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# **A new measure of environmental reporting practice based on the recommendations of the Task Force on Climate-related Financial Disclosures**

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## **Abstract:**

Climate change is introducing greater risk and uncertainty into the economy and financial system. Despite wide acceptance of the need to reduce emissions, information failures limit understanding of the financial risks. As a result, the Financial Stability Board is pushing for greater disclosure via an international initiative: the Task Force on Climate-related Financial Disclosures (TCFD). Based on content analysis of firms' reference documents over 2015-2017, this article examines CAC 40 firms' compliance with the recommendations of TCFD by building a new index (Comprehensive Compliance Index-CCI) to measure the disclosure of environmental information. Our results highlight a gradual improvement in environmental disclosure by CAC 40 companies over the three years. CCI levels were relatively satisfactory in 2015 and 2016 to the extent that the TCFD report had not yet been published, but it masks discrepancies. Sectors with high environmental impact have higher index scores than low impact sectors. In 2017, CAC 40 companies communicated the most in the areas of risk management, metrics and governance, far ahead of strategy, and there was an improvement in the environmental disclosure in each area. Finally, our content analysis allows us to develop a matrix of climate risks and opportunities per sector.

**JEL:** M40, M14

**Keywords:** Environmental disclosures, CSR reporting, climate-related risk, TCFD recommendations

## Introduction

The issues of global warming and the energy transition are a crucial challenge for economic and financial activity (IPCC 2012 ; Stern 2013 ; Burke et Hsiang 2015). They involve physical and transition risks that result respectively from the damage caused directly by weather and climate phenomena triggered by changes in the climate system (damage to firm's assets, infrastructure and supply chains), and from the adjustments made for the transition to a low-carbon economy particularly, when these are poorly anticipated or occur suddenly (ACPR and Direction générale du trésor 2017). Such a transition towards a low-carbon trajectory requires taking up new challenges, including a substantial and sustainable reduction of GHG emissions via greater energy efficiency,<sup>1</sup> a reduction<sup>2</sup> of carbon intensity in production systems and the development of renewable energies<sup>3</sup>. In this context, COP 21 (2015) was an historic moment when 175 countries committed to complying with the Paris Agreement to maintain the global temperature increase below to 2°C by 2100.

On this occasion, the Financial Stability Board (FSB) launched an international initiative to introduce the Task Force on Climate-related Financial Disclosures (TCFD).<sup>4</sup> This working group, made up with account users (e.g. analysts), account preparers, and international experts from different sectors, was to make recommendations about financial transparency related to Climate Risks and Opportunities (CROs). These recommendations, published in July 2017, specify the elements of environmental reporting expected in the annual reports<sup>5</sup> of all types of companies with regard to governance, strategy, risk management and environmental metrics. The aim is to improve the information provided by companies on how they integrate CROs in these four areas (see Section 1 below). Such disclosure recommendations must be incorporated into the efficient markets theory framework *via* the market discipline mechanism. Indeed, to function efficiently through the low-carbon transition and to encourage trust, capital markets require quality and timely data.

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<sup>1</sup> It aims to reduce environmental, economic and social (direct and indirect) costs, resulting from production, transportation and consumption of energy.

<sup>2</sup> The purpose is to replace the existing carbon-intensive physical capital by more restrained use of carbon capital (which leads to depreciating the former).

<sup>3</sup> Solar and wind energy, hydraulics, biomass, geothermal.

<sup>4</sup> <https://www.fsb-tcfd.org/>

<sup>5</sup> The TCFD requires environmental disclosures in financial filings within a five-year period.

To the extent that we have witnessed a strong development of non-financial information over the two last decades due to regulations and/or soft law regulations, the TCFD reference system aims at harmonising environmental reporting focusing on climate risk, according to an international consensus; taking into account specific sector features (materials and buildings, transport, energy, food and finance) and managerial fields such as governance and strategy. The recommendations are not only based on the disclosure of CO2 metrics. This point is a benefit because, until now environmental/climate disclosures has been part of Corporate and Social Responsibility (CSR) which is more the prerogative of private and international organisations such as the Global Reporting Initiative (GRI) and the International Integrated Reporting Council (IIRC). By an illustration, GRI Standards seem to have distinct objectives and overlapping audiences from TCFD. The first ones focus on helping organizations communicate about their impacts (outward) related to climate change and other sustainability topics<sup>6</sup>, and are designed for a much wider range of stakeholders. While the TCFD are interested in the impacts of climate risks on societies and has identified investors, lenders, and insurance underwriters (“primary users”) as the appropriate target audience.

The TCFD grid seems to have become a global reference (albeit not binding) for financial transparency related to climate risk. It has received support from the French Government, the European Union’s HLEG<sup>7</sup> group (2016), and the European Union Technical Expert Group on Sustainable Finance (2019) pledges for its integration into the guidelines of the non-financial reporting directive scheduled for June 2019 (21014/95 EU). Moreover at the 2017 One planet summit 237 companies, including 20 CAC 40 firms<sup>8</sup> have committed to follow the TCFD’s recommendations (Henze, 2017). This growing interest requires a better understanding of the firms’ reporting practices with regard to climate risk.

Up to now, the academic literature has focused on mandatory or voluntary disclosure trying to evaluate level of disclosure and to explain it with respect to the theory of legitimacy (Cho et Patten 2007 ; Morhardt 2010). In this context, companies use disclosure as a strategic tool to legitimize their activities with stakeholders. Many papers have shown that companies have significantly improved their level of mandatory or voluntary disclosure over the past decade (Chauvey et al. 2015 ; Russo-Spena et al. 2018). However, it appears that the information is

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<sup>6</sup> E.g., emissions, water, labor, human rights etc...

<sup>7</sup> High-Level Expert Group on Sustainable Finance

<sup>8</sup> With total market capitalisation of \$6.3 trillion and \$81.7 trillion in assets under management.

still sometimes imprecise and too descriptive for some countries (Beck et al. 2010 ; Melloni et al. 2017). The case of France is particularly studied in the literature because, since 2000, this country has been at the forefront in promoting energy transition, with the promulgation of a wide series of environmental laws including more stringent disclosure requirements. This paper analyses CAC 40 firms' compliance with the TCFD by building a new index – Comprehensive Compliance Index (CCI) to measure the level of environmental information disclosed. Indeed, in order to identify the level of environmental disclosure with regard to the TCFD's recommendations, it is necessary to create a new adapted measurement grid. In line with Beck et al. (2010), Lock et Seele (2016) or Pistoni et al. (2018) who have created grids for analyzing disclosure in relation to GRI or Integrated reporting, we are creating a new measurement grid adapted to the TCFD recommendations.

This article contributes to the literature on environmental disclosure in several ways. To our knowledge, this is the first academic study which analyses environmental disclosures regarding the TCFD recommendations; all other studies generally focus on the NER Act requirements or on the GRI grid. Then, we build a new index to measure the environmental disclosures that adopt a very accurate approach to business activity by identifying CRO indicators. By identifying a matrix of key indicators in the 4 areas requested by the TCFD and a matrix of climate risk and opportunity by sector, this article has managerial contributions for both firms and regulators. Based on content analysis of firms' reference documents over 2015-2017, our results highlight a gradual improvement in environmental disclosure by companies over the three years. Sectors with high environmental impact have higher index scores than low impact sectors. In 2017, CAC 40 companies disclosed the most in the areas of risk management, metrics and governance, far ahead of strategy, and there was an improvement in the environmental disclosure in each area. Our content analysis allows us to develop a matrix of indicators by domain and a matrix of climate risks and opportunities.

Section 1 details the TCFD recommendations and its added value, Section 2 reviews the academic literature on environmental disclosures, Section 3 describes the data and methodology, Sections 4 and 5 present the results and discuss them.

## **1 The recommendations of the Task Force on Climate-related Financial Disclosures (TCFD)**

The 2007-2008 financial crisis was an important reminder of the repercussions that weak corporate governance and risk management practices can have on asset values. This resulted in increased demand for transparency from organisations on their governance structures, strategies and risk management practices. Without the right information, investors and others may incorrectly price or value assets, leading to a misallocation of capital. Hence the objective of the Task Force on TCFD is to develop voluntary, consistent climate-related financial risk disclosures for use by companies in providing information to investors, lenders, insurers and other stakeholders. The Task Force will consider the physical, liability and transition risks associated with climate change and what constitutes effective financial disclosures across industries. In June 2017, the TCFD published a final report that established recommendations for disclosing clear, comparable and consistent information about CROs. The recommendations take the form of a grid of themes for which companies may provide information on their practices in terms of governance, strategy, risk management and environmental indicators ([www.fsb-tcfd.org](http://www.fsb-tcfd.org)). The TCFD reference system has several benefits:

- it tries to link the financial with non-financial information requiring firms to present the CROs financial impacts on their business plan and their financing plan in the financial filings.
- It adopts a forward-looking approach asking firms to disclose not only on their past performance but also on what they will implement to face the CROs.
- It requires information on the resilience of the companies' business in relation to low carbon scenarios, including 2°.
- It emphasizes the climate risks but also the climate opportunities (in comparison with the European directive on non-financial information)
- Is an international initiative (and not a state initiative) better able to promote the “level playing field”.

Table 1: Areas and sub-areas of the TCFD recommendations grid

Areas	Governance	Strategy	Risk management	Metrics and objectives
Sub-areas	Vision of the Board of Directors on climate issues	Identification of the CRO in the short, medium and long term	Description of the process to identify and evaluate the CRO	Dissemination of information on the metrics used to evaluate the CRO
	Role of management in the assessment of the climatic risks and opportunities	Description of the impacts of the CRO on business, strategy, and financial planning	Description of the CRO management process	Dissemination of information on the Scopes 1, 2 and if relevant of scope 3
		Description of the potential impacts of different scenarios, including 2°, on the business of Organization, strategy, and financial planning	Description of how the process of identification and evaluation of the CRO are integrated into the overall risk management	Description of the objectives used to manage the CRO and the performance in relation to these objectives

Source: TCFD

In the governance area, the objective is to know whether the company's reporting accurately describes: (a) if the Board of Directors is informed about CROs and to what extent; (b) the role of managers in the evaluation and management of CROs. In the strategy area, this involves making sure that the company discloses information on: (a) the CROs it has identified in the short term, medium term and long term; (b) the impacts of the CROs on the organisation, strategy and financial planning; and (c) the resilience of the organisation's strategy, taking into account different scenarios including that of a 2°C rise in temperatures. For the area of risk management, the aim is to ensure that the company correctly describes: (a) the process or procedures implemented by the organisation to identify and evaluate climate risks; (b) procedures to manage these risks; and (c) how these procedures are integrated into the overall risk management organisation.

For the metrics and objectives (targets) area, the objective is to know whether the company uses statements that: (a) give metrics to evaluate the CROs in line with its strategy and its risk management process; and (b) describe the procedures for managing climate risks by disclosing information on emissions, namely, the company's Scope 1 & 2 emissions and, where relevant, its most significant Scope 3 emissions, as well as the trend in these indicators over time; and (c) describe how the procedures to identify, assess and manage climate risks are integrated into overall risk management. For each of these sub-areas, the TCFD analysis grid suggests one or more questions to help companies define their issue.

## **2 Review of the literature on environmental disclosures**

### **2.1 The legitimacy theory as a framework for analysing the environmental disclosure**

This research is in the line with academic articles on environmental disclosures that are based on the legitimacy theory (Deegan et al. 2002 ; O'Donovan 2002 ; Cormier et al. 2005 ; Hummel et Schlick 2016 ; Nègre et al. 2017 ; Russo-Spena et al. 2018). The main concept of this theory is defined by Suchman (1995) as “a generalised perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially-constructed system of norms, values, beliefs and definitions. In order to assert their legitimacy, companies must act within the limits that society identifies as socially acceptable”. The legitimacy theory makes it possible to understand companies' practices by analysing managers' strategic choices to meet society's expectations (Deegan et al. 2002). This leads O'Donovan (2002) to estimate that legitimacy theory posits that “the greater the likelihood of adverse shifts in the social perceptions of how an organisation is acting, the greater the desirability on the part of the organisation to attempt to manage these shifts”. This point of view is explained by the fact that the various stakeholders perceive the legitimate organisation not only as more worthy, but also as more meaningful, more predictable and more trustworthy (Suchman 1995). There would therefore be a kind of social contract established between organisations and society. According to Shocker et Sethi (1973), all organisations are linked to society by a social contract (expressed or implied), whereby the organisation's survival and growth are based on first, the delivery of some socially desirable ends to society in general, and second by the distribution of economic, social or political benefits to groups from which it derives its power. Therefore, organisational legitimacy and social contract compliance go hand in hand, and a breach of the contract may lead to a perception by society that the organisation is not legitimate (Nègre et al. 2017).

With regard to environmental information, Depoers et Jérôme (2017) consider that legitimacy theory places organisations within a socio-political framework and environmental disclosure is a means for managers to establish and maintain a firm's legitimacy. Companies can manage their legitimacy by increasing the volume of information, using narrative and positive language, or avoiding alarmist information (Albertini 2014). In this perspective, companies are required to disclose environmental information according to the image they want to project to the market. If environmental legitimacy is not a priority, a company may not disclose environmental information (Larrinaga et al. 2002 ; Chelli et al. 2014 ; Depoers et Jérôme 2017). In other words, legitimacy theory suggests that particularly poorly performing companies use sustainability disclosure as a legitimisation tactic to influence public perceptions regarding their sustainability performance (Deegan et al. 2002 ; O'Donovan 2002 ; Cho et Patten 2007). Hummel and Schlick

(2016) specifically assert that companies with high environmental performance will disclose good-quality information (accurate and quantified), while those with poor environmental performance, poor-quality information (fuzzy, descriptive and unquantified). In short, environmental disclosures are often linked to legitimization intentions.

## 2.2 Empirical literature review on environmental disclosures

There are two types of empirical works on environmental disclosure: i) studies which aim at describing disclosure of information practices from descriptive statistics based on content analysis of annual/sustainable development reports. The analysis may include the amount of disclosed information (presence of indicators) and/or the quality regarding the information's relevance (detailed and/or quantitative); ii) empirical studies on the determinants of environmental disclosure based on an econometric model which aims to explain a performance score according to the company's characteristics (sector, size, debt, media pressure, reputation, etc.). This article falls into the first category of studies because our objective is to measure the compliance level of the CAC 40 companies by building an index based on the TCFD recommendations.

The academic literature has focused both on mandatory and voluntary disclosure. Concerning the first information, several studies show that firms do not fully comply with disclosures requirements. For example, since the introduction of the NER Act (2001)<sup>9</sup>, studies seek to identify French companies'<sup>10</sup> level of compliance and investigate the reliability of information (Ben Rhouma et Cormier 2007 ; Delbard 2008 ; Damak-Ayadi 2010). These research generally show that, in the first few years of application of the law, the level of compliance was relatively low, regardless of the sector of activity. These French studies echo research conducted in Spain in 1997 by Larrinaga et al. (2002), who show that firms do not comply with accounting standards<sup>11</sup>.

In addition, some studies are interested in the voluntary application of environmental reporting frameworks such as GRI or Integrated Reporting. Researches based on content analysis of European CSR reports globally show that the level of environmental disclosure is not sufficient and leave much room for improvement (Beck et al. 2010 ; Lock et Seele 2016 ; Pistoni et al.

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<sup>9</sup> Before this first law, disclosures by listed companies were almost non-existent (Mikol 2000).

<sup>10</sup> CAC 40 or SBF 120

<sup>11</sup> The disclosure requirements of the accounting standards 437/98 are: current expenses with the aim of environmental protection; risks and expenses covered with provisions related to environmental actions, contingent liabilities related to environmental protection and improvement.

2018). Nevertheless, several studies show an improvement in the disclosure of environmental information. In France, ten years after the introduction of the NER Act, studies<sup>12</sup> highlight an indisputable increase in environmental disclosures for listed companies (Albertini 2014 ; Chelli et al. 2014 ; Chauvey et al. 2015). It is also the case of Russo-Spena et al. (2018) that confirm the trend towards the increasing environmental and social accountability from a sample of automotive firms between 2009 to 2014. Despite this improvement, many researches reveal that disclosures are often descriptive, rarely quantitative and negative. They favour optimistic information on environmental practices while negative impacts are largely ignored. This result is observed on a French sample (Albertini 2014 ; Chauvey et al. 2015 ; Depoers et Jérôme 2017) and on British and German companies (Beck et al. 2010) or Indian firms (Sen et al. 2011). In this line, Melloni et al. (2017) assert that international firms with poor environmental performance or belonging to the most polluting sectors tend to disclose less precise information on their environmental impacts.

Academic works also focus on identifying the characteristics of the companies that provide the most environmental information. Several studies show that firms in sensitive sectors (industry, buildings, energy, etc.) are the ones that disclose the most regarding environmental issues (Alnajjar 2000 ; Jose et Lee 2007 ; Villiers et van Staden 2011 ; Gallego-Alvarez et al. 2018). This is primarily explained by their need to legitimize their practices and neutralize their environmental impacts (Boiral 2016). We can also notice that large firms disclose the most environmental information (Albertini 2014 ; Chauvey et al. 2015). Larger firms, presumably due to greater visibility are assumed to face greater social and political pressures, and, as such, may use disclosure as a tool to reduce those exposures (Patten 2002). Furthermore, Haddock-Fraser et Fraser (2008) examine whether proximity to final consumers (Business to Consumers-B to C) affects the extent and form of environmental reporting of companies listed in the FTSE 250 in order to establish whether these firms are more or less likely to provide public environmental information than their Business to Business (B to B) counterparts. They find that companies who are close to market, or are brand-name companies, are highly likely to adopt one of the several forms of environmental reporting considered.

Thus, different researches on the disclosure of environmental information, whether in France or at the international level, indicate that companies adopt real strategies of environmental

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<sup>12</sup> Using the legitimacy theory as a conceptual framework.

information disclosure in order to meet stakeholders' expectations. However, most of studies show that companies disclose information according to their interests and do not strictly follow regulatory requirements (especially in France with the NER Act). Therefore, the search for legitimacy plays a fundamental role in strategic choices regarding environmental disclosure. Our research is in line with this literature by analysing the trend in French annual reports complying with an international grid of recommendations.

### **3 Data and methodology**

#### **3.1 Data**

Our sample includes the 40 largest market capitalisations on Euronext Paris (the CAC 40 index) from 2015 to 2017<sup>13</sup>. The choice of studying French companies is explained by the fact that France is regarded as a country with a considerable number of regulations regarding mandatory environmental disclosures and that The French government supports the implementation of the TCFD recommendations at European and G20 level. The existing French reporting regulation is not far apart from TCFD. We focused more specifically on the CAC 40 companies, which are those that are subject to the most stringent environmental legislation: the New Economic Regulations Act (NER Act, 2001)<sup>14</sup>; subsequently, the Grenelle II Bill<sup>15</sup> (2010) and the Energy Transition and Green Growth Act<sup>16</sup> (2015). In addition, these companies sometimes go further than the regulations by disclosing voluntary information because they may be subject to pressure from stakeholders (NGOs, analysts, the general public, etc.) regarding the dissemination of environmental information. This is particularly important in the context of our study for two reasons. Firstly, for the period 2015-2016, the TCFD recommendations had not yet been issued, so only the firms reporting significant disclosure can be studied. On the other hand, for 2017, the TCFD recommendations were not binding, so only large companies could be expected required to change their disclosure policies (due to the aforementioned external stakeholder pressure). Our longitudinal study shows the trend in environmental disclosures in the light of the TCFD's recommendations. The choice of this study period aims to observe the

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<sup>13</sup> The reference documents are available approximately three months after the end of the fiscal year.

<sup>14</sup> Information on the social and environmental consequences of their activities

<sup>15</sup> Information on how the company takes into account the social and environmental consequences of its activity and its societal commitments to sustainable development (43 information)

<sup>16</sup> Article 173 of the Energy Transition and Green Growth Law in 2016, which has brought the reporting of climate-related risks into the mainstream reports of large companies and institutional investors.

evolution of practices in order to identify if a change occurs after the publication of the TCFD's recommendations.

To assess French firms' compliance with the TCFD's guidelines, we have built an index. Based on the reference documents published each year by the companies. In general, these reports provide very detailed information (on the firm's financial situation, its CSR, etc.) and are subject to oversight by a market regulator. Reference documents are recognised as the main channel for a company to communicate with its shareholders (Wiseman 1982). In addition, some companies publish a report specifically dedicated to CSR or sustainable development;<sup>17</sup> such reports are not mandatory and publication frequency is at the discretion of the firms. According to Michelon et al. (2015), the information in the independent CSR reports is more unclear than in the CSR section of the annual report. Hence the choice to collect and analyse information in the reference documents<sup>18</sup> audited annually and containing more structured, comprehensive and therefore more reliable information (Beck et al. 2010). This positioning is consistent with most studies of voluntary or mandatory environmental disclosure (Wiseman 1982 ; Damak-Ayadi 2010 ; Chelli et al. 2014 ; Chauvey et al. 2015). Moreover, for Buisson (2008), the content analysis of annual reports is an integral part of research on the management of corporate legitimacy. Lastly, to identify sector reporting differences, we adopt the sector categorisation proposed by the TCFD:<sup>19</sup> high impact sectors (energy, transport, food & agriculture, materials & building, and finance) and low impact sectors (e.g. all other sectors). According to the TCFD, high-stakes sectors are not only those considered polluting, but also those whose practices may be affected by climate change (food sector) or those that may influence environmental change (financial sector).

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<sup>17</sup>It includes information on the company's economic situation, employment figures and the company's social situation, but also all information related to environmental protection (particularly CO<sub>2</sub> emissions) or the company's actions in terms of sustainable development, the results of these actions, as well as the guidelines and objectives set by the company for the future.

<sup>18</sup> It includes the entire annual report, not just the specific sections on the environment.

<sup>19</sup> This allocation was subject to a consultation which involved over 200 responses.

Table 2: Descriptive statistics of the for fiscal year 2017

Sectors	Firms	Separate CSR report	Length of CSR report	Length of DR	Length CSR section in DR	Quotation of Climate Change in DR	Firms that quote TCFD	Firms that apply TCFD	Market capitalization	Turnover
Measure	Number	Number	Mean of page			Mean	Number	Number	€m	€m
Energy	3	2	56	324	28	24	1	1	163,377	201,871
Finance	4	3	61	541	55	29	2	2	211,758	339,516
Food	4	3	27	318	52	10	0	0	112,654	135,360
Materials and Building	10	6	33	345	51	18	1	2	244,560	239,916
Transport	6	4	105	387	60	15	2	0	176,481	245,243
Low impact sectors	13	9	69	353	55	14	3	0	587,023	280,779
All sectors	40	27	58	378	50	18	9	5	1,495,853.961	1,442,684

Table 2 shows that the low impact sectors includes some 33% of firms (39% based on market capitalisation).<sup>20</sup> Some sectors include only a few firms but represent higher market capitalisations (e.g. finance and energy) and *vice versa* (e.g. food, building & materials and transport). It is also interesting to note that in 2017, 14 CAC 40 firms mentioned the TCFD's recommendations in their reference documents, only 9 quote them and 5 apply them.<sup>21</sup> Finally, only 27 companies published an independent sustainable development report.

### 3.2 Building the TCFD compliance index

We decided to use content analysis to determine the compliance of CAC 40 companies with the TCFD's recommendations. This research method is widely used in studies on environmental information disclosure (Beck et al. 2010 ; Bouten et al. 2011 ; Hooks et van Staden 2011). Bardin (2013) defines it as a group of communication analysis techniques that, by systematic and objective message content description procedures, seeks to gather indicators enabling inference. We have followed the recommendations of Krippendorff (2012) to achieve a stable, reliable and reproducible content analysis. To ensure the stability and accuracy of the study, the coding grid was first carried out by four encoders including two experts who are specialists in the work of the TCFD. Then, several encoders coded the same report simultaneously, and the results were assessed to guarantee the coherency of the study. This coding process with numerous encoders ensure the coding reliability (Bouten et al. 2011).

<sup>20</sup> Among the high impact sectors, building and finance are those with the highest market capitalisations.

<sup>21</sup> Note that the financial sector is particularly committed to the application of this standard, with the four firms belonging to the sector indicating their determination to apply it.

To build the compliance index, we created a specific database indicating whether or not the information required by the TCFD's recommendations is available in the four areas (i.e. governance, strategy, risk management, and metrics & targets) and in their sub-areas. To translate its recommendations for each sub-area into practical terms, the TCFD suggests one or more questions to help companies define the problem. Using the section 3-Guidance for all sectors of the TCFD final report (TCFD 2017), we identified 8 questions for governance, 13 for strategy, 7 for risk management and 10 for metrics & targets. Overall, we counted 38 questions<sup>22</sup>, assigning each question a value of 1 point, to create an overall compliance index on a scale of 38. To the extent that information may be qualitative and quantitative, we chose to transform the questions asked by the TCFD into closed-ended questions with a positive or negative answer.

Afterwards, the processing of the companies' reference documents was divided among three researchers over the period (120 reports in total). This very detailed coding process was lengthy to the extent that two researchers systematically checked the consistency between the code and the text justifying the coding, thus contributing to a greater harmonization of the coding and therefore its consistency.

Some content analysis studies measure the presence/absence of items whereas others measure the extent of the disclosures on those items (Bouten et al. 2011). In this research, the coding depends on whether or not the firm discloses the information (i.e. the presence of information) and on the degree of detail, not on its relevance. In line with (Cormier et Magnan 1999 ; Pistoni et al. 2018), we use a coding scale to more accurately capture the nature of the information disclosed. More specifically, each question is assigned a score of 1, 0.5 or 0 according to the relative presence of disclosed information<sup>23</sup>. A score of 1 corresponds to full compliance, a score of 0.5 partial compliance (information is not detailed) and a score of 0 to a lack of required information. The use of a coding scale to qualify a firm's environmental disclosure is appropriate for many reasons. First because a qualitative scale allows the researcher's judgement to be impounded in rating the 'value' of the disclosure made by a firm. And second while this process is more subjective, it ensures that irrelevant or redundant information is not considered to be a strategic environmental disclosure (Cormier et al. 2005). Overall, the database includes compliance scores per firm and per question, backed systematically by one or more quotes from the reference document (with a page number) to justify the coding.

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<sup>22</sup> See appendix 1.

<sup>23</sup> See appendix 2.

According to these coding criteria, scores per area range from 0 to 8 for governance, from 0 to 13 for strategy, from 0 to 7 for risk management, and from 0 to 10 for metrics & targets. Each company therefore has a score per sub-domain (governance (a) and governance (b), for example), a score per domain (governance) and a total compliance score. From these scores, we calculated a ratio of information disclosures that comply with the TCFD for each company by sub-area and area; this allows us to have an overall ratio per area and sub-area. This ratio corresponds to the firm's TCFD disclosure compliance index.

Figure 1 : Methodological synthesis

Methodological steps	
<b>Step 1: Sample selection</b>	
	Download the 120 reference documents in pdf format (French or English)
<b>Step 2: Construction of the TCFD analysis grid</b>	
	Identification of questions by domain based on TCFD guidelines
	Consistency check by domain and between domains
<b>Step 3: The coding</b>	
	Pre-coding on the same report to check the interpretation by coders
	Content analysis performed without computer software because the text requires interpretation by the coder
	Consistency check of the coding for all firms over the period
<b>Step 4: Analysis</b>	
	Calculation of scores
	Statistical analysis
	Interpretation

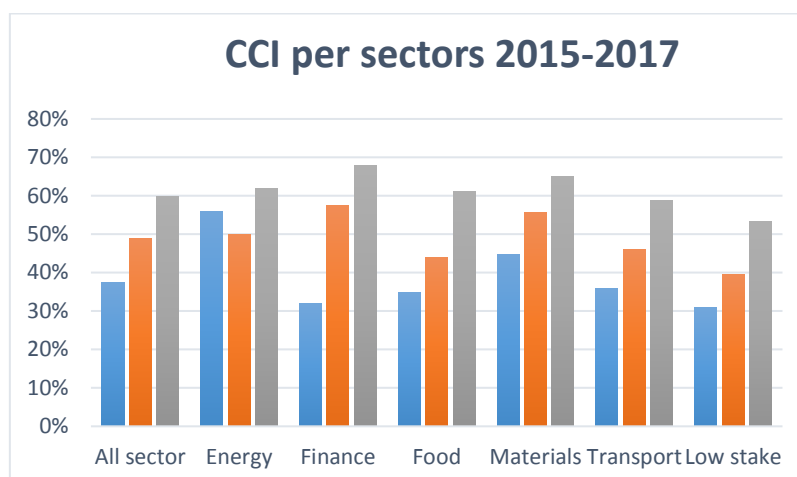
In order to check the consistency of our analysis grid, we tested if the different items in each area were actually measuring the same object and consequently if some redundant items should be removed (Pistoni et al. 2018). We used Cronbach's alpha test for each question of the four area. The alpha level is never equal to or above 0.7 for all the four areas. This provides evidence that each of the 38 items contributes incrementally to the assessment of the quality of IR and therefore should be kept in the CCI.

## 4 Results: A longitudinal analysis of the compliance of French firms with the TFCF

### 4.1 A satisfactory CCI but with disparities

Figure 2 shows a gradual improvement in CAC 40 companies' environmental disclosure over the three years.

Figure 2 : Comprehensive Compliance Index (CCI) per sector



The CCI stood at 59% in 2017 against 48% in 2016 and 37% in 2015, representing a growth rate of 38% between 2015 and 2017. The level of the index in 2015 and 2016 is relatively good to the extent that the TCFD report had not yet been published. The main explanation for this high score may be that France has required CSR disclosure since 2001: while the NER Act laid the foundations for improving environmental reporting, the Energy Transition Act (2015)<sup>24</sup> consolidates it by implementing more specific environmental requirements. Efforts initiated in early 2016 for the Energy Transition Act continued with the commitment of companies<sup>25</sup> to comply with the TCFD's international initiative. However, these results mask disparities across sectors and by company size.

Figure 2 also reveal that the financial sector has the highest CCI in 2017 and the highest growth (+53%) over the period 2015-2017. The high score of the financial sector reveals a relatively recent awareness which can be explained by Article 173 of the Energy Transition Act (2015). This article compels banks and investors to report on how they are addressing climate change. Similar to the Paris Agreement signed at Cop 21, the TCFD considers that the financial sphere has a huge responsibility as a motivator, and significant capacity to move the economy towards a low-carbon trajectory. We observe that the materials & building and energy sectors have good CCI levels, with 65% and 61%, respectively, but the latter would have been better if it had not been driven down by the low rates of three companies (Technip<sup>26</sup>, ArcelorMittal and Lafarge).

<sup>24</sup> Which came into force in 2016.

<sup>25</sup> 14 firms have committed to comply with the recommendations (see Table 2)

<sup>26</sup> Technip did not publish an annual report in 2016 (year of the acquisition by FMC) and its score was 49% in 2015 and only 12% in 2017.

The score of materials & building can be explained by the restrictive French regulatory<sup>27</sup> context, which requires companies to use more environmentally-friendly alternative solutions. Concerning the energy sector, the great deal of media attention it attracts encourages these companies (Total and Engie) to be leaders for environmental security and renewable energy. The food sector has an average CCI of 61% in 2017 and a good growth rate of 43% over the period. The transport and low impact sectors are lagging behind, with an index below the overall CAC 40 average (58% and 53%, respectively) despite significant growth rates (42% and 39%). The distinction between the two sub-sectors (automotive and aerospace) is relevant. While the scores of Airbus and Safran improved over the period, they remain very low. In short, we note that companies belonging to sectors considered to have high environmental stakes have higher scores than those belonging to low environmental stake.

Table 3: CCI by size of firms (market capitalisation)

CCI	2015	2016	2017
<b>5 largest firms</b>	<b>34%</b>	<b>48%</b>	<b>61%</b>
<b>5 smallest firms</b>	54%	52%	64%
<b>5 smallest firms (without Technip)</b>	<b>46%</b>	<b>59%</b>	<b>72%</b>
<b>10 largest firms</b>	37%	49%	64%
<b>10 smallest firms</b>	45%	51%	64%
<b>10 smallest firms (without Technip)</b>	44%	55%	68%

According to Table 3, we observe that the five smallest CAC 40 companies (Solvay, Veolia Environnement, Technip, Accor and Atos<sup>28</sup>) have a higher CCI than the five largest (LVMH, Total, L'Oréal, Sanofi and BNP Paribas<sup>29</sup>) over the period (despite Technip's very low score in 2016 and 2017). This result is increased if Technip is removed from the sample and replaced by Publicis. This gap narrows in 2016 and 2017. It must be noticed that results are similar if size is measured by the number of employees. In short, the firms with the smallest market capitalisations have the highest CCI scores. Two of the five smallest companies belong to sectors with high environmental impact. Conversely, the majority of large companies have low environmental impact (with the exceptions of Total and BNP Paribas).

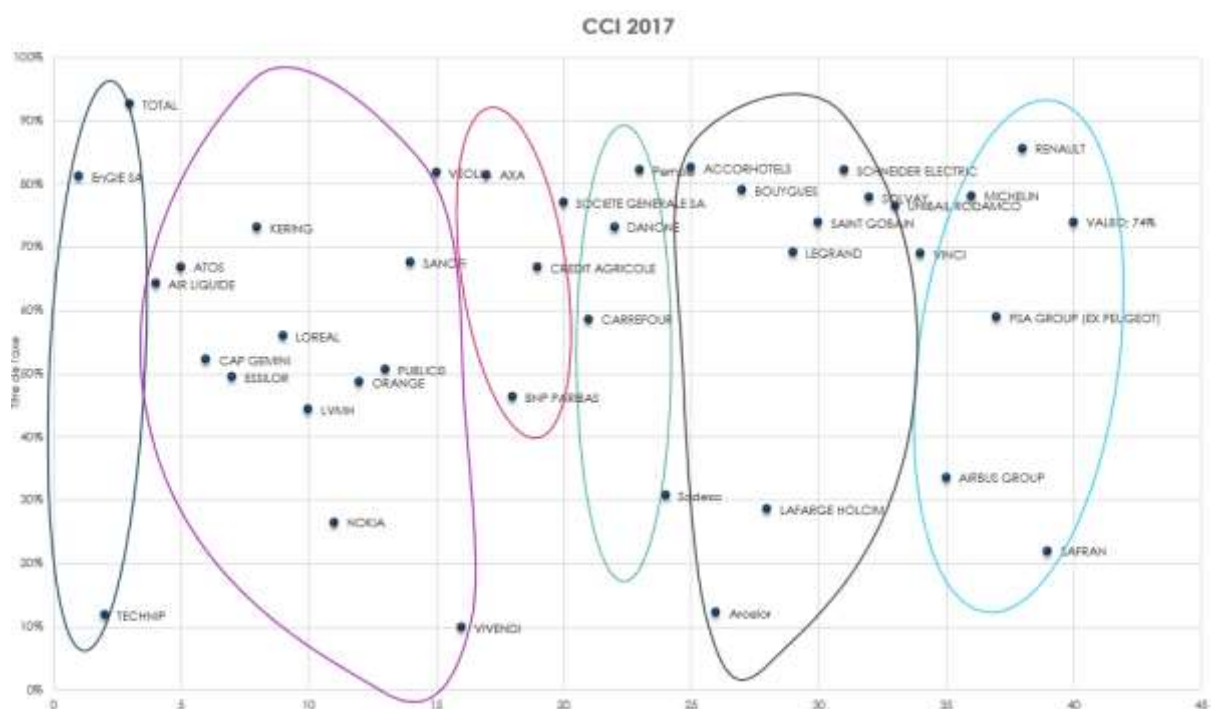
<sup>27</sup> Including the TR 2012 regulation relating to thermal protection, which limits the energy consumption of new buildings to 50 kilowatt-hours per square metre per year, or the National Low Carbon Strategy, which commits France to an 88% reduction in building sector emissions by 2050 compared to 1990.

<sup>28</sup> Totalling an average capitalisation of €11.971bn.

<sup>29</sup> Totalling an average capitalisation of €102.553bn.

If we look at the distribution of firms by score level, Figure 3 and appendix 5 show that over the period, there was some consistency among companies with the highest (lowest) CCI, such as Renault, Veolia Environment, Schneider Electric, Saint Gobain and Accor (Technip, Vivendi, Airbus, Lafarge, Nokia, Safran and Sodexo). These low scores can be partly explained by the different environmental regulations in the home country. ArcelorMittal and Airbus are domiciled in Luxembourg and the Netherlands, respectively. Four other firms came under French regulations prior to cross-border mergers: Solvay (merged with Rhodia), Nokia (merged with Alcatel-Lucent), Lafarge-Holcim and TechnipFMC. These four firms now have their headquarters in Belgium, Finland, Switzerland and the UK, in that order. Thus, there are wide disparities within Europe despite the CSR Directive, which came into force in 2014. Furthermore, four companies (Total, Société Générale, Unibail-Rodamco and Pernod Ricard) stand out by joining the virtuous group in 2017 in terms of environmental reporting.

Figure 3 : CCI of CAC firms in 2017



At last, we analyse the CCI score with regard to the firms' belonging to B to C or B to B activities. To allocate firms according to one or the other of the categories, we use the same criteria as Haddock-Fraser et Fraser (2008) and González-Benito et González-Benito (2006), namely firm are B to C if they supply goods or services directly into consumer markets rather than supplying to another business entity. However, there were a number of corporations with

a wide range of both B to C and B to B activities (e.g. Renault, Total), in such cases, as there is some consumer focused activity, a B to C categorization was given.

Table 4 : CCI distributed according to B to B and B to C activity

	CCI 2017	CCI 2016	CCI 2015	Governance 2017	Strategy 2017	Risk management 2017	Metrics 2017
<b>B to B<sup>30</sup> (21 companies)</b>	52,60%	43,46%	37,08%	57,89%	31,21%	68,45%	66,27%
<b>B to C (19 companies)</b>	68,05%	52,08%	37,93%	62,75%	43,64%	75,22%	75,77%

Table 4 shows a higher level of CCI (over the 3 years) for B to C firms. This confirms that companies that are directly involved with consumers tend to disclose more environmental information in order to provide a better image to stakeholders (Pernod, Danone or Accor). Environmental practices do not seem to be (for the moment) at the centre of business-to-business trade relations for B to B companies (Arcelor, Airbus or vivendi). We can notice that firm from the aerospace industry are less sensitive to consumer expectations than firms in the automotive sector, which are more B to C oriented and under media pressure. We also note that disclosure of information is better for B to C firms in the 4 areas.

## 4.2 Comprehensive Compliance Index according to the four TCFD areas

In 2017, CAC 40 companies communicated the most in the areas of risk management (71%), metrics (70%) and governance (60%), far ahead of strategy (37%), and there was an improvement in the environmental disclosure in each area (see figure 4).

Figure 4 : CCI according to the four TCFD areas



<sup>30</sup> Refer to the appendix 5 for the breakdown of companies by activity

In terms of governance related to CROs, the Board of Directors is informed more or less directly via a committee dedicated to CSR<sup>31</sup> which meets 1 to 6 times a year. It should be noted environmental performance criteria are very rarely included in the criteria for the variable remuneration of top management. Regarding the inclusion of climate risk in the strategy, while companies identify climate change risks as physical and/or transitional in nature, there is little information on the time period over which these risks can arise (short, medium or long term). Similarly, the opportunities associated with climate change on business and strategy are rarely explicitly mentioned, nor is the quantification of CROs by activity and geographical area.

In terms of risk management, firms set up very diversified specific processes to identify and assess climate risks, in particular through the use of environmental risk maps and materiality matrices. At the metric level, while companies communicate very well on the environmental indicators related to energy, water and waste management consumption and their trends, they also quantify GHG emissions under Scopes 1 and 2, and to a lesser extent under Scope 3, by specifying more or less the significant proportion of these emissions. In addition, they communicate little about the use of an internal carbon price.

The content analysis of the reference documents in relation to the TCFD's recommendation grid leads us to draw up a matrix of the indicators used by the firms for each of the areas (table 5). The latter are sometimes well, little or not informed. Regarding governance, it is not known how the board of directors is informed about CROs and how it assesses progress in this area, just as the environmental issue is often overwhelmed by the CSR committee. Finally, there is nothing on the responsibility of top management related to the CRO. With regard to strategy, while risks are generally identified, firms rarely specify the horizons over which they arise (short, medium, long term), their geographical or sectoral distribution and their financial impacts. In addition, firms do not specify how CROs are integrated into the strategies or overall management of CROs. Regarding metrics, firms communicate quite well except at the level of the most relevant GHG emission items in scope 3, which are particularly important. Table 5 summarizes the set of indicators disclosed by CAC 40 companies.

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<sup>31</sup> Its name may vary according to the firm (Ethics and Corporate Social Responsibility Committee, CSR Committee, Committee/Sustainable Development Department).

Table 5 : Matrix of indicators per TCFD area

Indicateurs	Governance	Strategy	Risk management	Metrics
Well informed	Existence of a committee dedicated to the environment meeting several times a year	* Physical risks *Transition risk *Description of the impact of these risks on the business (not quantified)	Existence of risk mapping or materiality matrix	*Indicators related to energy consumption, water, land use and waste management *Existence of a steering indicator *Evolution of indicators over time *Carbon footprint on GHGs on scope 1 and 2 and scope 3
Little or no information provided	*Variable compensation linked to environmental indicators *Description of environmental reporting (i. e. reporting) *Description of top management responsibility	*Climate change opportunities *Distribution of CROs at regional and sectoral level *Numbering of CROs (capex and opex) *Adaptation of the strategy according to scenario 2° C (horizon and disclosure of results and impacts)		*Use of an internal carbon price *Relevant emissions from scope 3 *The quantified objectives on these indicators

### 4.3 Matrix of risks and opportunities

In addition, the content analysis led us to develop a risk matrix (Table 6) based on the disclosure of CAC 40 companies. In terms of risks, we found that all the firms in the sample presented the risks related to climate change and the more and less impacts on their business. On the contrary, few of them have identified how climate change can be transformed into opportunities (3 firms detail the opportunities and 16 cite them without any details).

In terms of risks, we note that all sectors are confronted with both physical (impact of climatic phenomena) and transitional (financial or regulatory) risks. Geopolitical and reputational risks are only mentioned by the construction sector. With regard to opportunities related to climate change, firms mainly identify new market opportunities and the creation of new products due to new consumer expectations.

Table 6 : Matrix of Climate related risks and opportunities identified by CAC 40 firms

Sector	Risks	Opportunities
Energy	<p><b>Physical risks:</b> climatic phenomena (temperature variation, flooding, wind, drought)</p> <p><b>Transition risks :</b></p> <ul style="list-style-type: none"> <li>*Climate change could have a broader impact on the sector's activities: changes in regional or seasonal energy needs, the need to reduce CO<sub>2</sub>eq emissions, the scarcity of water resources and conflicts of use, the preservation of natural carbon sinks, sea level rise could affect some coastal activities, the increase in intense climatic events could damage installations on land or at sea.</li> <li>*financial risks: increase in financial costs or commitments, impacts on operating results and cash flows.</li> </ul>	<ul style="list-style-type: none"> <li>*New product offers: support for customers in reducing energy costs and environmental impact, an accelerated trend with digital technology</li> <li>*Promote hybrid solutions combining hydrocarbons and renewables (mobility) to meet the needs of various industries</li> <li>*Development of new energies: renewable energies, biofuels, CO<sub>2</sub> capture storage and recovery technologies</li> </ul>
Finance	<p><b>Physical risks:</b> extreme weather events, such as floods or storms, can have an impact on real assets (real estate or infrastructure) and on the amounts of damage under non-life insurance contracts</p> <p><b>Transition risk:</b> Sometimes referred to as "carbon asset risks", are the financial risks that could arise for investors as a result of the transition to a low-carbon economy (e.g. a potential devaluation of carbon-intensive financial assets).</p>	<ul style="list-style-type: none"> <li>*Offer of insurance products</li> <li>*Fund and promote research on risk and education</li> <li>*Prospective on climate change trajectories using claim databases.</li> </ul>
Materials and buildings	<p><b>Physical risks:</b> climate change (rising temperatures, droughts and floods, coastal erosion, sea level rise, etc.) can:</p> <ul style="list-style-type: none"> <li>-affect the resilience of a growing number of structures (buildings and infrastructure)</li> <li>-have operational consequences such as a risk of damage to facilities or its employees or a financial risk related to the increase in the cost of insurance</li> <li>-the extension of lead times (construction site interruptions, infrastructure damage) and operating losses due to supply difficulties or extreme weather events</li> </ul> <p><b>Transition risks:</b> tightening of regulatory constraints on environmental protection, carbon taxation, the expansion of allowance procedures, could lead to financial impacts such as higher taxes and raw material costs</p> <p><b>*Geopolitical risks:</b> climate disruptions put economic, social and political systems under stress and contribute to risks of regional instability and conflict</p> <p><b>*Reputational risks:</b> negative attitude of stakeholders if their concerns about climate change are not taken seriously.</p>	<ul style="list-style-type: none"> <li>* Develop product and service offers with a positive impact (energy efficiency) and low-carbon offers in buildings (BBCA certified)</li> <li>*Identify growth opportunities in low-carbon sectors, redirect industrial investments</li> </ul>
Food	<p><b>Physical risks:</b> impacts of climate change and natural disasters on:</p> <ul style="list-style-type: none"> <li>*supplies of agricultural raw materials, water</li> <li>*production sites</li> <li>*its operations, particularly in terms of customer behaviour</li> <li>*the direct or indirect impacts on its activities, assets and employees, and the consequences on its financial situation</li> </ul>	<ul style="list-style-type: none"> <li>*New product lines to meet consumer and stakeholder expectations</li> </ul>

	<b>Reputation risks:</b> consumers' environmental expectations that could negatively affect the sector	
Transport	<b>Physical risks:</b> climatic disturbances affecting: *raw material supplies *the choice of production sites and the protection of those located <b>Transition risks:</b> tightening of environmental regulations (GHG emissions), change in consumer behaviour.	*Reinforcement of regulations on CO2 emissions from vehicles, which represents an opportunity for the development of low-carbon mobility and represents a major competitiveness challenge for the sector. *New growth opportunities around electrification, the autonomous car and the new forms of mobility linked to digital technology.
Low impact	<b>Physical risks:</b> climatic risks are a risk that can: *a direct impact on the availability and quality of raw materials (supply chain) *Disrupt the proper functioning of operations (production site, technical infrastructure, etc.) * disrupt or interrupt services provided to customers, in particular due to increasing digitalization (distribution chain)  <b>Transition risks:</b> volatility of energy and raw material costs (e.g. additional tax on fossil fuels, emergence of carbon tax, etc.)	*Reducing GHG emissions is an opportunity to reduce associated costs (energy, transport), limit energy dependence, anticipate the application of binding climate agreements (taxes, allowances) and meet the expectations of investors or financial institutions, as well as customers *The implementation of all its consulting, technology and outsourcing skills to take advantage of the environmental benefits of the digital revolution *The offer of new technologies and sustainable solutions (intelligent solutions, eco-responsible data centers, carbon-neutral hosting, etc.) that help its customers to face their own challenges.

## 5 Discussion and conclusion

The purpose of this research is to provide insight of environmental disclosures practices of CAC 40 firms regarding the TCFD recommendations. This topic is at stake because to our knowledge academic studies generally focus on the NER Act requirements or on the GRI grid but not on TCFD recommendations. This article contributes to academic research by proposing a new analytical framework for environmental disclosure based on TCFD recommendations. This grid is essential for analysing firms' future practices since the TCFD is becoming a reference. The CCI may serve as a basis for further research work, in particular on other European countries.

Our results highlight a gradual improvement by French companies over the three years and show that firms with high environmental concerns disclose more than firms from the low stake sector. This first result is in line with Villiers et van Staden (2011) and Gallego-Alvarez et al. (2018). This can be explained by the media exposure of these sectors and their determination to reassure stakeholders by disclosing a significant amount of environmental information (Aerts and Cormier 2009; Depoers and Jérôme 2017). Then results put in light that over the period the smallest firms disclose more than the largest. This result seems relatively counter-intuitive

insofar as the literature shows that there is a size effect in favour of large companies (Albertini 2014 ; Chauvey et al. 2015) because they generally have more financial resources to devote to environmental communication. Moreover we find like González-Benito et González-Benito (2006) and Haddock-Fraser et Fraser (2008), that B to C firms tend to be more compliant with TCFD recommendations. This result shows that firms directly linked to consumers tend to disclose more environmental information to demonstrate their virtuous practices. All of these results are consistent with the legitimacy theory to the extent that the level of disclosure responds to legitimacy issues related to environmental pressures. Indeed, the evolution of the level of disclosure in accordance with the TCFD's recommendations reveals the willingness of French companies to be perceived as leaders by stakeholders. The analysis of this new environmental grid shows that B to B firms in with high environmental stake sectors have the best CCIs in order to ensure environmental legitimacy. These results reinforce Jose et Lee (2007) or Gallego-Alvarez et al. (2018) results.

This research also has managerial contributions for both firms and regulators. By identifying a matrix of key indicators in the 4 areas requested by the TCFD, this research contributes to making more readily implementable the recommendations of the TCFD for firms that wish to apply them. In addition, this matrix could be used as a tool for reflection by both the TCFD and the accounting standard-setter if they wish to harmonize the disclosure of non-financial information. Moreover, the climate risk and opportunity matrix is similar to a mapping of CROs by sector and can therefore be considered as a real tool for assessing the firms' level of disclosure (for example, for analysts or investors).

However, this research has several limitations. First, the sample selected is relatively small and should be expanded to provide a more representative sample. Moreover, content analysis is a method that suffers from limitations because it seeks to capture meaning from narrative in a coded 'numerical' form (Beck et al. 2010). Another limitation concerns the relevance of the information disclosed because it is not regulated and may fall within the scope of a firm's communication strategy or even of greenwashing (Bouten et al. 2011 ; Russo-Spena et al. 2018). We can illustrate this criticism in our research by the case of the financial sector, which registers in our research a very high CCI, while an NGO has revealed that six largest French banks keep on financing mainly fossil fuels at the expense of renewable energies (OXFAM 2018) pointing out the contradiction between their disclosure and their actual financing and investment strategies over the 2016-2017 period. This is why one future avenue of research will

consist in studying modes of analysing the relevance of environmental information and not just the amount of information.

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## Appendix 1: Questions used by domain for the content analysis

Gouvernance	Strategy	Risk Management	Metrics & Targets
<b>a) The Board's vision on climate issues</b> <i>Q1: Is the Board informed about climate issues?</i> <i>Q2: How often?</i> <i>Q3: Are climate topics taken into account in the evaluation and orientation of the strategy?</i> <i>Q4: How does the Board assess progress?</i> <b>Total : 4 points</b>	<b>a) Identification of CRO in the short, medium and long term</b> <i>Q1: Accuracy of the periods?</i> <i>Q2-3-4: Detail and costing of CRO by period)</i> <i>Q5: Distribution of CRO at sector and geographical level</i> <i>Q6: Impacts of risks and opportunities associated with climate change on the company's business and strategy</i> <b>Total : 6 points</b>	<b>a) Description of processes for identifying and evaluating CRO</b> <i>Q1: Are the processes presented?</i> <i>Q2: What is the materiality?</i> <i>Q3: Are current and potential regulations taken into account?</i> <i>Q4: Existence of materiality study?</i> <b>Total : 4 points</b>	<b>a) Disclosure of information on the metrics used to evaluate CRO</b> <i>Q1: Indicators related to energy consumption, water, waste management.....</i> <i>Q2: Indicator similar to an indicator for managing business risks</i> <i>Q3: Assessment of an internal carbon price.</i> <i>Q4: Evolution of indicators.</i> <b>Total : 4 points</b>
<b>b) The role of management in the evaluation of CRO</b> <i>Q5: Variable remuneration linked to climate indicators?</i> <i>Q6: What are the responsibilities of managers related to climate change?</i> <i>Q7: Climate information feedback process</i> <i>Q8: How does management manage climate issues?</i> <b>Total : 4 points</b>	<b>b) Description of the impacts of CRO on business, strategy and financial planning</b> <i>Q7: Identification of impacts?</i> <i>Q8: How are they integrated?</i> <i>Q9: Description of Capex and Opex related to CRO?</i> <b>Total : 3 points</b>	<b>b) Description of CRO management processes</b> <i>Q4: Management of climate-related risks.</i> <i>Q5: What are the priorities identified?</i> <b>Total : 2 points</b>	<b>b) Disclosure of information on Scopes 1, 2 and if relevant scope 3</b> <i>Q5: Carbon footprint, GHG emissions from Scopes 1 and 2</i> <i>Q6-7: GHG emissions of scope 3 and details of significant elements</i> <i>Q8: Evolution of these indicators</i> <b>Total : 4 points</b>
	<b>c) Description of the potential impacts of different scenarios, including the second one, on the organization's business, strategy and financial planning</b> <i>Q10: Study of the resilience of the business model?</i> <i>Q11: Analysis of different scenarios?</i> <i>Q12: Horizon of these analyses?</i> <i>Q13: Conclusions of the scenario analyses</i> <b>Total : 4 points</b>	<b>c) Description of how the processes for identifying and assessing CRO are integrated into overall risk management</b>  <b>Total : 1 point</b>	<b>C) Description of the objectives used to manage CRO and performance against these objectives.</b> <i>Q9-10: Are objectives posted for the different indicators?</i> <b>Total : 2 points</b>

Source: adapted from TCFD (2017)

## Appendix 2: Coding grid extract

Coding grid extract and score calculation			"TCFD" mentioned in the report	Are current and future regulations included in this risk evaluation?		Scope 1 & 2 emissions		Governance 8 questions		Strategy 13 questions			(...)	Risk management 2017	Risk management 2017	(...)	Total Governance 2017	Total Strategy 2017	Total Risk 2017	Total Metrics 2017	Total performance 2017
Company name	Coder	Year	1 or 0	1 or 0	Quote + source	1 or 0	Quote + source	a) 4 pt	b) 4 pt	a) 6 pt	b) 3 pt	c) 4 pt	(...)	a) %	b) %	(...)	%	%	%	%	%
ArcelorMittal	QCR	2017	0	1.0	"ArcelorMittal is subject to changing and increasingly stringent environmental laws and regulations concerning air emissions, water discharges and waste disposal, as well as certain remediation activities that involve the clean-up of soil and groundwater" p167	0.5	"the Company's emission footprint in 2016 was approximately 200 million tonnes" p263	0.0	0	1.0	1	0	(...)	25%	50%	(...)	3%	17%	25%	4%	12%

### Appendix 3: Descriptives statistiques of CCI per sector

Comprehensive Compliance Index (CCI)	All sectors	Energy	Finance	Food	Building & Materials	Transport	Low impact
No. firms	40	3	4	4	10	6	13
Mean 2015	37.48%	55.87%	31.94%	34.92%	44.76%	35.86%	30.89%
Mean 2016	48.77%	49.99%	57.57%	43.96%	55.58%	45.95%	39.58%
Mean 2017	<b>59.94%</b>	<b>61.91%</b>	<b>67.97%</b>	<b>61.21%</b>	<b>65.13%</b>	<b>58.73%</b>	<b>53.19%</b>
% Chg., 2015-2017	<b>37.46%</b>	<b>9.75%</b>	<b>53.00%</b>	<b>42.95%</b>	<b>31.27%</b>	<b>38.94%</b>	<b>41.93%</b>
Median 2015	35.96%	49.13%	32.73%	36.83%	53.67%	35.74%	32.64%
Median 2016	47.27%	73.22%	57.05%	49.24%	66.28%	48.13%	38.19%
Median 2017	67.30%	81.21%	72.01%	65.95%	75.24%	66.49%	52.30%
Min 2015	0.00%	43.79%	25.52%	9.81%	12.24%	8.51%	0.00%
Min 2016	8.51%	0.00%	40.10%	13.63%	10.42%	8.51%	9.81%
Min 2017	9.81%	13.48%	46.35%	30.73%	12.24%	22.01%	9.81%
Max 2015	74.69%	74.69%	36.81%	56.21%	74.52%	62.20%	63.54%
Max 2016	84.07%	74.69%	76.09%	63.72%	79.34%	84.07%	77.65%
Max 2017	92.71%	76.74%	81.51%	82.20%	82.64%	85.63%	81.81%
Std. deviation 2015	18.84%	13.48%	4.09%	16.72%	20.47%	18.66%	17.36%
Std deviation 2016	22.09%	35.37%	15.70%	20.09%	23.39%	26.26%	16.27%
Std deviation 2017	22.54%	35.74%	13.56%	19.50%	23.07%	23.50%	18.52%

### Appendix 4: CCI according to the four TCFD areas by sector

CCI 2017	All sectors	Energy	Finance	Food	Materials & Building	Transport	Low impact
Governance total	<b>60.20%</b>	<b>66.15%</b>	<b>67.19%</b>	<b>72.27%</b>	<b>72.19%</b>	<b>56.25%</b>	<b>45.55%</b>
Governance (a)	66.17%	65.63%	78.13%	72.66%	78.75%	67.71%	50.24%
Governance (b)	54.22%	66.67%	56.25%	71.88%	65.63%	44.79%	40.87%
Strategy total	<b>37.11%</b>	<b>62.04%</b>	<b>53.13%</b>	<b>29.86%</b>	<b>37.29%</b>	<b>37.34%</b>	<b>28.42%</b>
Strategy (a)	34.51%	58.33%	37.50%	37.50%	38.33%	37.03%	23.08%
Strategy (b)	54.79%	77.78%	75.00%	33.33%	51.67%	50.00%	54.49%
Strategy (c)	22.03%	50.00%	46.88%	18.75%	21.88%	25.00%	7.69%
Risk total	<b>71.67%</b>	<b>54.17%</b>	<b>78.13%</b>	<b>58.33%</b>	<b>80.83%</b>	<b>71.53%</b>	<b>70.83%</b>
Risk (a)	70.63%	45.83%	71.88%	62.50%	82.50%	72.92%	68.27%
Risk (b)	70.63%	50.00%	62.50%	37.50%	90.00%	66.67%	75.00%
Risk (c)	73.75%	66.67%	100.00%	75.00%	70.00%	75.00%	69.23%
Metrics total	<b>70.78%</b>	<b>65.28%</b>	<b>73.44%</b>	<b>84.38%</b>	<b>70.21%</b>	<b>69.79%</b>	<b>67.95%</b>
Metrics (a)	67.34%	58.33%	73.44%	78.13%	68.13%	73.96%	60.58%
Metrics (b)	78.44%	62.50%	78.13%	87.50%	73.75%	77.08%	83.65%
Metrics (c)	66.56%	75.00%	68.75%	87.50%	68.75%	58.33%	59.62%

## Appendix 5 : CCI scores (by company)

	Sector	Activity	CCI 2015	CCI 2016	CCI 2017	Trend 2015-2017	Market Cap 2017 (€ m)	Cite TCFD 2017
<b>Engie SA</b>	Energy	B to C	74.69%	73.22%	81.21%	9%	34,910	1
<b>Technip</b>	Energy	B to B	49.13%	0.00% <sup>32</sup>	11.81%	-76%	12,142	0
<b>Total</b>	Energy	B to C	43.79%	76.74%	92.71%	112%	116,325	1
<b>AXA</b>	Finance	B to C	36.81%	70.05%	81.51%	121%	59,986	1
<b>BNP Paribas</b>	Finance	B to C	32.12%	40.10%	46.35%	44%	77,715	1
<b>Crédit Agricole</b>	Finance	B to C	25.52%	44.05%	66.88%	162%	39,276	1
<b>Société Générale</b>	Finance	B to C	33.33%	76.09%	77.13%	131%	34,781	1
<b>Carrefour</b>	Food	B to C	33.16%	38.11%	58.68%	77%	13,975	0
<b>Danone</b>	Food	B to C	56.21%	60.37%	73.22%	30%	46,916	0
<b>Pernod Ricard</b>	Food	B to C	40.49%	63.72%	82.20%	103%	34,862	0
<b>Sodexo</b>	Food	B to B	9.81%	13.63%	30.73%	213%	16,901	0
<b>Accor</b>	Materials	B to C	60.50%	71.01%	82.64%	37%	12,418	0
<b>ArcelorMittal</b>	Materials	B to B	13.19%	10.42%	12.24%	-7%	27,582	0
<b>Bouygues</b>	Materials	B to C	56.81%	67.93%	79.04%	39%	15,630	0
<b>Lafarge Holcim</b>	Materials	B to B	12.24%	25.87%	28.65%	134%	22,279	0
<b>Legrand</b>	Materials	B to B	24.48%	29.82%	69.18%	183%	17,076	0
<b>Saint Gobain</b>	Materials	B to B	59.68%	76.00%	73.91%	24%	25,448	1
<b>Schneider Electric</b>	Materials	B to B	74.52%	76.26%	82.16%	10%	42,279	1
<b>Solvay</b>	Materials	B to B	50.52%	64.63%	77.91%	54%	10,545	1
<b>Unibail-Rodamco</b>	Materials	B to B	57.12%	79.34%	76.56%	34%	20,967	0
<b>Vinci</b>	Materials	B to B	38.54%	54.51%	69.01%	79%	50,336	0
<b>Airbus Group</b>	Transport	B to B	8.51%	8.51%	33.62%	295%	64,288	0
<b>Michelin</b>	Transport	B to C	41.32%	49.35%	78.13%	89%	21,452	0
<b>PSA Group</b>	Transport	B to C	30.16%	46.92%	58.94%	95%	15,341	1
<b>Renault</b>	Transport	B to C	62.20%	84.07%	85.63%	38%	24,814	0
<b>Safran</b>	Transport	B to B	19.40%	18.36%	22.01%	13%	35,663	0
<b>Valeo</b>	Transport	B to B	53.56%	68.49%	74.05%	38%	14,923	1
<b>Air Liquide</b>	Low impact	B to B	32.64%	38.19%	64.24%	97%	44,990	0
<b>Atos</b>	Low impact	B to B	45.31%	47.27%	66.93%	48%	12,766	1
<b>Capgemini</b>	Low impact	B to B	38.02%	39.45%	52.30%	38%	16,661	0
<b>Essilor</b>	Low impact	B to B	30.69%	29.38%	49.44%	61%	25,181	0
<b>Kering</b>	Low impact	B to C	53.13%	57.38%	73.13%	38%	49,628	0
<b>L'Oréal</b>	Low impact	B to C	27.95%	33.29%	56.03%	100%	103,551	0
<b>LVMH</b>	Low impact	B to C	32.99%	37.15%	44.31%	34%	124,416	0
<b>Nokia</b>	Low impact	B to C	0.00% <sup>33</sup>	19.88%	26.52%		26,515	0
<b>Orange</b>	Low impact	B to C	26.78%	40.71%	48.65%	82%	38,504	1
<b>Publicis</b>	Low impact	B to B	10.42%	32.90%	50.61%	386%	13,048	0
<b>Sanofi</b>	Low impact	B to B	35.11%	51.52%	67.66%	93%	90,756	0
<b>Veolia Envi.</b>	Low impact	B to B	63.54%	77.65%	81.81%	29%	11,986	1
<b>Vivendi</b>	Low impact	B to B	4.95%	9.81%	9.81%	98%	29,021	0

## Appendix 6: Statistics regarding TCFD areas and sub-areas over the period

Mean score (%)	Energy	Finance	Food	Materials	Transport	Low impact
<b>Governance total 2015</b>	56.35%	29.69%	42.97%	48.28%	27.34%	18.37%
<b>Governance total 2016</b>	53.65%	42.97%	49.61%	56.41%	35.42%	21.88%
<b>Governance total 2017</b>	66.15%	67.19%	72.27%	72.19%	56.25%	45.55%
<b>Governance (a) 2015</b>	54.38%	40.63%	45.31%	45.31%	29.69%	23.75%
<b>Governance (a) 2016</b>	57.29%	54.69%	49.22%	56.56%	31.25%	27.88%
<b>Governance (a) 2017</b>	65.63%	78.13%	72.66%	78.75%	67.71%	50.24%

<sup>32</sup> In 2016, Technip merged with FMC and did not produce a registration document.

<sup>33</sup> In 2015, Nokia has published an annual report in British format without any reference to environmental issues.

<b>Governance (b) 2015</b>	58.33%	18.75%	40.63%	51.25%	25.00%	12.98%
<b>Governance (b) 2016</b>	50.00%	31.25%	50.00%	56.25%	39.58%	15.87%
<b>Governance (b) 2017</b>	66.67%	56.25%	71.88%	65.63%	44.79%	40.87%

Mean score (%)	Energy	Finance	Food	Materials	Transport	Low impact
<b>Strategy total 2015</b>	37.96%	21.53%	20.14%	44.44%	18.52%	14.32%
<b>Strategy total 2016</b>	35.19%	44.10%	21.53%	27.78%	26.85%	18.91%
<b>Strategy total 2017</b>	62.04%	53.13%	29.86%	37.29%	37.34%	28.42%
<b>Strategy (a) 2015</b>	38.89%	14.58%	27.08%	27.08%	16.67%	13.46%
<b>Strategy (a) 2016</b>	22.22%	29.17%	31.25%	31.67%	27.78%	16.03%
<b>Strategy (a) 2017</b>	58.33%	37.50%	37.50%	38.33%	37.03%	23.08%
<b>Strategy (b) 2015</b>	66.67%	50.00%	33.33%	43.33%	0.00%	29.49%
<b>Strategy (b) 2016</b>	50.00%	75.00%	33.33%	49.17%	44.44%	39.74%
<b>Strategy (b) 2017</b>	77.78%	75.00%	33.33%	51.67%	50.00%	54.49%
<b>Strategy (c) 2015</b>	8.33%	0.00%	0.00%	0.00%	0.00%	0.00%
<b>Strategy (c) 2016</b>	33.33%	28.13%	0.00%	2.50%	8.33%	0.96%
<b>Strategy (c) 2017</b>	50.00%	46.88%	18.75%	21.88%	25.00%	7.69%

Mean score (%)	Energy	Finance	Food	Materials	Transport	Low impact
<b>Risk total 2015</b>	61.11%	29.17%	32.29%	53.33%	38.19%	43.91%
<b>Risk total 2016</b>	55.56%	72.92%	48.96%	75.83%	52.08%	59.29%
<b>Risk total 2017</b>	54.17%	78.13%	58.33%	80.83%	71.53%	70.83%
<b>Risk (a) 2015</b>	50.00%	50.00%	46.88%	65.00%	39.58%	47.12%
<b>Risk (a) 2016</b>	33.33%	68.75%	46.88%	82.50%	47.92%	47.12%
<b>Risk (a) 2017</b>	45.83%	71.88%	62.50%	82.50%	72.92%	68.27%
<b>Risk (b) 2015</b>	66.67%	12.50%	12.50%	55.00%	25.00%	46.15%
<b>Risk (b) 2016</b>	66.67%	50.00%	25.00%	75.00%	58.33%	69.23%
<b>Risk (b) 2017</b>	50.00%	62.50%	37.50%	90.00%	66.67%	75.00%
<b>Risk (c) 2015</b>	66.67%	25.00%	37.50%	40.00%	50.00%	38.46%
<b>Risk (c) 2016</b>	66.67%	100.00%	75.00%	70.00%	50.00%	61.54%
<b>Risk (c) 2017</b>	66.67%	100.00%	75.00%	70.00%	75.00%	69.23%

Mean score (%)	Energy	Finance	Food	Materials	Transport	Low impact
<b>Metrics total 2015</b>	68.06%	47.40%	44.27%	53.96%	59.38%	46.96%
<b>Metrics total 2016</b>	55.56%	70.31%	55.73%	62.29%	69.44%	58.25%
<b>Metrics total 2017</b>	65.28%	73.44%	84.38%	70.21%	69.79%	67.95%
<b>Metrics (a) 2015</b>	83.33%	60.94%	60.94%	55.63%	69.79%	47.60%
<b>Metrics (a) 2016</b>	58.33%	67.19%	67.19%	65.63%	70.83%	57.45%
<b>Metrics (a) 2017</b>	58.33%	73.44%	78.13%	68.13%	73.96%	60.58%
<b>Metrics (b) 2015</b>	54.17%	31.25%	40.63%	56.25%	54.17%	60.58%
<b>Metrics (b) 2016</b>	58.33%	81.25%	68.75%	63.75%	70.83%	75.00%
<b>Metrics (b) 2017</b>	62.50%	78.13%	87.50%	73.75%	77.08%	83.65%
<b>Metrics (c) 2015</b>	66.67%	50.00%	31.25%	50.00%	54.17%	32.69%
<b>Metrics (c) 2016</b>	50.00%	62.50%	31.25%	57.50%	66.67%	42.31%
<b>Metrics (c) 2017</b>	75.00%	68.75%	87.50%	68.75%	58.33%	59.62%