

The impact of the EU nonfinancial information directive on environmental disclosure: evidence from Italian environmentally sensitive industries

Information
directive

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Abstract

Purpose – To determine whether to entrust the European Union (EU) to create a new nonfinancial reporting framework or endorse the extant reporting framework developed by the Global Reporting Initiative (GRI), this study aims to explore whether the mandatory implementation of the EU Directive positively impacted the GRI-based environmental disclosure.

Design/methodology/approach – The authors compared the pre- and post-EU Directive environmental disclosure of 16 Italian environmentally sensitive companies. The authors used an extended coding scheme and developed a unique scoring system to compare the quantitative and qualitative changes in environmental disclosure.

Findings – The analysis showed that the quantity of environmental disclosure increased after the mandatory EU Directive adoption. The most significant change was observed regarding the disclosure topics explicitly required by the Italian legislature. Additionally, disclosure of soft information continued to prevail over that of hard information in the post-Directive period. While the Directive boosted the level of adherence to GRI standards, Italian companies disclosed information that could be easily mimicked (soft) instead of objective measures that could be verified (hard). In light of this evidence, the endorsement of extant GRI standards could be a valuable option for enhancing the comparability and transparency of environmental disclosure.

Originality/value – This study used an original extended coding system and proposed related environmental disclosure indexes that allow monitoring changes in environmental disclosure over time. To the authors' best knowledge, this study is one of the few that justifies the significant impact of regulation (here



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the EU Directive) on the increase in environmental disclosure and that uses hard and soft information typology to examine the quality of environmental disclosure.

Keywords Environmental disclosure, Directive 2014/95/EU, Global Reporting Initiative, Disclosure quality, Italy

Paper type Research paper

1. Introduction

In the aftermath of the approval of the [UN 2030 \(2015\)](#) Sustainable Development Goals, there has been a significant debate in Europe on how to best enhance companies' sustainable reporting. The two key standard setters, the European Union (EU) Commission and the International Financial Reporting Standards (IFRS) Foundation, have been involved in the development of nonfinancial reporting (NFR) standards. The EU Commission, through the adoption of [Directive 2014/95/EU \(2014\)](#) (hereinafter, the Directive) on nonfinancial disclosure (NFD), made the first decisive step toward corporate social and environmental reporting (CSR), as an essential condition for fostering sustainable development ([CSR Europe and GRI, 2017](#)). The proponents of standardized mandatory reporting regimes highlight the benefits of transparency and comparability of disclosed information in these regimes ([Christensen *et al.*, 2019](#); [Barth, 2006](#); [Hail *et al.*, 2010](#); [De George *et al.*, 2016](#)). Recently, in response to the inadequacy of the Directive in meeting the stakeholders' information needs ([European Commission, 2020a](#)), the commission started a revision process of the Directive, mandating the European Financial Reporting Advisory Group (EFRAG) to undertake a preparatory project for the elaboration of the EU NFR standards ([EFRAG, 2021](#)). Similarly, the [IFRS Foundation \(2020\)](#) launched a consultation paper to determine its role in rationalizing and harmonizing the existing multitudinous NFR standards (Climate Disclosure Standards Board [CDSB], Global Reporting Initiative [GRI], International Integrated Reporting Council [<IIRC>], Sustainability Accounting Standards Board [SASB], Task Force on Climate-Related Financial Disclosure [TCFD], etc.).

The abovementioned initiatives have raised a lively debate on whether to entrust the EU and/or the IFRS Foundation with the responsibility of creating a regional/global framework for NFR. Although both academics and policymakers support the need for a comparable, verifiable and universal set of sustainability standards, some contend that the GRI has already been offering a valid framework to harmonize NFR for more than 20 years ([Adams, 2020](#)). It is argued that rather than "reinventing the wheel," a mandatory regime including the extant GRI standards should be adopted by countries to enhance the comparability of NFR and increase firms' accountability ([Cho, 2020](#)).

In this context, our study aimed to shed light on the enhancement of NFR following the mandatory implementation of the Directive in Italy. Specifically, we focused on one aspect of the Directive: the disclosure of environmental information. Our aim was to explore whether environmental disclosure, reported in adherence to the GRI standards, significantly increased after the Directive adoption. We focused on environmental reporting due to the pressing and challenging nature of environmental concerns that are increasingly attracting stakeholders' attention ([Lomborg, 2020](#); [Krasodomska and Zarzycka, 2020](#)). Given the interconnection of environmental and economic themes, climate change, greenhouse gas emissions and energy efficiency illuminate the major concern of policymakers. The strategies implemented to achieve carbon neutrality by 2050, or the European Green Deal, consider carbon policies and other environmental policies as highly interrelated to delay climate change. Hence, environmental policies play a critical role in facilitating sustainable

development, and sustainability reporting is pivotal in driving environmental, social and governance (ESG) firms' accountability.

A considerable number of studies have examined various facets of environmental disclosure (Cormier *et al.*, 2011; Clarkson *et al.*, 2013; Qiu *et al.*, 2016; Baboukardos, 2018). In the ongoing debates on the relevance of NFR in communicating company's environmental performance and on the need for the harmonization of the reporting framework, a line of research has focused on the effectiveness of the EU regulation in increasing transparency and corporate accountability (La Torre *et al.*, 2018, 2020; Michelin *et al.*, 2020; Masiero *et al.*, 2020). We contribute to this literature carrying out a content analysis of environmental disclosure pre and post the EU Directive. Our aim is to explore whether the adoption of the new mandatory regime impacted the quantity and the quality of environmental disclosure. Specifically, we believe that our exploratory study provides several contributions to this debate.

First, our study contributes to the very recent and rapidly evolving stream of literature that provides an ongoing revision of the effectiveness of the Directive, by comparing NFD before and after its implementation (Cordazzo *et al.*, 2020; Erkens *et al.*, 2015; La Torre *et al.*, 2020; Mio *et al.*, 2020). Our work adds primarily to this literature by providing a more-in-depth revision of one and relatively homogenous aspect of firm's sustainable performance – the environmental issues. We examine both the quantity and the quality of environmental disclosure, providing evidence that after the implementation of the Directive, the quantity of environmental disclosure has significantly increased, whereas its composition in terms of quality characteristics has remained stable. In this regard, our work adds directly to the recent findings reported by Cordazzo *et al.* (2020) and Mio *et al.* (2020) by focusing on the quality of one ESG disclosure: the environmental dimension. It also adds to Doni *et al.* (2020) by presenting in-depth empirical evidence on environmental reporting practices in the pre- and post-Directive period.

Second, we provide evidence on the growing adherence of firms to the GRI standards as a consequence of the mandatory Directive adoption by revising the environmental disclosure in pursuit of the Directive. In this respect, our study adds to the emerging literature on the role and the importance of the GRI standards in achieving greater transparency, trust and comparability of environmental disclosure in the process of harmonizing NFR guidelines. Although some authors have documented that GRI stands up as an early winner in the harmonization of NFR (Doni *et al.*, 2020; Biondi *et al.*, 2020), there is a paucity of research about the effects of a mandatory regime on GRI disclosures. Our empirical evidence fills this gap and contributes to the recent call on how to rethink reporting practices to reflect a broader corporate social accountability (La Torre *et al.*, 2020).

A third relevant contribution of this exploratory study is the original methodological approach. We developed an extended GRI-based environmental disclosure coding system and a related set of indexes, driven by the environmental disclosure scoring proposed by Clarkson *et al.* (2008). More specifically, the coding system covers both the quantity and the quality of environmental disclosure. In this regard, our work contributes to the extant literature on CSR by providing new tools for the measurement of environmental disclosure (Lisi, 2018; Arvidsson, 2011).

This exploratory work investigates the consolidated nonfinancial (NF) statements (CNFSs)/sustainability reports of 16 Italian companies from four environmentally sensitive industries (ESIs): chemical, energy (oil and gas), transportation and utility. We focused on ESIs because there is a range of prior studies that have confirmed the relevance of stakeholders' influence in these industries concerning their environmental performance (Branco and Rodrigues, 2008; Fernandez-Feijoo *et al.*, 2014; Garcia *et al.*, 2017; Radhouane

et al., 2020). We manually collected data from the 2016 and 2018 reports by applying our coding instrument. The choice of Italy as an experimental setting was motivated by the peculiarity of the Italian regulation. In Italy, NFR was primarily voluntary before the Directive (Cordazzo *et al.*, 2020) and the Italian legislature introduced some novelties in adopting the Directive, such as the possibility of using a mixed reporting framework, the mandatory audit of nonfinancial information (NFI) and the articulate system of sanctions for missing or inaccurate information (Muserra *et al.*, 2020). In this regard, the unique regulatory setting of Italy enables reliable observations of the changes in environmental disclosure after the implementation of the EU Directive.

The results revealed that the overall quantity of environmental disclosure significantly increased after implementing the Directive. We observed this effect for the subtopics explicitly required by the Italian legislature. The analysis also showed that the examined Italian companies increased the quantity of soft (qualitative) and hard (quantitative) information in 2018, as compared to 2016, that is, the year before the Directive was adopted in 2017. There was also strong evidence that companies continued to report a higher extent of soft information compared to hard information. Overall, this evidence suggests that the Directive, as implemented by the Italian legislature, was effective in enhancing firms' environmental disclosure. We also observed an increase in adherence of firms to the GRI standards. Thus, the results show that the endorsement of the extant GRI standards by the EU is a more effective option as compared to that of developing a new NFR framework. In this regard, our results could support policymakers in the current process of rethinking NFR (Adams, 2020; Cho, 2020).

The remainder of this paper is organized as follows. Section 2 includes the institutional background for this study by introducing the Directive, discussing the GRI reporting standards and outlining the Italian regulation on NFI. Section 3 includes a literature review on mandatory NFI at national and supranational levels. Section 4 includes the development of research hypotheses, and Section 5 details the research design. Specifically, we illustrated how we developed an original coding system and the related scoring of environmental disclosure. Section 6 presents the study results, and Section 7 presents the discussion and the conclusion.

2. Institutional background of the study

2.1 EU nonfinancial reporting directive

The EU made the first decisive step toward CSR by issuing the Directive on NFR, as an essential condition for fostering sustainable development (Muserra *et al.*, 2020). In response to stakeholders' influence, the Directive aims to improve business transparency and accountability on social and environmental issues, while also being important for enhancing responsible business conduct (CSR Europe and GRI, 2017).

The Directive recommends that firms should inform about the:

Details of the current and foreseeable impacts of the undertaking's operations on the environment and as appropriate, on health and safety, the use of renewable and/or non-renewable energy, greenhouse gas emissions, water use and air pollution (Directive 2014/95/EU, par. 7).

The EU Commission published two sets of guidelines to support firms in providing relevant and more comparable disclosure. The first set includes methodical guidelines (EC, 2017), and the second set includes reporting guidelines related to climate change (EC, 2019).

The accounting literature identifies two main reasons that justify the introduction of a mandatory reporting regime: the economic effects of regulation on the functioning of capital markets and the regulatory role of disclosure (Michelon *et al.*, 2020). The economic effects

refer mainly to the increase in market liquidity driven by the reduction of adverse selection among investors, following disclosure improvements (Leuz and Wysocki, 2016). The regulatory role refers to the real effects of corporate disclosure. The introduction of a mandatory regime is expected to change firms' behavior as a consequence of increased stakeholder pressure (Christensen *et al.*, 2019).

Although the main objective of the Directive is to determine the real effects on corporate behavior, it is argued that it could just impact firms' disclosure and compliance strategies without lifting sustainable corporate practices (La Torre *et al.*, 2018). Christensen *et al.* (2017) contended that disclosure regulation can have two alternative outcomes:

- (1) it can prove to be effective in improving firms' ESG activities, or
- (2) it may only induce box-ticking and boilerplate disclosure (Spira and Page, 2010).

The Directive adoption has raised further concerns related to the lack of harmonization and comparability of NFR (European Commission, 2020b; La Torre *et al.*, 2020). The Directive leaves firms with wide discretion in preparing NF reports. Preparers may choose one of the many standards available across a variety of national and international NFR frameworks. Different quarters have criticized this flexibility of the Directive. For instance, the IFRS Foundation (2020) contended that the use of multiple standards and metrics increases the complexity and cost of NFR. This fragmentation of the NFR standards is amplified in the context of environmental disclosure, where many recommendations and standards have proliferated[1], introducing complexity in the engagement of capital markets to transition to a low-carbon economy. Moreover, the EU disclosure regulation has been regarded as inadequate in enhancing transparency and accountability, as it builds on a monological perspective that neglects the relational connectivity between the company and its audience (La Torre *et al.*, 2020). It is argued that mandatory NFR can be more effective if based on a bidirectional dialogue between the company and its stakeholders, with both parties influencing each other (Masiero *et al.*, 2020).

2.2 Global Reporting Initiative framework

In the debate on the effectiveness of the Directive and on the harmonization of the reporting framework, many consider the GRI (2016) as the preeminent standard to report NFI (Adams, 2020; Cho, 2020). In the last 20 years, the demand for comparable, reliable and verifiable NFI has led to the proliferation of various guidelines and standards for sustainability reporting (e.g. GRI, <IR>, SASB, TCFD). Among the existing frameworks, the GRI is the most influential set of standards (Adams, 2004; Boiral, 2013; Boiral *et al.*, 2019; Venturelli *et al.*, 2019; Doni *et al.*, 2020). According to the 2020 KPMG Survey of Sustainability Reporting, a majority (96%) of the world's largest 250 companies (the G250) use GRI to report on their sustainability performance. This significant diffusion of the GRI has fostered the harmonization of CSR and firms' legitimacy in the eyes of society (Einwiller *et al.*, 2015; Moneva *et al.*, 2006).

The main argument in favor of the GRI standards is that they draw on the *imperative stakeholder perspective* better than any other private NFR guidelines and standards (Cho, 2020). The most recent NFR frameworks, such as the <IR> and SASB, are highly focused on investors' information needs, rather than on wider stakeholders' interests (Michelon *et al.*, 2020). In contrast, the GRI follows a (social) accountability view of NFR. According to this perspective, the role of corporate reporting is to foster firms' accountability. Accountability is regarded as the duty of an organization to provide an account for all the actions for which it is held responsible in the eyes of all stakeholders (Owen *et al.*, 1997). In line with this perspective, the GRI establishes *Stakeholder Inclusiveness* as its first reporting principle

[GRI-101 Foundation, in [GRI \(2016\)](#)], stating that “The reporting organization shall identify its stakeholders and explain how it has responded to their reasonable expectations and interests.” This requires organizations “to demonstrate how they create, use and preserve a broad array of financial and nonfinancial resources to meet a wide range of stakeholders’ needs,” including, *at the very least*, employees, customers, suppliers, governments, civil society and the ecosystem ([De Villiers et al., 2014](#), p. 1049). Furthermore, the second GRI reporting principle, *Sustainability Context* [GR-101 Foundation, in [GRI \(2016\)](#)], places NFR in the wider context of sustainable development. In this respect, organizations should report their performances by referring to the improvement or deterioration of economic, environmental and social conditions at the local, regional or global level of operations.

A further main argument in favor of the GRI adoption is that its guidelines have been constantly updated and integrated to rely on technical protocols for all performance indicators ([Crisostomo et al., 2017](#)). Thus, from an initial set of core indicators with a clear emphasis on environmental disclosure ([GRI-G1, 2000](#)), the GRI framework has developed into a comprehensive set of detailed reporting standards, structured into *universal* and *topic-specific* standards. Universal GRI standards include the *Reporting Principles* [GR-101: Foundations, in [GRI \(2016\)](#)] and require the disclosure of the following general information about the organization: profile, strategy, ethics and integrity, governance, stakeholders’ engagement and reporting practices [GR-102, General Disclosure, in [GRI \(2016\)](#)]. The GRI 103: *Management Approach* allows the organization to provide a narrative explanation of why the topic may be considered material, where the impacts occur (the topic boundary) and how the organization manages each material topic ([GRI, 2016](#)). On a more detailed level, topic-specific standards (GRI 200, 300, 400 series) include disclosure on management approach and specific key performance indicators (KPIs) regarding economic (GRI 200), environmental (GRI 300) and social (GRI 400) topics. The environmental guideline (GRI 300) covers eight environmental subtopics:

- (1) materials (GRI 301);
- (2) energy (GRI 302);
- (3) water (GRI 303);
- (4) biodiversity (GRI 304);
- (5) emissions (GRI 305);
- (6) effluents and waste (GRI 306);
- (7) environmental compliance (GRI 307); and
- (8) supplier environmental assessment (GRI 308).

For each main subtopic, the standard provides a detailed list of KPIs.

It is also noteworthy that the GRI reporting framework is flexible by nature. Companies can adopt GRI standards:

- as a set to prepare a sustainability report; or
- using only selected standards to report specific ESG information – referred to as a *GRI-referenced claim*.

The former approach can be used in two ways: the *core option* (a_1) and the *comprehensive option* (a_2). The main difference is the use of topic-specific information required by the standards. Option a_1 requires full compliance with the topic-specific information for at least one material topic, whereas option a_2 requires for all topics to be considered as material.

Thus, the core option is essentially discretionary, as it requires full adherence for only one material topic, leaving managers flexibility regarding disclosure of other topics.

Although it is usually recognized that the adoption of GRI can lead to harmonized sustainability reports, its application can also result fragmented as, especially under a voluntary regime, firms can choose to disclose only some of the GRI indicators or to provide only subjective and declarative information to enhance their image among stakeholders (Niskanen and Nieminen, 2001; Adams and Evans, 2004; Cho *et al.*, 2010; Farneti and Guthrie, 2009; Boiral, 2013; Talbot and Boiral, 2015). For instance, Boiral (2013) revealed that the GRI indicators have been used by energy and mining companies to project idealized versions of themselves, camouflaging sustainability problems. Namely, 90% of the significant negative sustainable events were not reported, contravening the GRI principles of balance, completeness and transparency. Nevertheless, despite these limitations, the GRI framework is still regarded as a good candidate to be the leading standard for NFR. In this respect, some scholars argue that transparency will not occur unless GRI reporting standards are made mandatory and enforced by a regulatory body (Adams, 2020; Cho, 2020).

2.3 Uniqueness of Italian nonfinancial reporting regulatory setting – the Italian decree

In Italy, the Directive has been implemented with Legislative Decree No. 254/2016 (hereinafter, the Decree). This regulation represents a significant novelty for Italian sustainability reports, which, up until the Directive adoption, were essentially voluntary (Aureli *et al.*, 2020)[2]. The Decree not only mandated an extensive NFS but also introduced some novelties as compared to other national regulations. To better identify these specificities, Table 1 compares the relevant post-Directive NF regulation in Italy with that implemented in Germany, France, Spain and the UK. Table 1 reveals that the Italian regulation does not present significant differences in reporting topics and in the choice of the reporting framework and format as compared to that of other countries. However, the Italian case is notable for the following reasons:

- the provision of the option to choose a mixed reporting framework;
- the mandatory audit of NFI; and
- the articulate system of sanctions for missing or inaccurate information.

First, as for the scope, the Italian legislature has adopted the same Directive provisions, requiring that the NF regulations applies to large public interest entities (PIE) with 500+ employees and balance sheet of at least €20m or net turnover of €40m, whereas France and Spain have enlarged the Directive scope to largest entities, as illustrated in Table 1. The Italian legislature has also specified the discipline for the voluntary adoption of the Directive for entities outside the scope of the regulation. The Decree clarifies that if non-obligated entities comply with the provisions of the Decree, then the CNFS is considered by the legislature as prepared in accordance with the Decree. Specifically, the legislature has provided a flexible application of the Decree in the case of voluntary CNFS. In reality, para. 2 of Art. 5 of the Decree specifies that voluntary statements shall comply with the Decree's provisions, especially regarding the content of NFR and the control of it, (Articles 3 and 4):

Taking into account the size of the company in relation to the number of employees, the accounting results, any cross-border activity, in accordance with criteria of proportionality, so that the fair understanding of the business, its development, results and impact is not compromised.

Table 1.
Implementation of
the directive across
selected countries

Regulation features	Italy	France	Germany	Spain	UK
National law	Legislative decree n. 254/2016, 30.12.2016	Ordinance n. 2017-1180, 19 July 2017 Decree n. 2017-1265, 9 August 2017	Bundesgesetzblatt Teil I, Nr. 20 vom 18.04. 2017	Royal decree-law n. 18/2017, 24 November 2017 Law n. 11/2018, 28 December 2018	The Companies, Partnerships and Groups (Accounts and Non-Financial Reporting) Regulations 2016, 20.12.2016
Scope	PIE with 500+ employees and balance sheet of at least €20m or net turnover of €40m (PIE are defined as: listed companies; banks; insurance and reinsurance undertakings) Flexible application of the main regime in the case of companies outside the Decree scope	PIE with 500+ employees and balance sheet of at least €20m or net turnover of €40m (PIE are defined as: listed companies, credit institutions, insurance providers) Unlisted companies and non-listed investment funds with a net turnover over €100m and 500+ employees	PIE with 500+ employees and balance sheet of at least €20m or net turnover of €40m (PIE are defined as follows: credit institutions, insurance undertakings, capital market- oriented companies in the legal form of a limited liability company or cooperative)	PIE with 500+ employees and balance sheet of at least €20m or net turnover of €40m (PIE are defined as: listed companies; credit institutions; insurance undertakings; payment and electronic money; pension funds which, during two consecutive years, at the closing date of each year, have at least 10,000 participants; Investment services and collective investment institutions, which has 5,000+ clients or 5,000+ shareholders) Entities that during two consecutive years, at the closing date of each year, have a net turnover over €2bn and 4,000+ employees	PIE with 500+ employees (PIE are defined as: listed companies; credit institutions; insurance undertakings)

(continued)

Regulation features	Italy	France	Germany	Spain	UK
Reporting framework	An international, national or EU-based reporting framework A mixed reporting methodology constituted by one or more reporting standards	An international, national or EU-based reporting framework	An international, national or EU-based reporting framework	EMAS, UNGC, UNGP, OECD, ISO 26000, ILO Declaration or GRI	An international, national or EU-based reporting framework
Reporting format	Part of management report	Part of management report	Part of management report	Part of management report	Part of management report
Reporting topics and content	Separate report Information about the following nonfinancial topics: environmental matters; social and employee matters; respect for human rights; anti-corruption and anti-bribery matters A brief description of the company's business model Company policies relating to nonfinancial matters Company outcomes of policies relating to nonfinancial matters Principle risks related to nonfinancial matters and business activities Nonfinancial KPIs Further specifications	Separate report Information about the following nonfinancial topics: environmental matters; social and employee matters; respect for human rights; anti-corruption and anti-bribery matters A brief description of the company's business model Company policies relating to nonfinancial matters Company outcomes of policies relating to nonfinancial matters Principle risks related to nonfinancial matters and business activities Nonfinancial KPIs Further specifications	Separate report Information about the following nonfinancial topics: environmental matters; social and employee matters; respect for human rights; anti-corruption and anti-bribery matters A brief description of the company's business model Company policies relating to nonfinancial matters Company outcomes of policies relating to nonfinancial matters Principle risks related to nonfinancial matters and business activities Nonfinancial KPIs Further specifications	Separate report Information about the following nonfinancial topics: environmental matters; social and employee matters; respect for human rights; anti-corruption and anti-bribery matters A brief description of the company's business model Company policies relating to nonfinancial matters Company outcomes of policies relating to nonfinancial matters Principle risks related to nonfinancial matters and business activities Nonfinancial KPIs Further specifications	Information about the following nonfinancial topics: environmental matters; social and employee matters; respect for human rights; anti-corruption and anti-bribery matters A brief description of the company's business model Company policies relating to nonfinancial matters Company outcomes of policies relating to nonfinancial matters Principle risks related to nonfinancial matters and business activities Nonfinancial KPIs

(continued)

Table 1.

Table 1.

Regulation features	Italy	France	Germany	Spain	UK
Reporting principles	Comply or explain Safe harbor Materiality	Comply or explain Materiality	Comply or explain Safe harbor Materiality	Comply or explain Safe harbor Materiality	Comply or explain Safe harbor Materiality
Auditor's involvement	Presence of statement Consistency check of disclosure as part of the review of the management report	Presence of statement Consistency check of disclosure as part of the review of the management report	Presence of statement	Presence of statement	Presence of statement Consistency check of disclosure as part of the review of the management report
Implications of noncompliance	Fines: For omission of relevant information, noncompliance or failure to submit within timeframe, €20,000–€150,000 in sanctions will be applied	Fines: No fine is imposed unless an interested party asks for the disclosure of the nonfinancial information, if it is not available, subsequently financial penalties can be imposed by a judge	Fines: Up to the amount, which is the highest of the following, €10m or 5% of the total annual turnover of the company or twice the amount of the profits gained or losses avoided because of the breach	Fines: Not specified	Fines: Determined on a case-by-case basis and imposed on the responsible persons

Notes: National specifications of the Directive are highlighted in bold. EMAS = Eco-Management and Audit Scheme, UNGC = United Nations Global Compact, UNGP = United Nations Guiding Principles, OECD = Organisation for Economic Co-operation and Development, ILO = International Labour Organization

Additionally, with regard to the CNFS content, there were no significant differences compared with that of the Directive. The minimum reporting topics provided by the Decree are in line with the Directive, although the Decree is more articulate than the Directive in this regard. The Decree, after referring to the main CSR topics, specifies the aspects to be analyzed. Specifically, it provides a comprehensive list of NF topics, ranging from the use of energy resources to active and passive bribery policies. The Decree also includes provisions for five reporting areas:

- (1) business model;
- (2) policy implementation with directors' due diligence;
- (3) outcome;
- (4) principal risks and their management; and
- (5) KPIs.

Regarding the reporting framework and format selected by the Italian legislature, the Decree allows companies to adopt either national or supranational reporting standards (e.g. GRI, <IR>, SASB and TCFD) or, alternatively, to use an autonomous reporting methodology, that combines several reporting standards (Art. 3, para. 5). In this regard, Italy is the only country among those examined that allows the adoption of mixed NFR standards. Similarly, the Decree establishes (Art. 5) that firms can choose whether to integrate the CNFS into the management report or, alternatively, to prepare a separate report. This option is also provided in the German and Spanish regulations. Under the latter option, the company may also produce the statement as part of other documents, such as the sustainability report or the integrated report, provided that the words "nonfinancial statement drawn up in accordance with Leg. Dec. 254/2016" are added to the document.

A further distinctive feature of the Decree concerns the system of internal and external controls introduced to verify the information. First, the Decree explicitly mentions the board's duty to prepare and publish the CNFS (Article 8, para. 1). Further, the Decree establishes that the auditor in charge of the assurance of the financial statements, or another body entitled to carry out a statutory audit, must verify the presence of the CNFS (Art. 3, para. 10), and the same entity, or a different auditor, must assess whether its content is consistent with the regulation and the adopted reporting standard. Thus, in Italy, auditors' control goes beyond a formal check of the NFS publication, similar to that in France and the UK. Furthermore, the Decree has introduced an articulate system of monetary sanctions, ranging from EUR 20,000 to 150,000, related to the omission of relevant information, noncompliance or failure to submit the information within the required timeframe. Internal directors and external auditors are both liable to these fines. This is another distinguishing feature of the Decree, as the other countries examined do not extend the consequences of noncompliance to external auditors.

In summary, the Italian case can be regarded as an appropriate experimental setting to examine the effects of the Directive, since the case represents the first-time adoption of an extensive mandatory CSR regime in an unregulated setting, in addition to some novelties as compared to other EU countries. The Decree is more stringent in the external audit of the CNFS and is characterized by a more flexible reporting approach, allowing the use of a mixed reporting methodology. A further aspect of interest is the voluntary adoption system introduced by the Decree, which – in line with the "think small first" principle – allows small- and medium-sized enterprises to prepare the CNFSs by following the criteria of proportionality and with no obligation of assurance.

3. Effects of mandatory disclosure – literature review

In light of the growing concern about the environment and climate change, environmental disclosure is becoming increasingly important. In numerous studies, the relevance of stakeholders' pressure is considered to be the main driving force in enhancing a firm's accountability and transparency with regard to its environmental impacts (Helfaya and Moussa, 2017; Hovardas and Poirazidis, 2007; Zarzycka and Krasodomska, 2021; Aureli *et al.*, 2020; Kaur and Lodhia, 2018; Hahn *et al.*, 2015; Masiero *et al.*, 2020). There is also a considerable body of literature concerning various facets of environmental disclosure in the context of its informativeness or relevance from investors' perspectives (Cormier *et al.*, 2011; Clarkson *et al.*, 2013; Qiu *et al.*, 2016; Baboukardos, 2018). However, in the ongoing debate on the relevance of NFR in communicating a company's environmental performance and the need for harmonization of the reporting framework (La Torre *et al.*, 2020; Guthrie and La Torre, 2020), little is known about whether the mandatory reporting regime can positively impact environmental disclosure. Thus, to cover this gap, in this section, we discuss the benefits of a mandatory reporting regime over a voluntary regime in creating transparent and reliable information. Despite the scarcity of evidence due to the difficulty in disentangling the effects of regulatory changes from other changes in the economic and/or institutional environment (Leuz and Wysocki, 2016), we summarize the results of the relatively scarce empirical evidence on the effectiveness of national disclosure regulation and the evidence on the effects of supranational regulation (EU Directives).

Over the past few decades, several EU countries, including Denmark, France, Spain and Sweden, have introduced the obligation for large companies to provide NFI within their financial reports or to publish specific sustainability reports (Muserra *et al.*, 2020). Social and environmental accounting research has justified this shift toward mandatory models of NFR in various ways. Some authors (Adams, 2004; Alonso-Almeida *et al.*, 2014; Asif *et al.*, 2013; Beets and Souther, 1999; Deegan, 2002) argued that mandatory disclosure is preferable to voluntary disclosure because the latter is often incomplete, not comparable and not connected with the social and environmental performance of the company.

Other authors (Belal, 2002; Belal and Owen, 2007; Cerin, 2002; O'Dwyer, 2002; 2003b; Owen *et al.*, 1997) contended that standalone CSR reports have been unsuccessful in ensuring corporate accountability because they have been interpreted by managers "in a constricted fashion consistent with corporate goals of shareholders wealth maximisation purpose" (O'Dwyer, 2003a, p. 548), to legitimize corporate activities (Belal, 2002; Cerin, 2002) or pursue impression management strategies (Ben-Amar and Belgacem, 2018). Firms often follow an opportunistic approach when using the GRI or other sustainability reporting frameworks, dwarfing the quality and significance of the information reported (Diouf and Boiral, 2017). Thus, firms are often tempted to use sustainability reporting as a vehicle to improve their social legitimation or for impression management, significantly distorting and undermining its purpose (Cho *et al.*, 2010; Deegan, 2002).

To avoid this managerial distortion of the meaning of CSR, some scholars (O'Dwyer, 2002; Owen *et al.*, 1997) suggest that regulation is necessary to promote more extensive and enhanced reporting in the interest of the wider society. Gray and Laughlin (2012, p. 234) reiterated this need for regulation to encourage desired CSR corporate behavior. The main rationale behind transforming sustainability reports from voluntary to mandatory is that a mandatory reporting regime can lead to institutional reform (Owen *et al.*, 1997) that not only introduces new forms of social and environmental accounting (administrative reform) but also changes the governance structure of CSR policies, enabling stakeholders to participate in the reporting and decision-making process.

Based on the above considerations, several empirical studies have examined new regulations (national or supranational) to understand whether they improved CSR transparency and accountability (Larrinaga *et al.*, 2002; Chauvey *et al.*, 2015; Aureli *et al.*, 2020; Mio *et al.*, 2020). The effectiveness of a new regulation was measured via compliance with the law. This was evaluated through a longitudinal analysis, which compared the level and quality of information before and after the introduction of the regulation. To this end, the method used in these studies is content analysis, which contributes to identifying how many topics specified in the regulation are reported in the examined NFSs/social reports.

The existing research demonstrates the unsatisfactory level of compliance with the various national regulations, with reports often containing misleading NFI. In Spain and France, the introduction of mandatory CSR disclosure rules did not produce positive effects. In Spain, Larrinaga *et al.* (2002) reported significant noncompliance with the accounting standard 437/98, that dealt with environmental disclosure. Of the sample examined (70 companies), 80% did not provide any information required by the Spanish standard. In France, Chauvey *et al.* (2015) analyzed the NFD of publicly traded firms after the approval of the Nouvelles Régulations Économiques (NRE # 2001–420). Comparing information provided in the 2004 NFSs/social reports with information provided in 2010, the degree of transparency was found to be unsatisfactory. Specifically, despite a significant increase in the amount of information (from 17.47 pages in 2004 to 36.71 in 2010), the quality remained unvaried, both in terms of the coverage of the matters required by regulation and in terms of qualitative features of the content.

Regarding the case of the Directive, the empirical evidence available provides mixed results on the effectiveness of a mandatory regime in enhancing the disclosure of NFR and firms' accountability. On the one hand, some studies (Aureli *et al.*, 2020; Muserra *et al.*, 2020; La Torre *et al.*, 2020) suggested that the adoption of the Directive can become an opportunity to integrate ESG issues in internal reporting practices, going beyond mere compliance with the Directive requirements. Mio *et al.* (2020) found evidence that the adoption of the Decree increased the quantity of NFD, confirming the positive impact of a mandatory regime. On the other hand, other studies (Cordazzo *et al.*, 2020; D'Amico *et al.*, 2016) found that the implementation of the Directive did not produce any relevant increase in the quantity of NFI as Italian companies just disclosed the minimum requirements. In *similar vein*, Doni *et al.* (2020) confirmed that the Italian context showed an important disclosure gap in the post Directive period, with inadequate disclosure about business models and little integration between financial and NFD.

4. Research hypotheses

An overview of the above literature indicates that, although there is no conclusive empirical evidence available, regulation can play a role in improving firms' NFR practices and accountability. One possible reason is that national disclosure regulations pre-Directive were primarily concerned about the financial sustainability of the business as a *going concern*, rather than the sustainability of the planet. Larrinaga *et al.* (2002) pointed out the indifference of the Spanish legislature toward issues deemed irrelevant to the business-specific area. The emphasis of these regulations is on end-of-pipe activities aimed at limiting environmental damage rather than on initiatives to develop sustainable products and business models. It is observed that pre-directive national regulations should be considered insignificant in this regard because the content of the information required (e.g. provisions

for environmental risks) is already included in the financial reports. Differently, the Directive and the Italian Decree are focused on transparency and corporate accountability, living firms with wide discretion to prepare their NFS. They may use one of the many standards developed by self-regulation, among which the GRI is regarded as the most widespread and effective model to report companies' impacts on the economy, the environment and/or society (Adams, 2020; Cho, 2020).

In this context, testing whether a mandatory regime is supportive in changing the adherence to GRI environmental standards is an important issue, as GRI framework is also an option for the development of the new European Reporting Standards. Thus, a comparison of firms' adherence to the GRI before and after the implementation of the Directive could be informative in the current discussion on the shape of the reporting framework, as well as regarding the effectiveness of pursuing a mandatory regime.

Generally, it can be expected that the implementation of the Italian Decree could enhance the level of adherence to GRI, because of its novelties:

- the board responsibilities for CNFSs;
- the role of external auditors; and
- the penalties related to miss-reporting.

Yet, the adoption of the EU Directive could also result in a decrease of information, as the same novelties can encourage formal correctness and increase the focus on the reliability of the disclosure, at the expenses of a more comprehensive accountability. It is argued that companies may decide to delete some information (previously disclosed voluntarily) if this is regarded unreliable, although relevant to stakeholders' (Aureli *et al.*, 2020; La Torre *et al.*, 2020).

In light of these arguments and the prior inconclusive evidence on the positive effects of a mandatory regime, we posit the following nondirectional hypothesis:

- H1.* The level of adherence to the GRI standards regarding environmental disclosure changed after the implementation of the Directive.

An overview of the existing literature also suggests a concern about the ability of the mandatory regime in changing the characteristics of the reported NFI (Chauvey *et al.*, 2015). In other words, apart from the primary question about the effects of regulation on the quantity of the information disclosed, there is also a question about the quality of this information. To this end, different approaches have been proposed in the literature. Some studies examined whether CSR disclosure contained monetary, quantitative and qualitative information (Al-Tuwaijri *et al.*, 2004; Choi, 1999; Wiseman, 1982); whether the disclosure was descriptive, vague or immaterial (Hughes *et al.*, 2001; Mio *et al.*, 2020); or whether it was relevant, comparable, verifiable and clear (Chauvey *et al.*, 2015). However, these approaches suffer from the limitation of remaining rooted in the conceptual frameworks of financial statements and not in the principles of sustainability reporting (e.g. GRI standards or other self-regulation). The analysis of the coexistence of hard and soft disclosures is an alternative approach. This concept was introduced to accounting by Ijiri (1975), who distinguished between hard and soft disclosures in accounting-based communication. Hard disclosure is featured by verifiable statements that are difficult to disagree with, whereas soft disclosure can be easily pushed in another direction (Bertomeu and Marinovic, 2016).

The idea of controlling hard and soft environmental disclosure was adopted by [Clarkson et al. \(2008\)](#), who treated hard and soft disclosures as different types of information reported in NFS. This dichotomous distinction between types of disclosure is very useful in understanding the extent to which companies provide objective and non-imitable information about their environmental performance (as hard disclosure) or tend to disclose unverifiable claims (as soft disclosure). An important question arises as to whether a mandatory reporting regime is supportive in changing the formerly observed tendencies in the proportion of hard and soft disclosures. Thus, we posit our second hypothesis as follows:

- H2. The soft environmental disclosure level continues to be significantly different from the hard environmental disclosure level after the implementation of the mandatory regime.

5. Research design

5.1 Sample selection and coding of environmental disclosure

In light of the above research hypotheses, three critical aspects are addressed in the design of the research process:

- (1) the effects of the mandatory regime;
- (2) adherence to GRI regulations; and
- (3) type of disclosure (hard/soft).

To determine the effects of a mandatory regime, we controlled for the regulation regarding NFR, the industry effect and the time dimension. Within the regulatory dimension, we assessed the effects of the implementation of the Directive, focusing on Italy. As outlined in the institutional background section (subsection. 2.3), Italy offers a unique experimental setting, as NFR was generally voluntary before the Directive ([Aureli et al., 2020](#); [Cordazzo et al., 2020](#)) and the Italian legislature introduced novelties as compared to other national regulations.

Regarding the industry effect, our sample considers Italian listed companies drawn from four industries with significant environmental and social impacts: chemical, oil and gas, transportation and utility. These industries might be expected to be a “benchmark” in terms of CSR strategies and disclosure, not only because they are considered to have a high pollution propensity ([Clarkson et al., 2008](#)) but also because they are at the forefront of sustainable business practices ([World Bank Group, 2014](#)), which has been confirmed in numerous prior empirical works ([Branco and Rodrigues, 2008](#); [Fernandez-Feijoo et al., 2014](#); [Garcia et al., 2017](#); [Radhouane et al., 2020](#)). Using the primary global standard international code (four-digit), we identified 32 listed chemical, energy (oil and gas), transportation and utility companies that could be included in our empirical analysis.

The final number of companies in our sample was dependent on the time dimension of our analysis. We focused only on those companies that prepared CNFSS/ sustainability reports one year before and one year after the first-time adoption of the Decree in 2017. Thus, our final sample included 16 listed firms. We excluded 16 companies from the initially identified 32 listed firms that did not publish a voluntary sustainable report in 2016.

The choice of this period (2016 and 2018) provides the opportunity to capture the changes in disclosure that resulted directly from the implementation of the Directive. In

other words, any significant changes in 2018, compared to 2016, could be treated as the causal effect of the Directive. As we treated 2017 as the transition year, we excluded observations from this period. Given the evidence on the continuous improvement in NFR over time, we assumed that in the years 2014 and 2015, the state of environmental disclosure was similar to that in 2016. Similarly, we assumed that the disclosure in 2019 or 2020 was similar to that in 2018.

Our final sample of 16 listed firms comprised 11 firms with CNFSs based only on the GRI and five firms with CNFSs based on mixed reporting (based on the GRI and <IIRC>) (IIRC, 2013). Table 2 lists the specifications of the research sample.

To address the adherence to the GRI standards and examine the types of environmental disclosure, we developed a coding instrument inspired by Clarkson *et al.* (2008) and based on the GRI, 2016 standards, as well as on the regulations of the Decree. This coding instrument covered seven categories of environmental disclosure: the strategy and governance category (SG) and six subtopic categories based on the GRI 300: materials (MT), energy efficiency (ENEF), water management (WM), biodiversity (BIO), climate change (CLIM) and waste management system (WMS)[3]. Each category was coded considering two dimensions; hard/soft information and KPIs/narratives information. Figure 1 illustrates the architecture of the coding model.

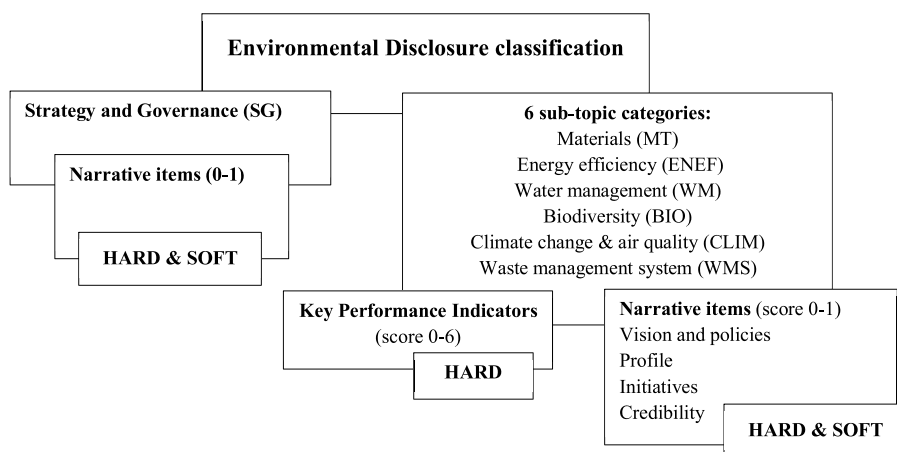
In our coding procedure, we followed the classification of environmental disclosure by Clarkson *et al.* (2008). They distinguished between hard and soft disclosure[4]. The hard disclosure covers information that “focuses on objectives and hard measures that cannot be easily mimicked by companies with poor environmental performance.” As this information reflects true commitment to the environment, the companies that present hard disclosure are awarded higher scores. On the other hand, information that reports a general claim, not easily verifiable, of commitment to CSR is regarded as soft information (Clarkson *et al.*, 2008, p. 309) and are awarded with lower scores. Since higher disclosure scores are awarded to

Company name	Industry classification	Reporting model	GRI reporting option	Sales 2018 (Euro mln)
ENI	Oil and Gas	Mixed	Core	88.094,05
ENEL	Utilities	GRI	Core	86.246,02
ATLANTIA	Transportation	Mixed	Core	8.958,66
HERA	Utilities	GRI	Core	7.587,23
A2A	Utilities	Mixed	Core	7.435,63
EDISON	Utilities	GRI	Referenced	6.193,55
IREN	Utilities	GRI	Comprehensive	4.626,69
ACEA	Utilities	GRI	Comprehensive	3.467,62
SNAM	Utilities	Mixed	Core	2.960,97
TERNA	Utilities	Mixed	Core	2.654,00
ASTM	Transportation	GRI	Core	2.281,32
ERG	Utilities	GRI	Core	1.197,26
SOL	Chemicals	GRI	Core	963,22
ASCOPIAVE	Utilities	GRI	Core	666,40
FNM	Transportation	GRI	Core	363,77
ISAGRO	Chemicals	GRI	Core	133,36

Table 2.
Research sample
specifications

Notes: The mixed reporting model refers to NFSs compliant with the GRI standards (GRI, 2016) and in accordance with the framework of the IIRC. The industry refers to the Global Standard Industry Classification

Figure 1.
Architecture of
coding model for
environmental
disclosure



companies with true environmental commitment, the [Clarkson *et al.* \(2008\)](#) index has been used by different authors ([Luque-Vilchez *et al.*, 2019](#); [Ong *et al.*, 2015](#)) to properly assess firms' environmental reporting. For the same reason, we built on the index by [Clarkson *et al.* \(2008\)](#) to assess whether adherence to the GRI standards increased after the implementation of the Directive.

For each category, we also coded the KPIs and narratives information items separately.

The KPIs consists of specific metrics derived from the GRI standards. The KPIs were scored from 0 to 6, depending on the type of information reported. Following [Clarkson *et al.* \(2008\)](#), we awarded one point for each of the following information:

- KPI is presented.
- KPI is presented relative to peers/rivals or industry.
- KPI is presented relative to previous periods (trend).
- KPI is presented relative to targets.
- KPI is presented both in absolute and normalized form.
- KPI is presented at the disaggregate level (i.e. business unit or geographical spread).

Narrative information items consist of statements about environmental policies and risks, the implementation of ESG standards and certification, along with the description of other environmental commitments and activities. They were scored using binary coding (0/1).

Within the SG category, we identified only 11 narrative items: seven based on the governance structure and management systems disclosure items proposed by [Clarkson *et al.* \(2008\)](#) and other four items regarded as relevant in assessing firms' environmental strategy. In [Table 3](#), we provide a detailed list of the information coded within the SG category, together with the reference to the GRI standard and the type of disclosure (hard/soft). Overall, among these 11 narratives, we identified 10 hard disclosure items and 1 soft disclosure item.

Within the six subtopic categories, our coding instrument covered a considerable number of KPI disclosure items ($n = 27$) that provide hard information by nature. The complete list of the KPIs is reported in [Table 4](#), together with the reference to the GRI standards.

GRI, 2016 standards	Type of disclosure	Disclosure item	Score (max. 11)
102-18	Hard	Existence of a highest governance body in the board responsible for ESG issues (e.g. ESG/ sustainability committee)	(0–1)
102-26/29/3032	Hard	Highest governance body's role in identifying and managing ESG topics and their impacts, risks and opportunities – including its role in the implementation of due diligence processes	(0–1)
102-20	Hard	Existence of a department for environmental policy (e.g. ethics officer, department for environmental management)	(0–1)
102-43-44	Hard	Stakeholders' engagement in setting environmental policies	(0–1)
102-17	Hard	Mechanisms for monitoring of environmental policies	(0–1)
102-28/35	Hard	Executive and no-executive compensation linked to environmental performance.	(0–1)
102.9; 308-1/2	Hard	Existence of terms and conditions applicable to suppliers and/or customers regarding environmental practices	(0–1)
*	Hard	Inclusion in Sustainability Index	(0–1)
102-14	Soft	CEO statement on environmental performance in letter to shareholders and/or stakeholders	(0–1)
102-16	Hard	A statement of corporate environmental policy, values and principles, if mentioned in a general section about environmental strategy	(0–1)
103-2	Hard	Implementation of ESG management standards and environmental certificates (e.g. use of ISO 14005), if mentioned in a general section about environmental strategy	(0–1)

Table 3.
Coding and scoring
of SG

Note: * Item added by authors. CEO = Chief Executive Officer

For each of the six subtopic categories, we also applied a binary coding scheme for 22 narrative items distributed as follows:

- vision and policies ($n = 4$);
- profile ($n = 5$);
- initiatives ($n = 7$); and
- credibility ($n = 6$).

This list is consistent with [Clarkson *et al.* \(2008\)](#) and also with the reporting architecture recently released by [EFRAG \(2021\)](#), that identifies NFR areas with specific firms' decision-making processes (strategy, implementation and performance measurement), to comprehensively reflect how firms address sustainability matters. As an example, in [Table 5](#), we provide a detailed presentation of the narrative items coded, with reference to the CLIM subtopic. It covers a total of 22 items, of which 13 are classified as soft disclosure and 9 as hard disclosure.

In summary, we deemed that this approach could help to examine the effects of the Directive on environmental disclosure. Our coding not only allowed measuring whether

			Information directive
GRI, 2016 Standards	Disclosure item	Score (max. 162)	
	Materials (MT)	max. 0–12	105
301-1	Materials used by weight or volume	(0–6)	
302-2	Recycled input materials used	(0–6)	
	Energy efficiency (ENEF)	max. 0–24	
302-1	Energy consumption within the organization (no) renewable sources	(0–6)	
302-2	Energy consumption outside the organization	(0–6)	
302-3	Energy intensity	(0–6)	
302-4/5	Reduction of energy consumption	(0–6)	
	Water management (WM)	max. 0–18	
303-1	Water withdrawal by source	(0–6)	
303-2	Water sources significantly affected by withdrawal of water	(0–6)	
303-3	Water recycled and re-used	(0–6)	
	Biodiversity (BIO)	max. 0–24	
304_1	Operational sites owned, leased, managed in or adjacent to, protected areas and areas of high biodiversity value outside protected areas	(0–6)	
304_2	Significant impacts of activities, products and services on biodiversity	(0–6)	
304_3	Habitats protected or restored	(0–6)	
304_4	IUCN Red List species and national conservation list species with habitats in areas affected by operations	(0–6)	
	Climate change and air quality (CLIM)	max. 0–54	
*	Greenhouse gas emissions	(0–6)	
305_1	Direct greenhouse gas emissions (scope 1)	(0–6)	
305_2	Indirect greenhouse gas emissions (scope 2)	(0–6)	
305_2	Indirect greenhouse gas emissions - marked based (scope 2)	(0–6)	
305_3	Other air emissions (scope 3)	(0–6)	
305_4	GHG emissions intensity	(0–6)	
305_5	Reduction of GHG emissions (change)	(0–6)	
305_6	Ozone-depleting substances	(0–6)	
305_7	Nitrogen oxides (NOX), sulfur oxides (SOX) and other significant air emissions (not TRI)	(0–6)	
	Waste management system (WMS)	max. 0–30	
306-1	Water discharge by quality and destination	(0–6)	
306_2	Disposals by type and method (e.g. recycling)	(0–6)	
306_3	Spills	(0–6)	
306_4	Transport of hazardous waste	(0–6)	
306_5	Water bodies affected by water discharges and/or runoff	(0–6)	

Notes: A score is awarded for each of the following items: (1) KPI is presented; (2) KPI is presented relative to peers/rivals or industry; (3) KPI is presented relative to previous periods; (4) KPI is presented relative to targets; (5) KPI is presented both in absolute and normalized form; and (6) KPI is presented at the disaggregate level (Clarkson *et al.*, 2008). * Item added by authors, about the total greenhouse emissions (Scope 1 and Scope 2). GHG = Greenhouse Gases

Table 4.
List and scoring of environmental KPIs

adherence to the GRI standards has increased after the adoption of the Directive, but it also assessed the changes in firms' disclosure policies after the introduction of the Directive:

- whether they have increased or decreased soft information disclosure compared to hard information disclosure; and
- whether KIPs prevail or not over narrative information.

Table 5.
Coding and scoring
of narrative items: an
example for climate
change (CLIM)

GRI Std	Type	Disclosure item Vision and policies	Score (max22) max. (0–5)
103-2	Soft	A general statement of firm’s climate change and air quality policy (e.g. goals, values and principles and codes of conduct)	(0–1)
103-2	Soft	A description of key climate change and air quality emissions, related impacts, risks and opportunities	(0–1)
103-2	Soft	A statement about formal management systems regarding climate change and air quality	(0–1)
103-2	Hard	Implementation of ESG management standards (e.g. use of ISO 14005; SA8000 and others), if mentioned in climate change and air quality sections	(0–1)
103-2	Soft	A statement about specific innovations and or new technologies, as related to climate change and air quality	(0–1)
102-12	Soft	Profile A statement about the firm’s compliance (commitment) with specific environmental and social standards (if not awarded under credibility), if related to climate change and air quality	max. (0–4) (0–1)
103-1	Soft	An overview of environmental and social impact of the industry, if related to climate change and air quality	(0–1)
103-2	Soft	An overview of the business operations and/or products and services and their impact on the environment and the society, if related to climate change and air quality	(0–1)
103-2	Soft	An overview of corporate environmental and social performance relative to industry peer, if related to climate change and air quality	(0–1)
103-2	Soft	Initiatives/activities A description of climate change and air quality activities, projects and initiatives undertaken during the year, if related to climate change and air quality	max. (0–7) (0–1)
103-3	Soft	Internal audits/certifications and monitoring related to climate change and air quality–related performance	(0–1)
103-2	Soft	Existence of response plans in case of environmental and social accidents/issues, as related to climate change and air quality	(0–1)
103-2	Soft	A description of employee training in environmental and social management and operations, if related to climate change and air quality	(0–1)
103-2	Hard	Spending on technologies, R&D and/or innovations related to climate change and air quality	(0–1)
103-2	Hard	Savings arising from initiatives/investments related to climate change and air quality	(0–1)
307-1	Hard	Amount spent on fines related to climate change and air quality issues	(0–1)
103-3	hard	Credibility Periodic independent verifications/audits on environmental and social performance and/or systems; if related to climate change and air quality	max. (0–6) (0–1)
103-3	Hard	External certification related to climate change and air quality	(0–1)
*	Hard	External Awards for climate change and air quality	(0–1)
102–43	Soft	Stakeholder involvement in the ESG processes if reported in the climate change and air quality section	(0–1)
102-13	Hard	Participation in intergovernmental organizations/national agency for the development climate change and air quality	(0–1)
102-13	Hard	Participation in industry specific associations/other organizations for the development of climate change and air quality	(0–1)

Notes: This coding was applied to the sis environmental subtopics identified in the study: materials (MT), energy efficiency (ENEf), water management (WM), biodiversity (BIO), climate change (CLIM) and waste management system (WMS). * Items added by the authors

5.2 Disclosure indexes

The coding procedure applied in this study made it possible to build several indexes that were further applied to test the hypotheses. First, we constructed the environmental disclosure index (EDI), computed as the ratio of the total score awarded to each company (for all 170 items scored in our coding instrument)[5], the disclosed KPIs and narrative items (NIs), with the overall maximum score (305):

$$EDI_{it} = \frac{\sum_{j=1}^m KPI_{ij} + \sum_{f=1}^n NIs_{if}}{M}$$

where:

KPI_{ij} = from 0 to 6 for KPI item *j* disclosed by firm *I* at the end of year *t*;

NIs_{if} = for narrative items coded in a binary system (1 if firm *I* discloses the *f* item at the end of year *t*, 0 otherwise;

m = total number of KPI items (*n* = 27);

n = total number of narrative items (*n* = 143) – 11 SG items and 132 items for the six subtopic categories; and

M = total maximum score (305).

Further, we computed seven environmental category disclosure indexes (ECDIs). These indexes are calculated as the percentage of the sum of the scores of the given category, divided by its maximum possible score. For instance, for a given firm, the ECDI for CLIM (climate change) is computed as the sum of the scores obtained for KPIs (Table 4) and narrative items (Table 5), divided by 76 (54 maximum score for CLIM KPIs and 22 maximum score for CLIM narrative items). Thus, the formula for computing the ECDIs for each of each category is as follows:

$$ECDI_{kit} = \frac{\sum_{j=1}^{mk} KPI_{ijk} + \sum_{f=1}^{nk} NIs_{ifk}}{M_k}$$

where:

k = seven environmental categories (ENV);

KPI_{ijk} = from 0 to 6 for KPI item *j* of category *k* disclosed by firm *I* at the end of year *t*;

NIs_{ifk} = 1 if firm *I* discloses narrative item *f* of category *k* at the end of year *t* and 0 otherwise;

mk = number of KPI items for ENV category *k*;

nk = number of narrative items for ENV category *k*; and

M_k = maximum score for the ENV sub-topic *k*.

Finally, to address the changes in a firm's disclosure policies, we implemented two indexes that helped capture the types of disclosure: the environmental hard disclosure index (EHDI) and environmental soft disclosure index (ESDI). The EHDI is computed as follows:

$$EHDI_{it} = \frac{\sum_{j=1}^m KPI_{ij} + \sum_{f=1}^o HNIs_{if}}{H}$$

where:

KPI_{ij} = from 0 to 6 for KPI item *j* disclosed by firm *I* at the end of year *t*;

HNIs_{if} = 1 if firm *I* discloses hard narrative item (HNI) *f* at the end of year *t* and 0 otherwise;

- m = total number of KPI items (n = 27), all classified as hard disclosure items with 162 maximum score;
- o = total number of hard narrative items (n. 64) – 54 for subtopic categories and ten for SG category; and
- H = total hard maximum score (226).

Overall, for a given firm, the EHDI is computed as the sum of scores for hard disclosure, divided by the total maximum score for hard disclosure (denoted as H). Our coding procedure assumed that all KPIs are hard disclosure items (162 maximum score), whereas among the SG category, we identified ten hard disclosure items and among each subtopic category, we identified nine hard disclosure items. Thus, the total maximum score for hard disclosure items was 226.

Similarly, we developed the ESDI for soft disclosure, computed as follows:

$$ESDI_{it} = \frac{\sum_{f=1}^p SNI_{sf}}{S}$$

where:

- SNI_{sf} = 1 if firm I discloses soft narrative item (SNI) f at the end of year t and 0 otherwise;
- p = total number of soft narrative items (n. 79) – 78 for sub-topic categories and 1 for SG category; and
- S = total soft maximum score (79).

5.3 Methods and reliability tests

Since our sample was relatively small (16 firms), we selected the Wilcoxon signed-rank test to determine whether the differences between the 2016 EDI and ECDI indexes (pre-Directive) and 2018 EDI and ECDI indexes (post-Directive) were statistically significant. This nonparametric test is used in cases of two related samples or repeated measurements on a single sample, when the population cannot be assumed to be normally distributed. Additionally, we computed the parametric paired samples Student's *t*-test, which is also applicable to compare the two related samples, if normally distributed.

As our coding instrument covered a considerable number of items, we performed internal and intercoder reliability tests to ensure reliable and sound results. The internal validity of our scores was tested using Cronbach's alpha to measure the capability of the data set to systematically capture an underlying construct (Cordazzo *et al.*, 2020; Elshandidy *et al.*, 2013). This test indicates the internal consistency of the EDI and ECDI indexes, as well as whether they reflect environmental disclosure. For the computed environmental disclosure scores, Cronbach's alpha is 0.82 and 0.75 for the 2016 EDI and 2018 EDI, respectively, and 0.79 and 0.71 for the 2016 ECDI and 2018 ECDI, respectively. These results are acceptable, given the generally agreed level of 70% upon social science (Botosan, 1997).

As a second validity test, we assessed the intercoder reliability of the coding process, that is, the capability of different individuals to code similar information (Krippendorff, 1980; Hackston and Milne, 1996). This test checks for errors in the assignment of environmental scores to the disclosure items of the analytical framework. An ex ante sample of CNFSs was independently coded by the authors. After discussing the coding of each item, a final list of classification rules and exclusions was prepared. Additionally, we controlled for coding errors between individuals using Cohen's (1960) kappa coefficient. Four randomly selected CNFSs were cross coded by two authors to assess the level of interrater agreement. The estimated Cohen's kappa coefficient of 82.75% provides significant assurance of the

intercoder agreement during the coding process (Krippendorff, 1980; Hackston and Milne, 1996).

6. Results

6.1 Descriptive statistics

Panel A of Table 6 reports the descriptive statistics for the environmental disclosure scores, one year before (2016) and one year after (2018) the first implementation of the Decree. We found that the total disclosure score increased after the Decree implementation. In 2016, the mean score was 69 (22.62%), while in 2018, the mean score was 77.4 (25.39%) [6]. The changes in score show an overall slight increase in SG and in each environmental subtopic. Climate change (CLIM, +2.5), strategy and governance (SG, +1.5), water management (WM, +1.13) and energy efficiency (ENEf, +1.06) contributed the most to the increase in the total score in 2018 (+8.44).

In Panel B, we report the descriptive statistics of the seven ECDIs, before and after the implementation of the Decree. We noticed low values for all environmental subtopics, ranging from 11.68% to 28.29%, whereas the SG Index is equal to 66.48% in 2016. The last column of Table 6 shows that the average score increased for all categories. We noticed the greatest changes in strategy and governance (SG +15.34%), climate change (CLIM +3.29%), water management (WM +2.81%) and energy efficiency (ENEf +2.31%).

In the last section of Table 6, we examine the type of environmental disclosure reported by Italian companies. Panel C reports the disclosure of KPIs and narrative items, and Panel D reports the soft and hard disclosure in 2016 and 2018. In 2016, narrative items exceeded KPI disclosure both in absolute (36 vs 33) and relative terms (25.17% vs 20.37%). The former information also shows a greater change both in the scores (6.31 vs 2.13) and indexes (4.42 vs 1.31).

In 2016, the “hard” and “soft” environmental disclosure are, respectively, 46.88 over 226 (20.74%) and 22 over 79 (28.01%). The scores increased in 2018 by +4.81 hard/+3.62 soft, whereas EHDl and ESDl change by +2.13% and +4.59%, respectively. We noticed that “soft” ESDIs are higher than “hard” EHDIs in both years and that ESDIs increased more than EHDIs.

The above disclosure patterns confirm the findings of Clarkson *et al.* (2008), who documented a total average environmental disclosure of over 20.15% (for a sample of 191 US firms in 2003). Clarkson *et al.* (2008) also documented the prevalence of soft over hard environmental disclosure (39.13% and 16.30%, respectively) [7]. In Italy, Cordazzo *et al.* (2020) found that after the implementation of the Directive, the total environmental disclosure decreased from 14% in 2016 to 12% in 2017, considering a sample of 40 companies. Differently, Mio *et al.* (2020) documented an increase in NF and environmental disclosure for 253 companies. However, the recent results by Cordazzo *et al.* (2020) and Mio *et al.* (2020), although referring to Italian companies, cannot be directly compared with our findings, as they are based on a different coding system, different industries and different years.

6.2 Directive's effects on quantity of Global Reporting Initiative environmental disclosure (H1)

For H1, we tested whether the level of adherence to GRI standards regarding environmental disclosure changed after the implementation of the mandatory reporting regime. To this end, we focused on EDI and ECDI (cfr. Panel B-Tables 6 and 7).

We found that the total EDI increase of 2.77% was statistically significant at the 5% level, both using the parametric Student's *t-test* and the nonparametric Wilcoxon signed-

Table 6.
Descriptive statistics

Environmental Disclosure	Pre-legislative decree (2016)				Post-legislative decree (2018)				2016 vs 2018	
	Mean	SD	Median	Min	Max	Mean	SD	Median	Min	Max
<i>Panel A: scores</i>										
SG (max 11)	7.5	2.4%	257	0.84 %	7.31	2.46%	2.00	0.68%	11.00	3.61 %
MT (max 34)	5.25	1.72%	497	1.63 %	4.00	1.31%	0.00	0.00%	15.00	4.92%
WWM (max 46)	10.38	3.4%	571	1.87 %	8.5	2.79%	0.00	0.00%	20.00	6.56%
ENEF (max 40)	8.25	2.7%	42	1.38%	7.00	2.30%	1.00	0.33%	15.00	4.92%
BIO (max 46)	5.38	1.76%	454	1.49 %	5.5	1.80%	0.00	0.00%	14.00	4.39%
CLIM (max 76)	21.5	7.05%	7.8	2.56%	21.5	7.05%	3.00	0.98%	31.00	10.16%
WSM (max 52)	10.94	3.59%	4.46	1.46%	9.00	2.95%	7.00	2.95%	19.00	6.23%
Total score/EDI (max 305)	69.00	22.62%	2466	8.08%	69.00	22.62%	31.00	10.16%	110.00	36.07%
<i>Panel B: Indexes</i>										
SG	66.48	%	234	%	68.18	%	18.18	%	100.00	%
MT	15.44	%	1463	%	11.76	%	0.00	%	44.12	%
ENEF	22.55	%	1242	%	18.48	%	0.00	%	43.48	%
WWM	20.63	%	1051	%	17.5	%	2.5	%	37.5	%
BIO	11.68	%	988	%	11.96	%	0.00	%	30.43	%
CLIM	28.29	%	1026	%	28.29	%	3.95	%	40.79	%
WSM	21.03	%	859	%	17.31	%	13.46	%	36.54	%
<i>Panel C: KPIs vs narratives</i>										
KPIs (max 162)	33.00		1215		31.5		17.00		54.00	
Narrative items (max 143)	36.00		1456		37.5		12.00		57.00	
KPIs (%)	20.37	%	7.50	%	19.44	%	10.49	%	33.33	%
Narrative items (%)	25.17	%	10.17	%	26.22	%	8.39	%	39.86	%
<i>Panel D: Hard vs soft info</i>										
Hard (max 226)	46.88		1800		47.00		18.18		79.00	
Soft (max 79)	22.13		867		25.00		8.00		34.00	
EHDH1 (%)	20.74	%	7.96	%	20.79	%	9.73	%	34.96	%
ESDI (%)	28.01	%	10.98	%	31.64	%	10.13	%	43.04	%
Notes: This table presents the descriptive statistics for environmental disclosure scores (Panel A), EDIs (Panel B), KPIs and narrative items (Panel C) and hard vs soft information (Panel D), computed for 2016 and 2018. The last column (2016 vs 2018) indicates the difference between the mean values. The sample size was 16 firms. The percentage in panel A was computed by dividing the scores by the maximum disclosure (305); in Panel B, the ECDIs refer to the score of each category over the category maximum score. In Panels C and D, the values refer to the disclosure scores and the indexes. The disclosure categories are SG: strategy and governance; MT: materials; ENER: energy efficiency; WM: water management; BIO: biodiversity; CLIM: climate change; WS: waste management; EHDH1: environmental hard disclosure index; and ESDI: environmental soft disclosure index. 2016 vs 2018 was the mean difference										

Table 7.
Differences on
environmental
disclosure: pre- vs
post-decree
implementation

Env. disclosure indexes	Mean % (2016)	Mean % (2018)	Difference (2018 vs 2016)	Student T-statistic	Wilcoxon Z-statistic
EDI	22.62	25.39	+ 2.77	-2.824**	-2.716***
ECDI-SG	66.48	81.82	+15.34	-3.3909***	-2.776***
ECDI-MT	15.44	17.65	+2.21	-1.260	-0.711
ECDI-ENEF	22.55	24.86	+2.31	-1.807*	-1.332
ECDI-WM	20.63	23.44	+2.81	-2.179**	-2.143**
ECDI-BIO	11.68	12.50	+0.82	-0.765	-0.390
ECDI-CLIM	28.29	31.58	+3.29	-2.070*	-1.897*
ECDI-WMS	21.03	22.84	+1.81	-0.917	-1.456

Notes: The sample size was 16 firms. The ECDI indexes refer to strategy and governance (SG), materials (MT), energy efficiency (ENEF), water management (WM), biodiversity (BIO), climate change (CLIM), waste management system (WMS). ***, ** and * represent significance levels (two-tailed) at 1, 5 and 10%, respectively

rank tests. When we considered the single ECDIs, we noticed a significant increase in the SG category (SG, + 15.34%) and in the environmental subtopics explicitly indicated by the Italian legislature. Namely, the increase in water management (WM, +2.81%) and climate change (CLIM, +3.29%) were significant at 5% and 10%, respectively, for both the parametric and nonparametric tests, whereas the increase in energy efficiency (ENEF, +2.31%) was significant at 10%, only using the Student's *t*-test.

These findings confirmed that after the implementation of the mandatory reporting regime, 81% of the sample companies increased their environmental disclosure. Furthermore, according to ECDIs, environmental disclosure of companies, explicitly required by the Italian Decree, registered a significant change. Overall, this evidence supports *H1*, although the differences in firms' adherence levels to the GRI standards do not appear to be substantial.

6.3 Directive's effects on quality of Global Reporting Initiative environmental disclosure: hard vs soft disclosure (*H2*)

For *H2*, we tested whether the level of hard and soft environmental disclosure continued to be significantly different after the implementation of the Decree. In other words, we expected that while both soft and hard disclosures would increase in 2018, the level of soft disclosure would have exceeded the level of hard disclosure in 2018, as in 2016. To this end, we focused on EHDI/ESDI and computed a two-way mixed analysis of variance (ANOVA) with one between-subject factor and one within-subject factor. The between-subject factor represents the two types of environmental disclosure (hard and soft), whereas the within-subject factor was the 2016 EDI and the 2018 EDI. This test allows us to understand whether there is a two-way interaction between the type of disclosure (hard and soft) and years (2016 and 2018). In other words, we examined whether there was a significant difference in the mean values of EHDI (hard) and ESDI (soft) in 2016 and 2018. The results of the two-way mixed ANOVA presented in Table 8, Panel A, reveal that the interaction term between the type of disclosure (EHDI and ESDI) and year was not statistically significant, whereas there was a significant difference in all EDI scores in 2016 and 2018 ($F = 11.21$, $df = 1, 30$, $p = 0.002$) and between EHDI and ESDI ($F = 6.87$; $df = 1, 30$; $p = 0.014$). These results suggested that firms are inclined to provide more soft information compared to hard information and confirm the main change in environmental disclosure after the implementation of a mandatory regime.

Table 8.
Differences of
environmental
disclosure by type
(hard vs soft) and
years

Source of variation				F-statistic	d.f.	Probability
<i>Panel A: ANOVA analysis</i>						
Model				10.93	33	0.000
Main effects	Type of information (hard vs soft)			6.87	1	0.014
	Years (2016 vs 2018)			11.21	1	0.002
Interaction	Type of information × years			1.44	1	0.239
Residuals					30	
<i>Panel B: Student's t test and Wilcoxon rank test</i>						
	Obs	Mean % 2016	Mean % 2018	Student T-statistic	Wilcoxon Z-statistic	
EHDI	16	20.74	22.87	−2.163**	−2.018**	
ESDI	16	28.01	32.59	−2.619**	−2.508**	
		EHDI	ESDI			
2016	16	20.74	28.01	−3.552**	−3.561***	
2018	16	22.87	32.59	−5.672***	−3.516***	
Notes: ***, ** and * represent significance levels (two-tailed) at 1, 5 and 10%, respectively. The sample size was 16 firms. EHDI: environmental hard disclosure index; ESDI: environmental soft disclosure index						

To assess this pattern in depth, we also computed the Student's *t-test* and the nonparametric Wilcoxon signed-rank test across years (2016 and 2018) and between types of disclosure (EHDI and ESDI).

In Table 8, Panel B indicates that both hard and soft disclosure increased after the implementation of the mandatory regime. The mean of EHDI increased from 20.74% in 2016 to 22.87% in 2018. Similarly, the mean of ESDI increased from 28.01% in 2016 to 32.59% in 2018. These differences of 2.13% for EHDI and of 4.58% for ESDI are statistically significant at the level of 5%, both on the parametric and non-parametric level.

We also tested whether the soft information was significantly greater than the hard information for each year. The two test statistics indicate that ESDI (soft) exceeds EHDI (hard) for all companies in both years. These findings provide strong support for *H2* and imply that if we consider the type of disclosure (hard vs soft), the implementation of a mandatory regime did not influence the disclosure quality of Italian ESI.

7. Conclusions

The analysis sheds light on the mixed effects of the EU Directive on environmental disclosure practices of Italian ESI firms. First, it documented a significant increase in the total quantity of environmental disclosure, both in terms of score and EDI. Moreover, the difference between 2016 ECDI and 2018 ECDI revealed a significant improvement across the environmental topics explicitly required by the Italian Decree: climate change, water management and energy efficiency. This trend confirmed the effectiveness of the EU Directive in boosting the transparency and accountability of Italian ESI firms. However, we documented light changes in the level of adherence to the GRI standards between 2016 and 2018 that may be attributed to the attitude of ESI firms to disclose their performance in response to stakeholder pressure, as well as in the pre-Directive adoption regime. Second, the overall increase in the quantity of environmental disclosure is accompanied by a persistent prevalence of narrative items over KPIs (pre- and post-Directive), which seems to be mainly associated with varying degrees of effectiveness of stakeholder pressure. In this respect, even if it is true that KPIs express objective measurements, narrative items may

also be relevant, as they correspond to initiatives and actions undertaken to develop a company's environmental policies. Thus, the analysis revealed that a mandatory regime increases firms' adherence to the GRI environmental reporting standards, highlighting the importance of regulatory guidance to change firms' behavior, at least with respect to firms' reporting practices (Spira and Page, 2010).

The impact of disclosure regulation on the quality of environmental disclosure is a key concern in this study. Prior research (Al-Tuwaijri *et al.*, 2004; Chauvey *et al.*, 2015; Mio *et al.*, 2020) largely operationalized environmental disclosure quality by referring to features borrowed from the area of financial reporting. Our analysis of soft and hard information shed further light on how Italian companies' characteristics of environmental disclosure changed after the implementation of the Decree. We provided significant evidence that soft information remains the prevalent environmental disclosure in both the pre- and post-Directive periods. Thus, the implementation of the Directive did not impact the quality of environmental disclosure. Information that can be easily mimicked by poor environmental performers (e.g. a general statement of a firm's climate change and air quality policy) appears to be preferred to objective measures that can be easily verified and cannot be mimicked by other companies (e.g. direct greenhouse gas emissions).

We conclude that Italian ESI firms have increased the level of adherence to the GRI standards to be compliant with the Decree and leveraged the quantity of soft disclosure to a greater extent than the hard disclosure. This pattern can be attributed either to the Directive or to a general increase in disclosure, which requires further investigation. The prevalence of soft information over the hard one, in both years, may also signal that Italian companies adopted impression management techniques to mislead the audience of NF reports, disclosing general statements about their environmental commitment. In other words, the quality of environmental disclosure appears to be affected not only by the introduction of the EU Directive but also by managers' incentives to convey an opportunistic message through the disclosed information (Michelon *et al.*, 2020).

This study offered some empirical evidence that contributes to the ongoing debate on the relevance of a mandatory regime for NFR in communicating a company's environmental performance and on the need for the harmonization of NFR standards.

First, we add directly to the recent evidence reported by Mio *et al.* (2020), Cordazzo *et al.* (2020) and Doni *et al.* (2020), by revising the change in the quantity of environmental disclosure more in-depth in the pre- and post-Directive. More importantly, we add to this literature by presenting evidence on the changes in the quality of environmental disclosure by considering the typology of information (hard *vs* soft) by Clarkson *et al.* (2008).

A second important contribution of this study is to the debate on the need for the harmonization of NFR standards and for the call of a new global NFR framework. Our results suggested that the implementation of the EU Directive boosted firms' level of adherence to the GRI standards, supporting the view that the endorsement of the extant GRI by the EU can be an effective option in rethinking EU NFR, instead of developing a new set of standards (Adams, 2020; Cho, 2020; La Torre *et al.*, 2020). Indeed, GRI already provides a framework that is acknowledged worldwide, that has been developed through a rigorous and independent consultation process rooted in the imperative stakeholders' perspective. However, the continued prevalence of soft disclosure over hard disclosure, as well as low levels of adherence to the GRI standards, suggests that the implemented regulation did not overcome impression management reporting practices aiming to hide poor results or emphasize good ones. Thus, the current proposal for revising the EU Directive could be an opportunity to mandate the GRI along with stronger enforcement actions.

There is a third relevant contribution of this exploratory study to the literature. We developed an extended GRI-based environmental disclosure coding system based on the types of disclosure considered by [Clarkson *et al.* \(2008\)](#): hard vs soft. In this regard, our work contributes to the extant literature on NFR by providing new insights into the measurement of the quality of environmental disclosure ([Lisi, 2018](#); [Arvidsson, 2011](#)).

Our findings were limited by the relatively small sample size. However, even with this limited number of observations, we obtained statistically significant results supported by reliability tests. Further research should be conducted to verify these findings on larger samples of environmentally sensitive (nonsensitive) companies and to examine in depth the reasons for the persistent prevalence of soft disclosure. Moreover, we do not know the extent to which sustainability reports prepared in 2016 have been affected by the new EU requirements, already implemented in the Italian regulation in 2016, but required in 2017. Thus, it may also be worthy to extend the time dimension of the analysis to cover three years before the adoption of the Directive.

There is also a paucity of research investigating the implementation of the EU Directive across countries with different institutional and socioeconomic environments. For instance, mandatory environmental disclosure may be lower in countries where enforcement is weak or sustainability policies are not encouraged. Thus, we also deem that it is important to examine companies operating in different institutional and environmental settings that are not yet investigated.

Notes

1. The EU Commission climate change guidelines consider the GRI framework, as well as the recommendations and frameworks developed by TCFD, CDSB, SASB, IIRC and EMAS. The EU Commission guidelines cover greenhouse gas emissions, energy consumption, physical risk, product and services and green finance [see [Zarzycka and Krasodomska \(2021\)](#) for a detailed overview].
2. The Italian Civil Code, since the implementation of the Accounting Modernization Directive (Directive 2003/51/EC), requires limited liabilities companies to include NF performance indicators in the management report if this action is necessary for a proper understanding of their situation, operating trends and performance.
3. Compared to GRI 300 environmental subtopics, we have considered supplier environmental assessment (GRI 306) in our SG category, whereas environmental compliance (GRI 307) has been regarded as part of the narrative items of each subtopic category.
4. In [Clarkson *et al.* \(2008\)](#), hard disclosure comprises four broad disclosure categories: government structure and management systems, credibility, environmental performance indicators and environmental spending. Soft disclosure covers three categories: vision and strategy claims, environmental profile and environmental initiatives.
5. The 170 disclosure items (11 for SG, 27 for ENV KPIs and 132 ENV MG items) are the consequences of the specification of the narrative items for each of the six main environmental categories (ENV) sub-topics.
6. The medians and un-tabulated interquartile ranges for 2016 and 2018 reveal values similar to those of means and SD, with a stronger variability in 2016. An unreported box-plot analysis reveals that the distributions of environmental scores and ECDIs are not driven by outliers. We also observe a reduction in the dispersion of scores (± 8.08 SD in 2016 and ± 7.39 in 2018).
7. These scores are our elaborations from [Clarkson *et al.* \(2008\)](#).

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