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2024-32 Document de Travail/ Working Paper



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Environmental and climate mandatory disclosure : a paper tiger ? Evidence from France*

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Résumé

During the 2010s, mandatory disclosure of extra-financial information in France has been encouraged by five major laws passed to reinforce corporate social, environmental and climate responsibility of systemic actors, key to the transition process to a low-carbon, circular and sustainable economy. Whether these laws are paper tigers is of the utmost importance in understanding, notably, how firms disclose when disclosure is mandatory. Considering laws as linguistic formulations and their meanings, we provide a qualitative analysis of Universal Reporting Documents of some of the largest publicly traded French companies (CAC40). We demonstrate that this intense regulation period has fostered a common language, instilling an environmental and climate reporting culture. In addition, based on a variety of accountability profiles - *responsiveness-oriented*, *controllability-oriented*, and *out-of-step* firms -, we highlight diverse dynamics as to the appropriation of the successive laws, along with private and institutional standards.

Keywords : Mandatory disclosure, Accountability, Textual analysis, Environment, Climate, Law analysis

JEL Codes : C43, C81, C88, D83, K20, Q56, Q58

*We thank Nadine Levratto and all the participants of the RIODD 2023 18th Congress, the AFED 2023 : 8th annual conference of the Association Française d'Economie du Droit, the EconomiX lunch seminar for their useful comments.

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1 Introduction

Mandatory disclosure of extra-financial information by corporations, specifically on environmental and climate matters, has recently gained momentum.¹ For instance, on the European level, the most recent piece of legislation, the Corporate Sustainability Reporting Directive (CSRD) that came into force in January 2024, requires EU companies to provide a comprehensive reporting, aligned with the European Sustainability Reporting Standards (ESRS). In the same vein, the directive on Corporate Sustainability Due Diligence (CSDDD), inspired by the French duty of vigilance law, was adopted on May 24, 2024.

From a firm's point of view, the exercise of extra-financial reporting consists of putting into words their productive activity externalities, both negative and positive ([36]), as well as effective and potential. Disclosure laws, by enabling firms to understand and analyse those production linked-externalities sustain the "conceptual universe of collective action based on externalities", a vision of firms as a common good ([41]), endowing them with political responsibility, in addition to legal and moral responsibilities ([4]). This type of information-based regulation brings in a new era of corporate environmental and climate accountability (CECA) (see, e.g., [45]).

On the regulatory function of information, France stands out as the first extra-financial reporting legislation for French publicly traded companies, the *Loi sur les Nouvelles Régulation Economiques*, dates back to 2001. Between 2010 and 2021, additional laws have been passed, from Grenelle II to the Taxonomy regulation, by way of TECV, Vigilance and DPEF.² Substantively, these laws with limited enforcement mechanisms and unprescribed standards and norms, conditioned companies' disclosure. Such a regulatory approach, by leaving companies a certain amount of leeway, can be described as quasi-obligatory ([31]), and these laws qualified as quasi-hard laws. Given these features, one may legitimately question if quasi-hard laws of this type have some effects [24] or whether they are just *paper tigers*.

This period of regulation of self-regulation or hybrid regulation [42], combining centralized and decentralized approaches, has the advantage of addressing both market and government failures - negative externalities, transaction costs, and territoriality of jurisdictions [9] - and to overcome limits to the practice of voluntary disclosure that used to prevail in the field of CSR. If voluntary disclosure - often referred to as soft law - is generally considered as a way to ward off restrictive regulation and prepare the ground for subsequent regulations, it also has drawbacks : heterogeneity of reporting practices, greenwashing and slow pace of GHG emissions reductions. Given these limits, the objective of these quasi-hard laws is twofold : to favor symmetry of information and foster accountability, a core concept in the governance of any productive organization.

Castiglione [11] defines accountability as "a principle according to which a person or institution is responsible for a set of duties and can be required to give an account of their fulfillment to an authority that is in a position to issue rewards or punishment". Mandatory disclosure imposing such a requirement to firms, *the problem of many eyes* [7] becomes more acute : in a stakeholders' capitalism perspective [5, 40, 20], as firms have to deal with diverse expectations and informational needs from their stakeholders, they find themselves confronted with different types of accountability (and potentially multiple sanctions or rewards). This suggests the idea of several dimensions to corporate

1. see, e.g., the review of some disclosure policies and regulations in [12].

2. These laws are detailed in subsection 2.1

accountability, a point we propose to explore further in this paper.

Mandatory disclosure provides firms with information about their own actions and behaviors as well as information to some interested public, tackling both acquisition and sharing of information purposes [33]. As to the sharing of information, these laws apply to situations of asymmetric information, in which the unraveling result ([23], [32]), a principle in information economics [43] that "favorable" verifiable information may be disclosed voluntarily, does not apply.³

In this paper, we look at how firms account of their accountability in their annual reports, providing a qualitative analysis of their environmental and climate reporting practices. Sharing the viewpoint that accountability as a "social relations of discipline" has to be addressed from a dynamic perspective [39], we aim to characterise how the successive laws have influenced companies' reporting practices. To do so, we build a unique database using a regulation-specific dictionary based on an analysis of the French legislative acts from 2010 to 2021 which enables us to characterize the type of accountability that comes out of these reports as well as its dynamics. Our dictionary-based textual analysis is motivated by observations in [29] and [30] that this literature should be more driven by hypothesis tied to some theories and less focused on computational textual methods (for a review of methodologies, see e.g., [3] and [21]).

Our content analysis of the Universal Registration Documents published by 27 CAC40 companies between 2010 and 2021 highlights that the shift from soft law to quasi-hard law has fostered the adoption of a common language and promoted a variety of accountabilities with different trajectories of laws' appropriation. In other words, this period of intense regulation has enabled significant changes in reporting practices bringing out varieties of reporting practices among firms that reflect differences in their awareness and willingness regarding environmental and climate challenges. Our empirical study thus fills in the growing literature on mandatory disclosure (see, e.g., [14] for a review) on the topic of quality effects of mandatory disclosure [24], sustaining the idea that information-based regulation, by fostering the "missing motivation" [1] - an environmental and climate consciousness through an environmental and climate reporting culture - may not be just symbolic.

The article is structured as follows. In section 2, we describe both the French regulatory environment and the creation of the dataset. In section 3, we characterize the successive laws according to different dimensions of accountability, and we construct indexes so as to assess the degree of laws' appropriation. An accountability-based classification of firms is presented in section 4. Section 5 presents the results on accountability' pathways through inter and intra-clusters' dynamics analysis. These results are put into perspective and some conclusions are drawn in section 6.

3. This result, derived under the assumption of costless disclosure, has been extended by authors like [26] and [44] who have shown that the argument still holds under costly disclosure with sufficiently low costs.

2 Materials

2.1 French regulatory environment

2.1.1 Disclosure laws...

During the 2000s, several ESG disclosure laws have passed, which aim to strengthen companies' accountability for the social, environmental and climate impacts of their activity. We restrict our attention to legal provisions that concern publicly traded companies, and that affect environmental reporting practices from the fiscal year 2010 to 2021.

The first laws, defined at the national level, namely the *Nouvelles Régulations Économiques* or NRE Act, passed in May 2001, followed by the *Grenelle II* Act, passed in 2010, and the *Transition Énergétique pour la Croissance Verte* (TECV) Act, that came into force in 2015, were introduced in order to provide stakeholders, and more specifically shareholders, with non-financial information. Article 116 of the NRE Act added Article L. 225-102-1 to the French Commercial Code, which stipulates that the annual reports of listed companies must include information on how the company takes into account the social and environmental consequences of its business activities. This act was supplemented by the decree of 20 February 2002 that specified a predetermined list of non-financial information, identical for all companies. The *Grenelle II* Act will amend this article by introducing a mandatory audit by an independent third-party organization. And the decree of 24 April 2012 increases the quantity of information to 42 items, several on environment and climate (pollution management, energy consumption, carbon footprint, emissions reduction, Greenhouse gas).⁴ Finally, the *TECV* Act added to the required information the consequences, on climate change, of the company's activity and the use of the goods and services it produces : carbon budget, circular economy, global warming, low-carbon transition, low-carbon strategy, indirect and direct emissions, etc..⁵

It was in 2017 that the binding nature of environmental information disclosure took shape with, on the one hand, the publication of the French Duty of Vigilance Act and, on the other, the introduction of the extra-financial performance declaration (DPEF) in Article L225-102-1 following the transposition of Directive 2014/95/EU of July 19, 2017, which concerns the reporting of non-financial information (NFRD).

The French Duty of Vigilance Act, adopted in February 2017, requires parent companies and large companies acting as principals that employ at least 5,000 employees in France or 10,000 employees worldwide to establish a vigilance plan to identify risks and to prevent the occurrence of harm to the health and safety of employees, the violation of human and environmental rights caused by their activities and those of their trading partners. The vigilance plan includes but is not limited to : risk mapping, value chain assessment processes, preventive actions, alert mechanisms and monitoring systems on the effective and efficient implementation of company-specific vigilance measures.⁶ Note that the risks concern third parties and the environment, and not the company itself. It focuses primarily on detecting the risks that the company may impose on some stakeholders, as opposed to risks to the company. Also, the corporation has the obligation to publish the vigilance plan. While the principle of civil fines of up to 30 million euros, provided for in Article L. 225-102-5, was invalidated by the French Constitutional Council, the formal notice mechanism and the liability action brought before the competent court

4. All the keywords that characterize the Grenelle Act are listed in Table 2, see Appendix.

5. All the keywords that characterize the TECV Act are listed in Table 15, see Appendix.

6. All the keywords that characterize the Vigilance Act are listed in Table 16.

by any person justifying an interest in acting for this purpose were confirmed.⁷

With the extra-financial performance declaration (DPEF), the aim of which is to provide a complete and concise information, targeted at stakeholders, established by the Order of 19 July 2017, the reporting system is drastically modified : the materiality principle replaces the reporting on a list of items and companies key performance indicators and the business model should be specified.⁸ Note that companies can refer to the information contained in the vigilance plan. In the event of failure to declare, a formal notice mechanism is provided.

More recently, with the Taxonomy regulation that entered into force on July 2020, large companies that are required to publish non-financial information pursuant to the Non-Financial Reporting Directive (NFRD) shall disclose information to the public on how and to what extent their activities are associated with environmentally sustainable economic activities. According to Article 8, non-financial companies have to identify which of their capital expenditure (Capex) and operating expenditure (Opex) relate to sustainable activities, key performance indicators (KPIs) being provided.⁹ With the taxonomy regulation, a European vision of public disclosure asserts itself : financial information and non-financial information are no longer dissociated and the principle of "double materiality", according to which companies must report on both financial materiality (the impact of ESG risks on the company) and impact materiality (the company's impact on society and the environment) is fostered.

2.1.2 ...without prescribed standards

This period of intense regulation corresponds to a transition period between the "soft law" era and the "hard law" new regulatory European framework that includes mandatory European standards. These quasi-hard laws allowed firms to adopt norms and standards of their own (internal, national, international standards), which were developed during the voluntary disclosure period following recommendations from the public sphere. Indeed, the most significant impetus has come from international institutions - principally the UN through the publication of major principles (Global Compact in 2005, Sustainable Development Goals in 2015) and the organization of treaties (Rio Agenda in 1992, Paris Agreement in 2015) - and European bodies - principally the Commission, in the form of non-binding regulations and directives (EMAS in 1993 on environmental management, European Directive 2004/35/EC on environmental liability, Directive 2014/95/EU on the publication of non-financial information). The rest of the production of norms, standards, and methods governing the disclosure of environmental information fell within the private sphere. This production has an oligopolistic character, resulting from the mobilization of a small number of private players : non-profit organizations - International Organization for Standardization (ISO) in 1996 with the ISO 14 000 (environmental management) and the ISO 26 000 (social responsibility) in 2010, Global Reporting Initiative (GRI) in the 2000s, Carbon Disclosure Project (CDP) from 2003, Sustainability Accounting Standards Board (SASB) in 2011 - consultancies or consortia like the Climate Disclosure Standards Board (CDSB) since 2007, the International In-

7. With Article L.211-21 of the French Code of Judicial Organization, in force since 23 December 2021, the entire litigation process is assigned to the Judicial Court of Paris. Facing an increasing number of environmental liability cases based on the Vigilance law, the Court announced, on January 15, 2024, the setting up of a chamber dedicated to emerging litigation within its economic division.

8. All the keywords that characterize the DPEF Act are listed in Table 17.

9. All the keywords that characterize the Taxonomy Act are listed in Table 18.

egrated Reporting Council (IIRC) in 2013, the Science Based Targets (SBTi) in 2015, the Task force on Climate-related Financial Disclosures (TCFD) from 2016 and business associations such as the GreenHouse Gas Protocol (GHG) from 1998. These players will provide companies with the tools to standardize environmental information : guidelines, quasi-accounting frameworks, and reporting methods (notably "materiality analysis"). Today, there is a trend towards concentration, with the merger of two major players in this field (IIRC and SASB), as well as a clear desire to see the tools thus produced made mandatory by governments, as evidenced by the CDSB's communication, for example.¹⁰

2.2 Dataset of Universal Registration Documents

In this section, we detail the constitution and curation of a dataset of Universal Registration Documents from 27 CAC40 French companies over the period 2010-2021.

French listed companies are required to publish a Universal Registration Document (URD) every year on the French financial markets authority's website¹¹. We considered the period 2010-2021 and downloaded the URDs of companies present continuously in the CAC40 French index during this period. This results in a collection of 324 URDs from 27 companies over a 12 years period, giving 324 documents in PDF format for a total of 123k pages and 71M words. The companies considered for this study are detailed in Table 1.

10. <https://www.cdsb.net/blog-news/cdsb-framework/796/looking-back-10-years-cdsb>

11. <https://www.amf-france.org>

Companies	Accountability profile
Banking	
BNP	<i>out-of-step</i>
Société Générale	<i>out-of-step</i>
Insurance	
AXA	<i>out-of-step</i>
Energy	
Engie	<i>out-of-step</i>
TotalEnergies	<i>responsiveness-oriented</i>
Veolia	<i>responsiveness-oriented</i>
Transportation	
Michelin	<i>responsiveness-oriented</i>
Renault	<i>responsiveness-oriented</i>
Materials and buildings	
Air Liquide	<i>responsiveness-oriented</i>
Bouygues	<i>responsiveness-oriented</i>
Safran	<i>out-of-step</i>
Saint-Gobain	<i>responsiveness-oriented</i>
Schneider	<i>controllability-oriented</i>
Unibail	<i>controllability-oriented</i>
Vinci	<i>responsiveness-oriented</i>
Agriculture, food and forest	
Carrefour	<i>controllability-oriented</i>
Danone	<i>responsiveness-oriented</i>
Pernod-Ricard	<i>out-of-step</i>
Technology and media	
Cap Gemini	<i>controllability-oriented</i>
Orange	<i>out-of-step</i>
Publicis	<i>out-of-step</i>
Vivendi	<i>out-of-step</i>
Consumer goods	
Essilor	<i>controllability-oriented</i>
Kering	<i>out-of-step</i>
L'Oréal	<i>out-of-step</i>
LVMH	<i>controllability-oriented</i>
Sanofi	<i>out-of-step</i>

TABLE 1 – The 27 companies selected for this study are those that remained in the French CAC40 index during the period 2010-2021. Activity sectors are from the Task Force on Climate-related Financial Disclosures (TCFD). Accountability profile refers to our firms’ classification derived in section 4.2 : *out-of-step* firms (cluster 1), *responsiveness-oriented* firms (cluster 2), and *controllability-oriented* firms (cluster 3).

A schematic diagram of the methodology used is available in Fig.1, providing an overview of the various stages involved.

2.2.1 Text extraction from PDFs

An extraction pipeline, developed for this study in the Python programming language, is used to extract textual content from the PDF documents. The first step is to remove headers, footers and margins that include highly redundant and irrelevant text (document title, company name, page number). We use the *pdfarranger* software [37] to manually estimate the coordinates of a bounding box excluding this peripheral text. This step is done once per document and the coordinates of the boxes are stored for further use. The *python-poppler* library [8] is then used to automatically extract the text within the

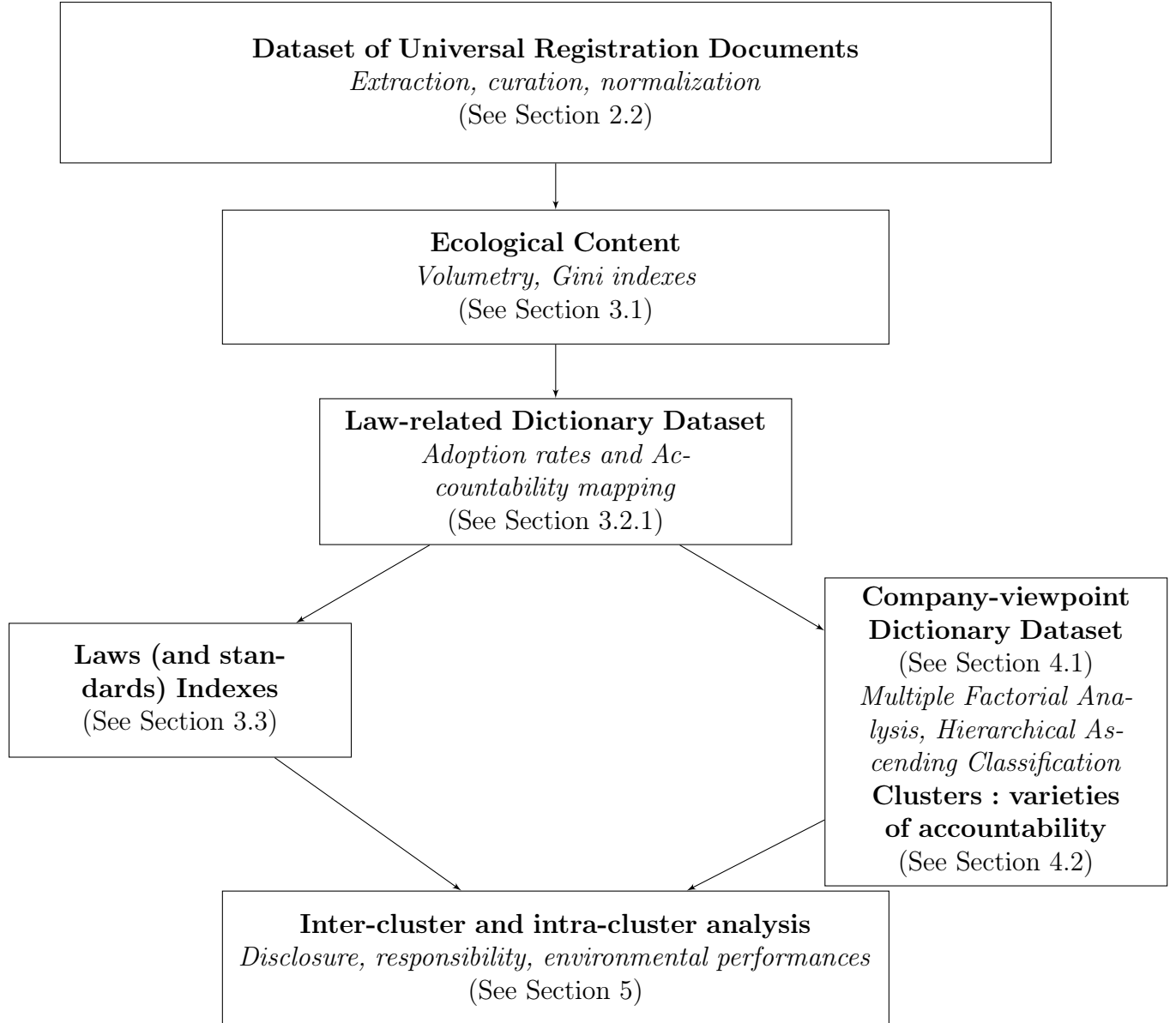


FIGURE 1 – Flowchart of the proposed methodology

bounding box, for each page of each document. The extracted text is structured into *chunks* that correspond roughly to the reading order of the page (see Fig. 2).

Nevertheless, most of the structure of PDF documents is lost. The extracted text chunks do not match original paragraphs (one paragraph can be split in several chunks or several paragraphs can be merged in a single chunk). As a consequence the sentences boundaries are lost as well. Moreover the document plan and sections boundaries are not retrieved with our method. Those limitations are inherent to the PDF file format, dedicated to print and display but not to structured content extraction. Machine-readable formats will in all likelihood replace the PDF format in coming years and will ease automatic content extraction¹². In this study, after text extraction from the raw PDF documents, we have access to three level of analysis : pages, text chunks and words ; but the section, paragraph and sentence levels are not captured.

12. The EU "Open Data" directive 2019/1024 defines and promotes the use of machine-readable formats such as XHTML for the diffusion of URDs.

Five documents were entirely corrupted due to the fonts being not embedded in PDF files (Safran, 2011 ; Air Liquide, 2018 ; Saint-Gobain, 2018 ; Renault, 2019 ; Pernod-Ricard, 2020), resulting in a meaningless text. In those cases, we manually built a character based transcription table. Indeed, each corrupted character has a one-to-one mapping to a valid one, this mapping being constant over the entire document.

2.2.2 Text curation and normalization

Some of the text chunks extracted from PDFs are irrelevant for a textual analysis because they contain only numbers (when extracted from a table), very few words (legend or section title) or corrupted text (due to an issue with PDF encoding). Therefore, a text chunk is considered invalid and removed from the analysis if one of the following conditions apply : it contains less than 10 words, it includes less than 30% of French words, more than 60% of the characters are numbers or less than 50% of the characters are ASCII. Those thresholds have been calibrated manually to deal with most of the cases.

A normalization step is then applied to the valid chunks. The text is first cleaned : ligatures are converted to usual graphemes, special characters are suppressed (a total of 419 such as bullets, arrows or other symbols, most of them come from encoding issues in PDF files) and spaces are normalized (multiple spaces, tabulations and new lines are replaced by a single space). The text is then lemmatized using the SpaCy library [25]. Lemmatization is the linguistic process of converting words to their corresponding root (or lemma) : verbs are turned into infinitive form, nouns and adjectives into the singular masculine form, etc. Then a list of 503 frequent words useless for textual analysis are removed from the text (articles or pronouns such as « the », « a », « and », or « it » in English, also known as stop-words). Finally the punctuation is removed and the text is turned into lower-case. With the normalization pipeline just described, the sentence « *Lemmatization is the linguistic process of converting words to their root (or lemma).* » becomes « *lemmatization linguistic process convert word root lemma* ».

3 Ecology and laws in URD

3.1 Ecological content disclosure evolution

As URDs cover a lot of topics (financial and operational results, internationalization, industrial strategy, among others), we need to focus the analysis to the part of the documents related to environment and climate change. To do so, we built a list of 25 expressions within the semantic field of ecology (see Table 5). Then, a text chunk is flagged as *ecological* if it contains at least one expression in the list, or if it is contiguous to an ecological chunk. Some expressions include variations, *e.g.* the name *écologie* and the adjective *écologique*. They are both looked-up in the text and linked to a single target expression, *ecology* in this case. Because the text and expressions are normalized, we can safely ignore plurals and uppercase. Furthermore, the expressions are searched in text after word tokenization to avoid sub-word matching so that, for instance, a search for *cat* does not match *category* or *advocate*. From here, we only use ecological counts, *e. g.* counts performed on ecological content.

Regarding the volume of information, the average percentage of chunks with ecological content rose from 18% to 27% over the period. Minimal values rose from 6% to 16% during the period. In 2010, one out of two companies had more than 18% of ecological chunks



FIGURE 2 – Automatic text extraction on a single page of an Universal Registration Document (Orange, 2018, page 101). Dashed line delimits the bounding-box used to crop headers and footers. Full lines indicates the 7 text chunks extracted from the page, out of 51 chunks before cleaning (chunks too short or containing mostly numbers have been filtered out). The extracted text is then normalized and lemmatized (see Section 2.2 for details).

in their annual report against 24% chunks in 2021. Half of the companies have between 11% and 21% of chunks in their reports in 2010, and between 21% and 34% in 2021. See Fig. 3 for details.

To evaluate the location of ecological content in the URDs, we look at the Gini coefficient. Higher values, close to one, mean that ecological information is highly dispersed in the document, which would affect the readability by stakeholders. Between 2010 and 2021, the Gini coefficients of the ecological content have not changed significantly, at around 0.45, i.e., an intermediate concentration of ecological information - meaning that ecological information is rather scattered throughout the reports than concentrated in one place. Also, from 2013, there is a significant negative correlation between the percentage of ecological content in a company’s annual report and its concentration : the correlation values, using the Spearman correlation method, varies between -0.48 in 2013 to -0.71 in 2021, at a 5% level of significance. In other words, companies that disclose more on these topics are those for which the disclosed information on these same topics is more concentrated, all the more in the recent years.

Result 1 *Over the period 2010-2021, companies disclose much more on environmental and climate themes in terms of volume. Although the concentration of ecological information has been relatively steady over the period, companies that disclose more are those for which the disclosed information is more concentrated.*

This result on the impact of mandatory disclosure on volumetry corroborates the result established by Chauvey [13] considering the NRE law.

3.2 Laws and accountability

In order to assess the impact of laws on reporting practices, we need to produce information that doesn’t exist since no database or precise monitoring system has been proposed by any organization - public or private - on how the companies studied are following the successive pieces of legislation described in Section 2.1. To this end, the first step is to compile a dictionary of terms specific to each law to take account of their main features, and to isolate the elements of language that characterize each one of them. As these laws have been passed in a very short period of time and constitute successive and complementary layers of required information, it necessitates a holistic analysis, meaning that we look at the five laws altogether. Such a dictionary that focuses on the linguistic aspects of law is related to Jeremy Bentham’s theory of law [6] : his “legal positivism” is based on his claims about the meaning and use of words.¹³ In the same vein, as pointed out by Wroblewski [46], legal language is distinct from natural language - the language of communication in a linguistic society. Legal language, which is the result of the activity of the legislator who formulates the texts of normative acts, is a register of natural language that fulfils more specialised functions. Considering laws as linguistic formulations and their meanings, the set of meanings included in laws is not given a priori. This set of meanings can be freely chosen, and this choice is influenced by culture [47]. This « analytical vision » of law adapted to our language-oriented disclosure laws supports the idea according to which the set of meanings chosen freely is conditioned by the environmental and climate corporate culture. Public discourse constrained by law thus delivers companies’ accountability.

13. Jeremy Bentham (1782) is probably the first legal philosopher for whom legal language is an essential element of his theory of law.

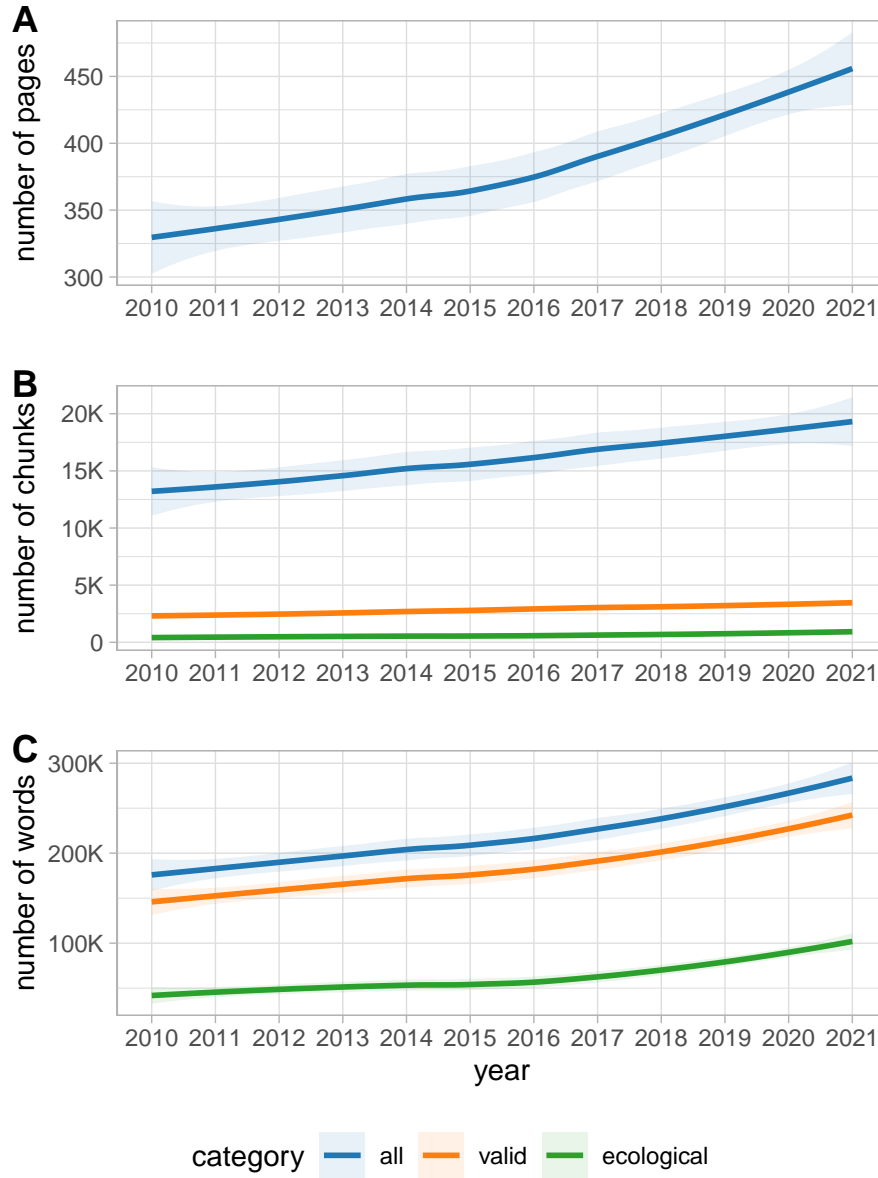


FIGURE 3 – Descriptive statistics of the URDs dataset over the period 2010-2021. Mean over the 27 companies, shaded areas are 95% confidence intervals. (A) Evolution of the mean number of pages for the 27 companies, with an increase by 37.8% over the period. (B) Evolution of the mean number of text chunks extracted from the URDs, valid and ecological chunks represent respectively 17.8% and 4.4% of all chunks. (C) Evolution of the mean number of words extracted from URDs, with an increase by 59.6% over the period for all words and by 141.9% for words in ecological chunks. Words in valid and ecological chunks represent respectively 84.4% and 32.5% of all words.

3.2.1 On words : "Law-related" dictionaries

The first disclosure law on non-financial reporting in France, the NRE act, was published in 2001, almost ten years before our period of analysis and laid the foundations of impact materiality - the consequences of firms' activities on the environment - in a pioneering and exhaustive way, reducing the room for new terms related to ecology in the following laws. At the beginning of our period, most of the NRE-specific words show high adoption rates such as biodiversity (70.4%), renewable energy (77.8%), environmental risks (85.2%), certification (88.9%). Those words are at a 100% adoption rate in 2021, like sustainable development for which a 100% is observed all over our period of analysis. Discharges (74.1%), and pollution (81.5%) reach respectively (85.2%) and (96.3%) adoption rates in 2021.¹⁴ Law-specific terms are identified through an iterative process to assign each keyword to one, and only one, law. By doing so, we obtain five law-related dictionaries named respectively : Grenelle Law-related dictionary, TECV Law-related dictionary, Vigilance Law-related dictionary, DPEF Law-related dictionary and Taxonomy Law-related dictionary. These dictionaries are given in tables 10 to 14, see Appendix.

3.2.2 On meanings : accountability dimensions

To clarify the concept of accountability, we refer in this subsection to the five-part typology of accountability conceptions proposed by Koppell [27]. Although developed for public administration, this typology appears relevant for private companies regarding their environmental and climate accountability, as discussed in [34] and [22]. In [27], accountability encompasses five dimensions - transparency, liability, controllability, responsibility and responsiveness. Among those five dimensions, two of them, namely transparency and liability, support the other three « substantive conceptions » of accountability : responsiveness, responsibility and controllability. While transparency, which refers to the presentation of truthful information, and liability, which refers to firms facing the consequences of this disclosure, can be considered as established conceptions of accountability shared by all publicly traded companies, the other dimensions are idiosyncratic. Responsiveness refers to expectations of stakeholders and corresponds to an horizontal vision of accountability whereas controllability is about control and refers to a more vertical vision of accountability relying on the means to verify the assertions. Responsibility pertains to laws, professional standards (rules, norms), internal standards (not set by legislators) and even moral or implicit obligations.¹⁵

Considering the five law-related dictionaries, three categories of words can be distinguished : references to legislative acts, general words linked to environmental and climate

14. Adoption rates correspond to the proportion of companies that mention the keyword in question at least once in a given year's report, which is a fairly undemanding measure of adoption. Adopting a more restrictive definition would require fixing an adequate number of occurrences for each keyword which, given the diversity of their nature, would be difficult to justify.

15. According to the Corporate Reporting Dialogue (CRD) - an initiative, convened by the IIRC, that brings together influential organizations in the corporate reporting landscape : CDP, CDSB, FASB, GRI, IASB, IIRC, ISO and SASB -, transparency is core to accountability : « Transparency and accountability are critical elements to achieve high quality governance mechanisms and empowerment of stakeholders in modern societies and markets. [...] Accountability can only be fulfilled if those held accountable disclose their behaviour and performance such that those looking for accountability can actually hold the other to account. Accountability therefore needs transparency. Equally transparency needs accountability in order to drive effective behaviour or performance : disclosing in itself is not enough if those holding to account do not have the power to influence the behaviour or performance, do not have an incentive to take actions or do not have a relationship with those accounting. »

issues, and more technical words with a quantitative dimension allowing for greater comparability and verifiability. These three categories of words can be matched with the three « substantive conceptions » of accountability ([27]) : the first category referring to responsibility, the second category to responsiveness and the third category to controllability. This matching for the Grenelle Law-related dictionary is displayed in Table 2 (for the other law-related dictionaries, see Tables 15, 16, 17 and 18 in Appendix).

The three categories of words characterizing the law-related dictionaries can also be recasted using the corporate culture framework ([18]). Likewise awareness and willingness regarding organisational practices are crucial to the building of a corporate culture, awareness and willingness concerning environmental and climate stakes can favour the building of an environmental and climate reporting culture. If the first category, responsiveness oriented words aims at fostering awareness, the two others categories of words (responsibility and controllability oriented words) enable firms to demonstrate their willingness to commit to environmental and climate challenges. By fostering awareness and willingness regarding environmental and climate challenges, those laws contribute to the building of an environmental and climate corporate culture.

Result 2 *If awareness dominates in Grenelle, TECV and Taxonomy laws, Vigilance and DPEF laws rather promote willingness. Among this set of laws, Vigilance and DPEF are peculiar : those laws emphasize controllability and responsibility.*

To assess the appropriation of this set of laws by firms, rather than conducting a word by word analysis, we propose to build some indexes of laws' appropriation.

3.3 Laws' and standards' indexes

Our indexes are derived from the previously built matrix of "law-related" dictionary keywords for each firm over the 2010-2021 period. To capture the intensity of use, we opt for frequencies, defined as the ratio of the ecological counts of a specific word to the total number of ecological words. We then construct an index that positions each firm with respect to the ones with the maximal intensity of use in 2021. In other words, as no absolute measure of the number of times a word should be used (per year in an annual report) exists, we develop a relative measure based on a max-min normalization, taking the minimum value at the beginning of the period and the maximum value at the end of the period.

Let's denote $N_{j,t}$ = the total number of ecological words in annual report of firm j in year t , $n_{i,j,t}$ = the number of ecological counts for each keyword of each law-related dictionary in annual report of firm j in year t , D = the total number of keywords of each law-related dictionary and $f_{i,j,t}$ = the frequency of keyword i of firm j in year t . For each law, we opt for the following indicator at the *word-firm-year* level :

$$I_{i,j,t} = \frac{f_{i,j,t} - \min_j f_{i,2010}}{\max_j f_{i,2021} - \min_j f_{i,2010}} \quad (1)$$

with

$$f_{i,j,t} = \frac{n_{i,j,t}}{N_{j,t}} \quad (2)$$

which gives, for each law, the following aggregated (by firm and law-related keywords) index,

GRENELLE 2012					
Adoption rate in 2011			Adoption rate in 2021		
[0%, 33%]	[33%,66%]	[66%,100%]	Relative stagnation	Small increase	High increase
<i>Responsibility dimension of accountability</i>					
R. 225-105-1 (0) L-229-25 (0)			L-229-25 (0)		R. 225-105-1 (51.8)
<i>Responsiveness dimension of accountability</i>					
Pollution prevention (18.5)	Patronage (59.3)	Climatic (96.3) Emission reductions (81.5) Greenhouse gas (92.6)		Climatic (100) Emission reductions (100) Greenhouse gas (100) Patronage (66.7) Pollution prevention (29.6)	
<i>Controllability dimension of accountability</i>					
Independent third party audit (3.7)	EMAS (59.2) Carbon footprint (37)		EMAS (59.2)	Carbon footprint (48.1)	Independent third party audit (100)

TABLE 2 – Grenelle Law : adoption rates before FY vs 2021

Keywords are classified according to the three accountability dimensions : *responsibility*, *responsiveness*, *controllability*, with statistically significant keywords belonging to the "company-viewpoint" dictionary in bold.

$$I_t = \frac{\sum_{i=1}^D \sum_{j=1}^{27} I_{i,j,t}}{D * 27} \quad (3)$$

Such an index's design, where all keywords have the same weight, is motivated by the peculiarities of laws in terms of accountability (established in the previous section). It allows both completeness (each word counts) and total compensation.¹⁶

We observe that all the law-related indexes (LRI) increase, meaning that the degree of laws appropriation, captured by the median evolution from the year before the fiscal year of due compliance to the 2021 reference point, has increased over the period (see the two first columns Table 6 in Appendix). More precisely, the multiplier factor range from 2.33 for DPEF-LRI to 4.39 for Vigilance-LRI (see column three of the same table). Also, the interquartile ratios, indicative of the inequality of laws' appropriation, decrease from : 3 to 1.76 for Grenelle-LRI 2012 and 3.07 to 1.59 for TECV-LRI, 2.43 to 2.12 for Vigilance 2017, 4.88 to 1.63 for DPEF-LRI and 3.46 to 1.56 for Taxonomy-LRI. Note that Vigilance is the only law for which the inequality stays above 2 which contrast with the range of values for the other laws. This suggests that these laws foster homogeneity in reporting practices except for the Vigilance law. Finally, the Jarque-Bera tests conducted on those indexes after the year of due compliance suggest that the indexes' distributions cannot be distinguished from a normal distribution whereas the same tests before the year of due compliance lead us to reject normality for those indexes, except for DPEF. Interestingly, the normality of the distribution can be observed before and after the year of due compliance for this law, as most of the related keywords have very low and homogeneous adoption rates, even after the enactment of the law.

Result 3 *Although the degree of laws' appropriation differs from one law to another, a trend towards laws-induced homogenisation is highlighted, except for Vigilance for which the dispersion indicator remains stable. From the fiscal year of laws' due compliance, laws' indexes distributions are normalized, suggesting the fostering of a common language, except for DPEF.*

The methodology used to construct the LRIs is further applied to build standard indexes. The chosen standards are the private reporting standards previously mentioned in section 2.1.2, distinguishing between institutional and private standards according to their date of appearance (see Table 7 in Appendix). As our focus is on mandatory reporting, regarding private standards, which were developed during the nineties to support voluntary disclosure, we opt for those with a clear institutional designation and considered as references in the field (see, for instance, [10]). Two institutional standards have been chosen, Un Global Compact for period 1 and SDGs for period 2, according to their release date and importance, as testified by their adoption rates at the end of the period, respectively around 78% and 96%. As to the release date, two periods are considered : period 1 gathers those that were released before 2010, the starting date of our analysis, and those released between 2010 and 2021 - the contemporary ones - are regrouped in period 2). We shall come back to these indexes in subsection 5.3 and 5.4.

We now turn to a deeper analysis of companies' disclosure regulation appropriation by focusing on relevant keywords, that is keywords that have undergone a significant evolution before and after the enactment of each law, leading to five companies-viewpoint dictionaries that reflect their perceptions of the different laws.

16. Contrary to [38] methodology, we did not choose to use any partial compensation rule between the different indicators as such a rule would have necessary been arbitrary.

4 Accountability profiles

4.1 "Company-viewpoint" dictionary

For an objective selection of vocabulary that has undergone a statistically significant evolution before and after the enactment of each law, we did some Wilcoxon tests on all the terms of the law-related dictionary.¹⁷ Those tests reduce the subset of keywords from 68 to 33 (see Table 9 in Appendix).¹⁸ In an analytical vision of law, the "companies-viewpoint" dictionaries reveal the set of meanings associated to each law. Interestingly, Grenelle is rather responsiveness, TECV refers solely to this dimension. While DPEF and Taxonomy are predominantly associated with the controllability dimension of accountability. Finally, responsibility and controllability characterize Vigilance.

4.2 Companies' classification

Focusing on the "Companies-viewpoint" dictionary, we conduct a Multiple Factor Analysis (MFA) followed by a hierarchical ascending classification (HAC) to synthesize this information by clustering firms based on their environmental communication in relation to laws' vocabulary. This enables us to exhibit different firms' profiles for the considered period.

The first stage corresponds to the MFA which is a factor analysis applied to a set of grouped variables.¹⁹ The aim is to synthesize all gathered information by principal components analysis to implement in a fourth stage a classification on orthogonal axis of information. In our study, the numerical variables (words' counts) are grouped according to their affiliation to our five laws of interest. MFA allows us to study these groups simultaneously to respect the holistic approach we choose. At this stage, to treat firms on equal terms as to the knowledge of the law, we only make use of counts, for each variable, after the enactment of the related law. Those groups are weighted to make the influence of each one comparable such that none had a dominant influence on the first factor of the analysis. In our setup, the concern was about different laws' lifespans : Grenelle law exists for 9 years, TECV law for 6 years, DPEF and Vigilance for 4 years, and Taxonomy for one year. MFA allows us to balance the influence of each law given that Weights are determined such as a single group will not give rise to the first factor. Each group is weighted with the inverse of the first eigen value of its separate analysis. This MFA has been computed using the FactoMin R package. We found that the total variability explained by the three first principal components is about 50.2%.²⁰

The second step is to conduct an ascending hierarchical classification, based on the previous multiple factor analysis, carried out using Rstudio available tools (Package FactoMinR, function HCPC), enabling companies with similar profiles to be grouped together. We obtain three classes of enterprises according to their use of the reduced dictionary.²¹

17. The Wilcoxon test is a non-parametric test, used to determine changes in average for dependent samples when data are not normally distributed.

18. For Grenelle, the number of words is divided by 2, for TECV, by 2.2, for Vigilance, by 1.4, for DPEF by 3 and for Taxonomy by 2.2.

19. This method allows us to deal with different sizes of groups of quantitative variables - keywords counts by law -.

20. Robustness checks have been performed to verify the stability of the results to the normalisation of counts according to the number of years of appearance, since laws are more or less recent.

21. Robustness tests have been done on the complete dictionary and have led to a similar classification.

The first and most numerous class, comprising 12 companies out of 27, stands out for its significantly less frequent use of words related to controllability and responsiveness dimensions of accountability (minimum significance level in brackets) : greenhouse gas (1%), emission reductions (1%), circular economy (1%), stakeholder (5%), key performance indicators and environmental objectives (10%). This class makes less use than the average firm of concepts referring to the consideration of a sustainable development of the company - spillovers of companies on environment - as well as the basic elements of a structured communication of extra-financial information that takes stakeholders into account. We name this cluster 1 : firms with an *out-of-step accountability*.

The second group of 9 companies is distinguished by a significantly greater use of words related to the responsiveness dimension of accountability : circular economy (at 1%), greenhouse gas (at 1%), emission reductions (at 5%), alert mechanisms (at 5%), low carbon strategy (at 5%). On the contrary, these companies use the terms aligned (at 5%) and sustainability (at 5%) significantly less often. They care to communicate on environmental issues. We named this cluster 2 : firms with a *responsiveness-oriented accountability*.

The last class comprises just 6 companies, distinguished by a significantly more pronounced use of controllability-related words : sustainability (at 1%), key performance indicators (at 1%), independent third-party audit (at 5%), taxonomy (at 5%), mitigation (at 10%) and Opex (at 10%). On average, however, they make less reference to ecological transition than companies as a whole. This third cluster is labeled firms with a *controllability-oriented accountability*.

Given these accountability profiles, the dynamics of the disclosure regulation appropriation can be more precisely described at the cluster level.

5 Accountability pathways : inter and intra-clusters' dynamics

5.1 What about ecological content ?

To exhibit differences in ecological content between the clusters (inter-clusters analysis), and given the specificity of our database and the non-normality of most of our variables, we run inter-cluster Kruskal-Wallis (KW) tests²², the results of which are gathered in Table 3. Regarding the ecological content, we found that the volume and readability of environmental and climate information differ according to firms' type of accountability. Firms with a *responsiveness-oriented* accountability exhibit significantly more ecological content than respectively firms with *controllability-oriented accountability* and *out-of step* ones. Companies focused on controllability have the highest readability according to the Gini coefficient, compared to the other two clusters.

Result 4 *Responsiveness-oriented firms lead in terms of volume of information whereas controllability-oriented ones provide a more readable information.*

22. The Kruskal-Wallis test is a non-parametric test which extends the Wilcoxon test to more than two groups of variables. It is used to determine if there are significant differences between groups.

Variables of interest	Kruskal-Wallis test : P-value	Out of step <i>vs</i> Responsiveness-oriented	Out of step <i>vs</i> Controllability-oriented	Responsiveness-oriented <i>vs</i> Controllability-oriented
Ecological content				
Chunks	0.0001	**** (1<2)	*(1<3)	****(2>3)
Gini coefficients	0.01	ns	* (1<3)	****(2<3)
Standards Indexes				
UN Global Compact	0.00036	*** (1<2)	ns	ns
SDGs	0.057	ns	ns	ns
GRI	0.018	ns	* (1<3)	* (2<3)
GHG	0.011	* (1>2)	ns	ns
ISO14000	<0.0001	**** (1<2)	** (1<3)	ns
ISO26000	0.38	ns	ns	ns
CDP	<0.0001	ns	**** (1<3)	ns
SASB	0.088	ns	ns	ns
SBTi	0.83	ns	ns	ns
TCFD	0.078	ns	ns	ns
Performance Scores				
TR Emissions (2010-2016)	0.68	ns	ns	ns
TR Emissions (2017-2021)	0.58	ns	ns	ns
TR Environment (2010-2016)	0.046	ns	ns	* (2>3)
TR Environment (2017-2021)	0.22	ns	ns	ns
GHG emissions 2021				
Scopes 1 and 2	0.002	** (1<2)	ns	** (2>3)
Scopes 1, 2 and 3	0.085	** (1<2)	ns	ns

TABLE 3 – **Inter-cluster Kruskal-Wallis tests.**

Out-of-step (1); Responsiveness-oriented (2); Controllability-oriented (3)

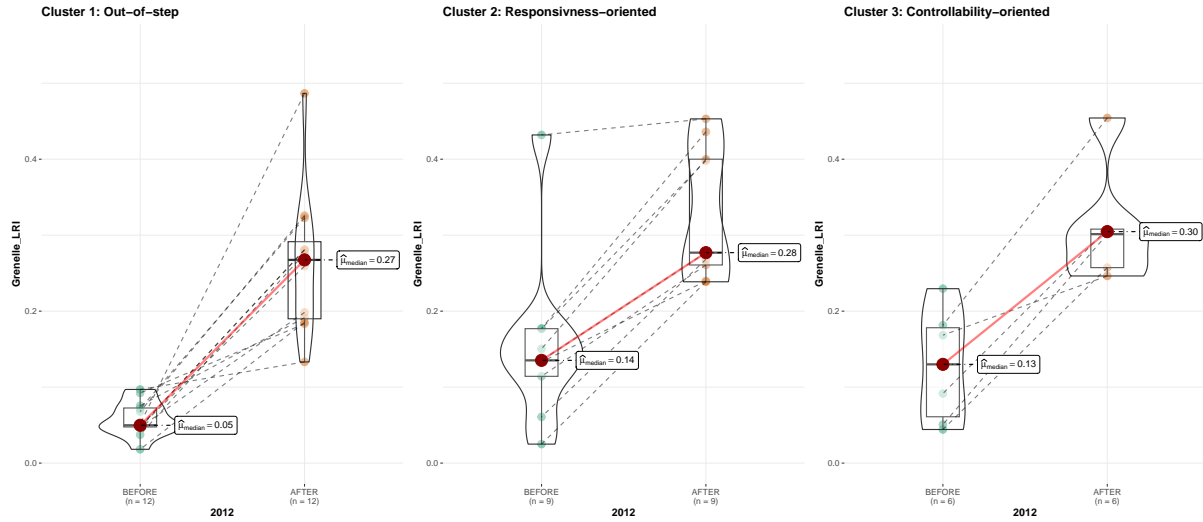


FIGURE 4 – Grenelle Law’s appropriation by accountability, before and after the first fiscal year of due compliance

5.2 What about the responsibility dimension of accountability for Laws ?

To assess the responsibility dimension of accountability which refers to laws, and institutional and private standards, we look at their appropriation using an intra-cluster analysis of the previously designed indexes. To highlight the impact of each law on firms’ reporting activity, we study the evolution, by cluster, of laws’ indexes before and after the FY of due compliance (intra-cluster dynamics). As illustrated in Fig. 4 for Grenelle law (Grenelle-LRI), the potential boosting effects of information-based regulation on reporting practices depend on both the law and the type of accountability. (See Fig. 5 in Appendix for the other laws).

The results of the paired samples Wilcoxon tests by law, given in Table 8, highlight different degree of responsibility. Cluster 2 appears to be responsible in a systematic way as all indexes are significantly different before and after the year of due compliance of each law. For Grenelle and TECV, cluster 2 is ahead of all clusters since the implementation of those laws. For Vigilance, they are ahead of all clusters at the end of the period. Cluster 1 is responsible to a lesser extent as there is no sign of a significant change in reporting practices before and after the implementation of DPEF (despite their leading position in 2021), whereas there are significant changes for other laws. Cluster 3 is responsible in a very selective way as changes in reporting practices are only significant for Grenelle and Taxonomy laws. Over the period, this cluster has lost its leading position on almost all laws, except Taxonomy.

If all firms have been receptive to Grenelle and Taxonomy, TECV and Vigilance have only been significantly followed by clusters 1 and 2, while DPEF is the law with the lowest impact on firms’ reporting practices, as captured by our selected keywords.

Result 5 Regarding laws,

- *Responsiveness-oriented firms are the most responsible, followed by out-of-step firms. Controllability-oriented firms are the least responsible.*
- *All firms have been receptive to both Grenelle and Taxonomy.*

5.3 What about the responsibility dimension of accountability for Standards ?

Considering institutional and standards indexes, we look at the intra-cluster evolution considering two turning point dates (see Table 4). Given our classification of standards and norms in two periods, we opt for 2012 for standards released during period 1 and 2017 for contemporary standards of the second period. Note that those dates correspond to the FY of due compliance for respectively Grenelle and Vigilance-DPEF.

At the cluster level, the year before the chosen turning point, we observe that *controllability-oriented* firms indexes are the highest, meaning the cluster 3 is ahead in the appropriation of private and institutional standards. This leading position explains partially the more numerous non significant evolutions for this cluster. The leading position is maintained in 2021 for GRI and SDGs'. But cluster 2 firms have caught up with cluster 3 firms for ISO 14000, CDP and SASB. However, cluster 3 was overtaken by cluster 2 for ISO 26 000 and UN Global Compact and by both cluster 2 and 1 for GHG. As to TCFD, clusters 3 and 2 reached a same level that is lower than cluster 1 level.²³ The three clusters have similar values for SBTi.

Responsiveness-oriented firms have known significant evolutions for SDGs' and TCFD. In 2021, those firms have a leading position for almost all first period private and institutional standards, overtaking controllability-oriented firms. Whereas cluster 1 has a single leading position for TCFD, a private standard developed by the Financial Stability Board to improve climate related financial information, consistent with the belonging of all our firms of the banking and insurance sectors to this cluster.

At the index level, contemporary standards increase for the three clusters. On the contrary, several standards of the first period like GRI (for clusters 2 and 3), ISO 14000 (for all clusters), and UN Global Compact (for cluster 1) have lost ground. Overall, during this period of intense public regulation, the climate-related and contemporary standards have been quite successful whereas older standards have rather fallen. It suggests that, although international standards have been updated over our period, to some extent, they have been outrun by more recent laws.

As for laws, the degree of appropriation of standards and norms depends on the type of accountability.

Result 6 *Regarding norms and standards, despite their leading position at the beginning of the period, controllability-oriented firms give way to responsiveness-oriented firms, while out-of-steps firms struggle to catch up.*

5.4 What about the coexistence between Laws and Standards ?

Finally, to address the question of the co-existence of laws and standards, we look at the significant at 5% correlations between laws and standards. The consistency or inconsistency between laws and standards depends on the type of accountability.

First, for all clusters, significant relationships are exhibited for Taxonomy only, the last piece of legislation of our observation period. Companies with higher degrees of Taxonomy appropriation are those with higher use of global standards-setting initiatives internationally recognized. Compliance with the Taxonomy regulation goes hand in hand with SDGs for cluster 2 (correlation of 0.66), TCFD for cluster 1 (correlation of 0.58),

23. [2] and [16] provide an empirical analysis of French firms compliance with TCFD.

Institutional and standards indexes (Date)	P-value	Significance	Effect size	Index (Date−1)	Index in 2021
Out-of-step					
GRI (2012)	0.722	ns	small	0.04	0.08
GHG (2012)	0.0346	*	large	0	0.09
ISO14000 (2012)	0.056	ns	large	0.26	0.13
ISO26000 (2012)	0.295	ns	moderate	0	0
CDP (2012)	0.351	ns	small	0.008	0.02
UN Global Compact (2012)	0.155	ns	moderate	0.03	0.07
SDGs (2017)	0.0093	**	large	0.053	0.3
SASB (2017)	0.181	ns	moderate	0	0
SBTi (2017)	0.0143	*	large	0	0.2
TCFD (2017)	0.0039	**	large	0	0.31
Responsiveness-oriented					
GRI (2012)	0.294	ns	moderate	0.08	0.03
GHG (2012)	0.201	ns	moderate	0	0.19
ISO14000 (2012)	0.426	ns	small	0.46	0.27
ISO26000 (2012)	1	ns	small	0	0.09
CDP (2012)	0.234	ns	moderate	0.025	0.07
UN Global Compact (2012)	0.652	ns	small	0.05	0.16
SDGs (2017)	0.0078	**	large	0.049	0.2
SASB (2017)	0.371	ns	moderate	0	0.35
SBTi (2017)	0.0592	ns	large	0	0.16
TCFD (2017)	0.0225	*	large	0	0.185
Controllability-oriented					
GRI (2012)	0.591	ns	large	0.44	0.11
GHG (2012)	0.855	ns	small	0	0.05
ISO14000 (2012)	0.59	ns	small	0.5	0.29
ISO26000 (2012)	0.371	ns	large	0	0
CDP (2012)	0.688	ns	small	0.037	0.09
UN Global Compact (2012)	0.156	ns	large	0.27	0.06
SDGs (2017)	0.0313	*	large	0.117	0.4
SASB (2017)	0.181	ns	large	0	0.27
SBTi (2017)	0.181	ns	large	0.063	0.20
TCFD (2017)	0.181	ns	large	0	0.184

TABLE 4 – Intra-cluster Paired Wilcoxon tests on Institutional and standards Indexes (median values)

ns : non significant at 5%

and CDP for cluster 3 (correlation of 1). However, for cluster 2, a negative correlation with SASB has been found (-0.71), suggesting a potential mismatch between those international sector-specific standards and the reporting logic of the European regulation.

A clear compatibility between Grenelle law and the ISO 14000 (correlation of 0.81) and ISO 26000 (correlation of 0.77) standards is highlighted for cluster 2. For cluster 3, a negative correlation with ISO 26000 is apparent (correlation of -0.82) : *controllability-oriented* firms that comply the most with Grenelle law are those that appeal the least to ISO 26 000. Such an inconsistency for cluster 3 may be explained by the fact that ISO 26000 provides only guidance on social responsibility, for which no accredited certification exists. No significant correlation has been found for out-of-step companies for this category of standards (ISO).

Other cluster-specific inconsistencies are highlighted. For *out-of-step* firms, a negative correlations has been found for TECV and GRI (-0.62) suggesting that firms that report according to the GRI standards are those that have been less prone to use the TECV-specific vocabulary.

For *responsiveness-oriented* firms, reporting on SDGs, which requires a survey of improvements towards objectives, seems to be inconsistent both with reporting on potential violations of human rights and the environment as required by the Vigilance law, the correlation between SDGs and Vigilance-LRI being about -0.75 and with reporting on items of Grenelle (correlation of -0.66).

Finally, for *controllability-oriented* firms, a negative correlation of -0.88 between DPEF and UN Global Compact is indicative of discrepancies between the obligation to report according to the DPEF framework and the annual Communication on Progress (COP) required from companies committed to UN Global Compact. Overall, those correlations suggest that firms have coherent reporting designs.

Result 7 *In line with their accountability profiles,*

- *Responsiveness-oriented and controllability-oriented firms take hold of laws and standards that respectively pertain to a logic of awareness and willingness.*
- *Out-of-step firms prove to make a less coherent use of laws and standards.*

5.5 What about environmental scores ?

To confront our results to environmental scores, we first consider the Thomson Reuters ESG Environment pillar score and TR Emissions score a category of the TR Environment score due to their availability for all our firms over the period 2010 to 2021. The Emission category score includes data on emissions and waste. The Environmental pillar score gathers the emissions category, the innovation category (data on product innovation, green revenues, R&D and Capex) and the resource use category (data on water and energy). Those scoring are based on intra-industry relative performances. The median value of the scores for our 27 firms lies between 86.3 and 94.6 from 2010 to 2021 meaning that most of our firms would be graded 'A' or 'A+' over the period, indicating excellent relative emissions performances and a high degree of transparency in reporting according to Thomson Reuters grading methodology.

Interestingly, although we give evidence of varieties of accountability, this is not reflected in standards ESG firms assessment like Thomson-Reuters ESG scores for the second period of our study - period 2017-2021-. Indeed, there are no significant differences between our clusters on the ESG performance measures reduced to their environmental

components (See Table 3). For the previous period, 2010-2016, cluster 2 had significantly higher TR environment scores than cluster 3 suggesting that the TR scores for this period reflect a form of environmental performance that is more related to responsiveness.

However, focusing on a particular negative externality, namely GHG emissions (scopes 1 and 2) as reported in 2021 by companies in their URDs, significant differences are highlighted for responsiveness-oriented firms characterized by higher emissions than the two other clusters (see Table 3). When scope 3 is included, a unique significant difference is exhibited, between out-of-steps and responsiveness-oriented firms. It should be noted that in 2021 a great heterogeneity in the calculation of scope 3 emissions exists, notably regarding the emissions associated with the usage of goods and services.

Result 8 *Regarding scores :*

- *For the second period of our study (2017-2021), using TR Environmental scores, no significant differences are detected according to the type of accountability.*
- *In 2021, significant differences between responsiveness-oriented firms and the two other clusters are found in terms of GHG emissions (scopes 1 and 2).*

6 Discussion and concluding remarks

In this paper, we look at information disclosure by firms, "the most common artefacts of accountability", and the accountability-based classification of systemic actors we provide refers to the "information disclosure portion of accountability" [28]. For mandatory disclosure framed by quasi-hard laws to be fully efficient, i.e., for information disclosure to be as little symbolic as possible, an institution with expertise in the assessment of this portion of accountability may be necessary. In addition, by focusing on how firms disclose when disclosure is mandatory, our analysis of environmental and climate disclosure laws provides a case study of how firms mediate the impact of law on society [17]. Through the process of response to disclosure quasi-hard laws, firms participate in the formulation of the meaning of environmental and climate accountability. At an aggregated level, firms' responses to law help design what constitutes environmental and climate accountability along with the due care level of effort required for assessing such an accountability.

In the following sequence, *knowledge-attitudes (awareness, willingness)-behaviours*, we focused on the relationship between knowledge and attitudes. How attitudes are reflected in behaviors and what are the economics consequences of this regulation are beyond the scope of this paper. Similarly, we do not look at the determinants of laws' appropriation (i.e., the determinants of attitudes) as this would involve firm-specific information not well-documented over our period (non-availability of information because of poorly adapted information systems and/or selective reporting).²⁴ As to the content analysis methodology, the *word-match* approach was chosen instead of a neural network based solution. Such a solution would have needed to fine-tune the network on the dataset and to train it on a sentence-to-word similarity task to extract chunks related to ecology or environmental laws. This would have implied to build a training dataset for each law, not an easy task a priori.

In the set of laws analysed in this paper, the duty of Vigilance Law is peculiar due

24. For instance, sustainability governance structure, degree of complexity of the value chain, scarcity of resources, etc.

to the tort law-based enforcement mechanism awaited by civil society.²⁵ The efficiency of such a law depends on the efficiency of the liability rule that prevails under tort law - the negligence rule (or fault-based) -. In a law and economics perspective [15], mandatory disclosure regulation, by fostering "accountability-oriented" information revelation, participate in leveraging some uncertainty regarding the so called due care level that could help judges in their assessment of the duty of care and its breach, and provide adequate incentives to firms. As to the compensation objective, given the nature of environmental and climate damages, by contributing to the empowerment of, notably, harmed stakeholders, those laws might foster the implementation of environmental restorative justice ([19], [35]).

Références

- [1] Akerlof, G.A. : The Missing Motivation in Macroeconomics. *The American Economic Review* **97**(1), 3–36 (2007)
- [2] Amar, J., Demaria, S., Rigot, S. : What are the drivers of corporates' climate transparency? Evidence from the S&P 1200 index. *Ecological economics* **213**, 107945 (2023)
- [3] Ash, E., Hansen, S. : Text algorithms in economics. *Annual Review of Economics* **15**, 659–688 (2023)
- [4] Baumgärtner, S., Petersen, T., Schiller, J. : The concept of responsibility : norms, actions, and their consequences. (2018). DOI 10.2139/ssrn.3157667
- [5] Beck, D., Ferasso, M. : How can Stakeholder Capitalism contribute to achieving the Sustainable Development Goals? A Cross-network Literature Analysis. *Ecological Economics* **204**, 107673 (2023)
- [6] Bentham, J.. : Of Laws in General. H.L.A. Hart (ed.), London : Athlone Press (1970)
- [7] Bovens, M. : Analysing and Assessing Accountability : A Conceptual Framework. *European Law Journal* **13**(4), 447 – 468 (2007)
- [8] Brunet, C. : python-poppler PDF manipulation library. <https://github.com/cbrunet/python-poppler> (2023)
- [9] Bénabou, R., Tirole, J. : Individual and Corporate Social Responsibility. *Economica* **77**(305), 1–19 (2010)
- [10] de Cambourg : Ensuring the relevance and reliability of non-financial corporate information : an ambition and a competitive advantage for a sustainable Europe. Tech. rep., Report submitted to the Minister for the Economy and Finance (2019)
- [11] Castiglione, D. : accountability. *Encyclopedia Britannica* (2012). URL <https://www.britannica.com/topic/accountability>.

25. There are currently several cases underway in the environmental and climate domains that rely on the Vigilance law, see <https://vigilance-plan.org/court-cases-under-the-duty-of-vigilance-law/>).

- [12] CDP : Shaping High-Quality Mandatory Disclosure : Taking stock and emerging best practice. https://cdn.cdp.net/cdp-production/cms/policy_briefings/documents/000/007/292/original/CDP_High_Quality_Mandatory_Disclosure.pdf?1693840960 (2023)
- [13] Chauvey, J.N., Giordano-Spring, S., Cho, C.H., Patten, D.M. : The Normativity and Legitimacy of CSR Disclosure : Evidence from France. *Journal of Business Ethics* **130**, 789–803 (2015)
- [14] Christensen, H.B., Hail, L., Leuz, C. : Mandatory CSR and sustainability reporting : economic analysis and literature review. *Review of Accounting Studies* **26**(3), 1176–1248 (2021)
- [15] Cooter, R., Ulen, T. : *Law & Economics*, 6th edn. Prentice Hall (2012)
- [16] Demaria, S., Rigot, S. : Corporate environmental reporting : Are French firms compliant with the Task Force on Climate Financial Disclosures’ recommendations? *Business Strategy and the Environment* **30**(1), 721–738 (2021)
- [17] Edelman Lauren, B. : Legal Ambiguity and Symbolic Structures : Organizational Mediation of Civil Rights Law. *American Journal of Sociology* **97** (6), 1531–1576 (1992)
- [18] Fehr, E. : Behavioral Foundations of Corporate Culture. UBS International Center of Economics in Society **UBS Center Public Paper nb.7** (2018)
- [19] Forsyth, M., Cleland, D., Tepper, F., Hollingworth, D., Soares, M., Nairn, A., Wilkinson, C. : A future agenda for environmental restorative justice ? *The International Journal of Restorative Justice* **4**(1), 17–40 (2021)
- [20] Freeman, R.E., Martin, K., Parmar, B. : Stakeholder Capitalism. *Journal of business ethics* **74**(4), 303–314 (2007)
- [21] Gentzkow, M., Bryan, K., Taddy, M. : Text as Data. *Journal of Economic Literature* **57**, 535–574 (2019)
- [22] Grabs, J. : Business Accountability in the Anthropocene. *Environmental Policy and Governance* **33**(6), 615–630 (2023)
- [23] Grossman, S. : The Informational Role of Warranties and Private Disclosure about Product Quality. *Journal of Law and Economics* **24**(2), 461–483 (1981)
- [24] Haji, A.A., Coram, P., Troshani, I. : Consequences of CSR reporting regulations worldwide : A review and research agenda. *Accounting, Auditing and Accountability Journal* **36**(1), 177–208 (2023)
- [25] Honnibal, M., Montani, I., Van Landeghem, S., Boyd, A. : spaCy : Industrial-strength Natural Language Processing in Python (2020). DOI 10.5281/zenodo.1212303
- [26] Jovanovic, B. : Truthful Disclosure of Information. *The Bell Journal of Economics* **13**, 36–44 (1982)

- [27] Koppell, J.G.S. : Pathologies of Accountability : ICANN and the Challenge of “Multiple Accountabilities Disorder”. *Public Administration Review* **65**(1), 94 – 108 (2005)
- [28] Kraft, B., Wolf, S. : Through the Lens of Accountability : Analyzing Legitimacy in Environmental Governance. *Organization & Environment* **31**(1), 70–92 (2018)
- [29] Li, F. : Textual Analysis of Corporate Disclosures : A Survey of the Literature. *Journal of Accounting Literature* **29**, 143–65 (2010)
- [30] Loughran, T., McDonald, B. : Textual Analysis in Accounting and Finance : A Survey. *Journal of Accounting Research* **40**, 1–43 (2016)
- [31] May, P.J. : Regulation and compliance motivations. *Public Administration Review* **65**(1), 31–44 (2005)
- [32] Milgrom, P. : Good News and Bad News : Representation Theorems and Applications. *The Bell Journal of Economics* **12**, 380–391 (1981)
- [33] Mitchell, R.B. : Transparency for governance : The mechanisms and effectiveness of disclosure-based and education-based transparency policies. *Ecological Economics* **70**(11), 1882–1890 (2011). Special Section - Earth System Governance : Accountability and Legitimacy
- [34] Nuesiri, E.O. : Accountability of Powerful Actors for Social and Environmental Outcomes. NRGF Conceptual Paper, Gland, Switzerland : IUCN and CEESP. (2016)
- [35] Pali, B. : The Palgrave Handbook of Environmental Restorative Justice. Springer International Publishing (2022)
- [36] Pigou, A.C. : The Economics of Welfare. London (1920)
- [37] Robert, J. : pdfarranger software. <https://github.com/pdfarranger/pdfarranger> (2022)
- [38] Ruiz, F., Cabello, J.M. : MRP-PCI : A Multiple Reference Point Based Partially Compensatory Composite Indicator for Sustainability Assessment. *Sustainability* **13**, 1 – 19 (2021)
- [39] Sareen, S., Wolf, S.A. : Accountability and sustainability transitions. *Ecological Economics* **185**, 107056 (2021)
- [40] Schwab, K., Vanham, P. : Stakeholder capitalism : A global economy that works for progress, people and planet. John Wiley & Sons (2021)
- [41] Severino, J.M. : Firms as a common good. *Revue d’économie du développement* **24**, 25–53 (2016)
- [42] Steurer, R. : Disentangling governance : a synoptic view of regulation by government, business and civil society. *Policy Sciences* **46**, 387–410 (2013)
- [43] Stiglitz, J.E. : The Contributions of the Economics of Information to Twentieth Century Economics. *The Quarterly Journal of Economics* **115**(4), 1441–1478 (2000)

- [44] Verrecchia, R. : Discretionary Disclosure. *Journal of Accounting and Economics* **5**, 179–194 (1983)
- [45] Wolf, S.A., Arnold, N. : Accountability in the Anthropocene. *Environmental Policy and Governance* **33**(6), 579–582 (2023)
- [46] Wroblewski, J. : Legal Language and Legal Interpretation. *Law and Philosophy* **4**, 239–255 (1985)
- [47] Zirk-Sadowski, M. : Jerzy Wroblewski’s Legal Theory and His Influence on Humanist Legal Thought. *Review of Central and East European Law* **45**, 200–216 (2020)

7 Appendix

Target (English)	Expressions (French)	Count	Proportion (%)
environment	environnement environnemental	76304	30.1
energy	énergie énergétique	34748	13.7
norm	norme	33210	13.1
carbon	carbone décarbonner CO2	24266	9.6
waste	déchets	18194	7.2
sustainable development	développement durable	14648	5.8
climat	climat climatique	14544	5.7
greenhouse gaz	gaz à effet de serre GES	8508	3.4
biodiversity	biodiversité	6283	2.5
pollution	pollution	3804	1.5
green	vert	3712	1.5
ecosystem	écosystème	3210	1.3
circular economy	économie circulaire	2817	1.1
emission reduction	réduction des émissions	2494	1.0
carbon footprint	empreinte carbone	2453	1.0
ESG	ESG	2354	0.9
ecology	écologie écologique	2244	0.9

TABLE 5 – Expressions related to ecology and climate change. Those 24 expressions are used to detect URD chunks related to ecology. The count is the total number of occurrences of expressions found in dataset.

Law-related Indexes (LRI)	Median value (before FY)	Median value (2021)	Multiplier coefficient	Interquartile ratio (before FY)	Interquartile ratio (2021)
Grenelle-LRI	0.077	0.25	3.25	3	1.76
TECV-LRI	0.06	0.22	3.97	3.07	1.59
Vigilance-LRI	0.06	0.28	4.39	2.43	2.12
DPEF-LRI	0.086	0.20	2.33	4.88	1.63
Taxonomy-LRI	0.06	0.21	4.83	3.46	1.56

TABLE 6 – "Law-related" Indexes (LRI) : Descriptive statistics.

Norms and Standards Indexes	Period 1	% of adopters in 2010	% of adopters in 2021	Period 2	% of adopters in 2017	% of adopters in 2021
	II 1		II 2			
Institutional Indexes (II)	UN Global Compact	51.8%	77.8%	SDGs	44.4% (2015)	96.3%
	PI 1		PI 2			
Private standards Indexes (PI)	ISO 26000	14.8%	37%	SASB	18.5% (2018)	59.3%
	ISO 14000	85.2%	81.5 %	SBTi	18.5%	74.1%
	CDP	48.1%	88.9%	TCFD	25.9%	100%
	GHG protocol	18.5%	70.4%			
	GRI	51.8%	77.8%			

TABLE 7 – **Norms and standards indexes : descriptive statistics.** Global Compact : United Nation Global Compact ; SDGs : Sustainable Development Goals ; ISO 14 000 and ISO 26 000 : International Organization for Standardization ; CDP : Carbon Disclosure Project ; GHG : GreenHouse Gas Protocol ; GRI : Global Reporting Initiative ; SASB : Sustainability Accounting Standards Board ; SBTi : Science Based Targets ; TCFD : Task force on Climate-related Financial Disclosures.

Laws indexes	P-value	Significance	Effect size	Index the year before FY+	Index in 2021+
Out-of-step					
Grenelle-LRI	0.000488	***	large	0.057	0.204
TECV-LRI	0.000488	***	large	0.081	0.174
Vigilance-LRI	0.00244	**	large	0.066	0.251
DPEF-LRI	0.38	ns	small	0.064	0.221
Taxonomy-LRI	0.000488	***	large	0.056	0.179
Responsiveness-oriented					
Grenelle-LRI	0.00391	**	large	0.151	0.317
TECV-LRI	0.00391	**	large	0.146	0.270
Vigilance-LRI	0.00391	**	large	0.065	0.286
DPEF-LRI	0.0195	*	large	0.094	0.196
Taxonomy-LRI	0.00391	**	large	0.059	0.209
Controllability-oriented					
Grenelle-LRI	0.0313	*	large	0.135	0.227
TECV-LRI	0.219	ns	large	0.142	0.192
Vigilance-LRI	0.0625	ns	large	0.109	0.196
DPEF-LRI	1	ns	small	0.141	0.184
Taxonomy-LRI	0.0313	*	large	0.077	0.246

TABLE 8 – **Intra-cluster Paired Wilcoxon tests on Law Indexes**

ns : non significant at 5% ; + : median values

Keywords	Counts	% of total	% by law	Wilcoxon test	Accountability
GRENELLE 2012					
R. 225-105-1	315	0,3	1,6	****	responsability
Climatic	9829	7,8	38,2	****	responsiveness
Emission reductions	2494	1,9	9,4	**	responsiveness
Greenhouse gas	8508	6,9	33,8	**	responsiveness
Independent third party audit	1188	1,1	5,6	****	controllability
TECV 2016					
Circular economy	2817	1,8	20,5	****	responsiveness
Climate risks	398	0,3	3,2	**	responsiveness
Ecological transition	264	0,2	1,7	***	responsiveness
Energy transition	1595	1	11,1	***	responsiveness
Good waste	408	0,4	4,3	****	responsiveness
Global warming	549	0,4	5	**	responsiveness
Low-carbon strategy	129	0,1	1,1	**	responsiveness
Mitigation	701	0,5	5,8	****	responsiveness
VIGILANCE 2017					
2017-399	111	0,1	1,1	**	responsability
L 225-102-4	44	0	0,4	**	responsability
Alert mechanisms	136	0,1	1,1	**	controllability
Due diligence	780	0,5	6,8	****	responsability
Parent companies and ordering companies	101	0,1	0,9	**	responsability
Risk mapping	1504	1,2	15,7	***	controllability
Stakeholders	5943	4,9	61,9	****	responsiveness
Vigilance plan	1145	0,8	9,7	****	controllability
DPEF 2017					
Key performance indicators	1352	1,2	30,1	*	controllability
Business model	633	0,4	10,8	****	controllability
Materiality	922	0,8	20,4	**	controllability
Non-financial performance statement	870	0,6	16,7	****	controllability
TAXONOMY 2021					
Aligned	654	0,5	15,6	****	controllability
Article 8	136	0,1	2,9	***	responsability
Climate goals	52	0	1,1	*	responsiveness
Eligibility	438	0,3	10,8	***	controllability
Environmental objectives	288	0,2	7,7	***	responsiveness
Opex	101	0,1	2,3	**	controllability
Sustainability	795	0,6	20,7	****	responsiveness
Taxonomy	520	0,3	9,6	***	controllability

TABLE 9 – "Companies-viewpoint" dictionaries and the dimensions of accountability.

Counts refer to the number of occurrence; % of total refers to the ratio to the total amount of keywords, % by law corresponds to the ratio for each specific law; Wilcoxon test reports the significance level with large size effect for all listed keywords; Accountability refers to the three substantive types of [27].

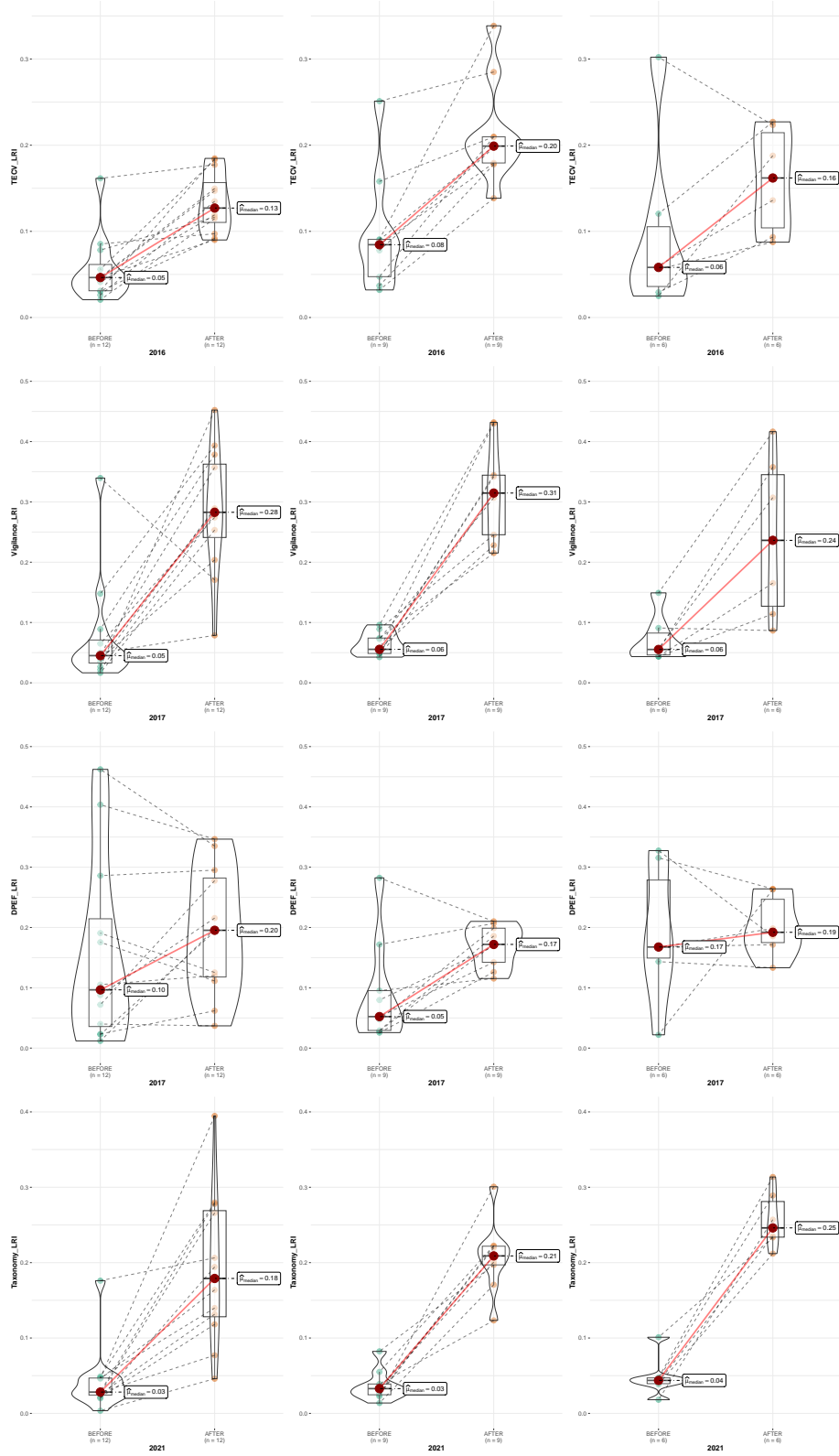


FIGURE 5 – Laws' appropriation by accountability, before and after the first fiscal year of due compliance

GRENELLE 2012							
Keywords	Counts	% of total	% by law	Wilcoxon test	Effect size	Adoption rate before FY	2021 Adoption rate (%)
EMAS	760	0.7	3.3	ns	small	59.2	59.2
R. 225-105-1	315	0.3	1.6	****	large	-	51.8
Carbon footprint	551	0.5	2.6	ns	small	37	48.1
Climatic	9829	7.8	38.2	****	large	96.3	100
Emission reductions	2494	1.9	9.4	**	large	81.5	100
Greenhouse gas	8508	6.9	33.8	**	large	92.6	100
Independent third party audit	1188	1.1	5.6	****	large	3.7	100
Patronage	1099	1	4.8	ns	moderate	59.3	66.7
Pollution prevention	155	0.1	0.6	ns	small	18.5	29.6
L-229-25	0	0	0	-	-	-	-

TABLE 10 – **Grenelle Law-related dictionary**

TECV 2016							
Keywords	Counts	% of total	% by law	Wilcoxon test	Effect size	Adoption rate before FY	2021 Adoption rate
Carbon budget	33	0	0.2	ns	large	-	14.8
Circular economy	2817	1.8	20.5	****	large	37	100
Climate risks	398	0.3	3.2	**	large	14.8	92.6
Direct emissions	952	0.9	9.9	ns	small	66.7	88.8
Ecological transition	264	0.2	1.7	***	large	7.4	85.2
Energy transition	1595	1	11.1	***	large	37	77.8
Food waste	408	0.4	4.3	****	large	3.7	85.2
Global warming	549	0.4	5	**	large	33.3	96.3
Indirect emissions	873	0.8	8.5	ns	moderate	59.2	92.6
Low-carbon transition	54	0	0.4	ns	large	-	25.9
Low-carbon strategy	129	0.1	1.1	**	large	-	55.5
Mitigation	701	0.5	5.8	****	large	29.6	100
National low-carbon strategy	59	0	0.3	ns	moderate	-	14.8
Non-financial information	90	0.1	1	ns	large	3.7	44.4
Targets	1391	1.1	12.4	ns	large	81.5	100
Waste management	1591	1.3	14.7	ns	small	92.6	96.3
Art. L 225-37	0	0	0	-	-	-	-
Art. L 533-22-1	0	0	0	-	-	-	-

TABLE 11 – **TECV Law-related dictionary**

VIGILANCE 2017							
Keywords	Counts	% of total	% by law	Wilcoxon test	Effect size	Adoption rate before FY	2021 Adoption rate
2017-399	111	0.1	1.1	**	large	-	55.5
L 225-102-4	44	0	0.4	**	large	-	11.1
Alert mechanisms	136	0.1	1.1	**	large	-	40.7
Due diligence	780	0.5	6.8	****	large	18.5	92.6
Liability action	74	0.1	0.9	ns	moderate	22.2	11.1
Parent companies and ordering companies	101	0.1	0.9	**	large	-	70.4
Prioritization	177	0.1	1.6	ns	large	22.2	55.5
Risk mapping	1504	1.2	15.7	***	large	88.8	100
Stakeholders	5943	4.9	61.9	****	large	100	100
Vigilance plan	1145	0.8	9.7	****	large	7.4	92.6
L225-102-5	0	0	0	-	-	-	-

TABLE 12 – **Vigilance Law-related dictionary**

DPEF 2017							
Keywords	Counts	% of total	% by law	Wilcoxon test	Effect size	Adoption rate before FY	2021 Adoption rate
Key performance indicators	1352	1.2	30.1	*	large	37	96.3
Business model	633	0.4	10.8	****	large	18.5	96.3
Directive 2014/95/UE	26	0	0.5	ns	moderate	-	18.5
Extra-financial information	183	0.2	5.3	ns	large	18.5	55.5
Green economy	28	0	0.4	ns	small	7.4	18.5
Internal standards	114	0.1	3.4	ns	moderate	18.5	18.5
International standards	117	0.1	3.2	ns	small	29.6	37
Materiality	922	0.8	20.4	**	large	70.4	96.3
National standards	10	0	0.3	ns	small	3.7	7.4
Non-financial performance statement	870	0.6	16.7	****	large	-	100
Product life cycle	377	0.3	8.9	ns	small	51.8	62.9
Art. R 225-105-1	0	0	0	-	-	-	-

TABLE 13 – **DPEF Law-related dictionary**

TAXONOMY 2021							
Keywords	Counts	% of total	% by law	Wilcoxon test	Effect size	Adoption rate before FY	2021 Adoption rate
Complementary Climate Delegated Act	10	0	0.2	ns	moderate	-	14.8
IAP	99	0.1	2.5	ns	small	25.9	25.9
NACE	9	0	0.2	ns	large	-	25.9
Regulation (EU) 2020/852	20	0	0.4	ns	large	-	40.7
Aligned	654	0.5	15.6	****	large	92.6	96.3
Article 8	136	0.1	2.9	***	large	14.8	88.8
Capex	368	0.3	10.4	ns	large	33.3	66.6
Capture	563	0.3	10.3	ns	small	18.5	22.2
Carbon sink	100	0	1.5	ns	moderate	11.1	25.9
Climate goals	52	0	1.1	*	large	18.5	59.2
Eligibility	438	0.3	10.8	***	large	33.3	88.8
Environmental objectives	288	0.2	7.7	***	large	59.2	92.6
Mitigation solutions	29	0	0.5	ns	small	7.4	11.1
Negative impacts	126	0.1	3.2	ns	small	40.7	44.4
Opex	101	0.1	2.3	**	large	11.1	70.3
Sustainability	795	0.6	20.7	****	large	92.6	96.3
Taxonomy	520	0.3	9.6	***	large	29.6	96.3

TABLE 14 – Taxonomy Law-related dictionary

TECV 2016					
Adoption rate in 2015			Adoption rate 2021		
[0%, 33%]	[33%,66%]	[66%,100%]	Relative stagnation	Small in-crease	High increase
<i>Responsibility dimension of accountability</i>					
Art. L 225-37 (0) Art. L 533-22-1 (0) National low-carbon strategy (0)			Art. L 225-37 (0) Art. L 533-22-1 (0)	National low-carbon strategy (14.8)	
<i>Responsiveness dimension of accountability</i>					
Climate risks (14.8) Ecological transition (7.4) Food waste (3.7) Low carbon transition (-) Low-carbon strategy (0) Mitigation (29.6) Non-financial information (3.7)	Circular economy (37) Energy transition (37) Global warming (33.3)				Circular economy (100) Climate risks (92.16) Ecological transition (85.2) Energy transition (77.8) Food waste (85.2) Global warming (96.3) Low carbon transition (25.9) Low-carbon strategy (55.5) Mitigation (100) Non-financial information (44.4)
		Waste management (92.6)		Waste management (96.3)	
<i>Controllability dimension of accountability</i>					
Carbon budget (0)		Direct emissions (66.7)		Carbon budget (14.8)	Direct emissions (88.8)
	Indirect emissions (59.2)	Targets (81.5)			Indirect emissions (92.6)
					Targets (100)

TABLE 15 – **TECV Law : adoption rates before FY vs 2021**

Keywords are classified according to the three accountability dimensions : *responsibility*, *responsiveness*, *controllability*, with statistically significant keywords belonging to the "company-viewpoint" dictionary in bold.

VIGILANCE 2017					
Adoption rate in 2016			Adoption rate in 2021		
[0%, 33%]	[33%,66%]	[66%,100%]	Relative stagnation or decrease	Small increase	High increase
<i>Responsibility dimension of accountability</i>					
2017-399 (0) L 225-102-4 (0) Due diligence (18.5) Parent companies and ordering companies (0) L225-102-5 (0)				L 225-102-4 (11.1)	2017-399 (55.5) Due diligence (92.6) Parent companies and ordering companies (70.4)
<i>Responsiveness dimension of accountability</i>					
		Stakeholders (100)	Stakeholders (100)		
<i>Controllability dimension of accountability</i>					
Alert mechanisms (0) Liability action (22.2) Prioritization (22.2) Vigilance plan (7.4)		Risk mapping (88.8)	Liability action (11.1)	Risk mapping (100)	Alert mechanisms (40.7) Prioritization (55.5) Vigilance plan (92.6)

TABLE 16 – **Vigilance Law : adoption rates before FY vs 2021**

Keywords are classified according to the three accountability dimensions : *responsibility*, *responsiveness*, *controllability*, with statistically significant keywords belonging to the "company-viewpoint" dictionary in bold.

DPEF 2017					
Adoption rate in 2016			Adoption rate in 2021		
[0%, 33%]	[33%,66%]	[66%,100%]	Relative stagnation or decrease	Small increase	High increase
<i>Responsibility dimension of accountability</i>					
Directive 2014/95/UE (0) Internal standards (18.5) International standards (29.6) National standards (3.7) Art. R 225-105-1 (0)			Internal standards (18.5) Art. R 225-105-1 (0)	International standards (37) National standards (7.4)	Directive 2014/95/UE (18.5)
<i>Responsiveness dimension of accountability</i>					
Extra-financial information (18.5) Green economy (7.4)	Product life cycle (51.8)			Green economy (18.5) Product life cycle (62.9)	Extra-financial information (55.5)
<i>Controllability dimension of accountability</i>					
Business model (18.5) Non-financial performance statement (0)	Key performance indicators (37)	Materiality (70.4)			Key performance indicators (96.3) Business model (96.3) Materiality (96.3) Non-financial performance statement (100)

TABLE 17 – DPEF Law : adoption rates before FY vs 2021

Keywords are classified according to the three accountability dimensions : *responsibility*, *responsiveness*, *controllability*, with statistically significant keywords belonging to the "company-viewpoint" dictionary in bold.

TAXONOMY 2021					
Adoption rate in 2020			Adoption rate in 2021		
[0%, 33%]	[33%,66%]	[66%,100%]	Relative stagnation or decrease	Small in-crease	High increase
<i>Responsibility dimension of accountability</i>					
Complementary Climate Delegated Act (0) Regulation (EU) 2020/852 (0) Article 8 (14.8)				Complementary Climate Delegated Act (14.8)	Regulation (EU) 2020/852 (40.7) Article 8 (88.8)
<i>Responsiveness dimension of accountability</i>					
NACE (0) Capture (18.5) Carbon sink (11.1) Climate goals (18.5) Mitigation solutions (7.4)	Environmental objectives (59.2) Negative impacts (40.7)	Sustainability (92.6)		Capture (22.2) Carbon sink (25.9) Mitigation solutions (11.1) Negative impacts (44.4) Sustainability (96.3)	NACE (25.9) Climate goals (59.2) Environmental objectives (92.6)
<i>Controllability dimension of accountability</i>					
API (25.9) Opex (11.1) Taxonomy (29.6)	Capex (33.3) Eligibility (33.3)	Aligned (92.6)	API (25.9)	Aligned (96.3)	Capex (66.6) Eligibility (88.8) Opex (70.3) Taxonomy (96.3)

TABLE 18 – Taxonomy Law : adoption rates before FY vs 2021

Keywords are classified according to the three accountability dimensions : *responsibility*, *responsiveness*, *controllability*, with statistically significant keywords belonging to the "company-viewpoint" dictionary in bold.