are required by regulation"*. Therefore, the following proposition is advanced:

P2: *The quality of environmental disclosure reaches a medium level in the long run, irrespective of the type of NGO-corporate relationship established.*

While the quality of environmental disclosure (ED) tends to converge at a medium level in the long run, regardless of the type of relationship established with the NGO, the trajectory toward this outcome may, in fact, be influenced by it. Specifically, higher levels of ED in the initial stages were more frequently observed when Greenpeace exerted pressure through activism and conflict-driven strategies. For example, Inditex and Levi's achieved a "high" level of ED during the short and medium terms of the Detox campaign (see **Table 18** and **Table 19**), before eventually converging at a medium level in the long term.

Table 19. Example of the type of relationship and the level of environmental disclosure

Relationship	Company	Short-term	Intermediate term	Long-term
Conflictual	Inditex	H	H	M
	Levi's	H	H	M
Collaborative	Mango	M	M	M
	Esprit	L	M	M
	Victoria Secret	L	M	M

Table 14 (see letter F) also shows that both were mentioned in the report "Toxic Threads: The Big Fashion Stitch-Up" (2012), which denounces that these companies used hazardous chemicals, with about 60% of products containing the harmful chemical

NPE.[1] Greenpeace sought to establish a conflictual relationship with these companies, as their environmental performance was comparatively poor relative to other brands engaged in the campaign. To this end, Greenpeace organized several non-violent actions, mobilizing activists to exert public pressure. Interestingly, Table 14 (see letter F) also indicates that other companies—such as M&S, Esprit, and Victoria's Secret—had similarly high percentages (above 50%). In these cases, however, Greenpeace adopted a more conciliatory approach, opting to establish systematic dialogue. Notably, when the relationship tended toward cooperation, the trajectory of environmental disclosure followed the opposite pattern to that observed under conflictual relationships (see Figure 2).

Figure 2. The trajectory of environmental disclosure quality over time based on the type of NGO-corporate relationship.

In the first stage of the campaign - from 2011 to 2016 - the quality of ED of brands (e.g., Victoria's Secret or Esprit), with which Greenpeace activated more dialogue-based relationship, was very low (see Disclosure 2016 in Table 18), whereas at the end of the campaign the performance reached a low-medium level (see Disclosure 2021 in Table 18). This evidence suggests that the type of NGO–corporate relationship influences the trajectory of ED quality over time. The relatively stronger results achieved by companies engaged in more conflictual relationships in the short and medium term can be interpreted as a response to the pressure exerted by Greenpeace to

[1] "NP/NPEs, also known as nonylphenols and nonylphenol ethoxylates, are non-ionic surfactants, or detergent-like substances, with uses that lead to widespread release into aquatic environments." (EPA).

meet the demands of the Detox campaign. Consistent with Stakeholder Theory, firms are compelled to satisfy the demands of powerful stakeholders (in this case, Greenpeace) to avoid reputational losses in the immediate term. Indeed, companies heavily criticized by the NGO demonstrated stronger initial commitment to the Detox campaign following non-violent activist actions—likely driven by opportunistic or competitive motives. This behavior aligns with what Sutantoputra (2022) describes as a *reactive approach*, whereby firms signal engagement and communicate a positive environmental image to stakeholders and society only after perceiving a threat to their legitimacy. By contrast, a more collaborative relationship tends to reduce the urgency to provide high-quality ED in the short or medium term, as firms' primary focus shifts to achieving the objectives of the partnership itself, with disclosure improvements materializing more gradually in the longer run. On this basis, the following proposition is advanced:

P3. *The type of NGO-corporate relationship significantly shapes the trajectory of the quality of environmental disclosure. Companies establishing at first more conflictual relationship with an NGO exhibit high quality of environmental disclosure in the short and medium term, settling at a medium level in the long run. In contrast, companies establishing at first more collaborative relationship with an NGO exhibit low quality of environmental disclosure in the short and medium term, settling at a medium level in the long run.*

3.4.3. Linking the type of NGO-corporate relationship and the risk of greenwashing

3.4.3.1. Content analysis on the risk of greenwashing

The sustainability documents (e.g., SR, website) published by the "Toxic Addicted" companies were analyzed taking into the consideration the GRI standards previously selected (see Table 13). The results of this analysis are summarized in **Table 20**.

Table 20. Transparency and standardization upon companies' sustainability reports.

Company	Source	GRI 102-9	GRI 303-1	GRI 303-4	GRI 308-2	Explanation	Transparency
Dolce & Gabbana	"Code of Ethics" Website Section (https://world.dolcegabbana.com/corporate/code-of-ethics/)	No ESG disclosure; only a section on their website				In the dedicated section, the three most important aspects of sustainability are explored through brand ambitions and declarations. However, these statements are too meagre and evanescent because they lack the support of standards or, in general, guidelines, such as the GRI.	Low
Gap	Sustainability report (https://www.gapinc.com/en-us/values/sustainability/esg-resources/past-reports-and-disclosures)	✓			✓	In its sustainability reports, ESG commitments and objectives are declared. Their focus on environmental protection and the presence of a sustainable business strategy follow the GRI guidelines. They also use other standards that compensate for the absence of GRI 303-1 and 303-4. Real commitment can also be inferred by the presence of a list and related links of past sustainability reports.	High
Metersbonwe	Website	No disclosure				-	Low
Calvin Klein (PVH)	Sustainability report (https://www.pvh.com/search?query=CR%20)	✓	✓		✓	In the PVH (brand group) sustainability reports, an excellent degree of detail in sustainability information shines through. The commitment, objectives, and strategies are credible and truthful, as they are consistently supported by different reporting methodologies (GRI, SASB, and TCFD). Regarding the criteria we have taken into consideration, it is evident that there is substantial transparency of information about their suppliers, thanks also to the possibility of downloading an Excel sheet containing the complete list with details on the reference level and the presence of a delineated criterion for evaluating them on environmental operations.	High
Versace (Capri holding)	Sustainability report (https://www.capriholdings.com/RESPONSIBILITY/CSR-Resources/default.aspx)	Disclosure without GRIs				The first sustainability report was published in 2020, but only SASB and TCFD (not GRI) standards are integrated in the reporting methodology.	Low

An analysis of D&G's ESG documents suggests that the company's disclosure strategy on its website reflects a lack of transparency, as the information provided does not adhere to any recognized reporting framework, particularly the GRI standards. Similarly, in the case of Metersbonwe, the complete absence of retrievable data on environmental practices highlights a clear deficiency in transparency and traceability. By contrast, GAP and Calvin Klein, which incorporate GRI standards into their reports, demonstrate higher levels of transparency and traceability, thereby lending greater credibility and reliability to the information disclosed—an approach consistent with prior findings (Adams, 2004; Ruiz-Blanco et al., 2022). Versace represents a different case: although its first sustainability report was published in 2020, it did not follow GRI standards. Consequently, the risk of greenwashing is relatively high, as, consistent with the view expressed by Greenpeace GMDC, the report lacks transparency and traceability in environmental and supply chain disclosures in line with established standards.

In the following two sections, two propositions (P4 and P5) are developed concerning the risk of greenwashing in relation to SR and environmental commitment. This risk is examined in connection with the communication strategies adopted by NGOs and the type of relationship established during the campaign. In doing so, the analysis addresses the fourt research question (RQ4), which explores how NGO communication strategies influence companies' participation in the campaign and may, unintentionally, foster false or superficial commitments (Proposition P4). Furthermore, it addresses the fifth research question (RQ5), which investigates how a persistent conflictual NGO–corporate relationship can increase the likelihood of greenwashing practices by companies (Proposition P5).

3.4.3.2. Content analysis on the risk of greenwashing

When asked about possible greenwashing practices adopted by companies during the Detox campaign, Greenpeace GMDC said: *"*[…] *The demands of the Detox campaign, especially in the early years, were really challenging for companies: production of disclosure reports as well as case studies on the replacement of hazardous chemicals. Once a company started a negotiation with us on the level of ambition of their commitment, and we got into the technical and scientific merits of the measures to be taken in order to implement change, for them it meant accepting a challenge"* (Greenpeace GMDC).

In the first phase of the campaign (2011–2016), Greenpeace strategically framed its demand for the elimination of hazardous chemicals as a competitive contest within the fashion industry, effectively positioning companies against one another in a race to meet this objective. To amplify this framing, Greenpeace employed metaphors drawn from sport and fashion—labelling compliant companies as “winners” or “vanguard,” and resistant firms as “losers.” Given their reliance on consumer perceptions, these companies were highly sensitive to reputational pressures. Greenpeace’s labeling mechanism thus aimed to shape public opinion and directly influence firms’ legitimacy. As a result, and consistent with Stakeholder Theory, 19 out of 24 companies ultimately committed to Greenpeace’s request.

On the one hand, the choice of launching a competitive challenge has had excellent results in terms of the participation rate in the campaign. On the other hand, classifying and assigning each company to one of the four categories (from "Avant-guard" to "Toxic addicted") based on the obtained results, put substantial pressure on the participating companies, especially those starting from a disadvantaged position (e.g., initially lower environmental performance). As such, these companies may have been more inclined to adopt greenwashing practices to fulfil the stakeholder’s requests. This is the case of Adidas, Puma, Nike, and Li Ning, which countered Greenpeace's call for eliminating dangerous chemicals from their supply chains by redefining the NGO's goal as a complex and slow process that requires cooperation. Greenpeace denounced these companies for greenwashing and stalling and undertook continuous non-violent actions by NGO activists (see **Table 14**) until the companies, feeling threatened by potential loss of reputation, decided to participate effectively in the campaign. Accordingly, we formulate the following proposition:

P4. *More pressure by an NGO in early stages of its campaign is more likely to prompt immediate companies’ commitment, but also a higher risk of greenwashing.*

Greenwashers often employ multiple strategies simultaneously, designing communication tactics aimed at maximizing rewards from stakeholders while minimizing potential punishments. The case of H&M exemplifies the dynamic nature of greenwashing, as described by (Montgomery et al., 2023) in their “Model of Corporate Miscommunication”. Specifically, the so-called "Greenwashing 2.0" phase emphasizes the importance of considering the social network within which a firm's stakeholders operate. Greenwashers often employ multiple strategies simultaneously, designing communication tactics aimed at maximizing rewards from stakeholders while minimizing potential punishments. H&M's behavior illustrates this concept. On the one

hand, H&M proved very attentive and involved in the campaign organized by Greenpeace avoiding greenwashing practices. *"*[…] *The relationship over the years has been very positive and fruitful. They have set up a very efficient traceability system, they have demanded and obtained good levels of transparency from their suppliers, they have on the whole, always respected the deadlines for the elimination of hazardous chemicals."* (Greenpeace GMDC). On the other hand, in the same years, H&M practiced greenwashing concerning the advertising campaign "*There are no rules in fashion except one: recycle your clothes*" promoted by the company itself, on which Greenpeace lashed out forcefully, as witnessed by the GMDC: *" [...] we have been very critical about their business model which in our opinion is predatory towards the planet's limited resources. We have been very critical of their conscious line, especially, regard their take-back system for used clothes for recycling. When Greenpeace pointed out to H&M the need to reduce the disproportionate use of resources, the company responded with solemn promises, adding that technical innovations would soon enable true circularity of clothing. It sounded like an extraordinary and pioneering effort for the entire industry, yet through an investigation, some Danish journalists discovered that H&M even delivers new clothes to incinerators."* As documented by the Danish television, only in Denmark the fast-fashion giant has been dumping 12 tons of textile waste into the Roskilde incinerator every year since 2013 (Hinchcliffe, 2017). *"Should we therefore expect our old T-shirts, which we bring back to H&M shops, to end up the same way?"* (Greenpeace GMDC). This evidence suggests that a firm's commitment to specific environmental issues does not necessarily extend to other areas that are not under the direct scrutiny of NGOs or other stakeholders. Companies may strategically obtain favorable results on issues evaluated by intermediaries, such as Greenpeace in the case of the Detox campaign, while simultaneously greenwashing on other issues that are not currently under the lens of key stakeholders. This naturally poses a challenge for stakeholders (e.g., the government, the media, certifying bodies, and rating agencies) on how to coordinate their efforts and ensure that firms' commitment for environmental improvement is real along multiple directions.

3.4.3.3. Everlasting conflictual NGO-corporate relationship

Lastly, attention is given to the transparency and traceability of environmental information disclosed by brands that maintained an enduring conflictual relationship with Greenpeace due to their decision not to join the campaign. For clarity, they were subject to heavy activism by Greenpeace but never declared their commitment.

Regarding this category of brands, the GMDC said: *"So, many companies ignored us [...]. We like to think that they have lost favor in the eyes of consumers, who trust in our organization's ratings and doubt or distrust their greenwashing advertising messages."* Based on evaluation criteria considering the presence of specific GRI standards, three out of five companies—D&G, Versace, and Metersbonwe—did not provide transparent environmental information regarding their supply chains. The GMDC also expressed general skepticism regarding the credibility of sustainability reports from companies that refuse to meet fundamental requirements such as transparency and traceability, as expected by Greenpeace. Conflictual NGO–corporate relationships heighten the salience of non-market drivers of greenwashing, particularly the influence of NGOs and activists, creating conditions conducive to greenwashing practices (Delmas and Burbano, 2011). Firms heavily criticized for lack of transparency may respond by misrepresenting positive information in their sustainability reports, aiming to counteract negative perceptions among consumers and investors and quickly restore legitimacy. Such reactive corporate behavior elevates the risk of greenwashing, particularly in environmentally sensitive or polluting sectors such as the textile industry (Cho and Patten, 2007). Therefore, the authors of this study believe that there is a correlation between the everlasting conflicting nature of the NGO-corporate relationship and the lack of transparency by brands that have never worked towards achieving campaign goals. Accordingly, the fifth proposition is formulated as follows:

P5. *Everlasting conflictual NGO-corporate relationship raises the likelihood that companies not declaring their commitment to achieving certain environmental goals engage in greenwashing practices.*

3.5 Research Stream 2: THEORETICAL CONTRIBUTIONS AND MANAGERIAL IMPLICATIONS

The theoretical contribution of this research is twofold. First, the findings substantially extend Stakeholder Theory and its application to ED. Previous studies (e.g., Amran et al., 2014; Eesley and Lenox, 2006) have shown that environmental NGOs with higher levels of power and legitimacy are more likely to induce targeted companies to respond positively to requests for greater transparency in ED. This study adds to this perspective by introducing the concept that the type of relationship established between a company and a key stakeholder (NGOs) significantly shapes the trajectory of ED quality over time. In this regard, the results also advance the existing literature on the different roles, relationship types, and strategies adopted by NGOs and

their impact on companies (e.g., Kourula and Laasonen, 2010; Rivera-Santos and Rufín, 2010). Specifically, when the NGO–corporate relationship is conflictual, companies tend to achieve higher ED quality in the short and intermediate term. Conversely, more collaborative (dialogue-based) relationships result in initially lower ED quality. In line with Stakeholder Theory, companies under the pressure of NGO activism may perceive the urgency to publicize environmental achievements by promptly releasing higher-quality reports. By contrast, collaborative relationships may reduce the perceived urgency, as companies prioritize following the roadmap agreed with NGOs to improve environmental performance. In the long run, however, the type of relationship does not appear to yield differences in ED quality, as most companies tend to converge toward a medium level of ED. This supports the argument that companies ultimately make efforts primarily to comply with prevailing regulations and norms.

Second, this study enriches the literature on the drivers influencing the risk of greenwashing (e.g., Montgomery et al., 2023; Ruiz-Blanco et al., 2022; Schons and Steinmeier, 2016), which constitute the focus of the fourth and fifth research questions of this thesis. The findings indicate that visual rhetoric and social activism are effective communication strategies for NGOs to pressure companies and encourage active participation in campaigns for environmental improvement. However, excessive pressure—for instance, the presence of a competitive challenge imposed by NGOs on companies willing to collaborate—may have unintended consequences. While such pressure promotes company participation in campaigns, it can also lead to greenwashing practices, particularly among initially weaker performers. Moreover, the results further support Montgomery et al.'s (2023) claim that firms strategically design communication tactics to maximize positive responses from stakeholders while minimizing negative repercussions. The H&M case analyzed in this study illustrates this dynamic. The company pursued genuine environmental improvements in areas subject to intense scrutiny (e.g., the Greenpeace Detox campaign) while simultaneously engaging in greenwashing in other areas (e.g., recycling claims). This example underscores the importance of considering the social networks within which a firm's stakeholders operate, as highlighted in the "Greenwashing 2.0" phase by Montgomery et al., (2023). It demonstrates how companies can strategically manage their environmental reputation by selectively addressing issues under direct scrutiny from influential intermediaries (such as Greenpeace) while potentially downplaying or misrepresenting other environmental concerns. Additionally, the study highlights that the risk of greenwashing is substantial, particularly for companies that do not declare their commitment to

achieving specific environmental goals and, as a result, maintain a perpetually conflictual relationship with NGOs.

Finally, from a managerial perspective, several implications emerge. If NGOs aim to enhance corporate engagement in a campaign—particularly in terms of short- to medium-term responses—they should adopt appropriate forms of activism and implement them in a systematic manner. In the long run, however, two parallel actions are recommended. First, NGOs should directly address companies by emphasizing the economic benefits of pursuing sustainability goals and encouraging them to move beyond the medium standards achieved merely to comply with existing norms. Second, NGOs should appeal to governments to establish more stringent regulations, as most firms tend to comply only with the minimum requirements imposed by laws and standards.

To mitigate the risk of companies engaging in "double-crossing"—that is, performing well on issues under direct NGO scrutiny while simultaneously engaging in greenwashing on less visible matters—NGOs and other intermediaries (such as governments, the media, certifying bodies, and rating agencies) should design more sophisticated campaigns. These campaigns should encourage companies to improve their environmental performance in a holistic manner rather than focusing solely on selected issues. For example, fostering transparent communication across all stakeholder groups can help reduce the likelihood of greenwashing, as firms will find it more difficult to provide conflicting messages to different audiences.

Furthermore, NGOs should take into account the initial differences in environmental performance among companies participating in a campaign. Excessive pressure through competitive challenges may inadvertently lead to the adoption of greenwashing practices, especially among weaker performers. At the same time, companies that refuse to join an NGO campaign for environmental improvement may face skepticism. Rather than engaging in greenwashing and risking reputational damage, such companies could enhance their credibility by openly acknowledging possible disagreements on specific issues (e.g., timetable or targets). Transparency in communicating these divergences may strengthen trust among the broader public.

To the best of the authors' knowledge, this study represents the first attempt to examine how the type of NGO–corporate relationship may influence corporate environmental disclosure and the associated risk of greenwashing. Several limitations should be acknowledged, which also provide opportunities for future research. First, future studies are encouraged to broaden the theoretical perspectives applied to

environmental disclosure. The propositions developed in this study can serve as a foundation for further theory development, hypothesis formulation, and empirical testing. Second, as the analysis focuses on a single industry, additional research is needed to assess whether these findings generalize to other sectors. Third, the data are limited to the content of a single NGO campaign (Greenpeace Detox), companies' environmental reports, other secondary sources (e.g., corporate websites), and three interviews with the campaign's global manager. Future research could involve interviewing company representatives to gather insights directly from firms regarding their relationships with NGOs and the effects on environmental disclosure and greenwashing risk. Finally, although substantial efforts were made to account for the complexities of a multi-stakeholder perspective, subsequent studies should incorporate additional stakeholders, such as trade unions, industry associations, and regulatory agencies, beyond the traditional focus on NGOs, consumers, and investors.

3.5.1. From the Stakeholder Governance Relationships dimension (Chapter 3) to the Operational Coordination Among Multiple Stakeholders dimension (Chapter 4)

Chapter 3's analysis of NGO–corporate relationships sheds light on how external stakeholder pressure shapes corporate environmental disclosure trajectories. However, it remains unclear which organizational and inter-organizational mechanisms enable firms to translate disclosure intentions into standardized, verifiable, and comparable environmental information. Chapter 4 addresses the third dimension of the framework—*operational coordination among multiple stakeholders*—by investigating the challenges manufacturers face when developing EPDs in the European lighting sector. This study addresses research questions RQ6 and RQ7 of the thesis, through a multiple case study involving five manufacturers, two program operators, and two multi-stakeholder initiatives, examining how coordination among diverse actors shapes the production of credible product-level environmental data. The research reveals that even when firms are motivated to disclose (whether due to NGO pressure, regulatory requirements, or market incentives identified in previously chapters), substantial organizational and inter-organizational barriers hinder their ability to translate disclosure intentions into standardized and quantitative environmental information. Specifically, challenges in collecting data from internal departments and external suppliers, fragmentation in standardization efforts arising from conflicting multi-stakeholder initiatives, inadequate infrastructure among independent third-party verification bodies, all generate bottlenecks that undermine the comparability and

digital usability of EPDs. These findings highlight that environmental transparency cannot be achieved solely through effective communication strategies (Study 1) or through governance relationships that incentivize disclosure (Study 2). Instead, transparency requires robust institutional coordination mechanisms that pool resources, align incentives, and build collective capabilities across the stakeholder ecosystem. In the absence of such coordination, the scope and quality of environmental disclosure remain limited, and paradoxically, even well-intentioned disclosure efforts risk failing to meet standardization requirements—thereby reducing their comparability, credibility, and usefulness for external stakeholders.

Chapter 4

RESEARCH STREAM 3: "Environmental Product Declarations: Challenges and Opportunities in the European Lighting Sector"

4.1 INTRODUCTION

Market demands for disclosing a product's cradle-to-grave environmental impact are rapidly growing (Lewis et al., 2021). However, there is skepticism among users given the proliferation of product claims such as "green" and "environmentally friendly," underscoring the need for more comparable, verifiable data on product environmental impacts (Szabo and Webster, 2021). Starting in 2026/2027, the Green Claims Directive makes it mandatory for firms operating in the European Union (EU) to substantiate specific environmental claims with quantitative evidence (EU Council, 2024; Lighting Europe, 2024). This directive not only aims to strengthen consumer protection against misleading claims but also seeks to improve the harmonization of environmental labeling schemes and environmental claims within the EU market. As a result, some manufacturers have recently opted to develop environmental product declarations (EPDs) with most facing major challenges. For instance, Stoane Lighting has been on a 2-year journey to build in-house capability a publish its first EPDs, even though it is one of the pioneering lighting manufacturers investing resources in EPD creation (Arc-Mondo Magazine, 2024). EPDs are standardized and independently verified labels (ISO 14025, 2006) that provide quantified environmental information based on a product's life cycle. EPDs are recognized as reliable declarations that provide trustworthy information, enabling informed purchasing decisions and contributing points toward major green building certification systems, such as LEED or BREEAM, which already include EPDs as part of their sustainability requirements (LEED, 2024). Despite the increasing market demand for EPDs, their growth remains still slow especially in the lighting industry (OneClick LCA, 2024).

Past studies have found two major challenges for manufacturers during EPD development. First, there are significant technical difficulties associated with data collection. There is limited availability of high-quality secondary data, which is especially pronounced for materials such as cement and wood products (AzariJafari et al., 2021). Also, commercial databases offer data on construction materials (e.g., aluminum, copper, and steel) at varying levels of granularity, ranging from specific product data to more generic industry averages. This variability complicates the integration and comparison of data (Goglio et al., 2020; Lasvaux et al., 2015),

compromising EPD's quality. Second, the involvement of multiple stakeholders further complicates the EPD development process. For instance, program operators (POs) are responsible for developing product category rules (PCRs) and product specific rules (PSRs) in collaboration with manufacturers and multi-stakeholder groups. However, the absence of international standardization or regulation has resulted in the proliferation of rules issued by multiple POs, leading to many inconsistencies and a lack of comparability in EPDs. As a result, the comparison of two similar products using their EPDs is challenging because each EPD was developed according to different rules and assumptions. These two challenges were investigated in the construction sector where the EPD market is more mature (Gelowitz and McArthur, 2018; Ibáñez-Forés et al., 2016; Olanrewaju et al., 2024).

Most research on operations management has focused on transparency at the organizational or inter-organizational levels (Schnackenberg and Tomlinson, 2016). A few studies have begun to address the complexities of product-level transparency, often focusing on eco-labels and their influence on consumer purchasing decisions (e.g., Darnall et al., 2018; Gosselt et al., 2019). This study adds to this research stream by focusing on EPDs, a type of environmental label used in business-to-business contexts (i.e., a contractor and a manufacturer). It investigates the challenges that manufacturers face during EPD development in light of the rapidly growing EPD demand. In particular, the study explores the unique dynamics among the various actors within the EPD ecosystem, which have been largely overlooked. This lack of knowledge raises two research questions:

RQ (6): *What are the challenges in developing EPDs and how manufacturers manage them?*

RQ (7): *How does coordination between manufacturers and external stakeholders (e.g., program operators, multistakeholder groups, and databases providers) facilitate the management of and streamline the EPD process?*

We used a grounded research methodology to investigate these two research questions given the limited knowledge about managing information flows both within and beyond organizational boundaries for EPD development. We used the systematic three-step approach from Gioia et al., (2013) to ensure rigor in both the design and implementation of our study. We conducted a multiple case study with five manufacturers; two program operators; two multi-stakeholder initiatives (MSIs), such as Lighting Europe (LE) and the Green Light Alliance (GLA); and one database and software provider. To triangulate our data, we also use secondary data (e.g., industry

reports, news articles, and EPD reports) and leveraged our observations as an active LE member. We adopt the information processing theory given the extensive product lifecycle data required for EPD development and draw on MSI research given industry-wide collaborations needed for EPD development.

Our focus is on the European lighting industry for several reasons. First, Europe is widely recognized as a pioneer in environmental policy, actively enforcing stringent environmental regulations. Beginning in 2027, the European Union (EU) will implement a new regulation requiring for a wide range of products sold in the EU to feature a Digital Product Passport (DPP) (EU News, 2024). The DPP offers a streamlined, digital method for documenting a product's entire life cycle by providing detailed information about its origin, materials, environmental impact, and disposal recommendations (Forbes, 2025). EPDs would serve as the basis for developing such DPPs because manufacturers can readily gather and process most environmental information needed. Second, lighting powered by electricity accounts for 15–19% of global energy consumption and 5% of global CO2 emissions (UN Environment Programme, 2017). Some leading European lighting manufacturers have substantially invested in transitioning to energy-efficient LED technologies to reduce electricity usage. They are now investing in EPDs to communicate environmental product performance in response to customer demands and EU regulations. Third, by focusing on a single sector and region, we control for confounding factors (e.g., economic conditions and regulations) that could affect our results.

Our study aims to make several contributions. OM Studies have focused on environmental transparency at either corporate or supply chain level, overlooking the dynamics of environmental transparency at the product level. We aim to provide some initial insights on explain the challenges and opportunities to streamline the development of EPDs—a relatively new environmental label with a high increasing demand in the EU market. First, we contribute to the early research on EPDs that has been conducted mainly in the construction sector and focused mainly on improving efficiencies in the technical aspects of EPDs. Using the lighting sector, we not only confirm some similar challenges between sectors when manufacturers face in collecting secondary data (e.g., data paucity and inconsistency) (AzariJafari et al., 2021; Goglio et al., 2020; Lasvaux et al., 2015) but also reveal the significant difficulties in gathering data internally (e.g., from R&D, business units, procurement, and sustainability) and from suppliers (who often lack knowledge about EPDs). By including the perspectives of multiple actors within the EPD ecosystem, our research provides a grounded

theoretical that explains the enablers and obstacles of this process.

Our research also contributes to the stream of literature on MSIs by elucidating their functions in the EPD context and explaining how power differences shape MSIs and affect their efficacy in driving field-level change (Arenas *et al.*, 2020a; Gray *et al.*, 2022; Hehenberger *et al.*, 2019). Our findings show that the two MSIs—LE and GLA—pursue EPD harmonization and standardization. However, conflicts persist within and between these MSIs. These tensions stem from limited stakeholders' inclusion and misaligned business interests (e.g., POs prioritizing their business over sector-wide EPD harmonization). Interestingly, we found that the two MSIs are working in silos despite sharing common goals.

4.2 THEORETICAL FRAMEWORK

Transparency is now crucial for business because it allows them to build trust with stakeholders (Schnackenberg and Tomlinson, 2016). The literature suggests key internal drivers that foster transparency, such as governance structures (Ben-Amar and McIlkenny, 2015), CEO characteristics (Lewis et al., 2014), and corporate culture (Stubbs et al., 2013). External forces, such as customer and investor demands, also play a critical role (e.g., (Fernandez-Feijoo et al., 2014; Gibson, 2012; Jira and Toffel, 2013; Okhmatovskiy and David, 2012). For example, Prado-Lorenzo et al., (2009) investigate how shareholder power, particularly from governments and creditors, affect sustainability reporting. Villena and Dhanorkar, (2020) explore how coercive, mimetic, and normative institutional pressures, along with managerial incentives, influence supplier carbon transparency in global supply chains. However, there is some evidence that such external pressures may also lead firms to engage in greenwashing practices, as some firms seek to comply with institutional demands symbolically (Montgomery et al., 2023). For instance, they may rely on practices like carbon offsetting and carbon credits which allow companies to purchase credits—certificates representing avoided or reduced emissions elsewhere—rather than reduce their own emissions (Roemer et al., 2023).

Despite these significant contributions, a notable gap remains in the literature concerning the transparency of environmental information at the product level. Consider eco-labels, which emerged as a way to share information with customers: Eco-labels have been studied primarily for their influence on consumer purchasing decisions, especially when trust and credibility are established (Darnall et al., 2018; Gosselt et al., 2019). Eco-labels are generally more trusted by consumers, experts, and the media

when they are verified by a third party—especially when the certifying body is a public authority (Castka and Corbett, 2016; Darnall et al., 2018; Gosselt et al., 2019). However, as De Chiara, (2016) points out, eco-labels are truly effective when they are supported by a robust and credible sustainability strategy—one that clearly demonstrates reduced environmental impact and aligns with the core principles of sustainability. In reality, a gap often exists between environmental certification and actual sustainability performance, which risks undermining consumer trust and weakening the opportunity to build a strong, credible brand (De Chiara, 2016).

There are two types of eco-labels in the business-to-customer market: (1) Type I, which are verified third-party labels (ISO14024, 2018) and (2) Type II, which are uncertified internal labels placed on the product by the manufacturer (ISO14021, 2016). Also, there is a Type III of eco-labels, also known as environmental product declaration (EPD), which is commonly used in the business-to-business market (ISO 14025, 2006). Our focus is on EPDs, which provide quantitative, third-party-verified environmental information about a product's life-cycle impact. Several industries use EPDs as a voluntary tool to communicate product environmental performance in response to the regulatory gaps surrounding product environmental labeling (Ibáñez-Forés et al., 2016). EPDs are now gaining traction, particularly in regions with carbon reduction policies, such as the European Union and United States (e.g., California, Colorado, and Oregon), which mandate EPDs for construction products (Lewis, et al., 2023). EPDs require manufacturers to integrate diverse product-specific data from both internal and external stakeholders, while adhering to relevant industry-level guidelines and standards.

We will rely on information processing theory (IPT) because of the extensive product and process life-cycle information required for EPD development and the research stream on multi-stakeholder initiatives (MSIs) because EPD development require of industry-wide efforts.

4.2.1 Information processing theory (IPT)

To develop EPDs, manufacturers must process a substantial volume and variety of information at the product and process level. This view is in line with IPT, which identifies information processing as a critical mechanism through which organizations interact with their environment (Tushman and Nadler, 1978). Herein, information processing begins with the identification of a need, typically triggered by an emerging problem, uncertainty, ambiguity, or an impending decision (Choo, 2002). Firms then engage in information acquisition, collecting data from relevant internal and external

stakeholders (Frishammar and Åke Hörte, 2005). This is followed by interpretation, where the gathered data is analyzed to extract meaning (Huber, 1991), and transmission, in which the interpreted information is shared with relevant users (Frishammar and Åke Hörte, 2005; Huber, 1991). Once processed, information is stored for future reference, with the storage duration varying depending on whether the data is immediately actionable (Choo, 2002). The final steps involve information retrieval and utilization, wherein stored data is accessed and applied to inform decision-making (Moorman, 1995). This process may result in actual or potential changes in organizational activities (Huber, 1991).

In adopting IPT theory, we are interested in how manufacturers orchestrate their own and others' knowledge to collect the needed environmental information of their products. Research on EPDs have mainly focused on construction products and revealed significant challenges in data collection. One key issue is the scarcity of high-quality secondary data, especially for products such as cement, concrete and wood (AzariJafari et al., 2021). In addition, commercial databases often provide data for construction materials (e.g., aluminum, copper, glass) at different levels of granularity which complicates the process of integrating and comparing data in the construction sector (Goglio et al., 2020; Lasvaux et al., 2015). Another critical barrier is to compare the environmental performance of two similar products based on the information provided in their EPDs—a problem observed in the construction, food and beverage, and building machinery sectors (Gelowitz and McArthur, 2018; Ibáñez-Forés et al., 2016). Herein, the lack of international standardization has led to the proliferation of Product Category Rules (PCRs) published by different program operators, resulting in multiple inconsistencies (Ibáñez-Forés et al., 2016; Olanrewaju et al., 2024). Additionally, there are difficulties faced by non-experts (e.g., designers) in interpreting EPDs due to highly technical information provided (Gelowitz and McArthur, 2018; Ibáñez-Forés et al., 2016). We use the IPT lens to explain such challenges given that they are related to information acquisition, interpretation, and dissemination of comparable EPDs.

There are also key external stakeholders involved in EPD development (e.g., program operators and industry associations), and they too aim for effective information processing, especially when working within an industry group. Specifically, conflicts of interest and uneven levels of stakeholder engagement could make reaching common ground particularly challenging, demanding strong capabilities in both information gathering/processing and stakeholder coordination. Thus, we use the growing research stream on MSIs to identify the associated challenges in greater detail in the following

section.

4.2.2 Multi-stakeholder initiatives (MSIs)

Multi-stakeholder initiatives have emerged as central components of new governance frameworks developed to address urgent and global sustainability challenges (Zeyen et al., 2016). When state governance is either absent or insufficient, MSIs offer alternative forms of collective self-regulation, enabling effective governance to provide adequate regulation at national or global levels (Matten and Crane, 2005). The literature suggests four roles of MSIs in the context of corporate social responsibility: (1) "providing learning platforms," (2) "developing behavioral standards," (3) "establishing mechanisms for auditing and compliance," and (4) "issuing labels and certifications." MSIs may focus on addressing a single role or a combination of them (Scherer and Palazzo, 2011; Searcy, 2017). MSIs *can serve as learning platforms* that link supply chains to their broader sustainability context (Searcy, 2017). They identify key sustainability issues, raise awareness, and foster collaboration among stakeholders (Brown and Timmer, 2006). For instance, the United Nations Global Compact (UNGC) is widely recognized as an effective learning platform. It engages in a diverse set of stakeholders, including companies, governments, NGOs, and trade unions. It provides a wealth of resources and best practices through its sustainable supply chains website (Mena and Palazzo, 2012).

MSIs *can also develop and set standards* for an industry or broader markets (Zeyen et al., 2016). These initiatives often emerge as public–private or private–private partnerships and offer frameworks to address broader sustainability challenges (Mena and Palazzo, 2012). For instance, the Global Reporting Initiative (GRI) (Global Reporting Initiative, 2024) serves as a prominent MSI, engaging diverse stakeholders, including corporations, governments, NGOs, and academia, in its governance process (Mena and Palazzo, 2012; Searcy, 2017). The GRI standard is widely recognized as the leading global framework for sustainability reporting (Gualandris et al., 2015; Irwin and Schaltegger, 2016). The Science Based Targets Initiative (SBTi)—a collaborative effort among CDP, UN Global Compact, WWF, and the World Resources Institute in partnership with the We Mean Business coalition (Searcy, 2017)—is another example. The SBTi aims to enhance corporate ambition on climate action by redefining the approach to setting greenhouse gas (GHG) emissions reduction targets (SBTi, 2024). Participating companies are required to sign a formal commitment letter, pledging to develop science-based emissions reduction targets within 24 months (SBTi, 2024).

SBTi provides clear guidelines, tools, and methodologies, enabling firms to set science-based targets and measure progress consistently and comparably across them.

MSIs *can play a key role in establishing mechanisms* to verify adherence to their requirements (Searcy, 2017). Auditing is already a well-recognized practice for ensuring adherence to standards. For instance, management systems standards such as ISO 14001 include clauses mandating periodic internal audits (Wilhelm and Villena, 2021). The enforcement mechanisms of the SA8000 standard go beyond those of ISO standards. SA8000 requires a "Social Performance Team" (SPT) with a "balanced representation" of management and worker representatives (Searcy, 2017). The SPT is responsible for monitoring compliance with SA8000 requirements (SA8000, 2024).

MSIs *can establish criteria for labels, certifications, and/or ratings* (Searcy, 2017). For instance, eco-labels are widely acknowledged as an effective marketing tool for signaling superior environmental product characteristics (Agatz et al., 2021; Chen and Chang, 2013; Nyilasy et al., 2014). Various stakeholder groups have created organizations to issue ethical and eco-labels, with Fairtrade International being one of the most prominent and globally recognized ethical labels (Fairtrade Foundation, 2021). A noteworthy example is the Forest Stewardship Council (FSC), an innovative multi-stakeholder initiative providing voluntary, third-party certification. The FSC unites environmentalists, social activists, and private sector actors in forest management and the wood products industry (Gualandris et al., 2015).

A key theme in this research stream is that stakeholders must perceive MSIs to have both input and output legitimacy (e.g., Bäckstrand, 2006; Mena and Palazzo, 2012). Input legitimacy is determined by several factors: (1) the extent to which critical stakeholders are included, (2) the fairness of decision-making processes, (3) the promotion of a consensus orientation, and (4) the transparency of MSIs' structures and procedures. Output legitimacy, on the other hand, is shaped by (1) the broad stakeholder coverage of MSIs' initiatives, (2) their effectiveness in achieving goals, and (3) the reliability of their enforcement and monitoring mechanisms. If an MSI fails to meet expectations in either input or output legitimacy, its overall credibility and effectiveness could be significantly compromised. Managing an MSI has some challenges, particularly those related to coordination among participants (e.g., Arenas et al., 2020; George et al., 2024; Grimm and Reinecke, 2024). It arises from failure to integrate diverse perspectives and goals due to diversity in information and communication gaps among actors (Gray and Purdy, 2018; Gulati et al., 2012). Additionally, MSIs are an arena where conflict or tensions may emerge as members are required to adapt to new

roles and forms of interaction, such as shifting from competition to cooperation or from shaming to collaborating. Moreover, where diverse stakeholders must agree on a shared definition of the problem that the MSI intends to address, effective conflict management is essential. Without it, stakeholders may engage in strategic behavior, attempting to influence the problem definition to serve their interests (Roloff, 2008).

Both theories are the foundation of this study. However, disclosing the environmental impact of products through EPDs is a very new phenomenon. Customers are increasingly demanding it. Albeit positive, this new demand has created business opportunities for a set of stakeholders (e.g., POs, verifiers, database providers) who seek their self-interest and, thus, could compromise the comparability of EPDs in the long run. Manufacturers have started working together to create a set of PCRs that harmonize the rules. To learn about the EPD ecosystem and how power asymmetries emerged, we use a research methodology that provides a rich understanding of this new phenomenon.

4.3 RESEARCH METHODOLOGY

The European lighting industry was selected for this study for several reasons. Europe is widely recognized as a pioneer in environmental policy, actively enforcing stringent regulations and promoting the adoption of LCA methodologies (Financial Times, 2019). Lighting from electricity accounts for 15–19% of global energy consumption and 5% of global CO_2 emissions (UN Environment Programme, 2017). Leading lighting manufacturers have made substantial investments in transitioning to energy-efficient LED technologies to reduce electricity consumption and are increasingly investing in EPDs to communicate product-level environmental performance in response to customer demands and EU regulations.

A qualitative case study approach was employed to investigate the challenges faced by manufacturers during the EPD process. This approach allows for an in-depth examination of complex real-world issues, providing richer insights across multiple stakeholders (Yin, 2009). Manufacturers were selected according to three criteria. First, they were chosen to represent varying levels of experience with EPD development: three manufacturers had published verified EPDs, while the other two had completed LCA studies and were preparing to publish their first EPDs. Second, manufacturers were required to be members of Lighting Europe, ensuring adherence to a similar approach in EPD development. Third, manufacturers were selected to ensure geographic diversity across multiple EU countries. The five participants are located in Germany, Italy, the U.K., and the Netherlands.

To complement manufacturers' perspectives, two major MSIs were included. LE comprises the major global lighting manufacturers (Lighting Europe, 2024) and promotes trade practices and regulatory frameworks that foster innovation and fair competition. All five participating manufacturers are members of LE's EPD task force and have participated in PSR development efforts for luminaires and control gears.

The second MSI is the Green Light Alliance (referred to hereafter as GLA)—an alliance of lighting designers and manufacturers to facilitate knowledge sharing and address critical issues surrounding EPD development (GreenLight Alliance, 2024). Unlike LE, GLA is mainly driven by designers—one of the major EPD users—who have struggled to interpret and use EPDs. Participation in both MSIs and adherence to their rules are entirely voluntary. Two manufacturers participate in both, LE and GLA, while the other three participate only with LE.

To have a good understanding of the lighting ecosystem POs were also targeted. POs play a critical role during the EPD process because they oversee the verification process, offering a list of independent verifiers to companies, and ensuring the credibility and accuracy of the data. Additionally, they provide technical support to companies during the creation of PCRs and PSRs, promote the program to relevant stakeholders, and maintain a central database where verified EPDs are made publicly accessible. Given that the manufacturers considered in the sample have already chosen their POs, the researchers reached out to them. Both the two POs (PEP Ecopassport and IBU), with which the manufacturers have published EPDs, accepted the invitation. Both have already published PSR for luminaires (Global Lighting Association, 2024). Interviewing multiple stakeholders enabled insights into both manufacturers' internal capabilities and their interactions with external stakeholders. To complete the lighting ecosystem, a few software and database providers were invited who offer commercial EPD software and proprietary databases. One Click LCA accepted the invitation. It is the most adopted provider among our manufacturers. This provider offers access to updated product- and component-level data across different industries. Additionally, its software helps manufacturers to calculate product environmental metrics by combining primary data (from suppliers) and secondary data (from databases).

Anonymity was offered to all participating manufacturers to facilitate open discussion, and an executive report summarizing the study's findings was provided as an incentive. Interviews were conducted during the 2024–2025 period. Secondary data, including published EPDs, industry reports, and association guidelines, were used to triangulate and validate interview data, increasing rigor in the qualitative research

design (Gioia et al., 2013). **Table 21** provides a summary of all participants. To maintain participant confidentiality, the study uses the following identifiers: lighting manufacturer is labeled "M," the program operator is labeled "PO", the software and database provider is labeled "SDP", and the two MSIs are labeled "LE" and "GLA."

Table 21. Description of Respondents

Label	Interviewee(s) Position	N. interviews	MSI membership PO relationship	Employees	Location	Verified EPDs
M1	EPD expert Standard and Regulation expert	2 1	LE member, GLA member, EPD with PO1	>31000	The Netherlands	1
M2	Sustainability and EPD expert R&D director Sustainability Procurement Officer	1 1 1	LE member, GLA member, EPD with PO2	20-40	UK	1
M3	EPD expert	1	LE member, EPD with PO2	>3000	Germany	34
M4	Standard and Regulation expert Sustainability Procurement Officer	2 1	LE member, M4 is working with PO1	>1700	Germany	0
M5	Sustainability expert Sustainability Procurement Officer	1 1	LE member, M5 is working with PO1	15-20	Italy	0
PO1	Head of Verification Body	2	NA	-	Europe	NA
PO2	Treasurer	2	NA	-	Europe	NA
SDP1	LCA & EPD Consultant	1	NA	70-80	International	NA
LE	Task Force Chair	1	NA	-	Europe	NA
GLA	Founder	3	NA	-	International	NA
Total number		**21**				**36**

Note: To maintain participant confidentiality, we use the following identifiers: lighting manufacturer is labeled "M," the program operator is labeled "PO," the two MSIs are labeled "LE" and "GLA," and the EPD software and database provider is labeled "SDP."

The literature review performed along with preliminary discussions with EPD experts helped to design interview protocols. Multiple protocols were used —each one tailored for each stakeholder group (see Appendix). The interviews followed a funnel approach, starting with general topics and progressing to more specific ones. The interviews were transcribed verbatim right after the interviews to ensure accuracy and completeness. Qualitative data analysis followed the systematic three-step approach to grounded theory (Gioia et al., 2013). First-order categories were identified based on patterns emerging from informants' perspectives, providing evidence of specific challenges in EPD development. These categories were then organized into second-order themes and further distilled into five theoretical dimensions. This process culminated in the creation of our data structure, which is the basis for the grounded model of this study.

To ensure credibility, both authors independently coded the interview data.

Discrepancies in coding and labeling were discussed until consensus was reached. The same approach was applied to second-order themes and dimensions, ensuring that findings reflected a shared understanding rather than the interpretation of a single analyst. The next section describes the EPD ecosystem in the lighting sector.

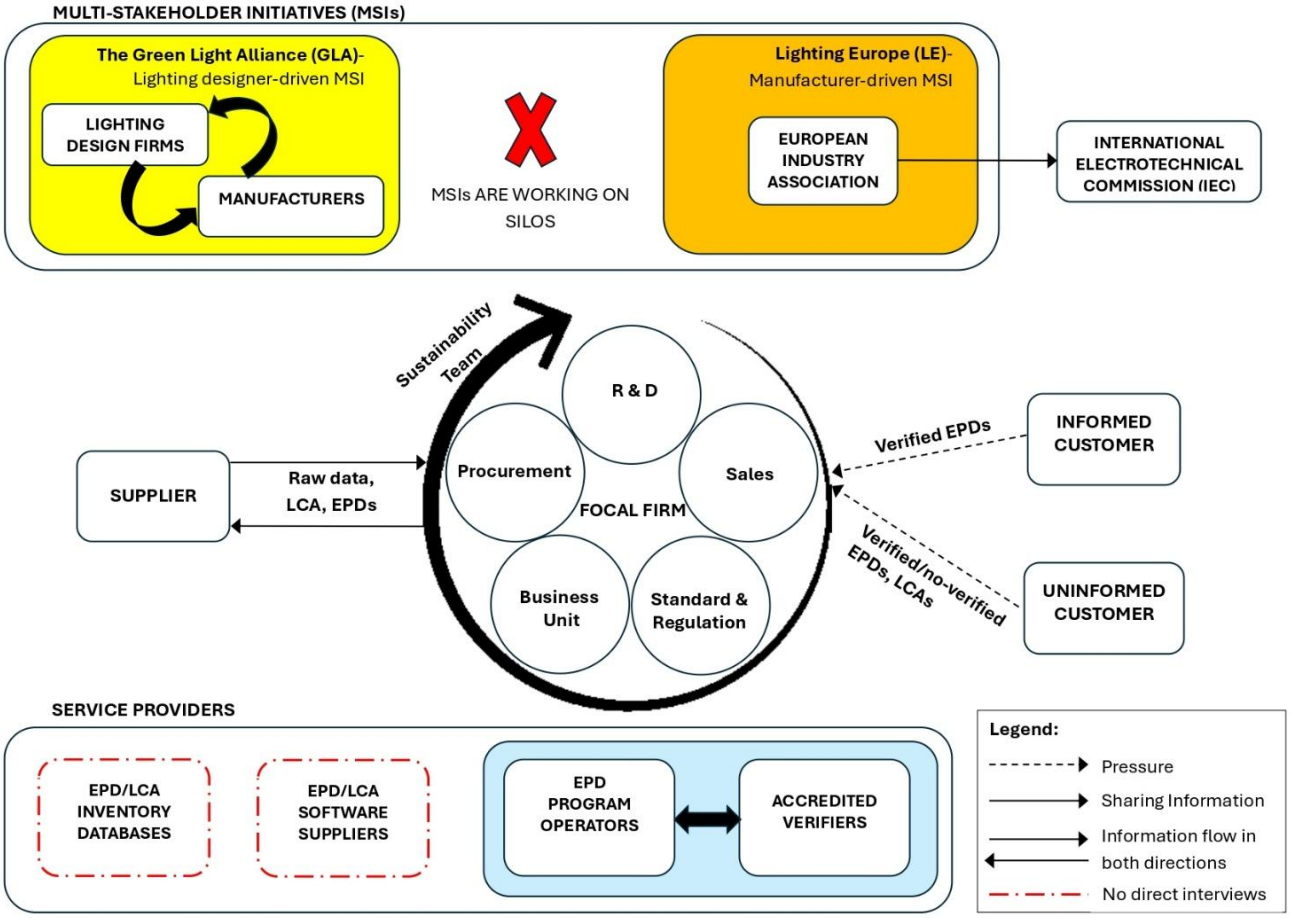
4.4 STUDY SETTING: THE LIGHTING INDUSTRY

4.4.1 The EPD generation process

Figure 3 illustrates the involvement of multiple stakeholders in the EPD development process. Manufacturers serve as the focal actors, as they are responsible for creating EPDs for their products to meet the requirements of different clients. Informed clients request verified EPDs, primarily using them to support purchasing decisions, whereas less informed clients may request LCAs or either verified or unverified EPDs, mainly to obtain data for accounting indirect emissions associated with purchased goods.

Two MSIs—Lighting Europe (LE) and the Green Light Alliance (GLA)—provide guidance throughout the EPD process. Program operators (POs) constitute another key stakeholder group, collaborating with a limited number of verifiers who are ultimately responsible for ensuring PCR/PSR compliance. Finally, support groups such as database and software providers assist manufacturers by supplementing data and streamlining the information processing required for EPD development. Two MSIs involved in EPD development were identified. The first, Lighting Europe (LE), is led by luminaire and lighting equipment manufacturers. LE has a broad mandate and comprises multiple working groups (e.g., sustainability, digital) to represent the lighting industry's interests in various regulatory and policy contexts. This study focuses specifically on LE's task force dedicated to EPDs. LE provides resources and guidelines to its members on conducting LCA studies and developing EPDs (Lighting Europe, 2024). It also organizes focus groups for manufacturers to exchange experiences in EPD development and hosts training webinars. Recently, the task force released a "technical memorandum" for control gear—a critical electronic component—which was shared with program operators for consultation and feedback (Lighting Europe, 2024). Furthermore, LE collaborates with the International Electrotechnical Commission (IEC) to establish clear, universally applicable standards. These efforts aim to ensure that EPDs are relevant and usable on a global scale, rather than restricted to specific regions or countries (Global Lighting Association, 2024).

Figure 3. Environmental Product Declaration Ecosystem for the European Lighting Sector

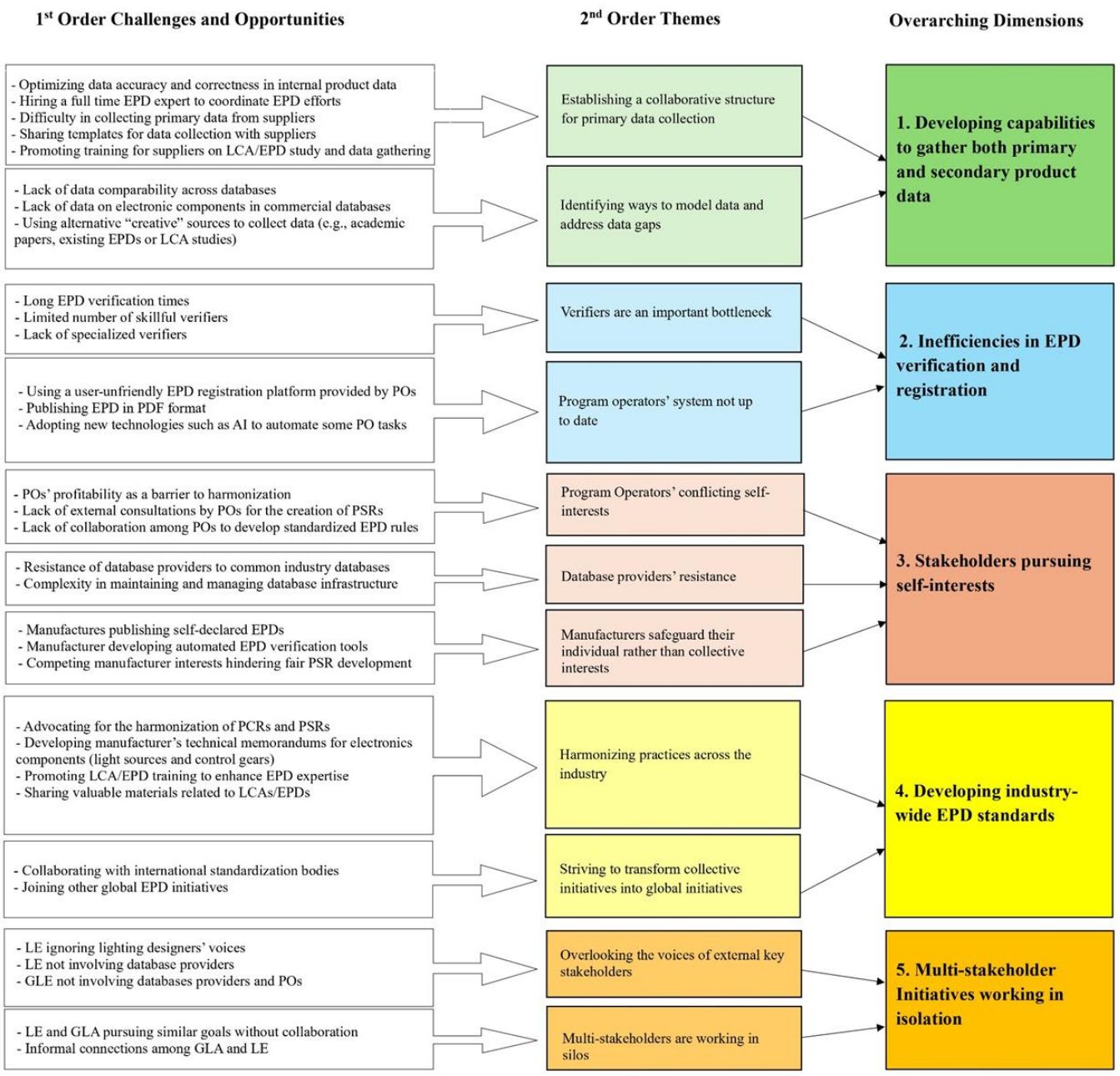


The second MSI is driven by lighting designers, who are key users of EPDs but are typically excluded from the PCR/PSR development process and lack representation within the manufacturer-led MSI. To address this gap, lighting designers, together with pioneering manufacturers, established the Green Light Alliance (GLA). This global network facilitates knowledge sharing related to LCAs and EPDs among professionals and advocates for greater harmonization across the industry. A notable initiative of GLA is the Lighting Life Cycle Assessment Incubator, a pilot program designed to create a collaborative global network between lighting designers and manufacturers. The incubator addresses LCA data gaps and methodological inconsistencies through an industry-led collective case study, involving 30 lighting manufacturers and 68 lighting design firms worldwide, thereby promoting transparency and cooperation toward globally harmonized standards (Shanker et al., 2024).

4.5 FINDINGS

Figure 4 displays the data structure, showing the emergent 1st-order categories (left) that generated the 2nd-order themes (center), which we distilled into five overarching dimensions (right). The findings are reported by each theoretical dimension.

Figure 4. Data structure



4.5.1. Developing capabilities to gather both primary and secondary data [dim.1 in Fig. 4]

4.5.1.1 Establishing a collaborative structure for primary data collection

The growing interest in EPDs has created a significant need for manufacturers to collect high-quality primary environmental data. By far, data collection is the most time-consuming phase of EPD development, especially for manufacturers engaging with this process for the first time. As the EPD expert for M3 noted, "*The data collection phase was the most demanding and time-consuming. Specific product-level data was never a focus for us. For example, detailed weight information for each component in the BOM [Bill of Materials] was neither used nor shared with customers because it wasn't deemed useful. When EPDs came into the picture, we realized that some component weights were obviously incorrect. . . . Correcting this data took considerable effort*."

Our five manufacturers made major organizational changes to improve data accuracy. Notably, each manufacturer hired or at least assigned a full-time person to coordinate this effort—often an EPD or a sustainability expert. This step allows them to more accurately communicate their products' environmental impact in their EPDs, differentiating themselves from competitors who rely more on secondary data—often based on industry averages data. Primary data collection is gathered both internally and externally. Internally, EPD experts coordinate closely with business units, R&D, standard and regulation, sustainability, and procurement. As the EPD expert for M1 shared, "*I would say huge cooperation among business units and the dedication of the EPD expert to bridge all internal stakeholders were critical."* High interaction among units is crucial to exchange the necessary information to develop an EPD. Therefore, a close internal cooperation is essential to manage the high complexity that an EPD requires, as another EPD expert said: "*So, I work very closely with many people located in different functions. For example, there is a colleague who provides the bill of materials and product drawings. Another colleague handles all product designs. Also, I communicate with the procurement department for suppliers, their locations, and all these things. I also work very closely with the workshop because we measure the electricity usage of each machine during production."*

Externally, procurement plays a critical role by collecting primary data from key suppliers. These data are converted into private data points for the manufacturer. As M4's Procurement Officer shared, *"We use a tool called BOM Check, which allows us to collect detailed information on the BOM of our suppliers' products, including the material breakdown that specifies the type and percentage of each material in every*

component, as well as the chemical composition." Additionally, procurement plays a significant role in verifying and correcting supplier data. However, our interviewees noted that only a handful of suppliers are capable of providing EPDs. As the EPD expert for M1 noted, "*We are starting to collect data from suppliers, meaning that where it is possible, we ask them to provide their LCA studies, their materials to convert into private data point. When suppliers have an EPD it's even better, but that is almost never the case*."

Given this situation, EPD experts along with their procurement counterparts have started to train suppliers on how to collect the data requested and develop an EPD or, at least, on how to conduct an LCA study. As one interviewee noted, "*We prepare data collection templates for suppliers to fill in. Explaining the type of data we need, such as recycled content percentage and certifications, is particularly challenging. Large suppliers, especially those familiar with the lighting industry, tend to understand our requirements better than smaller ones."* EPD experts also organize training webinars and courses to their suppliers as one interviewee noted, "*We provide training to new suppliers to ensure they understand our requirements. As part of this training, I guide them on how to deliver the necessary information accurately using the standard form we've designed. This form is uniform for all suppliers, and new suppliers simply need to be trained on its proper use*." The examples above illustrate manufacturer's efforts to enhance their information processing capacity by investing in lateral relations with their suppliers (Srinivasan and Swink, 2018). The remaining challenge lies in finding effective ways to motivate suppliers to develop their own EPDs. As mentioned earlier, knowledge-sharing in a buyer-supplier relationship can be a valuable approach, along with the right incentives to those suppliers who provide this valuable information (Villena *et al.*, 2021).

4.5.1.2 Identifying ways to model data and address data gaps

When primary data is unavailable, EPD experts switch to seek secondary data. Like others (AzariJafari et al., 2021; Goglio et al., 2020), we found that this practice is widely used among our manufacturers, particularly for raw materials. As the EPD expert at M2 explained, "*We also contacted some glass and aluminum suppliers to get data from them, but it wasn't always possible. So, we have sometimes to rely on secondary data."*

Relying on secondary data introduces critical challenges though. One major issue is the lack of compatibility among the various databases used, which severely limits the

comparability of EPDs. As the EPD expert at M4 noted, "*We need to ask ourselves: what is the ultimate goal? If it is to provide comparable information, one potential solution could be to develop a common database [for the industry]. For instance, we currently use the Sphera database, while other market players rely on different databases.*" By using different datasets, two EPDs for the same product can yield significantly different results, even when applying the same product rules from the same program operator. These discrepancies arise from variations in commercial databases—a challenge not limited to the lighting sector. Studies in the construction sector for raw materials (e.g., glass, copper, and steel) have demonstrated secondary data incompatibility among databases (e,g., Lasvaux et al., 2015).

Additionally, while we observed the use of secondary data for a few raw materials (e.g., glass and aluminum), that was not the case for major electronic components. As the EPD expert for M2 explained, *"Data for electronic components, such as power supplies, drivers, and light sources, is severely lacking."*. This challenge has not been identified in the construction sector (Lasvaux *et al.*, 2015; Olanrewaju *et al.*, 2024), but it is particularly pressing for the lighting industry because it impedes how manufacturers calculate their luminaires' environmental impact.

Additionally, to address the lack of data on electronic components, EPD experts acknowledged using "creative" sources to collect data, such as academic studies, as the EPD expert for M5 noted: "*It was quite challenging once because I was trying to model the LCA [Life Cycle Assessment] for a light source—specifically, an LED module—and there was no secondary data available. I ended up using data from an academic paper from 2011 that detailed the manufacturing process of a somewhat similar component. However, it was not the same thing and relied on very outdated data. This case highlights how poor the current data gathering situation is*." Another "creative" approach was to use data from existing EPDs published by large companies, even if these are not direct suppliers. As one interviewee explained: "*Manufacturers handle the lack of data in different ways, depending on their skill levels, which doesn't necessarily contribute to harmonization. For example, if a specific EPD isn't available from their supplier, they might rely on publicly available EPDs from other companies like [company name]. These may not be perfect matches, but they provide a starting point*." Clearly, the use of different data sources—often outdated, inadequate, or inconsistent—undermines the comparability and reliability of EPDs.

4.5.2 Inefficiencies in EPD verification and registration [dimension 2 in Fig. 4]

4.5.2.1 Verifiers are an important bottleneck

Our interviews reveal that the main bottleneck is the EPD verification phase due to several factors. First, each PO relies on a very limited number of independent verifiers who are often overburdened, resulting in a long verification time. As one EPD expert shared, "*The verification step is a significant bottleneck because there are not enough verifiers. Due to their heavy workload, it is challenging to secure a verifier promptly, and the process becomes slow as they are overwhelmed at work."* Second, our PO interviewees acknowledged that there is a shortage of skilled verifiers. With the increasing demand for EPDs, POs now consider recruiting more verifiers but have painfully learned that there are not many. As one PO representative shared, "*It is not easy to find verifiers. We are aware of this and are already working on developing training programs to train new professional verifiers.*" Third, enhancing the training quality for existing verifiers and consultants is essential to ensure consistent, high-level performance. As the PO1 representative emphasized, "*We need to implement stricter timelines and penalties, alongside leveraging technology to streamline workflows. Training [to verifiers and EPD experts] will also play a crucial role in addressing these challenges. Because of the high demand for EPDs, we are receiving low-quality studies, which lengthens verification times due to the extra back-and-forth rounds.*" Relatedly, verifiers may handle vastly different products, from concrete to luminaires. This lack of specialization hinders efficiency and attention to detail. As one EPD expert noted, "*It would help to have some sector-specific verifiers—for instance, verifiers dedicated to luminaires or other specific sectors. In this way, they can work faster and catch more details.*"

4.5.2.2 Program operators' systems not up to date

Our manufacturers encountered difficulties using their POs' outdated and user-unfriendly platforms designs. As the EPD expert from M1 noted, *"Communication through the [PO] platform is not the best. I would prefer to have direct communication, maybe through a chat or something."* Similarly, the EPD expert from M2 stated, *"Navigating the [PO] platform is extremely challenging. Even the simplest tasks, such as uploading our reports, become unnecessarily time-consuming and can take up to a week to complete. That platform is far from user-friendly!"* Furthermore, POs currently publish EPDs on their portals in PDF format, which limits the integration of EPD data into the users' data platform (Almeida *et al.*, 2015). For instance, most design and engineering firms in the construction sector use Building Information Modeling (BIM)

systems to assess the environmental impact of buildings (Feng *et al.*, 2023); however, PDF files cannot be easily integrated on such systems. As one interviewee explained, *"EPDs are currently issued as PDFs, which aren't practical for integration into building tools."* Given the rapid growing demand for EPDs, POs did not have much time to improve their systems to meet such large growth. As the PO1 representative shared, *"We recognize that PDFs are becoming obsolete. In the near future, only digital EPDs will be used, as they will seamlessly integrate with software tools, making it easier to perform building calculations and transfer data between different systems."*

Previously, manufacturers could cover multiple products with a single EPD using extrapolation rules. However, the market now demands single product-specific EPDs, further increasing the need for EPD verification. This growing demand can no longer be met solely through manual verification by independent verifiers; semi-automated tools are becoming essential. As a result, some POs are investing in semi-automated EPD verification software. For example, the PO2 representative described the new tool they are developing with a software house: "*We are transitioning to a system where verification is performed by automated tools, with an operator to oversee the process to ensure accuracy. The challenge is finding the right balance. We cannot eliminate manual verification entirely, as independent verification bodies must still play a role. The key is optimizing the process to maintain quality while improving efficiency*." The adoption of artificial intelligence (AI) technologies could play a crucial role in helping POs improve their efficiency. As the PO1 representative noted, *"Leveraging technology, including AI, data science, and digital tools, can significantly streamline the process. These technologies can increase verifier productivity."* However, integrating AI or other technologies to streamline verifiers' work is not yet widespread. One of participating POs recognized this opportunity and shared, *"We are starting a major research project to incorporate AI into the verification process to make it more efficient."*

4.5.3 Stakeholders pursuing self-interests [dimension 3 in Fig. 4]

4.5.3.1 Program operators' conflicting self-interests

Given the exponential growing demand for EPDs, POs have created a business model that may obstruct harmonization efforts. As noted by the LE representative, "*The proliferation of POs is a significant challenge. There are more POs than countries in Europe, and the current model is problematic. Many operators are financially incentivized and compete by offering specific services to [lighting manufacturers],*

which hinders harmonization. In my view, ISO14025 provides a clearer path forward by defining PO responsibilities to publish and manage PCRs and PSRs. This would help address the lack of alignment, but it requires a shift in the current model, which is not yet happening."

According to ISO14025 (2006), a PO should act as an independent third party in the Product Category/Specific Rules (PCRs/PSRs) development in collaboration with interested stakeholders. As the standard states, *"The program operator shall identify and invite interested parties to participate in the program development by an open consultation process and shall ensure that the role of interested parties in the process is made clear and open to enable their participation"* (ISO14025, 2006, p. 8). However, in the lighting sector, not all POs are effectively fulfilling this role. From the two participating POs, only PEP Ecopassport has involved LE in the development of luminaire's PSR (Association P.E.P., 2023). In contrast, IBU published its own rules in 2021 (Institut Bauen und Umwelt e.V. [IBU], 2021), without involving LE or any other MSIs.

Globally, the situation is even more fragmented. Even though there are already published PSRs for luminaires, POs develop new PSRs from scratch. For example, the U.S.-based PO, Smart EPD, is developing a luminaire PSR for the North American market (https://smartepd.com/pcr-library) (Global Lighting Association, 2024). In China, PSR development for lighting has been announced as part of its carbon footprint program (Global Lighting Association, 2024). This proliferation of rules further complicates the global adoption of common PSRs. As the representative from PO1, which was the first to publish PSRs for luminaires back in 2018, expressed frustration, *"We don't understand why other operators refuse to adopt [existing] specific rules for luminaires such as PSR0014 that we have developed with Lighting Europe."* This quote shows how PO decisions are directly contributing to the fragmentation of PSRs in the lighting sector.

This behavior contrasts with what we have observed in the construction sector where EPDs have a more mature market. Herein, POs are self-regulated by the ECO Platform—an international nonprofit association composed of various POs and supporting members (ECO Platform, 2024). ECO platform aims to harmonize EPD rules and facilitate networking among EPD programs worldwide. As the PO1 representative shared, "*We are members of ECO Platform because, as a program operator, we also cover construction products, and we are seeing some improvements in rules harmonization in that sector. I don't think there is anything similar specifically for*

the lighting sector." Also, the POs of ECO Platform had already made significant progress in harmonizing rules for construction products well before the revision of the Construction Products Regulation (CPR). This proactive, self-regulatory effort laid the groundwork for the changes introduced by the revised CPR (Regulation 2024/3110), which came into force in 2024. The new regulation mandates the use of harmonized rules to assess the environmental performance of construction products—rules that are developed directly by European standardization bodies. As the PO1 representative explained, *"The construction product category rules will now become part of the law and will be published in the Official Journal of the European Commission. We have established a new legal entity solely focused on validating environmental data as an impartial third party. Unlike program operators, we will no longer be involved in developing the rules, as these are now harmonized directly by the European Commission."* Although POs have lost their role in rule development within the construction sector, they can now focus on strengthening the EPD verification process as notified bodies. This evolution—from voluntary collaboration to formal regulation—demonstrates how self-regulation among POs has effectively contributed to shaping European legislation on that topic.

4.5.3.2 Database providers' resistance

Database providers also contribute to the lack of EPD harmonization. While there is a limited number of such providers, there is a notable lack of data comparability among them. As one of our EPD experts noted, "*Different commercial databases use different data sources, which may vary in terms of geography, technology, time, and representativeness. For example, one database might use European electricity grid data from 2015, while another uses U.S. data from 2020. These differences can influence the final results and comparability of our assessments."* These providers have a business interest in obstructing harmonization. As one interviewee explained, *"These providers lack incentives to harmonize their offerings because their business models rely on proprietary databases. Given the growing EPD demand, they are unlikely to prioritize harmonization unless it aligns with their incentives. Addressing database-related issues will likely require a broader, industry-level approach.*"

These database providers invest in building and maintaining their commercial databases; although, it might add complexity in data harmonization. The consultant from our software and database provider explained, *"Historically, public databases prioritize transparency but often suffer from a lack of centralized funding and dedicated*

teams for data development, which can lead to outdated data. In contrast, proprietary databases, while sometimes lacking harmonization for market reasons, benefit from centralized funding and dedicated data developers, allowing for more frequent updates and maintenance." Therefore, database providers have no incentives to standardize their products unless there is an industry-wide intervention that pressure them to collaborate toward EPD harmonization.

4.5.3.3 Manufacturers safeguard their individual rather than collective interests

As others have shown (e.g., Gray et al., 2022; Purdy, 2012), the largest manufacturer in our sample pursues its self-interest. It has recently issued *self-declared* EPDs without independent third-party verification. Its EPD expert explained, "*We certified just one EPD, and it was insanely expensive and time-consuming. So, we thought, okay, this is not feasible for thousands of EPDs. Therefore, we verified only one to ensure our process and way of working were correct. . . . We are currently using a software designed for producing EPDs, with functionalities already aligned with the EPD stages. This software provider collaborates closely with [PO's name]. However, this does not mean that every EPD produced using the software is verified by this PO. The PO will review and verify an EPD only if we pay for the verification service. As a result, we can generate an EPD with this software, but it will be considered a self-declared EPD unless we opt for verification.*" The same manufacturer also is developing a more automated tool to verify EPDs and is now working with a PO to achieve it. As the EPD expert elaborated, "*We are working to build our own verified tool. I contacted [the PO] we used for EPD verification and told them, 'I want to build a tool so that every EPD produced with it is automatically verified.' Together with a software house, they are designing this tool for us. Everything we produce using this tool will be third-party verified*."

Although these two solutions offer multiple benefits for this manufacturer (e.g., speed up and scale up the EPD development process), they also present significant challenges. In particular, they exacerbate the lack of harmonization, further weakening the already fragile comparability of similar products through EPDs in the lighting sector. One major issue is ensuring the appropriate and consistent use of these tools. Acknowledging this risk, a PO representative remarked: *"The primary challenge with such tools lies in their usage. Manufacturers often delegate tool operations to inexperienced staff, such as student interns, instead of involving senior product managers or engineers. This raises concerns about data quality and proper tool*

utilization. Automation in the EPD process has potential but must be managed carefully to ensure the generated data meets quality and accuracy standards." Additionally, these actions have created conflicts among other manufacturers. As one interviewee noted: "*It's frustrating that some competitors take different approaches—ones that are cheaper and faster but don't adhere to the same industry standards. We're committed to transparency, compliance with standards, and a harmonized approach within the lighting industry. While it's challenging to see others opting for less rigorous processes, we firmly believe in maintaining high standards for credibility and trustworthiness."* Members pursuing their self-interest is not new within MSIs as enforcement mechanisms are weak or, in some cases, entirely absent (Gray *et al.*, 2022; Zuzul, 2019). We found the manufacturer leading the LE industry effort is the one who might be deviating from the industry norms LE aspires.

Additionally, there is rivalry among lighting manufacturers, which further complicates the POs' mission to establish standardized product rules for entire industries. As explained by the PO1 representative, "*Normally, it becomes challenging when a single manufacturer approaches us and says, 'I want an EPD for my product.' If rules for that product don't exist, we have to develop them; this requires involving other manufacturers in the same industry, who are often competitors of our clients. However, manufacturers usually don't want us to contact their direct competitors. They aim to secure a first-mover advantage, as the initial developers of the rules can influence the parameters and technical details to favor their own products. Instead, when multiple manufacturers decide to collaborate with us through industry associations such as Lighting Europe, this concern no longer applies."* Therefore, the involvement of an industry association helps, in this case, to mitigate issues that stem from poor stakeholders inclusion in PSR development, as well as concerns regarding the procedural fairness of deliberations (Mena and Palazzo, 2012; Zeyen et al., 2016).

4.5.4 Developing industry-wide EPD standards [dimension 4 in Fig. 4]

4.5.4.1 Harmonizing practices across the lighting industry

Both, LE and GLA, aim to harmonize the rules to facilitate EPD comparison within the same product family. LE is doing so by engaging with POs. As the LE representative stated, *"Ideally, EPDs from different manufacturers should be comparable to enable fair product comparisons. Our goal is to harmonize practices across the industry, it is therefore crucial to engage with Program Operators."* For this reason, our five manufacturers collaborated in the LE's task force with a PO to develop PSRs for

luminaires, which were published in 2018. From 2022 to 2023, they revised and updated the document. As one interviewee noted, "*First, we developed the product specific rules to create an EPD for luminaires. This was a significant achievement. We then reviewed and refined these rules in collaboration with the same PO. This process culminated in the publication of PSR0014—the updated product-specific rules for luminaires*."

In 2024, LE launched its first technical memorandum outlining the rules for EPDs for control gears—a critical electronic component for most luminaires. LE shared this memorandum with several POs and invited them to provide feedback (Lighting Europe, 2024). LE seeks that each PO will develop PSRs for control gears in accordance with this memorandum to enhance harmonization. As M4's EPD expert explained, "*Regarding the set of rules, if we strive to harmonize them across POs, as is currently being attempted by LE—by developing PSRs internally and sharing it with the relevant POs—this lack of rules harmonization can be partially addressed*." Clearly, one manufacturer cannot be expected to address the significant rule misalignment alone. LE acts as a collaborative platform for addressing this challenge that is too complex and difficult for any firm to tackle alone (Gray and Purdy, 2018).

LE is also acting as a learning platform (Scherer and Palazzo, 2011; Searcy, 2017), working to educate and align manufacturers through webinars and training sessions. LE aims for these players to adopt its rules and advocate for its recognition and adoption. As the LE representative shared, *"Communication and education are key. We're working on what I call an 'advice statement'— the goal is to guide the industry. Last December, we held a more general webinar on LCAs and EPDs for all members, presented by a consultant. Now, we're preparing a more focused webinar on EPDs for luminaires. The aim is to clarify what can be done and to align the industry on the path forward."*

Similarly, GLA advocates for harmonization to improve EPD comparison across product families, which would simplify the process for end-users when selecting lighting products. As the GLA representative noted, "*While accuracy is essential, I think phase one should focus on achieving consistency. If we can align on a common approach for the analysis, we can add more detail and nuance over time. The priority is to ensure that everyone adopts the same language and methodology. This includes how data is presented, as well as its quantity and complexity. Simplifying these elements is critical for ensuring comparability and readability*." Additionally, also GLA serves as a learning platform (Mena and Palazzo, 2012; Searcy, 2017) by sharing educational materials among its members. As the GLA representative shared, *"If designers don't have the time to thoroughly study EPDs, they need support and allies to assist in that area. GLA*

members share case studies, leading to greater transparency and visibility regarding each other's initiatives."

4.5.4.2. Striving to transform collective initiatives into global initiatives

Through LE, manufacturers are working with international standardization organizations, such as the International Electrotechnical Commission (IEC), to publish the existing PSR0014 for luminaires as an IEC (global) standard. As the LE representative shared, "*We're working within broader frameworks like the IEC. For example, our luminaire PSR document will be published as a publicly available specification and could form the foundation for an interregional IEC standard."* Global IEC standards enhance EPD comparison, ensuring product benchmarking and empowering consumers to make sustainable choices based on reliable and consistent information (Global Lighting Association, 2024). Thus, it is crucial that EPD producers use IEC standardized methodologies to develop EPDs rather than rely on region-specific rules that hinder comparability. Also, manufacturers' interest in establishing a global standard for luminaire EPDs aims to put pressure on POs to harmonize PSRs. As the LE representative noted, "W*e advocate for IEC norms to serve as the foundation for standardization. This requires educating the industry to adopt these norms and pushing POs to align with them. We rely on industry pressure and collaboration to encourage alignment. It's essential for the lighting industry to collectively demand alignment. . . . [This is] our best option to address the challenges in standardization and ensure the industry moves forward cohesively.*"

Moreover, two out of our five manufacturers are members of GLA, which has promoted a pilot initiative to provide a global forum for collaborative efforts between lighting designers and manufacturers committed to addressing EPD data gaps and methodological inconsistencies (Shanker *et al.*, 2025). One of its initiatives is the lighting industry's first Industry-Average EPD Report—an industry-led, collective case study aimed at addressing gaps through the LCA analysis of five commonly used architectural luminaires. This marked the first global collaborative effort between lighting designers and pioneering manufacturers. In sum, both LE and GLA, are working to harmonize the standards for developing EPDs and aim to do so globally rather than regionally (e.g., EU).

4.5.5 Multi-stakeholder Initiatives working in isolation [dimension 5 in Fig. 4]

4.5.5.1 Overlooking the voices of key stakeholders

The literature warns us that MSIs could face issues of input legitimacy due to their limited external stakeholder participation and involvement (e.g., Mena and Palazzo, 2012; Searcy, 2017). We found that our two MSIs have this issue. The LE Task Force on EPDs has not engaged other critical stakeholders to address persistent issues related to EPD development. For instance, lighting designers, who are major end-users, have no participation in PSR development. As the LE representative confirmed, *"At the beginning of such efforts, it's often better to work with a smaller group of core members, those truly engaged and willing to lead. Bringing in too many stakeholders too early can make decision-making a nightmare. So, for now, we're focusing on the core group, including major manufacturers and national industry associations."* The GLA representative further shared, *"It's interesting that designers aren't at the table during the PSR development. Product engineers are the ones deciding on reporting frameworks. While their technical knowledge is important, they have added unnecessary complexity for designers who have to select their products at the end.*"

Additionally, although LE recognizes the importance of involving database providers to address issues related to data scarcity and lack of data comparability, it has not involved them yet. As the LE representative shared, *"Ideally, database providers should be involved in our discussions to increase harmonization in secondary data…. It is difficult to involve them because taking any action is complicated by intellectual property protections. Databases like EcoInvent and GaBi are legally protected, so we cannot simply publish their contents. Nevertheless, some level of transparency or a structured agreement regarding this data will be necessary in the future.*"

Similarly, GLA, established in 2022, has not involved POs or database providers yet. For instance, lighting designers advocate for a simplification of the current PSRs, suggesting the removal of certain rules that add unnecessary complexity to EPDs. Without involving POs, they are promoting cradle-to-gate reporting in EPDs—an approach that considers environmental impacts from raw material extraction (cradle) up to the factory gate. This contrasts with the cradle-to-grave approach, which also includes the use and end-of-life phases of the product. As the GLA representative explained, "*We've had a lot of discussion internally about EPD boundaries. I believe that a cradle-to-gate analysis could be sufficient for lighting designers to understand the environmental impact of a product. However, manufacturers prefer the cradle-to-grave approach, as it includes the use phase, which represents a significant portion of a*

lighting product's overall impact and demonstrates the luminaire's efficacy. That said, lighting designers are not currently engaging in discussions with program operators."

4.5.5.2 Multi-stakeholders are working in silos

As detailed in Section 4.5.4.1., both LE and GLA advocate for the EPD rule harmonization to enhance comparability. However, we found that they operate in silos. Each MSI carries out its activities independently, without coordination or collaboration with the other MSI. The GLA representative acknowledged this lack of synergy and communication between the two MSIs, stating, "*In an ideal world, the dialogue between GLA and LE would be regular and ongoing. While we were able to involve pioneering manufacturers into the LCA incubator initiative, the process was quite protracted. It's a bit of a chicken-and-egg situation. Designers need to be conversant in the language of LCA and EPDs to engage in dialogue with manufacturers, but these conversations remain limited right now."*

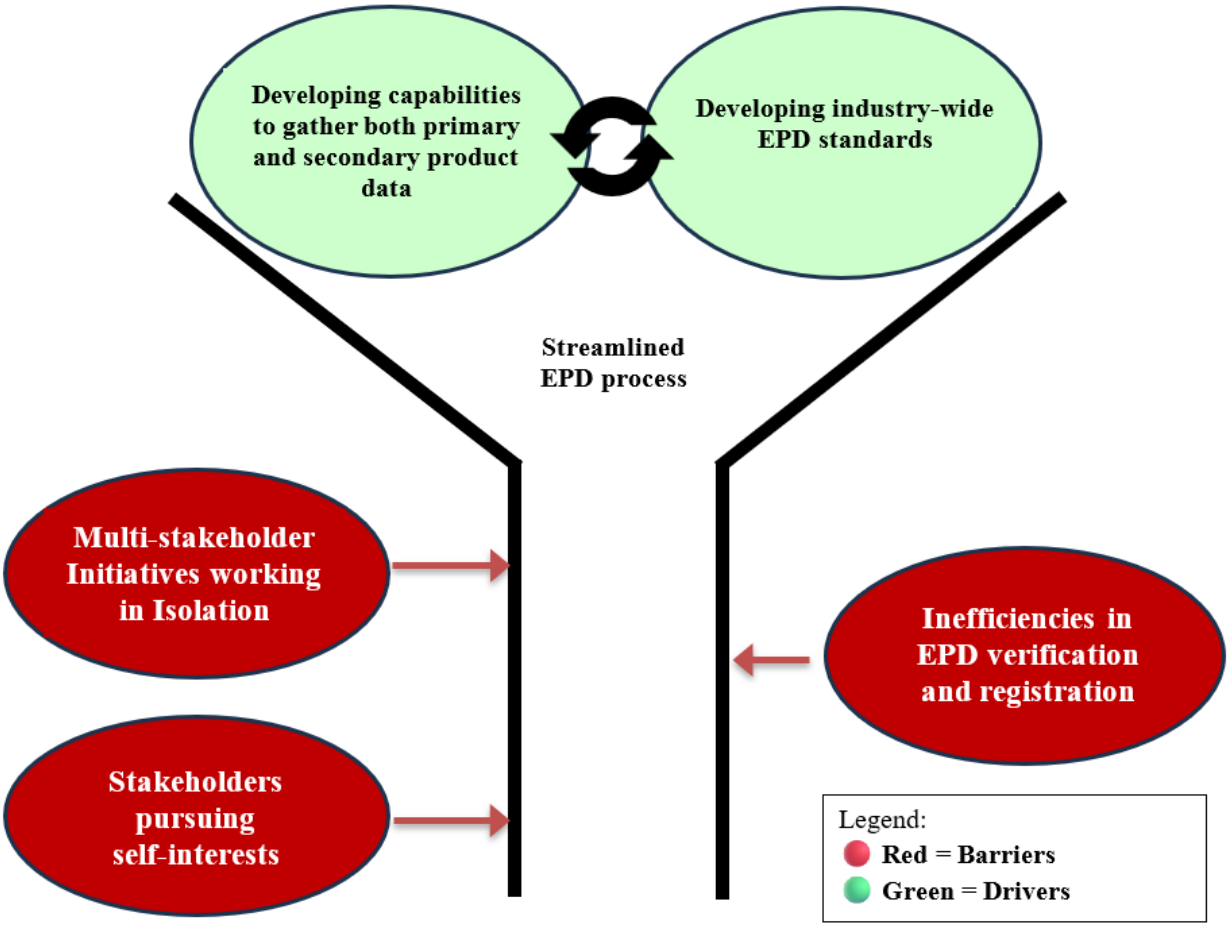
LE manufacturers also recognize the lack of involvement of GLA. As the LE representative shared, "*We haven't yet brought designers in or considered their specific needs, although we recognize their importance. We occasionally contact designers informally."* The EPD expert from M2 further explained, *"LE members are manufacturers, they tend to keep communication within the group. Bridging the gap between designers and manufacturers is definitely a missing piece in the whole story."*

The lack of synergy and communication between our two MSIs further complicates the landscape in the lighting sector, effectively creating two separate industry groups operating within the same domain. Although both pursue similar goals, the lack of collaboration and coordination undermines the overall effectiveness of their initiatives—what the literature calls output legitimacy problem (e.g., Mena and Palazzo, 2012). This lack of collaboration undermines their legitimacy. For instance, lighting designers have expressed dissatisfaction with PSRs for luminaires developed by LE, which are considered overly complex and not useful for their practical needs. As the GLA representative explained*, "I think that in the luminaire EPD rules there are layers of complexity that go beyond what is actually required for the ultimate application by designers who are specifying these products—and who are the ones rewarding manufacturers for doing this analysis."*

4.6 A GROUNDED THEORETICAL MODEL FOR MANAGING EPDs GENERATION

Figure 5 shows our grounded theoretical model. It illustrates the challenges associated with environmental product declaration (EPD) development and the drivers undertaken to streamline such a process. At the top of the model, two best practices aim to facilitate and streamline EPD development: manufacturers are *developing capabilities to gather both primary and secondary product data* and they participate with multi-stakeholder initiatives in *developing industry-wide EPD standards.* The lower part of the model identifies three major obstacles that hinder the broader adoption of EPDs. On the lower-right side, the model points to *Inefficiencies in EPD verification and registration* due to delays caused by third-party verification bodies. On the lower-left section, two additional barriers are presented: *Stakeholders pursuing self-interests* and *Multi-stakeholder Initiatives working in isolation.*

Figure 5. A grounded theoretical model of managing EPD related challenges and opportunities



The first two dimensions are closely interrelated, as indicated by the reciprocal arrows connecting them. This interconnection underscores the complexity of developing EPDs. On the one hand, firms must engage in a complex information processing effort to create an EPD, which require collecting product-related data from relevant internal (e.g., business units) and external stakeholders (e.g., suppliers). On the other hand, exceptional information processing capabilities alone are not sufficient if EPD rules are not standardized. Without standardization, comparability of environmental performance across products through EPDs is not guaranteed, limiting a manufacturer's ability to signal their product's environmental performance. This need for EPDs standardization drives individual stakeholders (e.g., manufacturers and lighting designers) to collaborate to develop industry-wide EPD standards and fine-tune their capabilities to meet such standards. Thus, developing data gathering capabilities and working with the EPD ecosystem requires a constant loop of feedback.

EPD development requires a concerted effort among stakeholders—including manufacturers, lighting designers, program operators, and database providers—to address existing challenges. We identified that one of its most significant obstacles is that *stakeholders pursuing self-interests*. This tendency to prioritize individual interests over shared objectives leads to a lack of alignment among stakeholders, resulting in misaligned priorities that impede the coordination necessary to streamline the EPD process. For example, our two POs have developed distinct PSRs for the same products. Additionally, even when a PSR already exists, some POs choose to create a new version from scratch rather than adopt an established rule, thereby undermining consistency.

The context is further complicated by a second obstacle: *Multi-stakeholder Initiatives working in isolation*. Our two MSIs, one led by manufacturers (i.e., Lighting Europe [LE]) and another led by lighting designers (i.e., Green Light Alliance [GLA]) operate in parallel. Both advocate for common goals, such as harmonization of EPDs practices and standardization of PCRs and PSRs at the global level. However, they currently operate in silos, with limited communication and collaboration between them. Additionally, they overlook the perspectives of other critical stakeholders. For instance, LE has not included lighting designers' and database providers' voice to date, effectively isolating the initiative and rendering it a manufacturer-centric MSI. Similarly, GLA has not involved POs or databases providers in its efforts to simplify EPD rules, thereby hindering harmonization. This lack of collaboration—both between the MSIs and with other key stakeholders—undermines their effectiveness and limits the impact of their initiatives, which hinder their intended outcomes.

The model also depicts a third obstacle—*Inefficiencies in EPD verification and registration*—as a more operational challenge on the PO side due to their insufficient investment in the verification process and infrastructure and the lack of independent qualified verifiers. The dynamics among these fifth dimensions form a theoretical framework grounded in the practices adopted and the challenges faced by actors in the EPD ecosystem. This framework offers a comprehensive approach to managing the EPD generation process and provides insights into how to streamline it effectively.

4.7 Research Stream 3: THEORETICAL CONTRIBUTIONS AND MANAGERIAL IMPLICATIONS

Considering the growing momentum of product environmental footprint initiatives in EU, this research seeks to bring attention to the challenges that European lighting manufacturers face when developing EPDs and identify opportunities to streamline such a process considering the EPD ecosystem. To date, the proliferation of EPD rules, lack of comparability among secondary datasets, and long verification times—due to verifier shortage and outdated verification systems—have created a complex, slow process for lighting manufacturers who have to meet customer demand and navigate avoiding greenwashing practices. The current literature has focused on environmental transparency practices at the firm or inter-firm level and research on eco-labels and EPDs have mainly focused on the technical aspects for efficiently measuring product environmental performance. This abductive study investigates the dynamics and complexities that manufacturers face within their corporations and with the EPD ecosystem.

Five dimensions that form the foundation of our grounded theoretical model (see Figure 5) are identified. The first dimension relates to manufacturers *developing capabilities to gather both primary and secondary product data*. This research reveals that it is becoming crucial for manufacturers to collect high-quality primary data to accurately communicate their products' environmental performance and expedite their EPDs. They are implementing efficient information systems across internal functions (e.g., business units, procurement) to collect such data and are investing in "lateral relations" with suppliers to enhance their information processing capacity (Srinivasan and Swink, 2018, p.1). When such efforts are not doable, manufacturers turn into secondary datasets, which are costly and likely suffer from outdated data, errors, and scarcity. Consistent with prior studies in the construction sector (AzariJafari et al., 2021; Goglio et al., 2020), also this study shows that there is a lack of comparability among

such databases in the lighting sector, highlighting this challenge is present across several industries.

Beyond inter-organizational collaboration with suppliers and clients, lighting manufacturers have collaborated with other industry members to *develop industry-wide EPD standards*. For instance, through LE, our five manufacturers have collaborated to develop PSRs for luminaires and, more recently, for one electronic component. Also, they are actively engaging with international standardization organizations, such as the IEC, to create global standards for luminaires. Similarly, some of the manufacturers along with lighting designers—through GLA—have worked together to simplify and harmonize the EPD process. Therefore, manufacturers have used collaborative platforms, such as LE and GLA, for addressing one of the most pressing EPD challenge—the proliferation of PSRs and PCRs—that is too complex and difficult for any organization to manage alone (Gray and Purdy, 2018). However, both platforms have shortcomings, as explained below.

The findings not only confirm internal sources of conflict within MSIs (Roloff, 2008; Sethi and Schepers, 2014; Zuzul, 2019), but also uncover previously overlooked external tensions between MSIs. Internally, tensions within LE arise due to the behavior of powerful manufacturers who are playing a double game. They actively participate in LE's efforts to promote EPD harmonization and standardization and build industry consensus in the development of EPD rules. Simultaneously, they are disregarding agreed-upon rules and undermining the fairness of LE's decision-making processes. For instance, the biggest manufacturer in our sample leveraged their market position to publish self-declared EPDs to meet growing customer demand and bypass the inefficiencies of third-party verification, gaining a competitive advantage over less mature competitors. At the same time, it retains a powerful position within LE to actively shape EPD's rule development and standardization initiatives, thereby safeguarding its interests in the long term. To explain this seemingly contradictory behavior, the adoption of the paradox theory could be useful (Smith and Lewis, 2011). Rather than viewing this manufacturer's actions as merely opportunistic, it attempts to manage the tension between securing market legitimacy through industry-wide participation in EPD harmonization efforts and maintaining competitive differentiation within an uncertain environment. Given the uncertainty surrounding the future regulation of EPDs, this manufacturer seeks to shape long-term industry standards while exploiting short-term regulatory gaps within LE. Clearly, such behavior creates frustration among its peers and confusion for EPD end users.

Externally, the two MSIs, LE and GLA, are *working in isolation*. First, both suffer from input legitimacy (Bäckstrand, 2006; Mena and Palazzo, 2012)—they have not included relevant stakeholders in their efforts, which undermine their legitimacy in pursing EPD harmonization. For example, LE's initiatives are driven mainly by a handful of manufacturers and had previously collaborated with a single program operator (PO) in the development of PSR0014 for luminaires. Surprisingly, LE has not included designers—a major EPD user—in its efforts. This limited openness creates a fundamental weakness in this MSI's ability to exert meaningful pressure on a wide range of POs, database providers, and other stakeholders to harmonize EPD rules. Previous studies have suggested that such exclusionary behavior may be motivated by an intent to protect or promote the interests of dominant actors or prevent opponents from gaining power and reconfiguring the field to their advantage (e.g., Gray et al., 2022; Nicholls and Huybrechts, 2016). This study's observations confirm that this was the case in the lighting sector. Thus, authors call for a broad stakeholder participation within LE to enhance the quality of standard-setting (Mena and Palazzo, 2012; Searcy, 2017).

Also, given both MSIs share the common goal of advocating for EPD harmonization and standardization, it is surprising that they have not collaborated to date. There are many contributing factors. First, LE's decision to exclude GLA from EPD-related activities may stem from its member-oriented structure. To date, designers are not members. Second, the limited openness within each MSI have created a lack of a collaborative environment in the lighting sector, leading to what the MSI literature refers to as output legitimacy issue (Bäckstrand, 2006; Mena and Palazzo, 2012). Namely, the main challenges related to EPDs remain unresolved, and current initiatives aimed at streamlining the EPD process lack broad stakeholder coverage, thus legitimacy. For instance, the PSRs for luminaires and lighting components developed by LE are not well received by lighting designers, who argue that manufacturers are producing overly complex EPDs for users to interpret and apply effectively.

The landscape is further complicated by s*takeholders pursuing self-interests*. For example, database providers tend to overlook manufacturers' calls for greater comparability and efficiency in secondary data, as they have little incentive to harmonize their proprietary datasets or to co-develop an industry-specific shared database. Similarly, the two POs examined, rather than fulfilling their original role as independent third-party verifiers and developers of harmonized EPD rules through public consultation with various stakeholders, have shifted toward building profitable

private business models. Such POs have created new, proprietary rules and offered customized EPD verification services tailored to powerful manufacturers rather than recognize and adopt PCRs and PSRs already developed by other POs or industry associations. POs' self-interest has further undermined the efforts toward EPD rule harmonization and standardization.

Finally, *Inefficiencies in EPD verification and registration,* which includes technological and operational delays by third-party verifiers is the last obstacle identified. Challenges such as a shortage of skilled and specialized independent verifiers, outdated program operator systems, and the lack of fully digitalized EPDs create significant barriers. To the best of authors' knowledge, these issues have been largely overlooked, despite their substantial impact on the number of published EPDs. Interestingly, the two POs examined are active in the construction sector where they have demonstrated a stronger commitment to harmonizing EPD rules. In that sector, they joined the ECO Platform—an association that brings together the main European POs with the aim of improving EPD rules harmonization—reflecting a self-regulation approach (Schuessler et al. 2023). In contrast, in the lighting sector, the current pressure exerted by the two MSIs independently appears insufficient to compel POs to prioritize collaboration over individual profit maximization. POs have chosen not to apply the best practices and lessons learned from more EPD-mature sectors into the lighting sector. This strategy allows them to optimize their own interests but creates inefficiencies for manufacturers (e.g., in the verification process and rules development), and disadvantages for end users (e.g., lighting designers).

This research has implications for MSIs, POs, and manufacturers. MSIs must continue allocating resources to their efforts aimed at EPD standardization globally. One of the best practices is to collaborate with international standardization bodies (e.g., IEC) to establish a global framework for specific products based on existing PSRs. A recommendation is to continue this long-term strategy. It is also recommended that MSIs urge the European Commission to promote the development of uniform rules directly by European standardization bodies. These rules should establish a common technical language for assessing product performance, following the example already set by the revised Construction Products Regulation (European Commission, 2022). Additionally, MSIs should engage with database providers to develop and manage sector-specific databases to increase data accuracy. This collective effort could compel POs and database providers to reduce the current variability and discrepancies among their services, ultimately enhancing harmonization, standardization, and, consequently,

better comparability among EPDs.

Lighting manufacturers individually have little power in prompting POs and database providers to improve the consistency of their services. The lighting sector represents just one industry among many to them. Thus, to exert greater pressure and amplify its influence, the lighting sector must first achieve a coordinated and unified stance. This requires joint efforts from lighting manufacturers and designers, which is not currently happening. A stronger involvement of lighting designers in activities related to the creation of PCRs and PSRs would also enhance their learning curve and increase their confidence in requesting and selecting luminaires with verified EPDs. This, in turn, would benefit manufacturers that have EPDs for their products, thereby motivating them to invest further in EPD development. In sum, LE and GLA should join their efforts and gain more collective power over POs, database providers, and others to achieve the common goal of EPD harmonization. A challenge for GLA—an alliance of lighting designers and manufacturers—to undergo a formalization process to enhance its legitimacy and recognition within the lighting sector.

At present, the verification phase represents the primary bottleneck, largely due to the limited availability of professional verifiers, who are unable to meet the growing demand for EPDs. To address this issue, it is recommended that POs invest in measures to align their capacity with the increasing market needs. First, POs should implement training programs aimed at developing a new cohort of professional verifiers, who should be directly employed by POs rather than relying on independent freelance verifiers who are often shared among multiple POs. Second, they should adopt new technologies, such as AI, to enhance user-interface platforms and improve efficiencies (e.g., automating repetitive tasks and improving overall process throughput). Similarly, publishing EPDs in more machine-readable formats that enhance interoperability and communication is needed.

Finally, this research is an initial step to uncover the multiple challenges in EPD development within the lighting sector. As this study focused on the European market, further research is required to evaluate how those findings might apply to other regions (e.g., United States) or other industries (e.g., food and beverage) that are adopting EPDs as an environmental disclosure tool. Additionally, the scope of this study is focused on manufacturers and, to some extent, other stakeholders within the EPD ecosystem. Future research should also explore the challenges related to engaging supply chain stakeholders during the EPD development process, such as tier-one and tier-two suppliers who are less mature in gathering, analyzing and reporting their product-level

environmental data. Third, given that prior studies have shown that trust in eco-labels is higher when they are verified by independent parties (Darnall et al., 2018; Gosselt et al., 2019), future research should investigate whether "self-declared" EPDs pursued by a few manufacturers ultimately undermines their long-term credibility and client trust. Moreover, this research employs a qualitative approach, which opens several opportunities for future studies to quantitatively test the relationships among the constructs proposed herein. Nevertheless, authors hope to initiate a broader discussion on advancing transparency in product-level environmental disclosure through future research.

Chapter 5
CONCLUSIONS

5.1 Final Takeaways

This doctoral thesis adopts an integrative perspective on corporate environmental transparency, treating it not as a single practice but as the outcome of interconnected communication, governance, and operational processes. By examining social media communication, stakeholder relationships, and product-level disclosure systems, the thesis shows that transparency emerges from the interaction of multiple actors, develops across different communication channels, and depends on both organizational routines and broader governance structures. Two overarching research questions guided the inquiry:

OQ1: *How do different stakeholders influence and shape corporate environmental transparency at both organizational and product levels across multiple communication channels?*

OQ2: *Under what conditions can credible and scalable environmental transparency be achieved?*

Viewed together Viewed together, the findings demonstrate that stakeholders shape environmental communication—and the resulting transparency—through three mutually reinforcing dynamics.

First, users' positive interactions with environmentally themed posts on social media influence firms' perceptions of what types of environmental information are attractive and worth communicating. Findings from the first stream of this thesis show that consumer demand for environmental information, expressed through engagement metrics on social media, signals to firms the perceived value of environmental messaging. This influence is channel-specific: platforms with more environmentally conscious users (e.g., Instagram and Facebook) generate stronger signals than more heterogeneous platforms (e.g., Twitter). This market-signaling mechanism increases the attractiveness of environmental transparency but does not necessarily translate into genuine improvements in environmental performance.

Second, in more traditional disclosure channels—such as sustainability reports—institutional relationships with NGOs and other actors shape expectations and push firms to increase reporting, at least in the short to medium term. NGOs and other institutional stakeholders exert influence through campaign activism, confrontation, and

relationship-building. Conflictual relationships generate acute, short-term improvements in transparency, whereas collaborative relationships foster sustained, long-term engagement with environmental performance. However, both types of relationships tend to converge toward medium-level performance aligned with industry norms. This institutional pressure establishes expectations for environmental transparency, but without complementary verification and governance mechanisms, it may inadvertently incentivize greenwashing.

Third, governance arrangements among stakeholders are essential for creating the systems and rules that make environmental transparency—and the comparability of information—possible, particularly at the product level. At the ecosystem level, multi-stakeholder initiatives establish standardized rules, shared data systems, and collective verification processes that enable transparency at scale. Yet governance coordination often fails when stakeholder incentives are misaligned, resulting in suboptimal transparency systems that impose excessive information-processing burdens and inadequately represent the interests of less-resourced stakeholders.

Importantly, none of these dynamics is effective on its own. Market demand may encourage superficial communication; institutional pressure can trigger only short-term responses; and governance structures remain ineffective without sufficient participation and aligned incentives. Transparency becomes credible only when these forces operate jointly and reinforce one another.

The thesis also shows that credible and scalable transparency requires a combination of supportive conditions. Stakeholders must have incentives that are sufficiently compatible to sustain cooperation. Power must be distributed in ways that enable all relevant actors—including less-resourced ones—to influence the design of transparency systems. Verification processes must have the capacity to keep pace with the volume and complexity of information being generated. Organizations need practical support—such as shared databases, tools, and training—to participate without incurring excessive costs. Moreover, expectations around transparency must remain stable over time so that firms do not reduce disclosure when external pressure diminishes. These conditions are tightly interdependent: when any one of them fails, transparency systems tend to weaken or lose credibility.

Overall, the thesis advances academic understanding by framing environmental transparency as a systemic and dynamic phenomenon rather than a collection of isolated

practices. It also offers practical insights for organizations and policymakers seeking to design more effective transparency systems. By illustrating how communication, governance, and operational processes can be aligned, the research identifies the pathways through which transparency can meaningfully support broader environmental sustainability goals.

5.2. Directions for future research

A promising stream of future research emerges from the three studies presented in this dissertation. Each of the papers addresses distinct yet interconnected aspects of environmental communication and disclosure, and together they provide fertile ground for deeper empirical investigation. By situating the insights of each study within broader conversations in sustainability and stakeholder engagement, the dissertation opens multiple pathways for future research.

Building on the first study, several directions for future research can be identified. Expanding the scope beyond the two retailers in a single national industry to include additional sectors, global firms, or multi-industry analyses would improve generalizability and reveal sectoral differences. Studying emerging platforms such as TikTok and Snapchat would also provide insights into how distinct formats and user communities shape the effectiveness of sustainability communication. In addition, combining social media data with surveys or interviews of managers and consumers could clarify why firms choose particular communication strategies and how audiences interpret them, including the role of greenwashing concerns. Finally, exploring additional moderators such as advertising content type, brand positioning, or firm characteristics could lead to a more comprehensive understanding of the conditions under which green communication is most effective.

The second study underscores the important role of NGOs in influencing environmental disclosure and raising questions about how different types of relationships between NGOs and firms impact communication outcomes. Future research could extend these insights by exploring how companies manage multiple stakeholder pressures simultaneously and what patterns emerge when additional actors such as trade unions, regulators, or industry associations are considered. Expanding the scope beyond a single industry and incorporating more direct engagement with companies could further clarify how disclosure practices evolve depending on the nature and intensity of stakeholder demands.

The third study highlights challenges in the implementation and credibility of Environmental Product Declarations, particularly the organizational and supply chain barriers that firms face in producing them. Future research should explore how these challenges unfold in other regions and industries, and how upstream supply chain actors with varying levels of experience in environmental reporting can be effectively engaged. An additional avenue lies in assessing whether self-declared EPDs undermine long-term credibility compared to independently verified ones, and under what conditions clients and other stakeholders view them as trustworthy. Moreover, quantitative research on EPD practices could complement existing qualitative studies, allowing for a more robust understanding of their effectiveness and the conditions that shape their impact.

Taken together, these avenues suggest that the three studies provide not only empirical contributions but also valuable starting points for a broader research agenda. By examining how green communication is conducted on social media platforms, how stakeholder relationships shape disclosure practices, and how environmental reporting tools are used and evolve, future research can further advance the understanding of how transparency in environmental practices is developed, contested, and sustained across diverse contexts.

REFERENCES

Aaronson, S.A. (2005), "'Minding Our Business': What the United States Government has done and can do to Ensure that U.S. Multinationals Act Responsibly in Foreign Markets", *Journal of Business Ethics*, Vol. 59 No. 1–2, pp. 175–198, doi: 10.1007/s10551-005-3414-z.

Acuti, D., Grazzini, L., Mazzoli, V. and Aiello, G. (2019), "Stakeholder engagement in green place branding: A focus on user-generated content", *Corporate Social Responsibility and Environmental Management*, Vol. 26 No. 2, pp. 492–501, doi: 10.1002/csr.1703.

Adamkiewicz, J., Kochańska, E., Adamkiewicz, I. and Łukasik, R.M. (2022), "Greenwashing and sustainable fashion industry", *Current Opinion in Green and Sustainable Chemistry*, Vol. 38, p. 100710, doi: 10.1016/j.cogsc.2022.100710.

Adams, C.A. (2004), "The ethical, social and environmental reporting-performance portrayal gap", *Accounting, Auditing & Accountability Journal*, Vol. 17 No. 5, pp. 731–757, doi: 10.1108/09513570410567791.

Agatz, N., Fan, Y. and Stam, D. (2021), "The Impact of Green Labels on Time Slot Choice and Operational Sustainability", *Production and Operations Management*, Vol. 30 No. 7, pp. 2285–2303, doi: 10.1111/poms.13368.

Agnihotri, R. (2020), "Social media, customer engagement, and sales organizations: A research agenda", *Industrial Marketing Management*, Vol. 90, pp. 291–299, doi: 10.1016/j.indmarman.2020.07.017.

Ajzen, I. (1991), "The theory of planned behavior", *Organizational Behavior and Human Decision Processes*, Vol. 50 No. 2, pp. 179–211, doi: 10.1016/0749-5978(91)90020-T.

Albareda, L., Lozano, J.M. and Ysa, T. (2007), "Public Policies on Corporate Social Responsibility: The Role of Governments in Europe", *Journal of Business Ethics*, Vol. 74 No. 4, pp. 391–407, doi: 10.1007/s10551-007-9514-1.

Albertini, E. (2013), "Does Environmental Management Improve Financial Performance? A Meta-Analytical Review", *Organization & Environment*, Vol. 26 No. 4, pp. 431–457, doi: 10.1177/1086026613510301.

Algharabat, R., Rana, N.P., Alalwan, A.A., Baabdullah, A. and Gupta, A. (2020), "Investigating the antecedents of customer brand engagement and consumer-based brand equity in social media", *Journal of Retailing and Consumer Services*, Vol. 53, p. 101767, doi: 10.1016/j.jretconser.2019.01.016.

Alhabash, S., Chiang, Y. and Huang, K. (2014), "MAM & U&G in Taiwan: Differences in the uses and gratifications of Facebook as a function of motivational reactivity", *Computers in Human Behavior*, Vol. 35, pp. 423–430, doi: 10.1016/j.chb.2014.03.033.

Alhabash, S. and Ma, M. (2017), "A Tale of Four Platforms: Motivations and Uses of Facebook, Twitter, Instagram, and Snapchat Among College Students?", *Social Media + Society*, Vol. 3 No. 1, p. 2056305117691544, doi: 10.1177/2056305117691544.

Almeida, M.I., Dias, A.C., Demertzi, M. and Arroja, L. (2015), "Contribution to the development of product category rules for ceramic bricks", *Journal of Cleaner Production*, Vol. 92, pp. 206–215, doi: 10.1016/j.jclepro.2014.12.073.

Amran, A., Lee, S.P. and Devi, S.S. (2014), "The Influence of Governance Structure and Strategic Corporate Social Responsibility Toward Sustainability Reporting Quality", *Business Strategy and the Environment*, Vol. 23 No. 4, pp. 217–235, doi: 10.1002/bse.1767.

Araujo, T. and Kollat, J. (2018), "Communicating effectively about CSR on Twitter: The power of engaging strategies and storytelling elements", *Internet Research*, Vol. 28 No. 2, pp. 419–431, doi: 10.1108/IntR-04-2017-0172.

Arc-Mondo Magazine. (2024), "Harmonising the way to Lighting EPDs", July, No. 140, pp. 118–123.

Arenas, D., Albareda, L. and Goodman, J. (2020a), "Contestation in Multi-Stakeholder Initiatives: Enhancing the Democratic Quality of Transnational Governance", *Business Ethics Quarterly*, Vol. 30 No. 2, pp. 169–199, doi: 10.1017/beq.2019.29.

Arenas, D., Albareda, L. and Goodman, J. (2020b), "Contestation in Multi-Stakeholder Initiatives: Enhancing the Democratic Quality of Transnational Governance", *Business Ethics Quarterly*, Vol. 30 No. 2, pp. 169–199, doi: 10.1017/beq.2019.29.

Arnaud, B. (2017), "Extended Producer Responsibility and Green Marketing: An Application to

Packaging", *Environmental and Resource Economics*, Vol. 67 No. 2, pp. 285–296, doi: 10.1007/s10640-015-9986-x.

Arora, N. and Manchanda, P. (2022), "Green perceived value and intention to purchase sustainable apparel among Gen Z: The moderated mediation of attitudes", *Journal of Global Fashion Marketing*, Vol. 13 No. 2, pp. 168–185, doi: 10.1080/20932685.2021.2021435.

Ashley, C. and Tuten, T. (2015), "Creative Strategies in Social Media Marketing: An Exploratory Study of Branded Social Content and Consumer Engagement", *Psychology & Marketing*, Vol. 32 No. 1, pp. 15–27, doi: 10.1002/mar.20761.

Association P.E.P. (2023), "PSR-0014-ed2.0-EN-2023 07 13".

Auger, P. and Devinney, T.M. (2007), "Do What Consumers Say Matter? The Misalignment of Preferences with Unconstrained Ethical Intentions", *Journal of Business Ethics*, Vol. 76 No. 4, pp. 361–383, doi: 10.1007/s10551-006-9287-y.

Aung, M.M. and Chang, Y.S. (2014), "Traceability in a food supply chain: Safety and quality perspectives", *Food Control*, Vol. 39, pp. 172–184, doi: 10.1016/j.foodcont.2013.11.007.

AzariJafari, H., Guest, G., Kirchain, R., Gregory, J. and Amor, B. (2021), "Towards comparable environmental product declarations of construction materials: Insights from a probabilistic comparative LCA approach", *Building and Environment*, Vol. 190, p. 107542, doi: 10.1016/j.buildenv.2020.107542.

Bäckstrand, K. (2006), "Multi-stakeholder partnerships for sustainable development: rethinking legitimacy, accountability and effectiveness", *European Environment*, Vol. 16 No. 5, pp. 290–306, doi: 10.1002/eet.425.

Badia-Melis, R., Mishra, P. and Ruiz-García, L. (2015), "Food traceability: New trends and recent advances. A review", *Food Control*, Vol. 57, pp. 393–401, doi: 10.1016/j.foodcont.2015.05.005.

Bamberg, S. and Möser, G. (2007), "Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour", *Journal of Environmental Psychology*, Vol. 27 No. 1, pp. 14–25, doi: 10.1016/j.jenvp.2006.12.002.

Banerjee, S.B. (2002), "Corporate environmentalism: the construct and its measurement", *Journal of Business Research*, Vol. 55 No. 3, pp. 177–191, doi: 10.1016/S0148-2963(00)00135-1.

Barnett, M.L. and King, A.A. (2008), "Good Fences Make Good Neighbors: A Longitudinal Analysis of an Industry Self-Regulatory Institution", *Academy of Management Journal*, Vol. 51 No. 6, pp. 1150–1170, doi: 10.5465/amj.2008.35732609.

Bedard, S.A.N. and Tolmie, C.R. (2018), "Millennials' green consumption behaviour: Exploring the role of social media", *Corporate Social Responsibility and Environmental Management*, Vol. 25 No. 6, pp. 1388–1396, doi: 10.1002/csr.1654.

Bellamy, M.A., Dhanorkar, S. and Subramanian, R. (2020), "Administrative environmental innovations, supply network structure, and environmental disclosure", *Journal of Operations Management*, Vol. 66 No. 7–8, pp. 895–932, doi: 10.1002/joom.1114.

Bellucci, M. and Manetti, G. (2017), "Facebook as a tool for supporting dialogic accounting? Evidence from large philanthropic foundations in the United States", *Accounting, Auditing & Accountability Journal*, Vol. 30 No. 4, pp. 874–905, doi: 10.1108/AAAJ-07-2015-2122.

Bellucci, M., Simoni, L., Acuti, D. and Manetti, G. (2019), "Stakeholder engagement and dialogic accounting: Empirical evidence in sustainability reporting", *Accounting, Auditing & Accountability Journal*, Vol. 32 No. 5, pp. 1467–1499, doi: 10.1108/AAAJ-09-2017-3158.

Ben-Amar, W. and McIlkenny, P. (2015), "Board Effectiveness and the Voluntary Disclosure of Climate Change Information", *Business Strategy and the Environment*, Vol. 24 No. 8, pp. 704–719, doi: 10.1002/bse.1840.

Bessi, A., Zollo, F., Del Vicario, M., Puliga, M., Scala, A., Caldarelli, G., Uzzi, B., *et al.* (2016), "Users Polarization on Facebook and Youtube", edited by Preis, T.*PLOS ONE*, Vol. 11 No. 8, p. e0159641, doi: 10.1371/journal.pone.0159641.

Beverland, M.B. and Farrelly, F.J. (2010), "The Quest for Authenticity in Consumption: Consumers' Purposive Choice of Authentic Cues to Shape Experienced Outcomes", *Journal of Consumer Research*, Vol. 36 No. 5, pp. 838–856, doi: 10.1086/615047.

Biel, A. and Thøgersen, J. (2007), "Activation of social norms in social dilemmas: A review of the evidence and reflections on the implications for environmental behaviour", *Journal of Economic Psychology*, Vol. 28 No. 1, pp. 93–112, doi: 10.1016/j.joep.2006.03.003.

Bierhoff, H.-W. (2005), *Prosocial Behaviour*, 0 ed., Psychology Press, doi:

10.4324/9780203989425.

Bigné, E., Oltra, E. and Andreu, L. (2019), "Harnessing stakeholder input on Twitter: A case study of short breaks in Spanish tourist cities", *Tourism Management*, Vol. 71, pp. 490–503, doi: 10.1016/j.tourman.2018.10.013.

Boiral, O. (2016), "Accounting for the Unaccountable: Biodiversity Reporting and Impression Management", *Journal of Business Ethics*, Vol. 135 No. 4, pp. 751–768, doi: 10.1007/s10551-014-2497-9.

Bonsón, E., Royo, S. and Ratkai, M. (2015), "Citizens' engagement on local governments' Facebook sites. An empirical analysis: The impact of different media and content types in Western Europe", *Government Information Quarterly*, Vol. 32 No. 1, pp. 52–62, doi: 10.1016/j.giq.2014.11.001.

Bortree, D.S., Ahern, L., Smith, A.N. and Dou, X. (2013), "Framing environmental responsibility: 30 years of CSR messages in National Geographic Magazine", *Public Relations Review*, Vol. 39 No. 5, pp. 491–496, doi: 10.1016/j.pubrev.2013.07.003.

Brander, P., De Witte, L., Ghanea, N., Gomes, R., Keen, E, Nikitina, A. and Pinkeviciute, J. (2023), *Compass—Manual for Human Rights Education with Young People*, 2nd ed., Chapter 4., Council of Europe.

Brown, A.D. and Starkey, K. (1994), "THE EFFECT OF ORGANIZATIONAL CULTURE ON COMMUNICATION AND INFORMATION*", *Journal of Management Studies*, Vol. 31 No. 6, pp. 807–828, doi: 10.1111/j.1467-6486.1994.tb00640.x.

Brown, L.D. and Timmer, V. (2006), "Civil Society Actors as Catalysts for Transnational Social Learning", *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations*, Vol. 17 No. 1, pp. 1–16, doi: 10.1007/s11266-005-9002-0.

Calculli, C., D'Uggento, A.M., Labarile, A. and Ribecco, N. (2021), "Evaluating people's awareness about climate changes and environmental issues: A case study", *Journal of Cleaner Production*, Vol. 324, p. 129244, doi: 10.1016/j.jclepro.2021.129244.

Calic, G. and Mosakowski, E. (2016), "Kicking Off Social Entrepreneurship: How A Sustainability Orientation Influences Crowdfunding Success", *Journal of Management Studies*, Vol. 53 No. 5, pp. 738–767, doi: 10.1111/joms.12201.

Campbell, M.C., Inman, J.J., Kirmani, A. and Price, L.L. (2020), "In Times of Trouble: A Framework for Understanding Consumers' Responses to Threats", *Journal of Consumer Research*, Vol. 47 No. 3, pp. 311–326, doi: 10.1093/jcr/ucaa036.

Cardoso, V.E.M., Sanhudo, L., Silvestre, J.D., Almeida, M. and Costa, A.A. (2024), "Challenges in the harmonisation and digitalisation of Environmental Product Declarations for construction products in the European context", *The International Journal of Life Cycle Assessment*, Vol. 29 No. 5, pp. 759–788, doi: 10.1007/s11367-024-02279-w.

Carlos, W.C. and Lewis, B.W. (2018), "Strategic Silence: Withholding Certification Status as a Hypocrisy Avoidance Tactic", *Administrative Science Quarterly*, Vol. 63 No. 1, pp. 130–169, doi: 10.1177/0001839217695089.

Castelló, I., Etter, M. and Årup Nielsen, F. (2016), "Strategies of Legitimacy Through Social Media: The Networked Strategy: Strategies of Legitimacy Through Social Media", *Journal of Management Studies*, Vol. 53 No. 3, pp. 402–432, doi: 10.1111/joms.12145.

Castelló, I., Morsing, M. and Schultz, F. (2013), "Communicative Dynamics and the Polyphony of Corporate Social Responsibility in the Network Society", *Journal of Business Ethics*, Vol. 118 No. 4, pp. 683–694, doi: 10.1007/s10551-013-1954-1.

Castka, P. and Corbett, C.J. (2016), "Governance of Eco-Labels: Expert Opinion and Media Coverage", *Journal of Business Ethics*, Vol. 135 No. 2, pp. 309–326, doi: 10.1007/s10551-014-2474-3.

Chen, G.M. (2015), "Why do women bloggers use social media? Recreation and information motivations outweigh engagement motivations", *New Media & Society*, Vol. 17 No. 1, pp. 24–40, doi: 10.1177/1461444813504269.

Chen, Y.-S. and Chang, C.-H. (2013), "Greenwash and Green Trust: The Mediation Effects of Green Consumer Confusion and Green Perceived Risk", *Journal of Business Ethics*, Vol. 114 No. 3, pp. 489–500, doi: 10.1007/s10551-012-1360-0.

Cheong, C. and Lloyd, A. (2023), "Inside the rise of the top 25 most followed TikTok accounts of 2023, from Hollywood stars to lip-sync sensations", *Business Insider*, available at: https://www.insider.com/most-followedtiktok- creators-2023-3.

Cho, C.H., Guidry, R.P., Hageman, A.M. and Patten, D.M. (2012), "Do actions speak louder than words? An empirical investigation of corporate environmental reputation", *Accounting, Organizations and Society*, Vol. 37 No. 1, pp. 14–25, doi: 10.1016/j.aos.2011.12.001.

Cho, C.H. and Patten, D.M. (2007), "The role of environmental disclosures as tools of legitimacy: A research note", *Accounting, Organizations and Society*, Vol. 32 No. 7–8, pp. 639–647, doi: 10.1016/j.aos.2006.09.009.

Choo, C. W. (2002), *Information Management for the Intelligent Organization: The Art of Scanning the Environment.*, Medford, NJ: American Society for Information Science and Technology, Information Today.

Clarkson, P.M., Li, Y., Richardson, G.D. and Vasvari, F.P. (2008), "Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis", *Accounting, Organizations and Society*, Vol. 33 No. 4–5, pp. 303–327, doi: 10.1016/j.aos.2007.05.003.

Colicev, A., Kumar, A. and O'Connor, P. (2019), "Modeling the relationship between firm and user generated content and the stages of the marketing funnel", *International Journal of Research in Marketing*, Vol. 36 No. 1, pp. 100–116, doi: 10.1016/j.ijresmar.2018.09.005.

Colleoni, E. (2013), "CSR communication strategies for organizational legitimacy in social media", edited by Golob, U.*Corporate Communications: An International Journal*, Vol. 18 No. 2, pp. 228–248, doi: 10.1108/13563281311319508.

Conad. (2021), "Bilancio di sostenibilità Conad. Archivio Conad", available at: https:// chisiamo.conad.it/assets/documents/Bilancio%20di%20Sostenibilita% 20Conad%202021.pdf?_u=1655899650851.

Confente, I. and Scarpi, D. (2021), "Achieving Environmentally Responsible Behavior for Tourists and Residents: A Norm Activation Theory Perspective", *Journal of Travel Research*, Vol. 60 No. 6, pp. 1196–1212, doi: 10.1177/0047287520938875.

Coop. (2021), "Bilancio di sostenibilità Coop. Coop Alleanza 3.0.", available at: https:// www.e-coop.it/noi/bilancio-sociale.

Cooper, S. and Slack, R. (2015), "Reporting practice, impression management and company performance: a longitudinal and comparative analysis of water leakage disclosure", *Accounting and Business Research*, Vol. 45 No. 6–7, pp. 801–840, doi: 10.1080/00014788.2015.1081554.

Cooper, S.M. and Owen, D.L. (2007), "Corporate social reporting and stakeholder accountability: The missing link", *Accounting, Organizations and Society*, Vol. 32 No. 7–8, pp. 649–667, doi: 10.1016/j.aos.2007.02.001.

Cormier, D. and Magnan, M. (2004), "The impact of the web on information and communication modes: the case of corporate environmental disclosure", *International Journal of Technology Management*, Vol. 27 No. 4, p. 393, doi: 10.1504/IJTM.2004.004278.

Crapa, G., Latino, M.E. and Roma, P. (2024), "The performance of green communication across social media: Evidence from large-scale retail industry in Italy", *Corporate Social Responsibility and Environmental Management*, Vol. 31 No. 1, pp. 493–513, doi: 10.1002/csr.2581.

Crapa, G., Roma, P. and Bruccoleri, M. (2025), "The influence of NGO -corporate relationship on environmental disclosure: Evidence from the fashion industry", *Corporate Social Responsibility and Environmental Management*, Vol. 32 No. 2, pp. 2104–2127, doi: 10.1002/csr.3056.

Crapa, G. and Villena, V.H. (2025), "Environmental Product Declarations: Challenges and Opportunities in the European Lighting Sector", Vol. 1, Academy of Management Proceedings, Copenhagen, Denmark, doi: https://doi.org/10.5465/AMPROC.2025.22539abstract.

Crawford, G.B. (1987), "The geometric mean procedure for estimating the scale of a judgement matrix", *Mathematical Modelling*, Vol. 9 No. 3–5, pp. 327–334, doi: 10.1016/0270-0255(87)90489-1.

Csikszentmihalyi, M. (2000), "The Costs and Benefits of Consuming", *Journal of Consumer Research*, Vol. 27 No. 2, pp. 267–272, doi: 10.1086/314324.

Daft, R.L. and Lengel, R.H. (1986), "Organizational Information Requirements, Media Richness and Structural Design", *Management Science*, Vol. 32 No. 5, pp. 554–571, doi: 10.1287/mnsc.32.5.554.

Dangelico, R.M. and Pontrandolfo, P. (2015), "Being 'Green and Competitive': The Impact of Environmental Actions and Collaborations on Firm Performance", *Business Strategy and the Environment*, Vol. 24 No. 6, pp. 413–430, doi: 10.1002/bse.1828.

Dangelico, R.M. and Vocalelli, D. (2017), "'Green Marketing': An analysis of definitions,

strategy steps, and tools through a systematic review of the literature", *Journal of Cleaner Production*, Vol. 165, pp. 1263–1279, doi: 10.1016/j.jclepro.2017.07.184.

Darnall, N., Ji, H. and Vázquez-Brust, D.A. (2018), "Third-Party Certification, Sponsorship, and Consumers' Ecolabel Use", *Journal of Business Ethics*, Vol. 150 No. 4, pp. 953–969, doi: 10.1007/s10551-016-3138-2.

Daub, C. and Ergenzinger, R. (2005), "Enabling sustainable management through a new multi-disciplinary concept of customer satisfaction", edited by Polonsky, M.J.*European Journal of Marketing*, Vol. 39 No. 9/10, pp. 998–1012, doi: 10.1108/03090560510610680.

De Chiara, A. (2016), "Eco-labeled Products: Trend or Tools for Sustainability Strategies?", *Journal of Business Ethics*, Vol. 137 No. 1, pp. 161–172, doi: 10.1007/s10551-014-2510-3.

Delmas, M.A. and Burbano, V.C. (2011), "The Drivers of Greenwashing", *California Management Review*, Vol. 54 No. 1, pp. 64–87, doi: 10.1525/cmr.2011.54.1.64.

Delmas, M.A. and Grant, L.E. (2014), "Eco-Labeling Strategies and Price-Premium: The Wine Industry Puzzle", *Business & Society*, Vol. 53 No. 1, pp. 6–44, doi: 10.1177/0007650310362254.

Dennis, A.R. and Kinney, S.T. (1998), "Testing Media Richness Theory in the New Media: The Effects of Cues, Feedback, and Task Equivocality", *Information Systems Research*, Vol. 9 No. 3, pp. 256–274, doi: 10.1287/isre.9.3.256.

Dhanani, A. (2019), "Identity constructions in the annual reports of international development NGOs: Preserving institutional interests?", *Critical Perspectives on Accounting*, Vol. 59, pp. 1–31, doi: 10.1016/j.cpa.2018.06.001.

Dibb, B. and Foster, M. (2021), "Loneliness and Facebook use: the role of social comparison and rumination", *Heliyon*, Vol. 7 No. 1, p. e05999, doi: 10.1016/j.heliyon.2021.e05999.

Directive (EU) 2022/2464. (2022), "amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU, as regards corporate sustainability reporting (Text with EEA relevance)", 14 December.

Dobele, A., Lindgreen, A., Beverland, M., Vanhamme, J. and Van Wijk, R. (2007), "Why pass on viral messages? Because they connect emotionally", *Business Horizons*, Vol. 50 No. 4, pp. 291–304, doi: 10.1016/j.bushor.2007.01.004.

Doh, J.P. and Guay, T.R. (2006), "Corporate Social Responsibility, Public Policy, and NGO Activism in Europe and the United States: An Institutional-Stakeholder Perspective", *Journal of Management Studies*, Vol. 43 No. 1, pp. 47–73, doi: 10.1111/j.1467-6486.2006.00582.x.

Dunn, K. and Harness, D. (2018), "Communicating corporate social responsibility in a social world: the effects of company-generated and user-generated social media content on CSR attributions and scepticism", *Journal of Marketing Management*, Vol. 34 No. 17–18, pp. 1503–1529, doi: 10.1080/0267257X.2018.1536675.

ECO Platform. (2024), "Our 'ECO EPD Programmes'", available at: https://www.eco-platform.org/the-eco-epd-programs.html (accessed 28 December 2024).

Eesley, C. and Lenox, M.J. (2006), "Firm responses to secondary stakeholder action", *Strategic Management Journal*, Vol. 27 No. 8, pp. 765–781, doi: 10.1002/smj.536.

Eisenhardt, K.M. and Graebner, M.E. (2007), "Theory Building From Cases: Opportunities And Challenges", *Academy of Management Journal*, Vol. 50 No. 1, pp. 25–32, doi: 10.5465/amj.2007.24160888.

Escobar-Rodríguez, T. and Bonsón-Fernández, R. (2017), "Facebook practices for business communication among fashion retailers", *Journal of Fashion Marketing and Management: An International Journal*, Vol. 21 No. 1, pp. 33–50, doi: 10.1108/JFMM-11-2015-0087.

EU Council. (2024), "Green claims directive: Council ready to start talks with the European Parliament", available at: https://www.consilium.europa.eu/en/press/press-releases/2024/06/17/green-claims-directive-council-ready-to-start-talks-with-the-european-parliament/ (accessed 27 December 2024).

EU NEWS. (2024), "EU's Digital Product Passport: Advancing transparency and sustainability", available at: https://data.europa.eu/en/news-events/news/eus-digital-product-passport-advancing-transparency-and-sustainability.

Fabrizio, K.R. and Kim, E.-H. (2019), "Reluctant Disclosure and Transparency: Evidence from Environmental Disclosures", *Organization Science*, Vol. 30 No. 6, pp. 1207–1231, doi: 10.1287/orsc.2019.1298.

Fairtrade Foundation. (2021), "What is Fairtrade?", available at: https://www.fairtrade.org.uk/what-is-fairtrade/ (accessed 20 December 2024).

Falchi, A., Grolleau, G. and Mzoughi, N. (2022), "Why companies might under-communicate their efforts for sustainable development and what can be done?", *Business Strategy and the Environment*, Vol. 31 No. 5, pp. 1938–1946, doi: 10.1002/bse.2991.

Feng, H., Kassem, M., Greenwood, D. and Doukari, O. (2023), "Whole building life cycle assessment at the design stage: a BIM-based framework using environmental product declaration", *International Journal of Building Pathology and Adaptation*, Vol. 41 No. 1, pp. 109–142, doi: 10.1108/IJBPA-06-2021-0091.

Fernandez-Feijoo, B., Romero, S. and Ruiz, S. (2014), "Effect of Stakeholders' Pressure on Transparency of Sustainability Reports within the GRI Framework", *Journal of Business Ethics*, Vol. 122 No. 1, pp. 53–63, doi: 10.1007/s10551-013-1748-5.

Ferrón-Vílchez, V., Valero-Gil, J. and Suárez-Perales, I. (2021), "How does greenwashing influence managers' decision-making? An experimental approach under stakeholder view", *Corporate Social Responsibility and Environmental Management*, Vol. 28 No. 2, pp. 860–880, doi: 10.1002/csr.2095.

Financial Times. (2019), "Is the EU's green policy protecting the planet or European industry?", 10 December, available at: https://www.ft.com/content/0432eb26-15f2-11ea-9ee4-11f260415385 (accessed 27 December 2024).

Fisher, W.R. (1984), "Narration as a human communication paradigm: The case of public moral argument", *Communication Monographs*, Vol. 51 No. 1, pp. 1–22, doi: 10.1080/03637758409390180.

Follows, S.B. and Jobber, D. (2000), "Environmentally responsible purchase behaviour: a test of a consumer model", *European Journal of Marketing*, Vol. 34 No. 5/6, pp. 723–746, doi: 10.1108/03090560010322009.

Fontana, E. (2018), "Corporate Social Responsibility as Stakeholder Engagement: Firm-NGO Collaboration in Sweden: Stakeholder engagement with NGOs in Sweden", *Corporate Social Responsibility and Environmental Management*, Vol. 25 No. 4, pp. 327–338, doi: 10.1002/csr.1463.

Forbes. (2025), "How Digital Product Passports Improve Traceability", available at: https://www.forbes.com/sites/stevebanker/2025/02/01/digital-product-passports-a-game-changer-for-traceability/.

Fortanier, F., Kolk, A. and Pinkse, J. (2011), "Harmonization in CSR Reporting: MNEs and Global CSR Standards", *Management International Review*, Vol. 51 No. 5, pp. 665–696, doi: 10.1007/s11575-011-0089-9.

Fransen, L.W. and Kolk, A. (2007), "Global Rule-Setting for Business: A Critical Analysis of Multi-Stakeholder Standards", *Organization*, Vol. 14 No. 5, pp. 667–684, doi: 10.1177/1350508407080305.

Freeman, R.E. (2010), *Strategic Management: A Stakeholder Approach*, 1st ed., Cambridge University Press, doi: 10.1017/CBO9781139192675.

Freestone, O.M. and McGoldrick, P.J. (2008), "Motivations of the Ethical Consumer", *Journal of Business Ethics*, Vol. 79 No. 4, pp. 445–467, doi: 10.1007/s10551-007-9409-1.

Frishammar, J. and Åke Hörte, S. (2005), "Managing External Information in Manufacturing Firms: The Impact on Innovation Performance*", *Journal of Product Innovation Management*, Vol. 22 No. 3, pp. 251–266, doi: 10.1111/j.0737-6782.2005.00121.x.

Garcés-Ayerbe, C., Rivera-Torres, P. and Suárez-Perales, I. (2019), "Stakeholder engagement mechanisms and their contribution to eco-innovation: Differentiated effects of communication and cooperation", *Corporate Social Responsibility and Environmental Management*, Vol. 26 No. 6, pp. 1321–1332, doi: 10.1002/csr.1749.

Gatersleben, B., Steg, L. and Vlek, C. (2002), "Measurement and Determinants of Environmentally Significant Consumer Behavior", *Environment and Behavior*, Vol. 34 No. 3, pp. 335–362, doi: 10.1177/0013916502034003004.

Gelowitz, M.D.C. and McArthur, J.J. (2018), "Insights on environmental product declaration use from Canada's first LEED® v4 platinum commercial project", *Resources, Conservation and Recycling*, Vol. 136, pp. 436–444, doi: 10.1016/j.resconrec.2018.05.008.

Gensler, S., Völckner, F., Liu-Thompkins, Y. and Wiertz, C. (2013), "Managing Brands in the Social Media Environment", *Journal of Interactive Marketing*, Vol. 27 No. 4, pp. 242–256, doi: 10.1016/j.intmar.2013.09.004.

George, G., Fewer, T.J., Lazzarini, S., McGahan, A.M. and Puranam, P. (2024), "Partnering for Grand Challenges: A Review of Organizational Design Considerations in Public–Private

Collaborations", *Journal of Management*, Vol. 50 No. 1, pp. 10–40, doi: 10.1177/01492063221148992.

Ghali, M.R., Frayret, J.-M. and Robert, J.-M. (2016), "Green social networking: concept and potential applications to initiate industrial synergies", *Journal of Cleaner Production*, Vol. 115, pp. 23–35, doi: 10.1016/j.jclepro.2015.12.028.

Giacomini, D., Martini, M., Sancino, A., Zola, P. and Cavenago, D. (2021), "Corporate social responsibility actions and organizational legitimacy at the peak of COVID-19: a sentiment analysis", *Corporate Governance: The International Journal of Business in Society*, Vol. 21 No. 6, pp. 1043–1058, doi: 10.1108/CG-09-2020-0389.

Giacomini, D., Paredi, D. and Sancino, A. (2022), "Stakeholder interactions as sources for organisational learning: insights from the water sector", *Meditari Accountancy Research*, Vol. 30 No. 7, pp. 1–25, doi: 10.1108/MEDAR-11-2020-1066.

Giacomini, D., Rocca, L., Zola, P. and Mazzoleni, M. (2021), "Local Governments' environmental disclosure via social networks: Organizational legitimacy and stakeholders' interactions", *Journal of Cleaner Production*, Vol. 317, p. 128290, doi: 10.1016/j.jclepro.2021.128290.

Giacomini, D., Zola, P., Paredi, D. and Mazzoleni, M. (2020), "Environmental disclosure and stakeholder engagement via social media: State of the art and potential in public utilities", *Corporate Social Responsibility and Environmental Management*, Vol. 27 No. 4, pp. 1552–1564, doi: 10.1002/csr.1904.

Gibson, K. (2012), "Stakeholders and Sustainability: An Evolving Theory", *Journal of Business Ethics*, Vol. 109 No. 1, pp. 15–25, doi: 10.1007/s10551-012-1376-5.

Gioia, D.A., Corley, K.G. and Hamilton, A.L. (2013), "Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology", *Organizational Research Methods*, Vol. 16 No. 1, pp. 15–31, doi: 10.1177/1094428112452151.

Global Lighting Association. (2024), *Implementing Internationally Harmonised LCAs and EPDs for Lighting Product*, White Paper, Global Lighting Association.

Global Reporting Initiative. (2024), "Sustainability Reporting Guidelines", Amsterdam, The Netherlands.

Goglio, P., Williams, A.G., Balta-Ozkan, N., Harris, N.R.P., Williamson, P., Huisingh, D., Zhang, Z., *et al.* (2020), "Advances and challenges of life cycle assessment (LCA) of greenhouse gas removal technologies to fight climate changes", *Journal of Cleaner Production*, Vol. 244, p. 118896, doi: 10.1016/j.jclepro.2019.118896.

Golany, B. and Kress, M. (1993), "A multicriteria evaluation of methods for obtaining weights from ratio-scale matrices", *European Journal of Operational Research*, Vol. 69 No. 2, pp. 210–220, doi: 10.1016/0377-2217(93)90165-J.

Gosselt, J.F., Van Rompay, T. and Haske, L. (2019), "Won't Get Fooled Again: The Effects of Internal and External CSR ECO-Labeling", *Journal of Business Ethics*, Vol. 155 No. 2, pp. 413–424, doi: 10.1007/s10551-017-3512-8.

Gray, B. (1999), *Collaborating: Finding Common Ground for Multiparty Problems*, Jossey Bass.

Gray, B. and Purdy, J. (2018), *Collaborating for Our Future: Multistakeholder Partnerships for Solving Complex Problems*, Oxford University Press USA - OSO, Oxford.

Gray, B., Purdy, J. and Ansari, S. (2022), "Confronting Power Asymmetries in Partnerships to Address Grand Challenges", *Organization Theory*, Vol. 3 No. 2, p. 26317877221098765, doi: 10.1177/26317877221098765.

Gray, R., Dey, C., Owen, D.L., Evans, R. and Zadek, S. (1997), "Struggling with the praxis of social accounting: Stakeholders, accountability, audits and procedures", *Accounting Auditing & Accountability Journal*, Vol. 10.

GreenLight Alliance. (2024), "Green Light Alliance objectives", available at: https://www.greenlight-alliance.com/ (accessed 28 December 2024).

Greenpeace. (2018), *Detox My Fashion.*

Greenpeace. (2021), *Self Regulation: A Fashion Fairytale*.

Greenpeace. (2023), "Court confirms Greenpeace right to peaceful protest as activists' 200 hour long protest against deep sea mining in the Pacific continues—Greenpeace USA.", available at: https://www. greenpeace.org/usa/news/court-confirms-greenpeace-right-to-peace ful-protest-as-activists-200-hour-long-protest-against-deep-sea-miningin- the-pacific-continues/.

Grimm, J. and Reinecke, J. (2024), "Collaborating on the Edge of Failure: Frame Alignment

across Multiple Interaction Arenas in Multi-Stakeholder Partnerships", *Academy of Management Journal*, Vol. 67 No. 4, pp. 956–990, doi: 10.5465/amj.2021.0466.

Groening, C., Sarkis, J. and Zhu, Q. (2018), "Green marketing consumer-level theory review: A compendium of applied theories and further research directions", *Journal of Cleaner Production*, Vol. 172, pp. 1848–1866, doi: 10.1016/j.jclepro.2017.12.002.

Guadagno, R.E., Rempala, D.M., Murphy, S. and Okdie, B.M. (2013), "What makes a video go viral? An analysis of emotional contagion and Internet memes", *Computers in Human Behavior*, Vol. 29 No. 6, pp. 2312–2319, doi: 10.1016/j.chb.2013.04.016.

Gualandris, J., Klassen, R.D., Vachon, S. and Kalchschmidt, M. (2015a), "Sustainable evaluation and verification in supply chains: Aligning and leveraging accountability to stakeholders", *Journal of Operations Management*, Vol. 38 No. 1, pp. 1–13, doi: 10.1016/j.jom.2015.06.002.

Gualandris, J., Klassen, R.D., Vachon, S. and Kalchschmidt, M. (2015b), "Sustainable evaluation and verification in supply chains: Aligning and leveraging accountability to stakeholders", *Journal of Operations Management*, Vol. 38 No. 1, pp. 1–13, doi: 10.1016/j.jom.2015.06.002.

Gulati, R., Wohlgezogen, F. and Zhelyazkov, P. (2012), "The Two Facets of Collaboration: Cooperation and Coordination in Strategic Alliances", *Academy of Management Annals*, Vol. 6 No. 1, pp. 531–583, doi: 10.5465/19416520.2012.691646.

Gunther, M. (2015), "Under pressure: Campaigns that persuaded companies to change the world", *The Guardian*.

Gupta A. (2013), "The shift from words to pictures and implications for digital marketers", *Forbes*, available at: https://www.forbes.com/sites/onmarketing/ 2013/07/02/the-shift-from-words-to-pictures-and-implications-fordigital- marketers/?sh=14af2e37405a.

Hahn, R. and Lülfs, R. (2014), "Legitimizing Negative Aspects in GRI-Oriented Sustainability Reporting: A Qualitative Analysis of Corporate Disclosure Strategies", *Journal of Business Ethics*, Vol. 123 No. 3, pp. 401–420, doi: 10.1007/s10551-013-1801-4.

Hamzah, M.I. and Tanwir, N.S. (2021), "Do pro-environmental factors lead to purchase intention of hybrid vehicles? The moderating effects of environmental knowledge", *Journal of Cleaner Production*, Vol. 279, p. 123643, doi: 10.1016/j.jclepro.2020.123643.

Han, W., McCabe, S., Wang, Y. and Chong, A.Y.L. (2018), "Evaluating user-generated content in social media: an effective approach to encourage greater pro-environmental behavior in tourism?", *Journal of Sustainable Tourism*, Vol. 26 No. 4, pp. 600–614, doi: 10.1080/09669582.2017.1372442.

Hao, Y., Farooq, Q. and Sun, Y. (2018), "Development of theoretical framework and measures for the role of social media in realizing corporate social responsibility through native and non-native communication modes: Moderating effects of cross-cultural management", *Corporate Social Responsibility and Environmental Management*, Vol. 25 No. 4, pp. 704–711, doi: 10.1002/csr.1523.

Hatanaka, M. (2020), "Beyond consuming ethically? Food citizens, governance, and sustainability", *Journal of Rural Studies*, Vol. 77, pp. 55–62, doi: 10.1016/j.jrurstud.2020.04.006.

Hehenberger, L., Mair, J. and Metz, A. (2019), "The Assembly of a Field Ideology: An Idea-Centric Perspective on Systemic Power in Impact Investing", *Academy of Management Journal*, Vol. 62 No. 6, pp. 1672–1704, doi: 10.5465/amj.2017.1402.

Herman, J. (2014), "The ultimate beginner's guide to Instagram", available at: https:// jennstrends.com/wp-content/uploads/2014/05/The-Ultimate- BeginnersGuide-ToInstagram.pdf.

Hinchcliffe, T. (2017), "Fashion brands incinerate waste clothing", available at: https://www.ecotextile.com/2017101623026/fashion-retailnews/ fashion-brands-incinerate-waste-clothing.html.

Hojnik, J., Ruzzier, M. and Manolova, T.S. (2020), "Sustainable development: Predictors of green consumerism in Slovenia", *Corporate Social Responsibility and Environmental Management*, Vol. 27 No. 4, pp. 1695–1708, doi: 10.1002/csr.1917.

Holder-Webb, L., Cohen, J.R., Nath, L. and Wood, D. (2009), "The Supply of Corporate Social Responsibility Disclosures Among U.S. Firms", *Journal of Business Ethics*, Vol. 84 No. 4, pp. 497–527, doi: 10.1007/s10551-008-9721-4.

Hollebeek, L.D., Glynn, M.S. and Brodie, R.J. (2014), "Consumer Brand Engagement in Social Media: Conceptualization, Scale Development and Validation", *Journal of Interactive Marketing*, Vol. 28 No. 2, pp. 149–165, doi: 10.1016/j.intmar.2013.12.002.

Hollenbaugh, E.E. and Ferris, A.L. (2014), "Facebook self-disclosure: Examining the role of traits, social cohesion, and motives", *Computers in Human Behavior*, Vol. 30, pp. 50–58, doi: 10.1016/j.chb.2013.07.055.

Hong, J. (Jenny), Yang, J., Wooldridge, B.R. and Bhappu, A.D. (2022), "Sharing consumers' brand storytelling: influence of consumers' storytelling on brand attitude via emotions and cognitions", *Journal of Product & Brand Management*, Vol. 31 No. 2, pp. 265–278, doi: 10.1108/JPBM-07-2019-2485.

Hossan Chowdhury, M.M. and Quaddus, M.A. (2021), "Supply chain sustainability practices and governance for mitigating sustainability risk and improving market performance: A dynamic capability perspective", *Journal of Cleaner Production*, Vol. 278, p. 123521, doi: 10.1016/j.jclepro.2020.123521.

Huber, G.P. (1991), "Organizational Learning: The Contributing Processes and the Literatures", *Organization Science*, Vol. 2 No. 1, pp. 88–115, doi: 10.1287/orsc.2.1.88.

Hughes, D.J., Rowe, M., Batey, M. and Lee, A. (2012), "A tale of two sites: Twitter vs. Facebook and the personality predictors of social media usage", *Computers in Human Behavior*, Vol. 28 No. 2, pp. 561–569, doi: 10.1016/j.chb.2011.11.001.

Hummel, K. and Schlick, C. (2016), "The relationship between sustainability performance and sustainability disclosure – Reconciling voluntary disclosure theory and legitimacy theory", *Journal of Accounting and Public Policy*, Vol. 35 No. 5, pp. 455–476, doi: 10.1016/j.jaccpubpol.2016.06.001.

Hunecke, M., Blöbaum, A., Matthies, E. and Höger, R. (2001), "Responsibility and Environment: Ecological Norm Orientation and External Factors in the Domain of Travel Mode Choice Behavior", *Environment and Behavior*, Vol. 33 No. 6, pp. 830–852, doi: 10.1177/00139160121973269.

Huq, F.A., Chowdhury, I.N. and Klassen, R.D. (2016), "Social management capabilities of multinational buying firms and their emerging market suppliers: An exploratory study of the clothing industry", *Journal of Operations Management*, Vol. 46 No. 1, pp. 19–37, doi: 10.1016/j.jom.2016.07.005.

Ibáñez-Forés, V., Pacheco-Blanco, B., Capuz-Rizo, S.F. and Bovea, M.D. (2016), "Environmental Product Declarations: exploring their evolution and the factors affecting their demand in Europe", *Journal of Cleaner Production*, Vol. 116, pp. 157–169, doi: 10.1016/j.jclepro.2015.12.078.

IBU. (2021), "Part B: Requirements on the EPD for Luminaires, lamps and components for luminaires".

Irwin, R. and Schaltegger, S. (Eds.). (2016), *Bridging Corporate and Academic Contributions: Proceedings of the First WBCSD and EMAN Joint International Sustainability Accounting Symposium, Geneva, 2015*, World Business Council for Sustainable Development (WBCSD), Geneva/Lüneburg.

ISO 14025. (2006), "Environmental Labels and Declarations. Type III Environmental Declarations. Principles and Procedures.", International Standard Organization, Geneva, Switzerland.

ISO14021. (2016), "Environmental labels and declarations—self-declared environmental claims (type II environmental labelling)".

ISO14024. (2018), "Environmental labels and declarations—type I environmental labelling—principles and procedures".

Jalali, S.S. and Khalid, H.B. (2021), "The Influence of Instagram Influencers' Activity on Green Consumption Behavior", *Business Management and Strategy*, Vol. 12 No. 1, p. 78, doi: 10.5296/bms.v12i1.18265.

Ji, Y.G., Chen, Z.F., Tao, W. and Cathy Li, Z. (2019), "Functional and emotional traits of corporate social media message strategies: Behavioral insights from S&P 500 Facebook data", *Public Relations Review*, Vol. 45 No. 1, pp. 88–103, doi: 10.1016/j.pubrev.2018.12.001.

Jira, C. (Fern) and Toffel, M.W. (2013), "Engaging Supply Chains in Climate Change", *Manufacturing & Service Operations Management*, Vol. 15 No. 4, pp. 559–577, doi: 10.1287/msom.1120.0420.

Johnstone, M.-L. and Tan, L.P. (2015), "Exploring the Gap Between Consumers' Green Rhetoric and Purchasing Behaviour", *Journal of Business Ethics*, Vol. 132 No. 2, pp. 311–328, doi: 10.1007/s10551-014-2316-3.

Jones, S. (2022), "Climate activists throw mashed potatoes at Monet work in Germany", *The Guardian*.

Kang, S. (2022), "Travelers' pro-environmental behaviors in the Hyperloop context: Integrating norm activation and AIDA models", *International Journal of Tourism Research*, Vol. 24 No. 6, pp. 813–826, doi: 10.1002/jtr.2547.

Kao, T.-F. and Du, Y.-Z. (2020), "A study on the influence of green advertising design and environmental emotion on advertising effect", *Journal of Cleaner Production*, Vol. 242, p. 118294, doi: 10.1016/j.jclepro.2019.118294.

Kaplan, A.M. and Haenlein, M. (2010), "Users of the world, unite! The challenges and opportunities of Social Media", *Business Horizons*, Vol. 53 No. 1, pp. 59–68, doi: 10.1016/j.bushor.2009.09.003.

Kapoor, P.S., Balaji, M.S. and Jiang, Y. (2021), "Effectiveness of sustainability communication on social media: role of message appeal and message source", *International Journal of Contemporary Hospitality Management*, Vol. 33 No. 3, pp. 949–972, doi: 10.1108/IJCHM-09-2020-0974.

Khanal, A., Akhtaruzzaman, M. and Kularatne, I. (2021), "The influence of social media on stakeholder engagement and the corporate social responsibility of small businesses", *Corporate Social Responsibility and Environmental Management*, Vol. 28 No. 6, pp. 1921–1929, doi: 10.1002/csr.2169.

Kim, D.-H., Spiller, L. and Hettche, M. (2015), "Analyzing media types and content orientations in Facebook for global brands", *Journal of Research in Interactive Marketing*, Vol. 9 No. 1, pp. 4–30, doi: 10.1108/JRIM-05-2014-0023.

Klein, L.R. (2003), "Creating virtual product experiences: The role of telepresence", *Journal of Interactive Marketing*, Vol. 17 No. 1, pp. 41–55, doi: 10.1002/dir.10046.

Ko, E. and Megehee, C.M. (2012), "Fashion marketing of luxury brands: Recent research issues and contributions", *Journal of Business Research*, Vol. 65 No. 10, pp. 1395–1398, doi: 10.1016/j.jbusres.2011.10.004.

Kolk, A., Levy, D. and Pinkse, J. (2008), "Corporate Responses in an Emerging Climate Regime: The Institutionalization and Commensuration of Carbon Disclosure", *European Accounting Review*, Vol. 17 No. 4, pp. 719–745, doi: 10.1080/09638180802489121.

Korschun, D. and Du, S. (2013), "How virtual corporate social responsibility dialogs generate value: A framework and propositions", *Journal of Business Research*, Vol. 66 No. 9, pp. 1494–1504, doi: 10.1016/j.jbusres.2012.09.011.

Kourula, A. and Halme, M. (2008), "Types of corporate responsibility and engagement with NGOs: an exploration of business and societal outcomes", edited by Lenssen, G.*Corporate Governance: The International Journal of Business in Society*, Vol. 8 No. 4, pp. 557–570, doi: 10.1108/14720700810899275.

Kourula, A. and Laasonen, S. (2010), "Nongovernmental Organizations in Business and Society, Management, and International Business Research: Review and Implications From 1998 to 2007", *Business & Society*, Vol. 49 No. 1, pp. 35–67, doi: 10.1177/0007650309345282.

KPMG. (2025), *The Move to Mandatory Reporting. Survey of Sustainability Reporting 2024*.

Kumar, A., Bezawada, R., Rishika, R., Janakiraman, R. and Kannan, P.K. (2016), "From Social to Sale: The Effects of Firm-Generated Content in Social Media on Customer Behavior", *Journal of Marketing*, Vol. 80 No. 1, pp. 7–25, doi: 10.1509/jm.14.0249.

Laczniak, G.R. and Murphy, P.E. (2006), "Normative Perspectives for Ethical and Socially Responsible Marketing", *Journal of Macromarketing*, Vol. 26 No. 2, pp. 154–177, doi: 10.1177/0276146706290924.

Lasvaux, S., Habert, G., Peuportier, B. and Chevalier, J. (2015), "Comparison of generic and product-specific Life Cycle Assessment databases: application to construction materials used in building LCA studies", *The International Journal of Life Cycle Assessment*, Vol. 20 No. 11, pp. 1473–1490, doi: 10.1007/s11367-015-0938-z.

Lee, M.-D.P. (2011), "Configuration of External Influences: The Combined Effects of Institutions and Stakeholders on Corporate Social Responsibility Strategies", *Journal of Business Ethics*, Vol. 102 No. 2, pp. 281–298, doi: 10.1007/s10551-011-0814-0.

Lee, M.K.K. (2019), "Effective Green Alliances: An analysis of how environmental nongovernmental organizations affect corporate sustainability programs", *Corporate Social Responsibility and Environmental Management*, Vol. 26 No. 1, pp. 227–237, doi: 10.1002/csr.1674.

LEED. (2024), "Environmental Product Declarations", available at: https://www.usgbc.org/credits/new-construction-core-and-shell-schools-new-construction-retail-new-construction-data-15?view=language&return=/credits/New-construction/v4. (accessed 28 December 2024).

Lewis, B.W., Walls, J.L. and Dowell, G.W.S. (2014), "Difference in degrees: CEO characteristics

and firm environmental disclosure: Research Notes and Commentaries", *Strategic Management Journal*, Vol. 35 No. 5, pp. 712–722, doi: 10.1002/smj.2127.

Lewis, M., Huang, M., Waldman, B., Carlisle, S. and Simonen, K. (2021), "Environmental Product Declaration Requirements in Procurement Policies", In Carbon Leadership Forum.

Lewis, M., Waldman, B., Carlisle, S., Benke, B., and Simonen, K. (2023), *Advancing the LCA Ecosystem: A Policy-Focused Roadmap for Reducing Embodied Carbon*, Carbon Leadership Forum, University of Washington, Seattle, WA.

Li, Q., Li, T., Chen, H., Xiang, E. and Ruan, W. (2019), "Executives' excess compensation, legitimacy, and environmental information disclosure in C hinese heavily polluting companies: T he moderating role of media pressure", *Corporate Social Responsibility and Environmental Management*, Vol. 26 No. 1, pp. 248–256, doi: 10.1002/csr.1676.

Li, Y. and Xie, Y. (2020), "Is a Picture Worth a Thousand Words? An Empirical Study of Image Content and Social Media Engagement", *Journal of Marketing Research*, Vol. 57 No. 1, pp. 1–19, doi: 10.1177/0022243719881113.

Lighting Europe. (2024), "Members and Partners", available at: https://www.lightingeurope.org/about-us/members-and-partners (accessed 28 December 2024).

Lim, W.M. and Rasul, T. (2022), "Customer engagement and social media: Revisiting the past to inform the future", *Journal of Business Research*, Vol. 148, pp. 325–342, doi: 10.1016/j.jbusres.2022.04.068.

Lock, I. and Araujo, T. (2020), "Visualizing the triple bottom line: A large-scale automated visual content analysis of European corporations' website and social media images", *Corporate Social Responsibility and Environmental Management*, Vol. 27 No. 6, pp. 2631–2641, doi: 10.1002/csr.1988.

Luchs, M.G., Brower, J. and Chitturi, R. (2012), "Product Choice and the Importance of Aesthetic Design Given the Emotion-laden Trade-off between Sustainability and Functional Performance", *Journal of Product Innovation Management*, Vol. 29 No. 6, pp. 903–916, doi: 10.1111/j.1540-5885.2012.00970.x.

Luo, X.R., Wang, D. and Zhang, J. (2017), "Whose Call to Answer: Institutional Complexity and Firms' CSR Reporting", *Academy of Management Journal*, Vol. 60 No. 1, pp. 321–344, doi: 10.5465/amj.2014.0847.

Lyon, T.P. and Montgomery, A.W. (2015), "The Means and End of Greenwash", *Organization & Environment*, Vol. 28 No. 2, pp. 223–249, doi: 10.1177/1086026615575332.

Macdonald, S. and Chrisp, T. (2005), "Acknowledging the Purpose of Partnership", *Journal of Business Ethics*, Vol. 59 No. 4, pp. 307–317, doi: 10.1007/s10551-004-3235-5.

Mackson, S.B., Brochu, P.M. and Schneider, B.A. (2019), "Instagram: Friend or foe? The application's association with psychological well-being", *New Media & Society*, Vol. 21 No. 10, pp. 2160–2182, doi: 10.1177/1461444819840021.

Madsen, H. and Ulhøi, J.P. (2001), "Integrating environmental and stakeholder management", *Business Strategy and the Environment*, Vol. 10 No. 2, pp. 77–88, doi: 10.1002/bse.279.

Mancha, R.M. and Yoder, C.Y. (2015), "Cultural antecedents of green behavioral intent: An environmental theory of planned behavior", *Journal of Environmental Psychology*, Vol. 43, pp. 145–154, doi: 10.1016/j.jenvp.2015.06.005.

Marquina, P. and Morales, C.E. (2012), "The influence of CSR on purchasing behaviour in Peru and Spain", edited by Fastoso, F.*International Marketing Review*, Vol. 29 No. 3, pp. 299–312, doi: 10.1108/02651331211229778.

Marquis, C., Toffel, M.W. and Zhou, Y. (2016), "Scrutiny, Norms, and Selective Disclosure: A Global Study of Greenwashing", *Organization Science*, Vol. 27 No. 2, pp. 483–504, doi: 10.1287/orsc.2015.1039.

Matten, D. and Crane, A. (2005), "Corporate Citizenship: Toward an Extended Theoretical Conceptualization", *Academy of Management Review*, Vol. 30 No. 1, pp. 166–179, doi: 10.5465/amr.2005.15281448.

McDonough, W. and Braungart, M. (2002), "Design for the Triple Top Line: New Tools for Sustainable Commerce", *Corporate Environmental Strategy*, Vol. 9 No. 3, pp. 251–258, doi: 10.1016/S1066-7938(02)00069-6.

Mena, S. and Palazzo, G. (2012), "Input and Output Legitimacy of Multi-Stakeholder Initiatives", *Business Ethics Quarterly*, Vol. 22 No. 3, pp. 527–556, doi: 10.5840/beq201222333.

Meng, X.H., Zeng, S.X., Tam, C.M. and Xu, X.D. (2013), "Whether Top Executives' Turnover

Influences Environmental Responsibility: From the Perspective of Environmental Information Disclosure", *Journal of Business Ethics*, Vol. 114 No. 2, pp. 341–353, doi: 10.1007/s10551-012-1351-1.

Miles, M. B., Huberman, A. M., and Saldana, J. (2014), *Qualitative Data Analysis: A Methods Sourcebook*, Sage.

Mol, A.P.J. (2015), "Transparency and value chain sustainability", *Journal of Cleaner Production*, Vol. 107, pp. 154–161, doi: 10.1016/j.jclepro.2013.11.012.

Mont, O., Neuvonen, A. and Lähteenoja, S. (2014), "Sustainable lifestyles 2050: stakeholder visions, emerging practices and future research", *Journal of Cleaner Production*, Vol. 63, pp. 24–32, doi: 10.1016/j.jclepro.2013.09.007.

Montgomery, A.W., Lyon, T.P. and Barg, J. (2023), "No End in Sight? A Greenwash Review and Research Agenda", *Organization & Environment*, p. 108602662311689, doi: 10.1177/10860266231168905.

Moorman, C. (1995), "Organizational Market Information Processes: Cultural Antecedents and New Product Outcomes", *Journal of Marketing Research*, Vol. 32 No. 3, pp. 318–335, doi: 10.1177/002224379503200307.

Murillo-Luna, J.L., Garcés-Ayerbe, C. and Rivera-Torres, P. (2008), "Why do patterns of environmental response differ? A stakeholders' pressure approach", *Strategic Management Journal*, Vol. 29 No. 11, pp. 1225–1240, doi: 10.1002/smj.711.

Murphy, D. F., and Bendell, J. (1997), *In the Company of Partners: Business, Environmental Groups and Sustainable Development Post-Rio*, The Policy Press.

Nekmahmud, Md., Naz, F., Ramkissoon, H. and Fekete-Farkas, M. (2022), "Transforming consumers' intention to purchase green products: Role of social media", *Technological Forecasting and Social Change*, Vol. 185, p. 122067, doi: 10.1016/j.techfore.2022.122067.

Newberry, C. (2023), "34 Instagram stats marketers need to know in 2023", available at: https://blog.hootsuite.com/instagram-statistics/.

Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T. and Gwilt, A. (2020), "The environmental price of fast fashion", *Nature Reviews Earth & Environment*, Vol. 1 No. 4, pp. 189–200, doi: 10.1038/s43017-020-0039-9.

Nikolaeva, R. and Bicho, M. (2011), "The role of institutional and reputational factors in the voluntary adoption of corporate social responsibility reporting standards", *Journal of the Academy of Marketing Science*, Vol. 39 No. 1, pp. 136–157, doi: 10.1007/s11747-010-0214-5.

Nøjgaard, M. (2023), "The Value-Translation Model of Consumer Activism: How Consumer Watchdog Organizations Change Markets", edited by Price, L.L., Giesler, M. and Arsel, Z.*Journal of Consumer Research*, Vol. 49 No. 6, pp. 967–986, doi: 10.1093/jcr/ucac025.

Nyilasy, G., Gangadharbatla, H. and Paladino, A. (2014), "Perceived Greenwashing: The Interactive Effects of Green Advertising and Corporate Environmental Performance on Consumer Reactions", *Journal of Business Ethics*, Vol. 125 No. 4, pp. 693–707, doi: 10.1007/s10551-013-1944-3.

O'Dwyer, B., Unerman, J. and Hession, E. (2005), "User needs in sustainability reporting: Perspectives of stakeholders in Ireland", *European Accounting Review*, Vol. 14 No. 4, pp. 759–787, doi: 10.1080/09638180500104766.

Okhmatovskiy, I. and David, R.J. (2012), "Setting Your Own Standards: Internal Corporate Governance Codes as a Response to Institutional Pressure", *Organization Science*, Vol. 23 No. 1, pp. 155–176, doi: 10.1287/orsc.1100.0642.

Olanrewaju, O.I., Enegbuma, W.I. and Donn, M. (2024), "Challenges in life cycle assessment implementation for construction environmental product declaration development: A mixed approach and global perspective", *Sustainable Production and Consumption*, Vol. 49, pp. 502–528, doi: 10.1016/j.spc.2024.06.021.

OneClick LCA. (2024), "Decarbonize lighting with luminaire EPDs", available at: https://oneclicklca.com/en/resources/articles/decarbonize-lighting-with-luminaires-epds (accessed 27 December 2024).

Osei-Frimpong, K. and McLean, G. (2018), "Examining online social brand engagement: A social presence theory perspective", *Technological Forecasting and Social Change*, Vol. 128, pp. 10–21, doi: 10.1016/j.techfore.2017.10.010.

Ottman, J.A., Stafford, E.R. and Hartman, C.L. (2006), "Avoiding Green Marketing Myopia: Ways to Improve Consumer Appeal for Environmentally Preferable Products", *Environment:*

Science and Policy for Sustainable Development, Vol. 48 No. 5, pp. 22–36, doi: 10.3200/ENVT.48.5.22-36.

Overdevest, C. (2010), "Comparing forest certification schemes: the case of ratcheting standards in the forest sector", *Socio-Economic Review*, Vol. 8 No. 1, pp. 47–76, doi: 10.1093/ser/mwp028.

Parkman, I.D. and Krause, A.J. (2018), "The Diamond Model of Authentic Green Marketing: Evidence from the Sustainable Architecture Industry", *Business and Society Review*, Vol. 123 No. 1, pp. 83–118, doi: 10.1111/basr.12136.

Parmigiani, A., Klassen, R.D. and Russo, M.V. (2011), "Efficiency meets accountability: Performance implications of supply chain configuration, control, and capabilities⋆", *Journal of Operations Management*, Vol. 29 No. 3, pp. 212–223, doi: 10.1016/j.jom.2011.01.001.

Peloza, J. and Falkenberg, L. (2009), "The Role of Collaboration in Achieving Corporate Social Responsibility Objectives", *California Management Review*, Vol. 51 No. 3, pp. 95–113, doi: 10.2307/41166495.

Peloza, J., Loock, M., Cerruti, J. and Muyot, M. (2012), "Sustainability: How Stakeholder Perceptions Differ from Corporate Reality", *California Management Review*, Vol. 55 No. 1, pp. 74–97, doi: 10.1525/cmr.2012.55.1.74.

Perks, K. J., Viana, M. R., Farache, F., and Kollat, J. (2017), *A Critical Reflection on the Role of Dialogue in Communicating Ethical CSR through Digital Platforms*, In A. Lingreen, J. Vanhamme, R. Watkins, F.Maon (Eds.), Communicating corporate social responsibility in the digital era (p. 11)., Routledge.

Petrocchi, N., Asnaani, A., Martinez, A.P., Nadkarni, A. and Hofmann, S.G. (2015), "Differences Between People Who Use Only Facebook and Those Who Use Facebook Plus Twitter", *International Journal of Human-Computer Interaction*, Vol. 31 No. 2, pp. 157–165, doi: 10.1080/10447318.2014.986640.

Pittman, M. and Reich, B. (2016), "Social media and loneliness: Why an Instagram picture may be worth more than a thousand Twitter words", *Computers in Human Behavior*, Vol. 62, pp. 155–167, doi: 10.1016/j.chb.2016.03.084.

Pizzi, S., Moggi, S., Caputo, F. and Rosato, P. (2021), "Social media as stakeholder engagement tool: CSR communication failure in the oil and gas sector", *Corporate Social Responsibility and Environmental Management*, Vol. 28 No. 2, pp. 849–859, doi: 10.1002/csr.2094.

Pornpitakpan, C., Yuan, Y. and Han, J.H. (2017), "The Effect of Salespersons' Retail Service Quality and Consumers' Mood on Impulse Buying", *Australasian Marketing Journal*, Vol. 25 No. 1, pp. 2–11, doi: 10.1016/j.ausmj.2016.12.003.

Porter, M. E and Kramer, M. R. (2011), "La creación de valor compartido: cómo reinventar el capitalismo y liberar una oleada de innovación y crecimiento", Vol. 89 No. 1, pp. 31–49.

Pourazad, N., Stocchi, L. and Narsey, S. (2023), "A Comparison of Social Media Influencers' KPI Patterns across Platforms: Exploring Differences in Followers and Engagement On Facebook, Instagram, YouTube, TikTok, and Twitter", *Journal of Advertising Research*, Vol. 63 No. 2, pp. 139–159, doi: 10.2501/JAR-2023-008.

Prado-Lorenzo, J.-M., Gallego-Alvarez, I. and Garcia-Sanchez, I.M. (2009), "Stakeholder engagement and corporate social responsibility reporting: the ownership structure effect", *Corporate Social Responsibility and Environmental Management*, Vol. 16 No. 2, pp. 94–107, doi: 10.1002/csr.189.

Prakash, A. and Potoski, M. (2007), "Collective Action through Voluntary Environmental Programs: A Club Theory Perspective", *Policy Studies Journal*, Vol. 35 No. 4, pp. 773–792, doi: 10.1111/j.1541-0072.2007.00247.x.

Prakash, G. and Pathak, P. (2017), "Intention to buy eco-friendly packaged products among young consumers of India: A study on developing nation", *Journal of Cleaner Production*, Vol. 141, pp. 385–393, doi: 10.1016/j.jclepro.2016.09.116.

Prothero, A., Dobscha, S., Freund, J., Kilbourne, W.E., Luchs, M.G., Ozanne, L.K. and Thøgersen, J. (2011), "Sustainable Consumption: Opportunities for Consumer Research and Public Policy", *Journal of Public Policy & Marketing*, Vol. 30 No. 1, pp. 31–38, doi: 10.1509/jppm.30.1.31.

Purdy, J.M. (2012), "A Framework for Assessing Power in Collaborative Governance Processes", *Public Administration Review*, Vol. 72 No. 3, pp. 409–417, doi: 10.1111/j.1540-6210.2011.02525.x.

Reilly, A.H. and Hynan, K.A. (2014), "Corporate communication, sustainability, and social media: It's not easy (really) being green", *Business Horizons*, Vol. 57 No. 6, pp. 747–758, doi: 10.1016/j.bushor.2014.07.008.

Rietveld, R., Van Dolen, W., Mazloom, M. and Worring, M. (2020), "What you Feel, Is what you like Influence of Message Appeals on Customer Engagement on Instagram", *Journal of Interactive Marketing*, Vol. 49 No. 1, pp. 20–53, doi: 10.1016/j.intmar.2019.06.003.

Ring, P.S. and Van De Ven, A.H. (1994), "Developmental Processes of Cooperative Interorganizational Relationships", *The Academy of Management Review*, Vol. 19 No. 1, p. 90, doi: 10.2307/258836.

Rivera-Santos, M. and Rufín, C. (2010), "Odd Couples: Understanding the Governance of Firm–NGO Alliances", *Journal of Business Ethics*, Vol. 94 No. S1, pp. 55–70, doi: 10.1007/s10551-011-0779-z.

Rocca, L., Giacomini, D. and Zola, P. (2021), "Environmental disclosure and sentiment analysis: state of the art and opportunities for public-sector organisations", *Meditari Accountancy Research*, Vol. 29 No. 3, pp. 617–646, doi: 10.1108/MEDAR-09-2019-0563.

Roemer, N., Souza, G.C., Tröster, C. and Voigt, G. (2023), "Offset or reduce: How should firms implement carbon footprint reduction initiatives?", *Production and Operations Management*, Vol. 32 No. 9, pp. 2940–2955, doi: 10.1111/poms.14017.

Roloff, J. (2008), "A life cycle model of multi-stakeholder networks", *Business Ethics: A European Review*, Vol. 17 No. 3, pp. 311–325, doi: 10.1111/j.1467-8608.2008.00537.x.

Roma, P. and Aloini, D. (2019), "How does brand-related user-generated content differ across social media? Evidence reloaded", *Journal of Business Research*, Vol. 96, pp. 322–339, doi: 10.1016/j.jbusres.2018.11.055.

Roma, P. and Vasi, M. (2019), "Diversification and performance in the mobile app market: The role of the platform ecosystem", *Technological Forecasting and Social Change*, Vol. 147, pp. 123–139, doi: 10.1016/j.techfore.2019.07.003.

Rondinelli, D.A. and London, T. (2003), "How corporations and environmental groups cooperate: Assessing cross-sector alliances and collaborations", *Academy of Management Perspectives*, Vol. 17 No. 1, pp. 61–76, doi: 10.5465/ame.2003.9474812.

Rosenkrans, G. (2009), "The Creativeness and Effectiveness of Online Interactive Rich Media Advertising", *Journal of Interactive Advertising*, Vol. 9 No. 2, pp. 18–31, doi: 10.1080/15252019.2009.10722152.

Ruiz-Blanco, S., Romero, S. and Fernandez-Feijoo, B. (2022), "Green, blue or black, but washing–What company characteristics determine greenwashing?", *Environment, Development and Sustainability*, Vol. 24 No. 3, pp. 4024–4045, doi: 10.1007/s10668-021-01602-x.

SA8000. (2024), "Social Accountability 8000: International Standard", New York.

Sabate, F., Berbegal-Mirabent, J., Cañabate, A. and Lebherz, P.R. (2014), "Factors influencing popularity of branded content in Facebook fan pages", *European Management Journal*, Vol. 32 No. 6, pp. 1001–1011, doi: 10.1016/j.emj.2014.05.001.

Savitz, A. W. (2013), *The Triple Bottom Line: How Today's Best-Run Companies Are Achieving Economic, Social and Environmental Success-and How You Can Too.*, John Wiley&Sons.

SBTi. (2024), "Science Based Targets Initiative", available at: https://sciencebasedtargets.org/ (accessed 28 December 2024).

Schaltegger, S., Hörisch, J. and Freeman, R.E. (2019), "Business Cases for Sustainability: A Stakeholder Theory Perspective", *Organization & Environment*, Vol. 32 No. 3, pp. 191–212, doi: 10.1177/1086026617722882.

Schepers, D.H. (2006), "The Impact of NGO Network Conflict on the Corporate Social Responsibility Strategies of Multinational Corporations", *Business & Society*, Vol. 45 No. 3, pp. 282–299, doi: 10.1177/0007650306289386.

Scherer, A.G. and Palazzo, G. (2011), "The New Political Role of Business in a Globalized World: A Review of a New Perspective on CSR and its Implications for the Firm, Governance, and Democracy", *Journal of Management Studies*, Vol. 48 No. 4, pp. 899–931, doi: 10.1111/j.1467-6486.2010.00950.x.

Schnackenberg, A.K. and Tomlinson, E.C. (2016), "Organizational Transparency: A New Perspective on Managing Trust in Organization-Stakeholder Relationships", *Journal of Management*, Vol. 42 No. 7, pp. 1784–1810, doi: 10.1177/0149206314525202.

Schons, L. and Steinmeier, M. (2016), "Walk the Talk? How Symbolic and Substantive CSR Actions Affect Firm Performance Depending on Stakeholder Proximity: Walk the Talk", *Corporate Social Responsibility and Environmental Management*, Vol. 23 No. 6, pp. 358–372, doi: 10.1002/csr.1381.

Schuessler, E.S., Lohmeyer, N. and Ashwin, S. (2023), "'We Can't Compete on Human Rights': Creating Market-Protected Spaces to Institutionalize the Emerging Logic of Responsible Management", *Academy of Management Journal*, Vol. 66 No. 4, pp. 1071–1101, doi: 10.5465/amj.2020.1614.

Schwartz, S.H. (1977), "Normative Influences on Altruism", *Advances in Experimental Social Psychology*, Vol. 10, Elsevier, pp. 221–279, doi: 10.1016/S0065-2601(08)60358-5.

Searcy, C. (2017), "Multi-stakeholder initiatives in sustainable supply chains: Putting sustainability performance in context", edited by Kapuscinski, A.R. and Dooley, K.*Elementa: Science of the Anthropocene*, Vol. 5, p. 73, doi: 10.1525/elementa.262.

Seele, P. and Gatti, L. (2017), "Greenwashing Revisited: In Search of a Typology and Accusation-Based Definition Incorporating Legitimacy Strategies: Greenwashing Revisited", *Business Strategy and the Environment*, Vol. 26 No. 2, pp. 239–252, doi: 10.1002/bse.1912.

Severo, E.A., De Guimarães, J.C.F. and Dellarmelin, M.L. (2021), "Impact of the COVID-19 pandemic on environmental awareness, sustainable consumption and social responsibility: Evidence from generations in Brazil and Portugal", *Journal of Cleaner Production*, Vol. 286, p. 124947, doi: 10.1016/j.jclepro.2020.124947.

Shahbaznezhad, H., Dolan, R. and Rashidirad, M. (2021), "The Role of Social Media Content Format and Platform in Users' Engagement Behavior", *Journal of Interactive Marketing*, Vol. 53 No. 1, pp. 47–65, doi: 10.1016/j.intmar.2020.05.001.

Shanker, L., Mazzei, I. and Bowes, T. (2024), *Streamlining Life Cycle Assessment for Complex MEP Products – Learnings from Lighting.*, CIBSE Technical Symposium, UK.

Shanker, L., Mazzei, I. and Bowes, T. (2025), "Streamlining life cycle assessment for complex Mechanical Electrical and Plumbing products – Lessons from lighting", *Building Services Engineering Research and Technology*, p. 01436244241305759, doi: 10.1177/01436244241305759.

Sharma, S. and Vredenburg, H. (1998), "Proactive corporate environmental strategy and the development of competitively valuable organizational capabilities", *Strategic Management Journal*, Vol. 19 No. 8, pp. 729–753, doi: 10.1002/(SICI)1097-0266(199808)19:8<729::AID-SMJ967>3.0.CO;2-4.

Short, J., Williams, E. and Christie, B. (1976), *The Social Psychology of Telecommunications*, John Wiley and Sons.

Šikić, F. (2021), "Using Instagram as a Communication Channel in Green Marketing Digital Mix: A Case Study of *bio&bio* Organic Food Chain in Croatia", in Topić, M. and Lodorfos, G. (Eds.), *Critical Studies on Corporate Responsibility, Governance and Sustainability*, Emerald Publishing Limited, pp. 221–236, doi: 10.1108/S2043-905920210000015013.

Smith, A.N., Fischer, E. and Yongjian, C. (2012), "How Does Brand-related User-generated Content Differ across YouTube, Facebook, and Twitter?", *Journal of Interactive Marketing*, Vol. 26 No. 2, pp. 102–113, doi: 10.1016/j.intmar.2012.01.002.

Smith, N.W. and Joffe, H. (2009), "Climate change in the British press: the role of the visual", *Journal of Risk Research*, Vol. 12 No. 5, pp. 647–663, doi: 10.1080/13669870802586512.

Srinivasan, R. and Swink, M. (2018), "An Investigation of Visibility and Flexibility as Complements to Supply Chain Analytics: An Organizational Information Processing Theory Perspective", *Production and Operations Management*, Vol. 27 No. 10, pp. 1849–1867, doi: 10.1111/poms.12746.

Stafford, E.R., Polonsky, M.J. and Hartman, C.L. (2000), "Environmental NGO-business collaboration and strategic bridging: a case analysis of the Greenpeace-Foron Alliance", *Business Strategy and the Environment*, Vol. 9 No. 2, pp. 122–135, doi: 10.1002/(SICI)1099-0836(200003/04)9:2<122::AID-BSE232>3.0.CO;2-C.

Steenhaut, S. and Van Kenhove, P. (2006), "The Mediating Role of Anticipated Guilt in Consumers' Ethical Decision-Making", *Journal of Business Ethics*, Vol. 69 No. 3, pp. 269–288, doi: 10.1007/s10551-006-9090-9.

Stubbs, W., Higgins, C. and Milne, M. (2013), "Why Do Companies Not Produce Sustainability Reports?", *Business Strategy and the Environment*, Vol. 22 No. 7, pp. 456–470, doi: 10.1002/bse.1756.

Sun, Y., Liu, N. and Zhao, M. (2019), "Factors and mechanisms affecting green consumption in China: A multilevel analysis", *Journal of Cleaner Production*, Vol. 209, pp. 481–493, doi: 10.1016/j.jclepro.2018.10.241.

Sutantoputra, A. (2022), "Do stakeholders' demands matter in environmental disclosure

practices? Evidence from Australia", *Journal of Management and Governance*, Vol. 26 No. 2, pp. 449–478, doi: 10.1007/s10997-020-09560-8.

Swani, K. and Labrecque, L.I. (2020), "Like, Comment, or Share? Self-presentation vs. brand relationships as drivers of social media engagement choices", *Marketing Letters*, Vol. 31 No. 2–3, pp. 279–298, doi: 10.1007/s11002-020-09518-8.

Swim, J. K, Clayton, S. and Howard, G. S. (2011), "Human behavioral contributions to climate change: psychological and contextual drivers", Vol. 66 No. 4, p. 251.

Szabo, S. and Webster, J. (2021), "Perceived Greenwashing: The Effects of Green Marketing on Environmental and Product Perceptions", *Journal of Business Ethics*, Vol. 171 No. 4, pp. 719–739, doi: 10.1007/s10551-020-04461-0.

Teegen, H., Doh, J.P. and Vachani, S. (2004), "The importance of nongovernmental organizations (NGOs) in global governance and value creation: an international business research agenda", *Journal of International Business Studies*, Vol. 35 No. 6, pp. 463–483, doi: 10.1057/palgrave.jibs.8400112.

The Guardian. (2022), "Fashion brands grapple with greenwashing: 'It's not a human right to say something is sustainable'".

Trudel, R. and Cotte, J. (2009), "Does it pay to be good?", Vol. 50 No. 2, p. 61.

Tsoi, J. (2010), "Stakeholders' Perceptions and Future Scenarios to Improve Corporate Social Responsibility in Hong Kong and Mainland China", *Journal of Business Ethics*, Vol. 91 No. 3, pp. 391–404, doi: 10.1007/s10551-009-0091-3.

Tushman, M.L. and Nadler, D.A. (1978), "Information Processing as an Integrating Concept in Organizational Design", *The Academy of Management Review*, Vol. 3 No. 3, p. 613, doi: 10.2307/257550.

UN Environment Programme. (2017), "BRIGHTEN UP! Making the switch to efficient lighting", available at: https://www.unep.org/news-and-stories/story/brighten-making-switch-efficient-lighting (accessed 27 December 2024).

Ursavas, B. and Hesapci-Sanaktekin, O. (2013), "What happens when you're lost between happiness and sadness?", *Journal of Business Research*, Vol. 66 No. 7, pp. 933–940, doi: 10.1016/j.jbusres.2011.12.013.

Utting, P. (2005), "Corporate responsibility and the movement of business", *Development in Practice*, Vol. 15 No. 3–4, pp. 375–388, doi: 10.1080/09614520500075797.

Veleva, V. (2021), "The role of entrepreneurs in advancing sustainable lifestyles: Challenges, impacts, and future opportunities", *Journal of Cleaner Production*, Vol. 283, p. 124658, doi: 10.1016/j.jclepro.2020.124658.

Villena, V.H. and Dhanorkar, S. (2020), "How institutional pressures and managerial incentives elicit carbon transparency in global supply chains", *Journal of Operations Management*, Vol. 66 No. 6, pp. 697–734, doi: 10.1002/joom.1088.

Villena, V.H., Wilhelm, M. and Xiao, C. (2021), "Untangling drivers for supplier environmental and social responsibility: An investigation in Philips Lighting's Chinese supply chain", *Journal of Operations Management*, Vol. 67 No. 4, pp. 476–510, doi: 10.1002/joom.1131.

Vilnai-Yavetz, I. and Tifferet, S. (2015), "A Picture is Worth a Thousand Words: Segmenting Consumers by Facebook Profile Images", *Journal of Interactive Marketing*, Vol. 32 No. 1, pp. 53–69, doi: 10.1016/j.intmar.2015.05.002.

Voorveld, H.A.M., Neijens, P.C. and Smit, E.G. (2012), "The interacting role of media sequence and product involvement in cross-media campaigns", *Journal of Marketing Communications*, Vol. 18 No. 3, pp. 203–216, doi: 10.1080/13527266.2011.567457.

Voss, C. (2002), "Case research in operations management.", *Researching Operations Management*, Routledge, pp. 176–209.

Walker, K. and Wan, F. (2012), "The Harm of Symbolic Actions and Green-Washing: Corporate Actions and Communications on Environmental Performance and Their Financial Implications", *Journal of Business Ethics*, Vol. 109 No. 2, pp. 227–242, doi: 10.1007/s10551-011-1122-4.

Wang, C., Ghadimi, P., Lim, M.K. and Tseng, M.-L. (2019), "A literature review of sustainable consumption and production: A comparative analysis in developed and developing economies", *Journal of Cleaner Production*, Vol. 206, pp. 741–754, doi: 10.1016/j.jclepro.2018.09.172.

Wheeler, D., Colbert, B. and Freeman, R.E. (2003), "Focusing on Value: Reconciling Corporate Social Responsibility, Sustainability and a Stakeholder Approach in a Network World", *Journal of General Management*, Vol. 28 No. 3, pp. 1–28, doi: 10.1177/030630700302800301.

Whiting, A. and Williams, D. (2013), "Why people use social media: a uses and gratifications

approach", *Qualitative Market Research: An International Journal*, Vol. 16 No. 4, pp. 362–369, doi: 10.1108/QMR-06-2013-0041.

Wilhelm, M. and Villena, V.H. (2021), "Cascading Sustainability in Multi-tier Supply Chains: When Do Chinese Suppliers Adopt Sustainable Procurement?", *Production and Operations Management*, Vol. 30 No. 11, pp. 4198–4218, doi: 10.1111/poms.13516.

Williamson, D. (2022), "US Social Media Usage 2022", eMarketer, , available at: https://www.insiderintelligence.com/content/us-social-media-usage- 2022.

Wong, B. (2023), "Top social media statistics and trends of 2023", *Forbes*, available at: https://www.forbes.com/advisor/business/social-media-statistics/.

Yang, X., Weber, A. and Grimm, A.-K. (2022), "The effects of green consumer empowerment in advertising on corporate evaluations and purchase intention: the case of organic food", *Review of Managerial Science*, Vol. 16 No. 6, pp. 1877–1909, doi: 10.1007/s11846-021-00495-4.

Yarimoglu, E. and Gunay, T. (2020), "The extended theory of planned behavior in Turkish customers' intentions to visit green hotels", *Business Strategy and the Environment*, Vol. 29 No. 3, pp. 1097–1108, doi: 10.1002/bse.2419.

Yin, C. and Zhang, X. (2020), "Incorporating message format into user evaluation of microblog information credibility: A nonlinear perspective", *Information Processing & Management*, Vol. 57 No. 6, p. 102345, doi: 10.1016/j.ipm.2020.102345.

Yin, R. (1994), *Case Study Research*, Sage Publications.

Yin, R.K. (2009), *Case Study Research: Design and Methods*, 4. ed., [Nachdr.]., Sage, Los Angeles, Calif.

York, J.G. (2009), "Pragmatic Sustainability: Translating Environmental Ethics into Competitive Advantage", *Journal of Business Ethics*, Vol. 85 No. S1, pp. 97–109, doi: 10.1007/s10551-008-9950-6.

Yu, J. and Egger, R. (2021), "Color and engagement in touristic Instagram pictures: A machine learning approach", *Annals of Tourism Research*, Vol. 89, p. 103204, doi: 10.1016/j.annals.2021.103204.

Zahay, D., Griffin, A. and Fredericks, E. (2011), "Information Use in New Product Development: An Initial Exploratory Empirical Investigation in the Chemical Industry*: Information Use in New Product Development", *Journal of Product Innovation Management*, Vol. 28 No. 4, pp. 485–502, doi: 10.1111/j.1540-5885.2011.00821.x.

Zeyen, A., Beckmann, M. and Wolters, S. (2016), "Actor and Institutional Dynamics in the Development of Multi-stakeholder Initiatives", *Journal of Business Ethics*, Vol. 135 No. 2, pp. 341–360, doi: 10.1007/s10551-014-2468-1.

Zhang, L., Li, D., Cao, C. and Huang, S. (2018), "The influence of greenwashing perception on green purchasing intentions: The mediating role of green word-of-mouth and moderating role of green concern", *Journal of Cleaner Production*, Vol. 187, pp. 740–750, doi: 10.1016/j.jclepro.2018.03.201.

Zuzul, T.W. (2019), "'Matter Battles': Cognitive Representations, Boundary Objects, and the Failure of Collaboration in Two Smart Cities", *Academy of Management Journal*, Vol. 62 No. 3, pp. 739–764, doi: 10.5465/amj.2016.0625.

APPENDIX

Table A1. Content analysis' output, criterion: *Detox 2020*.

DETOX 2020			
Company	**Complete Judgment**	**Standard Judgment**	**Disclosure Level**
Adidas	**Adidas still uses the ZDHC's MRSL v.1.1**, which is not hazard-based, non-transparent and lacks detection limits on wastewater and certain key groups, such as PFCs. Although Adidas' programme has some positive elements, such as reference to a 'clean factory' approach, proactive chemical management, and supplier engagement tools, it is compromised by the fundamentally flawed ZDHC MRSL.	Basic ZDHC MRSL	Low
Benetton	**Benetton has developed its own MRSL that imposes a ban on the use of the 11 groups of hazardous and other chemicals**. It includes many positive elements, such as wastewater control limits, and defines its 'clean factory' approach, which it applies to the entire supplier plant, not just Benetton's own production. However, some details are missing, particularly on the updating and application of the hazardous chemicals screening methodology.	Individual MRSL	High
Burberry	Burberry describes its 'clean factory' approach that includes effluent testing and provides its suppliers with meaningful guidance and training on the implementation of its Detox plans. However, Burberry should communicate this approach to its supply chain and translate it into its MRSL by adding effluent limits. Despite **the addition of PFCs, the use of ZDHC's MRSL** with its fundamental flaws, is insufficient to achieve its detox commitment.	Basic ZDHC MRSL+ additions	Medium
C&A	C&A has improved its chemical management system, which defines its wastewater analysis standards for hazardous chemicals in wastewater. It also refers to its 'clean factory' approach. However, it still relies on the **inadequate screening methodology underlying ZDHC's MRSL**, which consequently has significant flaws.	Basic ZDHC MRSL	Low
Esprit	**Esprit's programme to implement its Detox Commitment is heavily dependent on the ZDHC, and in particular relies on the MRSL v1.1, which has fundamental flaws and is insufficient to achieve its Detox Commitment**. Esprit also demonstrates a misunderstanding of its role in the chain of responsibility for Detox when it states that suppliers are contractually obliged to remove the most hazardous chemicals when "less toxic or non-toxic substitutes can be found ...".	Basic ZDHC MRSL	Low
Fast Retailing (Uniqlo)	Fast Retailing takes individual responsibility for its chemical management programme by publishing its individual MRSL, based on a transparent screening methodology and updated annually. It implements the 'no safe level' requirement using the best current testing techniques.	Individual MRSL	High
G-star	G-Star has its own MRSL, which is completely derived from the ZDHC's MRSL v1.1. However, it makes some slight improvements by **adding other chemicals and details** that the ZDHC misses. However, G-star is back due **to the use of the ZDHC's MRSL**, which is not hazard-based and therefore has fundamental flaws.	Basic ZDHC MRSL+ additions	Medium
H&M	**H&M has a clear and comprehensive MRSL** for 2020, updated in 2016 and based on a transparent hazard-based screening method. It uses the best available technical detection levels for wastewater (and formulations) and **includes other commonly used hazardous chemicals in addition to the initial 11 groups**. The MRSL is applied in H&M's supply chain using a clean factory approach with a commitment to set deadlines starting in 2017 and ahead of the 2020 deadline.	Individual MRSL	High
Inditex	Inditex has a comprehensive and well-explained chemical management program with **an extensive 'list' (MRSL) of hazardous chemicals that goes beyond the original 11 groups** to be eliminated. Inditex describes its 'Clean Factory Approach," in which it recognises that the best and most comprehensive approach to achieving this goal is to "clean up" the production units in the supply chain—implemented in the main supply chain through three pioneering programs at Inditex' covering products, supplier environmental performance, and chemical supplier contamination management, respectively. Its methodology for screening new chemicals is detailed, but some concerns remain about the toxicological assumptions and	Individual MRSL	High

	decision-making process behind its criteria for selecting and prioritising chemicals, which must be transparently aligned with best practices.		
Levi's	LS & Co states that it is experimenting with a hazard screening methodology, but this has yet to be published and implemented in its chemical management communications, the main document for hazardous chemicals' restriction in production (its MRSL). **Its MRSL has not been updated since July 2014, giving way to ZDHC's MRSL with the addition of PFCs**. This is a step backwards, as the latter does not convey all the requirements of LS & Co's Detox plan to its supply chain (e.g., the banning of ALL PFCs).	Basic ZDHC MRSL+ additions	Medium
Li - Ning	Li-Ning has implemented a chemical management programme for products and provides some information to suppliers, but its program is limited and **the use of ZDHC's MRSL**, with its fundamental flaws, is insufficient to achieve its Detox 2020 commitment.	Basic ZDHC MRSL	Low
Limited Brands (Victoria Secret)	Although Limited Brands provides some commitment and training to its suppliers, its program is limited, and **the use of the ZDHC's MRSL**, with its fundamental flaws, is insufficient to achieve its Detox commitment. Limited Brands must create its own MRSL that proactively uses a hazard-based screening methodology to select chemicals for elimination beyond the first eleven groups and the limited additions made by ZDHC.	Basic ZDHC MRSL	Low
Mango	**Mango has developed its own MRSL**, which it updates regularly, and is very clear about using the lowest detection limits available. Mango has also applied a "clean factory" approach to a supplier's entire plant, not just its production line.	Individual MRSL	High
M&S	M&S refers to a 'clean factory' approach, and its program has some positive elements, such as mandatory disclosure of chemical inventories and working with suppliers on implementation. However, its efforts are hampered by **the use of the ZDHC's MRSL**, with its fundamental flaws. M&S makes at least a slight improvement on the ZDHC's MRSL by requiring the use of the best available detection limits, supporting the fact that there are no safe levels of hazardous chemicals.	Basic ZDHC MRSL	Low
Miroglio	**Miroglio publishes its MRSL with a comprehensive list of chemicals** but does not clarify the elements and steps of a transparent screening methodology for adding additional hazardous substances. The list also lacks details on the ban/elimination status of hazardous chemicals. Miroglio must also demonstrate that it has adopted a 'clean factory' approach to ensure that suppliers apply Detox throughout their factories, not just for branded products.	Individual MRSL	High
Nike	Although Nike was the first brand to adopt a credible screening methodology and has implemented it through its Chemicals Management Program, this has not been credibly implemented. While using GreenScreen's recommended hazard screening methodology, Nike adds its "risk-based approach" to reduce hazardous chemicals, not eliminate them. Its restrictions on hazardous chemicals in manufacturing **use the flawed ZDHC MRSL** (which has many loopholes), **and the only chemicals Nike has added to its MRSL relate only to footwear and equipment, not clothing.**	Basic ZDHC MRSL+ additions	Medium
Primark	Primark provides a comprehensive update on its program and describes its plans to work with suppliers for implementation; however, **the use of the ZDHC's MRSL**, with its fundamental flaws, is insufficient to achieve its Detox commitment. The 'alignment' between the Detox principles for the hazard assessment methodology and the ZDHC's MRSL is problematic, as it is not hazard-based. It uses its risk-based interpretation to arbitrarily subdivide the GreenScreen benchmark 1 criteria and is not transparent.	Basic ZDHC MRSL	Low
Puma	Puma is still using **the ZDHC's MRSL v.1.1**, which is not hazard-based, not transparent, and lacks detection limits for tests on wastewater and some key groups, such as PFCs. Although Puma's programme has some positive elements, such as proactive chemical management and supplier engagement tools, it is undermined by the fundamentally flawed ZDHC MRSL.	Basic ZDHC MRSL	Low
Valentino	**Valentine publishes its MRSL** but does not explain the use of a transparent screening methodology. Some important PFCs (all telomeric acids and alcohols) are also missing from the list, although these are included in his "Product RSL". However, the adoption of detection limits in line with the best available technology is included.	Individual MRSL	High

Table A2. Content analysis' output, criterion: *PFC Elimination*.

PFC ELIMINATION			
Company	**Complete Judgement**	**Standardized Judgement**	**Disclosure Level**
Adidas	**Adidas reports that 93% of the products it sells by the end of 2016 will be PFC-free, with the goal of 99% of its products being PFC-free by the end of 2017**. The company has pledged to publish a case study it is already working on but must ensure that a full risk profile of alternatives is included in it.	Communication of progress on the "PFC elimination" objective and case study's publication useful for substitution	High
Benetton	**Benetton has achieved its commitment to eliminate PFCs by the end of December 2015**, providing details of the process undertaken and the investigations conducted on PFCs in products and its supply chain. Alternatives have been tested for hazardousness to ensure that PFCs have not been replaced with other problematic chemicals. **Greenpeace also recommends publishing the full case study on PFC investigation and substitution in Subsport.**	Communication of progress on the "PFC elimination" objective without the case study's publication useful for substitution	Medium
Burberry	**Burberry has recently achieved its goal of eliminating all PFCs**, in line with its commitment; it must now publish a case study documenting this process and show a transparent risk assessment of alternatives.	Communication of progress on the "PFC elimination" objective without the case study's publication useful for substitution	Medium
C&A	**C&A successfully eliminated PFCs from its products in January 2015. It plans to write a case study to be published in Subsport** and provide information on PFC-free alternatives. However, it is unclear whether these have been subjected to a risk screening methodology.	Communication of progress on the "PFC elimination" objective without the case study's publication useful for substitution	Medium
Esprit	**Esprit successfully eliminated PFCs from its products by August 2014** and claims to closely monitor the implementation of the ban. However, **it has not yet published a case study** and must commit to documenting the PFC phase-out process, which should include an elaboration of the risk assessment of alternatives.	Communication of progress on the "PFC elimination" objective without the case study's publication useful for substitution	Medium
Fast Retailing (Uniqlo)	**Fast Retailing reports that it has eliminated PFCs from 98% of its products**; it has specified which products and **published a (still incomplete) case study on its website** on some of the substitutes used. Although its initial target was to eliminate all remaining PFCs by 1st July 2016 at the latest, Fast Retailing presented a credible revised timetable stating that all products put on the shelves for the autumn/winter 2017 collections should be PFC-free. However, Fast Retailing must be clear that it will continue its positive approach of making functional sacrifices where necessary (as it did for the current PFC replacement).	Communication of progress on the "PFC elimination" objective and case study's publication useful for substitution	High

G-star	**G-Star reports that all its garments have been PFC-free since January 2015, in line with its commitment. It has also published two case studies on PFC substitution** on Subsport, although it must include a risk assessment of the alternatives used.	Communication of progress on the "PFC elimination" objective and case study's publication useful for substitution	High
H&M	H&M was the first brand to eliminate hazardous PFC chemicals from its products, thus setting a standard. However, it has not yet fulfilled its commitment to provide a case for PFC substitution and a risk assessment of alternatives.	Communication of progress on the "PFC elimination" objective without the case study's publication useful for substitution	Medium
Inditex	**Inditex fulfilled its commitment to phase out PFCs on time. It documented the substitution process in case studies** and also provided details on the evaluation of alternatives in terms of functionality and toxicity, although the latter was limited to internal comparative toxicological tests that did not consider all hazardous properties and endpoints.	Communication of progress on the "PFC elimination" objective and case study's publication useful for substitution	High
Levi's	In its progress report, **LS & Co claims to have eliminated PFCs by 2016 in line with the target set in its commitment and has published a case study that includes a hazard assessment** of the substitute used, although it does not include a complete list of all PFC chemicals to be avoided in its MRSL. The company must also continue to search for PFC substitutes, as the risk assessment shows that the preferred alternative is not ideal.	Communication of progress on the "PFC elimination" objective and case study's publication useful for substitution	High
Li - Ning	Li-Ning has not committed to eliminating all PFC use in all its products; its commitment is limited to woven products and up to 95 percent of the PFCs used in these products. Moreover, it has not submitted a public report on progress towards this commitment.	Communication of progress on the "PFC elimination" objective not complete and without the case study's publication useful for substitution	Low
Limited Brands (Victoria Secret)	**Although Limited Brands has committed to eliminating all PFCs by July 2015, it has not provided a progress report to confirm whether this target has been 100% achieved** (it only states that it has explained the ban of the 11 priority chemical groups, including PFCs, to its suppliers).	Communication of progress on the "PFC elimination" objective not complete and without the case study's publication useful for substitution	Low
Mango	**Mango was among the first companies to eliminate PFCs in line with its commitment; none of its products contain PFCs. It has committed to publishing a case study documenting the process.**	Communication of progress on the "PFC elimination" objective and case study's publication useful for substitution	High
M&S	M&S will reach its target of not using PFCs in its products in July 2016; in the meantime, existing stocks made with PFC finishes will continue to be sold. However, **M&S does not provide adequate information to its customers by directly labelling these garments**. It could use this opportunity to communicate to its customers the benefits of eliminating PFCs, particularly if there has been a loss of functionality such as oil	Communication of progress on the "PFC elimination" objective not complete and without the case study's publication useful for substitution	Low

	repellence.		
Miroglio	Although **Miroglio unambiguously states that items placed on the market do not contain PFCs, it is unclear whether it has succeeded in eliminating completely PFCs** from its production chain. Its open approach, including publishing test results on products, is encouraging.	Communication of progress on the "PFC elimination" objective not complete and without the case study's publication useful for substitution	Low
Nike	Without any target for the elimination of all PFCs, Nike's commitment to Detox is not credible. **Although Nike has achieved its limited target of eliminating all PFCs C8 and has phased out 90% of PFCs, there is no timeline for eliminating all PFCs**, which is still an inadequate response to the problems posed by these persistent and hazardous chemicals.	Communication of progress on the "PFC elimination" objective not complete and without the case study's publication useful for substitution	Low
Primark	**Primark eliminated PFCs by the December 2015 deadline**. **It also published a case study documenting the process**, but a risk assessment of the PFC-free alternative could not be carried out because the full composition 'was not known'. Primark is working on enforcement and states that potential cross-contamination from other production lines is a challenge. Therefore, this shows how adopting a "clean factory" approach to the entire supplier plant is essential, not just to Primark's production.	Communication of progress on the "PFC elimination" objective and case study's publication useful for substitution	High
Puma	**Puma is still working to replace the remaining PFCs used to meet its commitment to eliminate them by 2017**; it has stated that it will test some PFC-free water-repellent fabrics in its autumn/winter 2016 clothing collections.	Communication of progress on the "PFC elimination" objective not complete and without the case study's publication useful for substitution	Low
Valentino	Valentino undertook a detailed investigation to examine the presence of PFCs in its supply chain and found that PFCs are still present in some cases. **Although it has stated that it does not use PFCs as of May 2015**, it is unclear whether Valentino has achieved 100% PFC elimination. Its open approach, which includes publishing a case study examining alternatives using risk assessment, is encouraging. However, the company needs to communicate the PFC ban more accurately to its suppliers, listing all PFCs in its MRSL and adopting a "clean factory" approach.	Communication of progress on the "PFC elimination" objective and case study's publication useful for substitution	High

Table A3. Content analysis' output, criterion: *Transparency*.

TRANSPARENCY			
Company	**Complete Judgement**	**Standardized Judgment**	**Disclosure Level**
Adidas	Adidas reports that since the end of 2015, 50% of its global wet-process suppliers have disclosed Detox data on the IPE platform, a percentage that will increase to 80% by September 2016. **Adidas also discloses the list of its suppliers for Tier 1 and Tier 2. It has committed to publishing a discharge analysis report and providing a brief overview of the results**, which should also include a root cause analysis of the source of any contamination. Although Adidas sampled its wastewater after it had been treated, it states that "in order to confirm the effectiveness of our holistic chemical management program, we will conduct pilot tests on wastewater intake prior to the wastewater treatment process."	The list of suppliers (all levels) and the list of data are complete	High
Benetton	Benetton has fulfilled all its commitments to disclose data on discharges of hazardous chemicals and continues to make good progress towards its long-term goal. In addition, it **provides information on monitoring wastewater discharges** and publishes full details of audited suppliers. **It needs to go a step further publishing a complete list of suppliers**.	The list of suppliers (all levels) is complete, but the list of data is incomplete or vice versa	Medium
Burberry	Burberry states that effluent testing data has been published on IPE and its website for over **80% of its global wet-processing suppliers** and that plant-level testing is published on its website; however, reporting is not broken down by region. **Burberry needs to ensure that its suppliers continue to report Detox data regularly.**	The list of suppliers (all levels) and the list of data are both incomplete	Low
C&A	**C&A provides a detailed update on its suppliers' reporting on the IPE online platform, broken down by reported regions and with targets to increase the percentage of suppliers reporting.** It also provides a report on the wastewater testing it intends to carry out annually and **has published a list of its top suppliers**, with a commitment to include wet processors by 2017.	The list of suppliers (all levels) and the list of data are complete	High
Esprit	Esprit has shifted focus, stating that it is working with its supply chain to "replace and promote better chemistry to ensure that chemicals are removed at the beginning of the process before they end up in the factory's wastewater." As a result, **the company is no longer ensuring that its suppliers publish their Detox data online**. However, by deciding to prioritise wastewater testing, the company is losing a vital safety net to check all sources of hazardous chemicals in a plant, which must then be traced to find the actual source. Furthermore, **the company is shirking its responsibility to the public and its customers to transparently disclose its discharges of hazardous chemicals.**	The list of suppliers (all levels) and the list of data are both incomplete	Low
Fast Retailing (Uniqlo)	**Fast Retailing was initially a pioneer in transparency, as it ensured that 80% of its suppliers reported Detox data online. However, suppliers have not recently updated the data**, even though it is carrying out regular wastewater testing.	The list of suppliers (all levels) and the list of data are both incomplete	Low
G-star	G-Star reported Detox data from 80% of its suppliers in 2013 and, although it has not reported since then, plans to publish new data between October and December 2016. **G-Star also has a list of suppliers in the form of an interactive map**; this is an interesting innovation that allows customers to access its direct suppliers through a "Where is it made?" button on its online shop. However, **Level 2 suppliers are not included, and the company does not disclose the details of suppliers that submit Detox data on IPE**.	The list of suppliers (all levels) and the list of data are both incomplete	Low
H&M	**H&M sets an example of good practice by disclosing a comprehensive list of suppliers, including second-tier suppliers. It also confirms that 46% of its wet-processing plants have published their hazardous chemical discharge data on a global online platform**; these plants are owned by its strategic tier-one suppliers in the global south, although it is	The list of suppliers (all levels) is complete, but the list of data is incomplete or vice versa	Medium

	unclear what percentage of H&M's global wet-processing corresponds to them.		
Inditex	**Inditex ensures that its suppliers make public their discharges of hazardous chemicals**. It also has an ambitious monitoring program that it presents in its wastewater analysis report, as well as a program to investigate and analyse the causes of contamination with hazardous chemicals in wastewater or products. **The company has published a list of its suppliers that includes both direct and indirect suppliers of wet products and will expand it in the future**.	The list of suppliers (all levels) and the list of data are complete	High
Levi's	**LS & Co. ensured that most of its wet-process suppliers reported their data on discharges of hazardous chemicals on a global online platform and also published an analysis of the discharge data**.	The list of suppliers (all levels) and the list of data are complete	High
Li - Ning	Li-Ning reports that it has fulfilled its commitment to disclose data from 80% of its suppliers on a global online platform. **Li-Ning must provide more information in the form of a discharge data report analysing trends** and providing evidence of root cause analysis to trace the sources of hazardous chemical discharges. **Li-Ning must also start disclosing the list of Level 1 and Level 2 suppliers.**	The list of suppliers (all levels) and the list of data are both incomplete	Low
Limited Brands (Victoria Secret)	Limited Brands is fulfilling its commitment to ensuring that its suppliers publish data on discharges of hazardous chemicals; 90% of its Chinese suppliers are reporting wastewater discharges. It also provides a breakdown of trends from 2013 onwards. However, **Limited Brands does not publish the list of suppliers and only tests wastewater after treatment**, which does not allow it to monitor compliance and progress on banned and removed substances and **does not account for the transfer of hazardous chemicals into sludge or filters.**	The list of suppliers (all levels) and the list of data are both incomplete	Low
Mango	Mango met the original deadline for publishing data on discharges of hazardous chemicals on the global online database IPE; since then**, it has not expanded the number of suppliers reporting data, nor does it indicate where they are located or what percentage of its supply chain is covered.**	The list of suppliers (all levels) and the list of data are both incomplete	Low
M&S	**M&S has ensured that at least 80% of its suppliers in China (representing 39% of its wet-process suppliers) disclose the Detox date on a global online platform and plans to extend this reporting to other regions**. **The company is also publishing an interactive online list of its suppliers and should be encouraged to extend this to Tier 2 suppliers**, at least for wet processes. The company has also undertaken to monitor hazardous chemicals in various processing steps and has published the results of tests on IPE; however, this type of data should also be part of a discharge analysis report.	The list of suppliers (all levels) is complete, but the list of data is incomplete or vice versa	Medium
Miroglio	**Miroglio reports that 80% of its global supply chain reports Detox data but does not provide a more precise breakdown of the percentage or number of facilities per region.**	The list of suppliers (all levels) and the list of data are both incomplete	Low
Nike	There has been no progress since 2015. **Nike has not yet publicly disclosed the number and percentage of its suppliers that publish data on discharges of hazardous chemicals**. The pilot project on chemical data transparency has been completed but is not being transparently communicated. However**, the company publishes an interactive online map of its suppliers**. No further commitment has been made to investigate and ensure the future publication of Detox data by its suppliers.	The list of suppliers (all levels) is complete, but the list of data is incomplete or vice versa	Medium
Primark	**Primark claims to have 'completed' its goal of having its global wet processing suppliers report their Detox data on IPE; however, the reporting is not broken down by region**. The report that analysed PFC discharges did not detect PFCs but APEOs, phthalates, heavy metals, and chlorinated solvents (all less than 1 ppm). However, it is unclear how the root cause was investigated, apart from a general statement that Primark is working with factories to identify sources.	The list of suppliers (all levels) and the list of data are both incomplete	Low
Puma	Puma reports that 82% of its apparel suppliers by volume and its main accessories' suppliers, 61% footwear leather, and 69% footwear fabric, published their Detox Wastewater tests online in 2015. Full details are also published on its website, along with links to the online data. **The company also publishes a list of**	The list of suppliers (all levels) is complete, but the list of data is incomplete or vice versa	Medium

	exemplary suppliers that includes its main component and material suppliers (Tier 2 and 3) as well as its main manufacturers (Tier 1 suppliers).		
Valentino	Valentino reports that 60% of its Italian supply chain is reporting Detox data, which represents about 60% of its global supply chain. **Compared to 2015, it appears that fewer suppliers are reporting their data. Moreover, it has not yet published a list of suppliers**.	The list of suppliers (all levels) and the list of data are both incomplete	Low

Table A.4. Case Studies Table - report 2018

'Destination Zero 2018"			
Company	Chemical Management	Trasparency	
Adidas	Basic ZDHC MRSL+ Additions	Wastewater data published >80% Tier 1, 2, and 3	→ The list of suppliers (all levels) and the list of data are complete
Benetton	Individual MRSL	Wastewater data published >80% Tier 1, 2, and 3	→ The list of suppliers (all levels) and the list of data are complete
Burberry	Basic ZDHC MRSL+ Additions	Wastewater data published 50-80% No disclosure	→ The list of suppliers (all levels) and the list of data are both incomplete
C&A	Basic ZDHC MRSL	Wastewater data published >80% Tier 1, 2, and 3	→ The list of suppliers (all levels) and the list of data are complete
Esprit	Basic ZDHC MRSL	Wastewater data published 50-80% Tier 1, 2, and 3	→The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa
Fast Retailing (Uniplo)	Individual MRSL	Wastewater data published 50-80% Tier 1, 2, and 3	→The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa
G-star	Basic ZDHC MRSL	Wastewater data published >80% Tier 1, 2, and 3	→ The list of suppliers (all levels) and the list of data are complete
H&M	Individual MRSL	Wastewater data published 50-80% Tier 1, 2, and 3	→The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa
Inditex	Individual MRSL	Wastewater data published 50-80% Tier 1, 2, and 3	→The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa
Levi's	Basic ZDHC MRSL+ Additions	Wastewater data published >80% Tier 1, 2, and 3	→ The list of suppliers (all levels) and the list of data are complete
Li-Ning	Basic ZDHC MRSL	Wastewater data published >80% No disclosure	→The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa
Limited Brands (Victoria Secret)	Basic ZDHC MRSL+ Additions	Wastewater data published >80% Tier 1	→The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa
Mango	Individual MRSL	Wastewater data published 50-80% Tier 1	→ The list of suppliers (all levels) and the list of data are both incomplete
M&S	Basic ZDHC MRSL+ Additions	Wastewater data published 50-80% No disclosure	→ The list of suppliers (all levels) and the list of data are both incomplete
Miroglio	Basic ZDHC MRSL	Wastewater data published >80% Tier 1, 2, and 3	→ The list of suppliers (all levels) and the list of data are complete
Nike	Basic ZDHC MRSL	Wastewater data published >80% Tier 1, 2	→The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa
Primark	Basic ZDHC MRSL+ Additions	Wastewater data published >80% Tier 1	→The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa
Puma	Basic ZDHC MRSL	Wastewater data published >80% Tier 1, 2, and 3	→ The list of suppliers (all levels) and the list of data are complete
Valentino	Individual MRSL	Wastewater data published >80% Tier 1, 2, and 3	→ The list of suppliers (all levels) and the list of data are complete

Table A5. Case Studies Table - report 2021

Fashion Fairytale 2021			
Company	All Hazardous Chemical	Trasparency	
Adidas	No disclosure	Wastewater data published 50-80% Tier 1, 2	→ The list of suppliers (all levels) and the list of data are both incomplete
Benetton	Basic ZDHC MRSL+ additions	Wastewater data published >80% Tier 1, 2	→The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa
Burberry	Basic ZDHC MRSL+ additions	Wastewater data published >80% No disclosure	→ The list of suppliers (all levels) and the list of data are both incomplete
C&A	Basic ZDHC MRSL+ additions	Wastewater data published >80% Tier 1, 2, and 3	→ The list of suppliers (all levels) and the list of data are both incomplete
Esprit	No disclosure	Wastewater data published 50-80% Tier 1, 2, and 3	→The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa
Fast Retailing (Uniplo)	Basic ZDHC MRSL+ additions	Wastewater data published <50% Tier 1	→ The list of suppliers (all levels) and the list of data are both incomplete
G-star	Basic ZDHC MRSL+ additions	Wastewater data published >80% Tier 1	→The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa
H&M	Basic ZDHC MRSL+ additions	Wastewater data published >80% Tier 1, 2, and 3	→ The list of suppliers (all levels) and the list of data are complete
Inditex	Individual MRSL	Wastewater data published 50-80% No disclosure	→ The list of suppliers (all levels) and the list of data are both incomplete
Levi's	No disclosure	Wastewater data published >80% No disclosure	→The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa
Li-Ning	No disclosure	Wastewater data published <50% No disclosure	→ The list of suppliers (all levels) and the list of data are both incomplete
Limited Brands (Victoria Secret)	No disclosure	Wastewater data published >80% Tier 1	→The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa
Mango	Individual MRSL	Wastewater data published <50% Tier 1	→ The list of suppliers (all levels) and the list of data are both incomplete
M&S	No disclosure	Wastewater data published <50% Tier 1	→ The list of suppliers (all levels) and the list of data are both incomplete
Miroglio	No disclosure	Wastewater data published <50% No disclosure	→ The list of suppliers (all levels) and the list of data are both incomplete
Nike	Basic ZDHC MRSL+ additions	Wastewater data published 50-80% No disclosure	→ The list of suppliers (all levels) and the list of data are both incomplete
Primark	No disclosure	Wastewater data published <50% No disclosure	→ The list of suppliers (all levels) and the list of data are both incomplete
Puma	Basic ZDHC MRSL+ additions	Wastewater data published >80% No disclosure	→The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa
Valentino	Individual MRSL	Wastewater data published >80% No disclosure	→The list of suppliers (all levels) is complete, but the list of data is incomplete and vice versa

APPENDIX- Interview Protocols

-1a. Interview protocol for Manufacturers (Ms)

1. EPD Development Process

Considering the most complex EPDs you've developed in 2023, please answer the following question:

- Tell us about this EPD (which product? Why do you develop this EPD? How do you use this EPD now)
- How long did the entire EPD process take from start to finish?
- What were the primary sources of complexity when developing this EPDs? (e.g., analyzing diverse inputs like energy consumption, resource depletion, and emissions)
- Which stages of the EPD process caused the most delays? (e.g., data collection, conducting LCA, transferring LCA into EPD format, EPD verification, registration, and publication) What were the common causes of these delays?
- Which factors did you consider choosing your Program Operator (PO)? (e.g., PO availability of Product Category Rules (PCR)/ Product-Specific Rules (PSR), verification costs, time, reputation, etc.)
- How crucial is the relationship with the Program Operators in ensuring a smooth EPD process, and how can your company improve this coordination?
- Based on your experience, what strategies can help you reduce the time and resource consumption involved in EPD developments?

2. Intra-organizational and Inter-organizational coordination

- Which departments have participated in the EPD development process? (e.g., R&D, sustainability) Please, tell us about the coordination, types of information exchanged, etc. What best practices would you recommend for internal coordination?
- Have you used primary data from your suppliers in the development of this EPD? If yes, please consider three suppliers that were highly engaged in this EPD. To what extent do you use primary data from these suppliers when developing this EPD? When requesting primary data from suppliers, how do you verify its accuracy?
- How can your organization improve the collaboration with suppliers to obtain high-quality primary data for EPD in the future?

3. Others

- There are a few Program Operators in the market. How do you think we could achieve the standardization of PCR and PSR across all Program Operators?
- Do you foresee any emerging trends or technologies that could further streamline the EPD process in the near future?

-1b. Interview protocol for Program Operators (POs)

- Multiple Program Operators (POs) have emerged independently at both national and regional levels, leading to the development of multiple Product Category Rules (PCRs) for the same product categories. Is there a single international organization overseeing the operation of these POs or the development of PCRs? If not, why do you think such coordination has not been established?
- How do the Mutual Recognition Agreements (MRAs) that your organization has with other POs function in practice? Could you provide examples of how these agreements benefit manufacturers and other relevant stakeholders (e.g., suppliers)?
- Is your organization collaborating with standardization bodies or other stakeholders to improve the standardization and harmonization of EPDs given the increasing demand for standardization and harmonization of EPDs by manufacturers and users? Do you see any drawbacks for POs if full standardization of EPD processes and rules were achieved?
- Some companies have expressed a need for EPD tools that can automatically verify EPDs to reduce the time and cost associated with the verification process, which is often seen as a bottleneck. Have you received this type of request from manufacturers? If so, how do you ensure these tools are tailored to client needs while maintaining compliance with standards and PCRs to guarantee the comparability of EPDs across companies?
- Which stakeholders does your organization engage with during the creation of PCRs/PSRs?

-1c. Interview protocol for the Lighting Europe representative

- During your tenure as the Chair of the Task Force, what have been the Task Force's primary goals, key achievements, and the main challenges encountered?
- In an ideal scenario, which stakeholders (beyond manufacturers) should be involved in the development of the EPD rules? Why do you choose each stakeholder?
- How can sufficient harmonization of rules among Program Operators be achieved? What actions could help improve the harmonization and standardization of EPD development process?
- Which role do European and international standardization bodies play in harmonizing and standardizing EPDs? To the best of your knowledge, are they currently taking any specific actions to address this? What are the main challenges they face, and what potential measures could be implemented to streamline the process?

-1d. Interview protocol for the Green Light Alliance representative

- Please share with us your role in the initiative of developing industry-average Environmental Product Declarations (EPDs) for lighting products.
- Which challenges did you encounter in coordinating multiple stakeholders (e.g., lighting manufacturers, lighting design firms) during this initiative?
- In your opinion, what was the most significant outcome of developing the industry-average EPDs for the lighting sector? Do you have any concerns regarding the use of industry-average EPDs, especially considering that they are based on aggregated data from multiple manufacturers?
- Which is the role of designers in the development of EPDs? When selecting manufacturers in a project, which criteria do designers prioritize? Is the manufacturer's ability to extend EPDs one of these criteria?
- What strategies or actions could make the information in EPDs more accessible and readable for designers and practitioners?
  -Follow up question: There are simplified LCAs that are easier to understand but lack the accuracy of EPDs. Do you think such tools would be useful, or would they undermine the rigor and comparability between products?
- Does the Green Light Alliance have an active dialogue with Lighting Europe? And with standardization bodies like ISO or organizations that are trying to globally harmonize the PCR/PSR? If not, why is this the case?

-1e. Interview protocol for EPD Software and Database Providers

- Could you briefly describe your organization's role in supporting the development of Environmental Product Declarations (EPDs)?

- Some manufacturers have reported difficulties in finding secondary data for certain product components within the commercially available databases. Has your organization received similar feedback, and are there any ongoing efforts to address this issue?

- Depending on the database or software used, EPD results for the same product can vary significantly. What challenges do you foresee in trying to harmonize the various databases currently on the market?

APPENDIX - Representative informant quotes underlying second-order dimensions

Dimension 1: Developing capabilities to gather both primary and secondary product data.	
Establishing a collaborative structure for primary data collection.	"We understood that we need to commit all together, because otherwise it is going to be a problem for our business. So, I would say huge cooperation among business units, key role of the sustainability team to be the bridge among business units. Additionally, the procurement team also played a big role in asking primary data from our suppliers" (EPD expert M1) "I joined the company when they were finishing their first EPD as a pilot project with consultant support. Then, they decided to have an in-house expert, so I took this position as an EPD expert. The first EPD was the most challenging because of the numerous decisions we had to take." (EPD expert, M3) "It's a bit of trial and error. We try to involve procurement in the process because they usually have the first contact with suppliers. Procurement can send an official request explaining why we need the data, which helps suppliers understand the importance of providing it." (EPD expert, M3) "We've noticed that we could get some EPDs from some suppliers, but they were mostly aluminum suppliers. So, for material suppliers that are more related to the construction industry it was easier to get that type of data." (Sustainability Procurement Officer, M2)
Identifying ways to model data and address data gaps	"We have sometimes to rely on secondary data due to the lack of primary data. For instance, we used just secondary data for some purchase parts such as LEDs and power supplies". (EPD expert, M3) "However, getting data for control gears and drivers can be challenging, especially when these components are sourced from other suppliers. In such cases, we often need to trace back further in the supply chain to second- or third-tier suppliers." (Sustainability and EPD expert, M4) "Data for electronic components, such as power supplies, drivers, and light sources, are severely lacking." (EPD expert, M2)
Dimension 2: Inefficiencies in EPD verification and registration.	
Verifiers are an important bottleneck	"I think verifiers are very busy with a lot of EPDs to verify because there are not many of them." (EPD expert, M1) "So, in terms of timing, I started with the actual LCA of the product around this time last year (December), and then the first round of third party verification started in March. It took basically around six months to finish the verification. That was the longest step in the process for different reasons." (EPD expert, M2) "Yes, I've found this area to be quite challenging, particularly with [PO name]. They don't currently offer tool verification, and verification remains a bottleneck. For verification, we need someone who is an accredited verifier, but such experts are scarce and expensive." (EPD expert, M3) "To improve efficiency, we have implemented a rule requiring verifiers to respond to any questions regarding an EPD within four weeks, based on the background report provided in the project. However, in some cases, verifiers fail to respond for up to three months. When this happens, they often need to re-read the entire report because they have shifted their focus to other tasks in the meantime, causing unnecessary delays." (Head of Verification Body, PO1) "In my family, we say: "Buy cheap, buy twice." The same applies here. When a manufacturer chooses the cheapest EPD expert, they often end up paying almost double in verification fees because instead of a smooth process, the verification can drag on for a year. The underlying problem is simple a lack of experience." (Head of Verification Body, PO1)
Program operators' system not up to date	"Previously, manufacturers were used to develop EPDs only for a few products. However, the market now demands EPDs for every product in a company's catalog. For us, as a Program Operator, this means we must verify thousands of EPDs. The current system, which relies on manual verification by an independent verifier, is no longer feasible. Therefore, we need to transition to a more automated verification

	system using software, with human verifiers primarily overseeing the process. To address this, we have recently hired a consultant who is working on this initiative." (Head of Verification Body, PO1) "The type of experience that I had with this program operator was horrible. First of all, I never know who I'm talking to, if it's the same person that I talked to last time, or if it's a new one. Secondly, they ask for an impossible amount of data. Even though you produce the EPD with the amount of data already in the model and in the report that you need to give to them, they ask to upload the same amount of data on their page, and their page is very difficult to read and to navigate, extremely slow in giving explanations. So, there were fields that were not clear at all for me how to fill them" (EPD expert, M1)
Dimension 3: Stakeholders pursuing self-interests.	
Program Operators' conflicting self-interests	"Unfortunately, Program Operators have built a business around EPDs and, as a result, they promote the idea of comparability and greater transparency—even though comparability among EPDs is just a dream!" (Standard and Regulation Expert, M4) "In the beginning, when Eco Platform was founded and EPDs first appeared, they were considered something "exotic". Participation was entirely voluntary, and there was no commercial interest involved. Capitalism had not yet entered the EPD world. However, nowadays, if one PO allows one approach and another allows something different, manufacturers could "cherry-pick" whichever option gives them the most favorable result. This is exactly what Eco Platform aimed to prevent in the construction sector." (Head of Verification Body, PO1) "I have never developed a PCR in collaboration with other program operators. For construction products, however, I believe there will be broader harmonization in the future, since all program operators will need to adopt the harmonized standards that will serve as complementary PCRs to EN 15804." (Project Manager, PO3) "To me, this smells like greenwashing. Self-declarations are not verification, and from the perspective of a verification and validation body, they are unacceptable. I cannot recognize a self-declaration as valid, because it is not actually verified. Therefore, in my view, it is not possible to tolerate Program Operators that offer self-declared EPD services." (Project Manager, PO3)
Database providers' resistance	"As for the database providers they don't have much incentive to harmonize. Their business models rely on proprietary databases, which are working well for them. While EPDs are a growing market, these providers are unlikely to prioritize harmonization because it doesn't align with their current incentives. Bringing them to the table to address this at a core level would be extremely challenging. At the European Union level, there's ongoing work in the context of PEF (Product Environmental Footprint) to develop a European database. However, I believe such efforts face significant challenges. Creating and maintaining such a database is not only a multi-million-euro effort but also threatens the business models of existing database providers." (Task Force Chair, LE) "The methodology is already in place. The real challenge now lies in data consistency—ensuring that databases harmonize data across sectors and countries so that the information collected and reported is reliable and comparable" (Managing Director, ECO)
Manufacturers safeguard their individual rather than collective interests	"Members exchanged views on the accuracy and comparability of EPD information, raising concerns about how EPD results are interpreted. While there was agreement on the existence of these issues, it appears that no one is addressing them, with everyone pursuing their own direction. Companies that have already invested in EPDs are defending the methodology, despite being aware of these issues. (Sustainability expert, M5) "There are initiatives that are starting to be popular like pre-verified LCA tools. I think it is helpful because for some people in a company that have not any LCA knowledge they can just play with these tools, but the LCA itself is very much burdened by uncertainties already if the industry adopts those tools. I'm afraid that we are just increasing that uncertainty even more. The problem with some of those tools is that they should still aim to follow or at least align to relevant standards/PSR. So that's the reason why we didn't want to go with it, because we really support the use of PSR for lighting. If there will be a tool that include the constraint of following those rules, we could probably take that into consideration." (Sustainability and EPD expert, M2) "The process of identifying core distortions is just beginning. Right now, we're working with a "version one" of these protocols. It's clear that some revisions will follow—version two, and so on. This iterative process is necessary. When I say

	"we," I sometimes mean "I" because this is partly my own view. Many seem to believe that simply having EPDs will solve all the problems. The reality is that the level of maturity among manufacturers varies widely. It's hard to expect that every industry player will align with the first version, and we don't expect immediate perfection. That said, not everyone grasps the complexity of this work. Some in high management think, "We've done an EPD—great, let's move on." But it's more nuanced. We have to take manufacturers along this journey without losing them when they see the imperfections." (Task Force Chair, LE) "I am frustrated! An EPD as a Type III communications, should undergo third-party verification. However, some large companies within Lighting Europe have produced EPDs without external verification, yet still make claims about their EPDs. This is seen as unfair by members who have developed fully verified EPDs, which are time-consuming and costly. XX claims to have developed over 2,000 EPDs, but these are self-certified EPDs and not verified by a Program Operator." (Standard and Regulation expert, M4)
Dimension 4: Developing industry-wide EPD standards.	
Harmonizing practices across the lighting industry	"Lighting Europe is leading an initiatives for the creation of technical documents for product specific rules of light sources and control gear. So, these are basically guideline documents that program operators can/should adopt to create product specific rules for these components." (EPD expert from M5) "The Life Cycle Assessment Incubator, within the Green Light Alliance, was intended to be a forum to share case studies and practical insights to harmonize what people were doing". (Founder, GLA) "I firmly believe that LCAs and EPDs are essential tools to improve the sustainability profile of our industry. However, I recognize that the tools we have now aren't perfect. So, our task is twofold: convince the industry of the value of these tools and encourage them to join us on this journey, even though the tools need refinement. Communication and education are crucial here. This year, we've published position papers and hosted webinars." (Task Force Chair, LE) "Our approach is to get it "good enough" for a first version, understanding that the process will evolve. It will take time to roll this out to the wider industry, educate other stakeholders, and refine the tools and standards. The key is starting with a solid foundation and building from there." (Task Force Chair, LE)
Striving to transform collective initiatives into global initiatives	"In the interest of the GLA, led by designers who ultimately apply the data and reward manufacturers conducting the analysis, we aimed for a global position. I can tell you it was very political—and remains so—but it has brought us to an interesting place. In North America, some POs are attempting to develop PSRs for luminaires while considering the already published PSR 0014 from an European PO. This happened because, as GLA, we had chosen PSR 0014 for our industry-average luminaires EPD. The reasoning was that adopting this PSR increased the likelihood of it being applied more broadly, especially as efforts toward international memorandums are underway." (Founder, GLA) "We have been working hard to create a global study. This approach is inherently challenging, especially in EPDs, given the prevalence of regional PCRs. It becomes even more complex for lighting designers, who find it difficult to navigate and adopt multiple systems." (Founder, GLA)
Dimension 5: Multi-stakeholder Initiatives working in isolation.	
Overlooking the voices of external key stakeholders	"I think that involving designers from the beginning helps shape the complexity of the assumptions being made. It also influences what kinds of scenarios are defined as standard, and what aspects truly matter to the ultimate users of the data. This, in turn, allows us to streamline the rules, as well as the data collection, measurement, and reporting involved in the process." (Founder, GLA) "I don't think there are many manufacturers actively engaging with designers to ask: How are you using this EPD data?" (Founder, GLA) "I think it's fair that the main role is played by manufacturers, because they will be those to apply these rules to their products. So, it's important to have that input. But if we think, for example, about other lifecycle stages of our products such as the repair stage, the installation stage, and the end of life, it would be really useful to have other inputs. It's a tricky conversation, because we don't know much about collaborating with other stakeholders" (EPD expert, M3)
Multi-stakeholders are working in silos	"LE members are primarily manufacturers, and they tend to keep communication within their group. I'm not entirely sure why, but this is definitely a missing piece in the bigger picture. The Green Light Alliance is addressing this issue effectively by

	bridging the gap between designers and manufacturers." (Sustainability and EPD expert, M2) "We have been communicating with Lighting Europe (LE) to keep them informed about our work as it progresses. However, LE tends to be very territorial, with its representatives traditionally focusing on regional issues and avoiding engagement beyond their regions." (Founder, GLA) "We've started having this discussion, but I'll admit we may have approached it with a bit of naivety initially. We thought we could create the standard and everything would fall into place. Now we're learning—diplomatically speaking—that the situation is far more complex. As of now, we haven't brought in designers or considered their specific requirements in our processes, though I recognize their importance." (Task Force Chair, LE) "GLA is a place where we can share resources. But I would say from the manufacturer side, there were a few voices, not many. It was a lot of a designer kind of voice." (EPD expert, M3) "I believe that the role of the industry association should be bigger, creating the network itself, not just between the manufacturers, but a wider network." (EPD expert, M5)