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Do Corporate Carbon Policies Enhance Legitimacy? A Social Media Perspective

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Abstract: Stakeholders are increasingly concerned about climate change and companies' commitment to anticipate future carbon-related risks, and grant or withdraw support depending on their perceptions of firms' carbon performance. The aim of this research is to analyse which carbon-related factors influence stakeholders with regards to the legitimacy-granting process. The sample in this study includes 146 firms from North America and Europe committed to carbon mitigation, whose legitimacy is measured via social media interactions. Findings show that setting a corporate carbon policy and disclosing an internal price of carbon are positively linked to legitimacy, while other factors are negatively or not related to legitimacy. This study makes theoretical contributions, proposing a metric based on social media stakeholder engagement to measure corporate legitimacy, as well as practical implications, revealing which carbon information shapes stakeholders' perception of firms' climate performance, and opening new possibilities for future research.

Keywords: corporate carbon policy; carbon management; stakeholder engagement; Carbon Disclosure Project; Facebook; corporate legitimacy

1. Introduction

The ambitious target of keeping the global temperature rise well below 2 degrees Celsius above pre-industrial levels, settled in the 2015 Paris Agreement [1], requires carbon and other greenhouse gas (GHG) emissions to be drastically reduced. In order to meet this target, firms need to set a corporate carbon policy (CCP) and also embed it into the global strategy [2]. Stakeholders are increasingly interested in how firms deal with these changes [3], the efforts made in fulfilling carbon-reducing goals, and how these are embedded into their business models, strategies and practices [4]. By disclosing this information, companies signal their commitment to a greener future and in turn gain social approval, i.e., legitimacy. For instance, ExxonMobil reported its intention to provide shareholders with information on "energy demand sensitivities, implications of two degree Celsius scenarios, and positioning for a lower-carbon future" [5]. As a result, firms recognize the need to set a mutually beneficial interaction with stakeholders [6], meeting their carbon-related demands to gain their approval and, consequently, reach higher levels of legitimacy.

Previous research have explored the effects of establishing a CCP through different sustainability performance measurements [7,8], while others confirm the relevance of carbon information disclosure: some works explore the impact of carbon disclosure on stock prices [9–12], others find a significant relationship between carbon disclosure and a wide range of firm performance metrics [13], while others conclude that there exists a positive relationship between carbon disclosure and subsequent carbon performance [14,15]. Board characteristics and their effects on carbon disclosure are also

examined in the literature [16], as well as the main determinants and motivations of participating in Carbon Disclosure Project (CDP) annual surveys [17,18]. Thus, the literature proves that both setting a CCP and disclosing carbon-related information exerts a positive influence, measured by financial and non-financial metrics, dwelling on the final effects for firms. However, there is a scarcity of works linking carbon issues and how they shape the stakeholders' perspective and, ultimately, if this perception enhances corporate legitimacy. Prior research regularly mentions legitimacy as a desired consequence of establishing a CCP and disclosing related information, but as far as the authors are aware, there is a gap in the literature exploring this link. Using carbon and economic information from 146 European and North American firms included in the CDP report (2016), the first aim of this study is to analyse to what extent establishing a CCP helps to reach higher levels of legitimacy.

The measurement of legitimacy is one of the most controversial points in the literature. Since conventional measures of legitimacy (i.e., direct surveys and interviews, or traditional media) do not take into account the judgements of all types of stakeholders, a recent branch literature has been focusing on social media as an alternative measure for legitimacy [19], to capture the heterogeneous perception of a firm's groups of interest. The rise of social media has provided stakeholders a set of platforms to express their views about which firms have gained social approval, and firms need to be aware of this shift [20]. Thus, the second aim of this study is to propose a new measure for legitimacy based on social media data. Legitimacy is here proxied by social media stakeholder engagement, a construct that encompasses a set of interactions that users can carry out on Facebook, one of the most important social networks world-wide.

From a theoretical perspective, the results can contribute to extending the literature on corporate legitimacy and its measurement, proposing a new approach based on social media stakeholder engagement. The added value to the existent research lies on the ability of this metric to capture the online interactions of a plurality of stakeholders, overcoming the limitations of traditional metrics. Practitioners can also benefit from this research, since findings help to understand how CCPs and the disclosure of related information can improve interaction with stakeholders, and therefore, help them to reach higher levels of legitimacy.

Following the introduction, the rest of the article is organized as follows: Section 2 offers the theoretical background, Section 3 presents the hypotheses of the research, Section 4 specifies the proposed model and provides information on the sample, in Section 5 results are commented and further discussed, and finally in Section 6 conclusions and final recommendations are provided.

2. Theoretical Framework

From a theoretical perspective, researchers ground corporate social responsibility (CSR) and carbon-related studies in some well-known economic theories, such as voluntary disclosure theory, institutional theory, or stakeholder theory [21,22], but no consensus exists since each theory presents subtle differences and is aligned more or less according to the researcher's focus, and even these theories overlap or can be reconciled [23]. Firms engage in sustainable initiatives mostly because of stakeholder pressure [24], and disseminate their sustainability performance in search of social approval, i.e., to gain legitimacy. Thus, legitimacy theory underpins this research. Under its precepts, corporate legitimacy is based on how firms seek social acceptance by adhering to regulative, normative or cognitive norms and expectations [25], and reach such legitimacy by disclosing information as a response to the expectations and pressures of society as a whole [26]. This habitually translates into communicating "non-financial" data for "non-financial" stakeholders, implying that CSR information disclosure is key to the legitimation process [23,27]. Following Suchman [28] and Basu and Pallazo [29], firms can adopt three different approaches: (1) pragmatic legitimacy, that is, considering legitimacy as a resource that can be managed (firms influence the environment by posturing that they are sustainable); (2) cognitive legitimacy, arising from the adaptation of firms to societal expectations (firms adapt to the environment, fostering consistency between global strategy and CSR activities); and (3) moral legitimacy, shaped by uncertainty conditions in which firms, together with relevant stakeholders, set

up or modify acceptable behaviours (firms are truly committed to shape the environment by engaging in CSR activities and embedding them in the corporate culture).

Whichever the perspective assumed by the firms, they must first deal with stakeholder pressure and reach legitimacy by establishing a sustainability strategy as part of the general corporate strategy, as it is not enough to merely react to changes in legislation but rather to be proactive in internalizing greener practices [30]. Once a sustainability strategy is established, firms alleviate stakeholder pressure by demonstrating their commitment through the disclosure of environmental, social and governance (ESG) information [31,32]. By doing so, firms enhance transparency [33], allowing stakeholders to grant their social support, and achieve legitimacy in the process. A dynamic equilibrium is then set, in that stakeholders continuously scrutinize actions taken and information disclosed by the firms in order to provide a social license for the businesses to keep operating [34], i.e., to keep implicitly legitimating their activities.

Among the ESG factors, stakeholders are increasingly concerned with corporate carbon performance, since carbon is the GHG most frequently emitted into the atmosphere (65% of total emissions in 2014 [35]), pushing firms to enhance their commitment to reduce emissions. The process to materialize this commitment usually begins by developing and implementing a specific CCP within their corporate sustainability strategy [36,37]. A CCP can be defined as a statement outlining objectives, strategies, actions and control mechanisms to address carbon management and how these are embedded into the corporate global strategy. Once a CCP is established, firms should adopt one of the strategies according to the goal established, namely carbon compensation, carbon reduction or carbon independence [38], and then set up a carbon management system (CMS) that encompasses all implementation plans and actions that allow them to meet the objectives outlined in the CCP, including how to integrate them into operational activities. Without establishing this entire mechanism, it is unlikely that a firm will be successful in managing carbon issues properly and less likely to obtain social legitimation. Thus, stakeholder pressure stands out as a key factor to enhance carbon efficiency and, by extension, a firm's carbon policy [39].

Companies must consider all stakeholder groups and engage with them in the process of establishing a CCP and communicating its evolution and performance, in order to ensure its successful implementation [40,41]. In general, there is no obligation to disclose carbon-specific data, with the exception of large companies that have facilities participating in the EU Emissions Trading Scheme [42,43]. Two types of initiatives try to fill this gap and help guide companies through the process of disclosure: (1) Given that no financial reporting standards that address this type of disclosure have emerged from accountancy communities or from regulators (compromising the transparency and comparability of financial statements, following De Aguiar [44]), practitioners and researchers are taking steps towards a theoretical and practical framework for "carbon accounting" [45–47]. This could be defined as "the voluntary and/or mandatory recognition of direct and indirect GHG emissions, their evaluation in non-monetary and monetary terms as well as their auditing and reporting for internal and external purposes" [48]. (2) Firms voluntarily disclose carbon information, by participating in the CDP annual survey or providing this information in their own CSR reports [49], usually following the Global Reporting Initiative (GRI) Guidelines (the GRI employs terminology coupling GHG Protocol and ISO 14064 standards; the GHG Protocol is an international standard for corporate GHG accounting and reporting, founded by the World Resources Institute [50]).

3. Development of Hypotheses

In order to meet financial and non-financial stakeholders' expectations, firms need to disseminate all manner of climate-related information such as the disclosure of carbon emissions data, whether they are meeting their own climate change-reduction objectives and targets, how they are performing in relation to their competitors, or what are the financial implications of climate change for the firm [51,52]. Therefore, the soundness of a CCP and its ability to engage stakeholders can be measured through a set of factors, which can be divided into four groups in line with Luo and Tang [15]:

- Carbon operations. Variables related to specific actions implemented to achieve the carbon-reduction goal: CCP, carbon reduction target, and internal carbon price.
- Carbon emissions tracking. Variables related to the control of carbon performance: volume of carbon emissions and year-on-year variation in carbon emissions.
- Carbon governance. Variables related to the organizational structures created to design, implement, manage and control the CCP: CSR committee.
- Reporting and disclosure. Variables related to how a company can disseminate carbon-related information to stakeholders to enhance their engagement: CSR reporting.

3.1. Carbon Operations

As firms engage in carbon reduction processes, the need to establish a CCP arises. A CCP encompasses a general strategy which includes all processes carried out and the measures implemented by a company to monitor, manage and reduce its carbon emissions [3]. It also includes information that facilitates the disclosure of corporate information on climate change [53], signalling to stakeholders a real commitment to reduce emissions. Previous literature confirms the positive effects of establishing a CCP. Eleftheriadis and Anagnostopoulou [8] state that embedding carbon reduction and compensation strategies into core business activities can help carbon strategies to succeed; Chakrabarty and Wang [54] conclude that although CCPs do not positively affect financial performance, neither do they harm it; Wong et al. [55] and Wong and Zapantis [56] explore the role of organizational culture in the adoption of carbon policies in the Australian construction industry. Based on the above, it is hypothesized that:

Hypothesis 1 (H1). *Firms with a CCP reach higher levels of corporate legitimacy.*

Setting specific carbon reduction targets (CRT) supports the global carbon strategy and helps to improve future emission reductions [3,7,8,57]. Luo and Tang [15] found that firms that effectively reduce carbon emissions are prone to set targets, initiate carbon programs and communicate internal information with external stakeholders, so a positive relationship between CRT and corporate legitimacy is expected.

Hypothesis 2 (H2). *Firms that set CRTs reach higher levels of corporate legitimacy.*

For firms, the question about climate change regulation is not a matter of whether they will be required to pay a price on carbon, but rather when they will be forced to do so. As companies' proactivity become more concerned with this matter it is necessary for the cost of carbon to be embedded into the global corporate strategy. A growing number of firms are already using or starting to use this cost of carbon in their analysis of current and future projects [58] in order to ascertain that those projects remain profitable in the long run whatever the environmental regulations [59]. This potential cost is commonly referred to as "internal carbon price", and it is freely and internally determined by each company depending on its current level of CO2 emissions, its national legislation and its own perspectives regarding the influence of carbon. By disclosing such sensitive information to stakeholders, firms are signalling their commitment to anticipating future risks in relation to climate change [60], fostering transparency and, in doing so, reaching legitimacy [61]. Hence, the following hypothesis is formulated:

Hypothesis 3 (H3). *Firms disclosing their internal carbon price attain higher levels of corporate legitimacy.*

3.2. Carbon Emissions Tracking

The search for legitimacy (to avoid future risks) forces firms to be proactive in order to show their green commitment by communicating how polluting their activity is. The literature is not conclusive as to whether carbon emission figures and their disclosure are considered positive or negative by

stakeholders. Some works conclude that investors react negatively to carbon emissions [9,62], in the belief that they imply an increase in costs and climate risks and could be a mere marketing action of greenwashing. Others find positive reactions [63] since carbon emission data is considered sensitive information, and its disclosure is associated with more transparency and a commitment to sustainability. These mixed findings are related to the limited availability of emissions data, which could lead to big misunderstandings [64]. Hence, data on carbon emissions performance is not expected to exert any influence on stakeholders since they are not homogeneously aware of the degree of compliance, stating the following research hypotheses in the null forms:

Hypothesis 4 (H4). *Carbon emissions volumes do not influence corporate legitimacy.*

Hypothesis 5 (H5). *Effective reduction of carbon emissions does not influence corporate legitimacy.*

3.3. Carbon Governance

It has been observed that board-related variables are common in discretionary carbon disclosure studies, and specific boards, such as auditing, attract researchers' attention [64,65]. An environmental or CSR committee is in charge of setting and implementing the carbon management strategy, and thus is expected to guarantee that "words are aligned with deeds" [66], and that the disclosed information helps stakeholders evaluate their investment risks, opportunities, and decisions [12], and consequently does not negatively affect the firm's legitimacy and reputation [37]. In this regard, Fuente et al. [67] state that the quality of CSR depends on the activity of the CSR committee. In addition, Haque [68] found that there is a positive relationship between company carbon reduction initiatives and the existence of a CSR committee. Likewise, Lock and Seele [66] prove that almost 93% of the most sustainable companies have stand-alone CSR structures, meaning that specific resources are allocated to CSR. Therefore, stakeholders are expected to acknowledge its importance to ensure the fulfilment of carbon reduction targets. Hence, the following hypothesis is proposed:

Hypothesis 6 (H6). *Firms that designate a specific CSR committee attain higher levels of corporate legitimacy.*

3.4. Reporting and Disclosure

Legitimacy is closely related to the successful implementation of CSR activities in organizations [69]. The traditional way to communicate ESG issues has evolved from information included in annual reports to an increasingly widespread practice of stand-alone CSR annual reports [70]. A firm is expected to gain legitimacy (or regain it if some critical event has damaged its image) by extensively disclosing CSR information [27], since it fosters the perception of transparency. Hence, it is expected that stakeholders rely on information provided in CSR reports, posing the following hypothesis:

Hypothesis 7 (H7). *Firms that publish a CSR report attain higher levels of corporate legitimacy.*

4. Research Design

4.1. Methodology

Palazzo and Scherer [71] assert that the challenge of legitimacy is to engage in true dialogue in a plural and globalizing society. According to Vergne [72], legitimacy is difficult to measure due to its inherently changing nature in space and time, the different perspectives potentially assumable (pragmatic, moral or cognitive), and the different dimensions that integrate the construct (environmental, competitive, accountability and transactional legitimacy). Most works rely on metrics based on traditional media or direct stakeholder perceptions, but a new stream of research is using legitimacy measures based on social media data [73], which "[. . .] has the potential to complement

extant measures and contribute to a more encompassing understanding of legitimacy based on the judgments by various evaluators" [19]. However, little has been said of how legitimacy can be measured through social media, with researchers mainly focusing on Twitter-based metrics [74,75].

Recent research uses the number of followers or fans as a measure of legitimacy [76], but a more elaborate metric is needed to encompass the broad set of manifestations permitted in social networks. The current study proposes a different approach based on Facebook data. Facebook, with 2320 billion users per quarter (as of January 2019, according to the metrics of Statista), is considered one of the most popular platforms for online interaction [77] and allows different types of interactions through three simple buttons: "Like", "Comment" and "Share" [78]. The metric proposed by Bonsón and Ratkai [79] is used to measure social media stakeholder engagement [80]. This metric is developed from the three main interactions allowed by Facebook, representing what companies can attain from users: popularity ("likes"), commitment ("comments") and virality ("shares"). The dimensions and the final metric of corporate legitimacy are presented in Table 1.

Table 1. Metrics for corporate legitimacy.

	Sign	Formula	Measurement
Popularity	P1	Posts with likes / total posts	Percentage of total posts liked
	P2	Total likes / total posts	Average number of likes per post
	P3	(P2 / number of fans) × 1000	Popularity of messages among fans
Commitment	C1	Posts with comments / total posts	Percentage of total commented posts
	C2	Total comments / total posts	Average number of comments per post
	C3	(C2 / number of fans) × 1000	Commitment of fans
Virality	V1	Posts with shares / total posts	Percentage of the total posts shared
	V2	Total shares / total posts	Average number of shares per post
	V3	(V2 / number of fans) × 1000	Virality of messages among fans
Legitimacy (L) = Popularity (P3) + Commitment (C3) + Virality (V3)			

Source: adapted from Bonsón and Ratkai [80].

All posts published by firms in their Facebook profile pages were considered to build the metrics. The main motive for this is that literature has corroborated that less than 20% of messages posted by companies on their Facebook or Twitter profile pages could be linked to CSR activities [81,82], and that " ... publics have a greater tendency to engage with non-CSR messages than CSR messages" [81]. In other words, publics liked, shared, and commented more on non-CSR messages. Although it seems of interest and logical to focus solely on CSR-related posts, that analysis does not fit with this work since it is focused on corporate legitimacy as a whole, that is to say, the social acceptance of all the economic activities of a firm.

In accordance with the research goal, the dependent variable selected was "Legitimacy". Assuming that the variables considered present a linear relationship, and using ordinary least squares (OLS), multiple linear regression was applied to determine the influence of factors identified as being relevant to the level of stakeholder engagement via Facebook fan-pages.

Table 2 shows the measurement and codification of independent variables: three carbon operation variables (CCP, carbon reduction target, and internal carbon price), two carbon emissions tracking variables (volume of carbon emissions and year-on-year variation in carbon emissions), one carbon governance variable (CSR committee) and one reporting and disclosure variable (CSR reporting). Table 2 also includes two control variables. Firstly, economic and environmental performance are common variables included in sustainability research, with Tobin's Q probably being the most used to predict long-term financial performance [13,15,26]. Although it does not appear extensively in the literature, financial performance has been related both positively [83], and negatively [16] to legitimacy via social media. Broadly speaking, most stakeholders, with the exception of investors,

assume that higher economic profitability is conversely related to sustainability performance [84] and thus stakeholders tend to believe that higher levels of profitability imply worse environmental performance. In this work, therefore, a negative relationship is expected between financial performance and stakeholder legitimacy.

Table 2. Independent variables.

Group	Hypothesis	Name	Variable	Measurement	Expected Relationship
Carbon operations	H1	Corporate carbon policy	Policy	0—Firm does not report having a carbon reduction policy 1—Firm reports having a carbon reduction policy	Positive
	H2	Carbon reduction target	Target	0—Firm does not report having a carbon reduction target 1—Firm reports having a carbon reduction target	Positive
	H3	Internal carbon price	ICP	0—Firm does not report an internal carbon price 1—Firm reports an internal carbon price	Positive
Carbon emissions tracking	H4	Total carbon emissions (2016)	Emissions	Tons of CO_2	No effect
	H5	Variation in carbon emissions 2015–2016	ΔEmissions	$\frac{Total\ carbon\ emissions\ (2016)}{Total\ carbon\ emissions\ (2015)} - 1$	No effect
Carbon governance	H6	Corporate social responsibility (CSR) committee	Committee	0—Firm does not have a CSR committee 1—Firm has a CSR committee	Positive
Reporting and disclosure	H7	Report on CSR or sustainability	Report	0—Firm does not publish a separate CSR or sustainability report 1—Firm publishes a separate CSR or sustainability report	Positive
Control variable		Tobin's Q	Profitability	(Market value common shares + Value preferred stocks + ST Debt + LT Debt) / Total Assets.	Negative
Control variable		Size	Size	Natural logarithm of a company total assets in USD	Negative

Source: Thomson Reuters Eikon database, except carbon operations variables (2016 CDP report).

Firm size is also a critical aspect habitually mentioned in the literature and is commonly used to help explain social, economic and environmental practices [85,86]. Many studies prove a positive relationship between size and CSR disclosure, since larger organizations present higher levels of emissions and consequently are more likely to disclose carbon information [87,88]. However, larger companies are more visible, subject to greater pressure and exposed to more intense public scrutiny [89]. This could lead to a greater likelihood of firms falsifying CSR information, modifying said information in order to appear more "attractive" to stakeholders [29,90]. Firms would otherwise risk disappointing stakeholders for failing to meet carbon mitigation goals, and thus making it difficult to reach legitimacy. Hence, a negative link is expected between company size and corporate legitimacy.

Another two variables commonly used in the related literature were initially considered in the analysis: industry [88,91] and country [32,92]. However, a previous correlation analysis proved that these two variables were found to be irrelevant and were therefore discarded from the study. The final model is as follows:

$$\begin{aligned} Engagement_i = {} & \beta_0 + \beta_1 \cdot ICP_i + \beta_2 \cdot Policy_i + \beta_3 \cdot Target_i + \beta_4 \cdot Emissions_i + \beta_5 \\ & \cdot \Delta Emissions_i + \beta_6 \cdot Committee_i + \beta_7 \cdot Report_i + \beta_8 \\ & \cdot Profitability_i + \beta_9 \cdot Size_i + \varepsilon_i \end{aligned} \quad (1)$$

4.2. Sample Selection and Data Collection

As carbon-related data disclosure is mostly voluntary, the search for companies started by considering those that show a strong commitment to anticipating future climate-change related risks, i.e., those participating in carbon disclosure initiatives. Because of its size and public availability, Carbon Disclosure Project initiatives have become one of the main sources of climate change

information from many of the world's largest firms [93]. In addition, it is one of the few initiatives to interview senior managers to ascertain their opinions, actions and prospects on carbon issues. Furthermore, and by adhering to this initiative, companies signal their commitment to addressing carbon issues. Therefore, and in line with many other authors [10,11,94], the initial sample of 517 firms was collected from the 2016 CDP report. The report also classifies firms at an industrial and regional level, including Africa (21) Asia (122), Europe (214), Latin America (26), North America (111) and Oceania (23). Region is a noticeable variable since the different degrees of technology development, regulations or cultural context may influence the importance that firms place on environmental issues [95,96]. Therefore, for the sake of greater homogeneity [97] and given their similarities in those aspects and also in the degree of carbon awareness, only firms from North America and Europe were initially considered.

Stakeholder engagement is thought to be the most important indicator for corporate legitimacy [98]. Therefore, it is not unreasonable to suggest that legitimacy could be proxied through social media stakeholder engagement, which could be defined as the degree of involvement that stakeholders manifest towards a company via social networks. The current study relies on Facebook data to capture the online interactions of stakeholders as a representative of such engagement. Based on the companies initially selected, researchers checked the existence and visited the official and active Facebook profile page of each company. Those without a profile page or one that was inactive were removed, reducing the sample to 223 companies. Following this, data from the Facebook profile pages was extracted on a daily basis and then aggregated. Given the large amount of data, a proper computerized treatment was deemed necessary and the principles of big data management were applied. Data gathering and aggregation were performed using specific software which was developed ad-hoc for this research. The extraction module retrieves public data available from Facebook pages through queries based on M language of Power Query to the API Graph of Facebook. Firms without information of carbon emissions were removed, finally totalling 146 companies (94 European and 52 North American). Table 3 describes sample selection and Table 4 exhibit sector information. Firms in the sample are shown in Appendix A.

Table 3. Sample selection.

Sample Selection (from CDP Report 2016)	Europe	North America
Firms based in Europe and North America	214	111
Less firms without an active Facebook page	(93)	(35)
Less firms not disclosing carbon emissions information	(27)	(24)
Final sample (N = 146)	94	52

Table 4. Sector statistics.

GICS Sector	Europe	North America	Total
Consumer Discretionary	15	3	18
Consumer Staples	6	4	10
Energy	8	10	18
Financials	14	4	18
Health Care	2	1	3
Industrials	12	10	22
Information Technology	2	3	5
Materials	12	6	18
Telecom. Services	4	1	5
Utilities	19	10	29
Total	**94**	**52**	**146**

4.3. Descriptive Analysis

Table 5 exhibits the main statistics for the independent variables, grouped according to their region of belonging. It is worth noting that, on average, European firms in the sample report emitting less CO_2 (11,403,001 tons) than North American (15,289,462), although being bigger in terms of size (total assets in billion $). Consequently, US and Canadian companies have a slightly higher carbon reduction rate (−3% vs. −1%). Firms from both regions present similar figures in terms of setting a CCP, having a stand-alone CSR report and a CSR committee, but Europeans declare setting carbon mitigation targets and using an internal carbon price more frequently.

Table 5. Mean and standard deviation of independent variables (N = 146).

	Europe (N = 95)		North America (N = 51)		Total (N = 146)	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Policy	0.11	0.31	0.10	0.30	0.10	0.305
Target	0.40	0.49	0.25	0.44	0.35	0.478
ICP	0.49	0.50	0.27	0.45	0.42	0.495
Emissions (Tons of CO_2)	11,403,001.34	23,333,333.76	15,289,462.35	25,897,905.40	12,760,600.73	24,242,183.14
ΔEmissions	−0.01	0.25	−0.03	0.16	−0.02	0.22
Committee	0.93	0.263	0.86	0.348	0.90	0.295
Report	0.99	0.103	0.92	0.272	0.97	0.182
Profitability	1.69	1.88	0.66	0.16	1.33	1.59
Size (billion $)	233.37	606.79	123.81	293.99	146.61	348.08

Table 6 shows the online corporate legitimacy data. For the year 2016, 29,772 posts from 43,883,907 fans were analysed. Of note and of outstanding relevance are the number of "likes", 15,957,315, which proved to be the most used interaction among the main options available in Facebook. This was much greater than the 812,772 comments and 2,805,527 sharing actions. [79] metrics display some interesting additional information. Almost 100% of the postings (96.63%) have been accepted (liked) by Facebook users (P1). To a lesser extent, 78.98% of all postings were disseminated through the action of sharing (V1), and only 64% of posts received a comment (C1). When calculating the metrics (Table 7), the previous hierarchy persists: greater interaction takes place through "Likes" (P2), 25,549 per post, followed by "Shares" (V2), 3,928 per post approximately, and finally "Comments" (C2), 619 per posting. Along the same line, if the number of fans (P3, C3, V3) is taken into account, popularity is still by far the most important dimension. Legitimacy (L), measured by simply adding the value of the last three metrics, determines the level of interaction reached by a firm with its fans. Most firms receive a valuation lower than 20, with an average of 7.18465, meaning that popularity makes up 72% of the total score. The absolute data reflects the same feature observed in the metrics: the predominance of simplicity (likes are preferred over shares, and shares over comments), since it is faster and easier to send a "like" or to share a post than to comment on it [79,99,100], and thus it is the preferred option for showing some level of engagement with the firm.

Having selected firms from only two regions and using the Kolmogorov–Smirnov test to confirm normality assumption, popularity, commitment and virality were further analysed using the t-Student test to see if there were further differences. Means of all the metrics for North American firms are not significantly different from those in Europe at p = 0.05 or better using a one-tailed student *t*-test, which allows the researchers to jointly analyse the legitimacy of all firms considered in the sample.

Table 6. Corporate actions, audience and interactions on Facebook (N = 146).

	Total	Min	Max	Mean	Standard Dev.
Number of Posts	29,772	1	584	203.92	156.228
Number of Fans	43,883,907	68	5,782,940	300,574.71	783,384.632
Number of Likes	15,957,315	3	4,292,266	109,296.68	395,814.723
Number of Shares	2,805,527	2	659,867	19,215.94	68,885.707
Number of Comments	812,772	0	104,048	5,565.02	14,440.834

Table 7. Corporate metrics of popularity, commitment, virality and legitimacy (N = 146).

	Metric	Min	Max	Mean	Standard Dev.
Popularity	P1	0.21752	1.00000	0.96629	0.11398
	P2	0.36253	25,549.20238	520.15631	2,177.22837
	P3	0.20875	64.705882	5.25588	8.20156
Commitment	C1	0.01208	1.00000	0.63696	0.31357
	C2	0.00000	619.333333	29.51013	81.29586
	C3	0.00000	9.66562	0.36034	1.13932
Virality	V1	0.01812	1.00000	0.78981	0.22172
	V2	0.01812	3,927.77976	88.78613	351.92247
	V3	0.02155	52.94117	1.56842	6.17198
Legitimacy	L	0.27698	121.56862	7.18465	14.23548

4.4. Correlation Analysis

A Pearson correlation matrix was completed to explore possible multicollinearity between the exogenous factors (Table 8). It also shows preliminary and surprising results for the dependent variable: four factors, namely carbon reduction target, CSR committee, CSR report and firm size exhibit negative and significant relationships with legitimacy. This test also reveals significant correlations between predictors. CCPs are positively correlated with CRT, the existence of a CSR committee, the publication of CSR reports, and size. Another interesting point is the negative relationship arising from the variables "Target" and "ΔEmissions", and the positive link between Target, CSR committee and CSR report. Although significant, all correlations do not affect the robustness of the model proposed, as seen in the variance inflation factors (VIF) shown in further Table 8.

Table 8. Correlation matrix (N = 146).

	1	2	3	4	5	6	7	8	9	10
Legitimacy (1)	1									
Policy (2)	0.001	1								
Target (3)	−0.218 ***	0.304 ***	1							
ICP (4)	0.080	0.025	−0.061	1						
Emissions (5)	−0.069	0.076	−0.021	0.104	1					
ΔEmissions (6)	0.020	−0.025	−0.149 *	0.025	−0.116	1				
Committee (7)	−0.189 **	0.281 ***	0.204 **	0.040	0.045	−0.001	1			
Report (8)	−0.316 ***	0.238 ***	0.201 **	0.007	0.096	0.038	0.194 **	1		
Profitability (9)	−0.042	0.002	−0.121	0.173**	−0.127	0.468 ***	−0.097	0.063	1	
Size (10)	−0.199**	0.193 **	0.110	0.170**	0.294 ***	−0.079	0.254 **	0.108	−0.258 ***	1

Note: significant at $p < 0.01$ ***; $p < 0.05$ **; $p < 0.1$ *.

Correlation analysis shows that CCPs are positively related to the existence of a CSR committee, confirming findings from previous research that firms that engage in sustainability strategies tend to appoint specific structures within the company to implement and control the global carbon strategy [37]. Related to this, CCP is also linked to size, implying that larger firms are more willing to establish a CCP and allocate specific resources to fulfil their carbon mitigation goals [101] and undertake a wider set of initiatives [38,57]. CCPs are also positively correlated with CRT and the publication of CSR

reports, confirming the findings of [8] signifying that firms committed to decreasing carbon emissions adopt the full set of minimum requirements to control the fulfilment of the established strategy and goals. Correlation results contradict the findings of Eleftheriadis and Anagnostopoulou [102], who do not detect an impact of emissions management practices on emissions performance.

The variables Target, CSR committee and CSR report are positively linked with each other, so perhaps CSR committees take all necessary measures to control the environmental issues and disclosure information on its performance, even though stakeholders may not perceive this. In summary, the results show a tendency for stakeholders to consider some data and dismiss others. Those mixed results could be due to: (1) the complexity of carbon-related data; (2) the diversity and heterogeneity of stakeholders; (3) the lack of mandatory guidelines; and (4) firm inconsistency.

5. Results and Discussion

According to the multiple regression analysis (Table 9), the explanatory ability of the model results in a moderate adjustment (21.1%) with six of the proposed variables making significant contributions. Companies using an internal carbon price and disclosing its value (H3), within a CCP framework (H1), gain more support from their stakeholders via social media, since this signals a commitment to anticipate climate-related future risks and to foster transparency [32,96].

Table 9. Regression results (N = 146).

	Unstand. Coefficients	Std. Error	t	VIF
(Constant)	59.937	16.982	3.529 ***	
Policy	19.511	8.418	2.318 **	1.221
Target	−6.477	3.031	−2.137 **	1.185
ICP	3.941	2.302	1.712 *	1.103
Emissions	−1.288E-8	0.000	−0.271	1.127
ΔEmissions	4.234	5.600	0.756	1.323
Committee	−5.869	3.984	−1.473	1.178
Report	−21.097	6.294	−3.352 ***	1.121
Profitability	−1.530	0.827	−1.850 *	1.477
Size	−1.667	0.683	−2.440 **	1.307
R-squared			0.211	
Durbin–Watson			1.914	

Significant at: $p < 0.01$ ***; $p < 0.05$ **; $p < 0.1$ *.

Mixed results derive from the regression analysis. Most factors exhibit a significant relationship with legitimacy, with the exception of the emission-related variables (as hypothesized in H4 and H5) and the CSR committee (thus rejecting H6). Two factors exhibit negative links, namely carbon reduction targets and CSR reports, leading to a rejection of H2 and H7. As expected, the existence of a CCP (H1) and the disclosure of the internal carbon price (H3) exert a positive influence on legitimacy.

Establishing a CCP is perhaps the main clue that a company is truly committed to sustainability, incorporating environmental practices into its internal processes and even its organizational culture [55]. Having a CCP implies that there exists at least some degree of coordination and that the initiatives performed effectively to contribute to the carbon mitigation goals. For this reason, stakeholders consider that a CCP creates value in sustainability terms (H1). In fact, stakeholder perception of corporate carbon mitigation efforts depends on the perceived utility of sustainable investments and their integration into the business strategy [103]. However, it seems that for stakeholders, it is not the existence of a CCP that is of utmost importance, but rather the lack of a CCP that sends a signal that the firm does not care about climate issues or risks and this in turn compromises future corporate performance [51].

The link between legitimacy and carbon price is also positive and significant (H3), meaning that disclosing the use of an internal price of carbon has a positive effect on legitimacy. This information

could be considered both sensitive and innovative. In the process of anticipating future climate risks, firms estimate the cost of their carbon emissions, assuming that in the future they will presumably face outflows of money in the form of taxes or carbon allowances to compensate for the pollution emitted [104,105]. Furthermore, only firms engaged in CDP have disclosed the use of an internal carbon price, so by publishing this exclusive data, firms are signalling to stakeholders their commitment to anticipate future climate-related risks, and thus attaining higher levels of social media engagement.

According to the results, setting a CRT exerts a negative influence on stakeholders (H2) who will then withdraw social media support. Although results show that CCPs are positively correlated with CRT (that is, a CCP usually involves setting specific carbon mitigation targets), it is difficult for some groups of stakeholders to discern whether such targets are realistic or the degree of compliance reached. As stated by Papagiannakis et al. [103], the mere introduction of CRT is not enough for the heterogeneous groups of stakeholders to grant their support. Interestingly, a negative relationship arises from the variables "Target" and "ΔEmissions", so those companies prone to setting a numerical objective of carbon reduction have a greater chance of achieving their goals [106].

As hypothesized, neither carbon emissions volumes (H4) nor their decrease from the previous year (H5) exhibit any relationship with legitimacy. One possible reason is that to confirm that targets are met stakeholders would need to look at the previous year's data and check if the accomplishment has been achieved. Such a level of effort does not seem worth their while in order to grant or withdraw their social media support, and contrary to Reilly and Hynan [107], legitimacy is not affected. Another explanation involves the volume of carbon emissions: firms with higher levels of GHG emissions tend to not promote such information since it can damage their reputation and stock market valuation, but the damage caused increases if such information is not disclosed [62,107]. Hence, there is an incentive to disguise carbon figures, and stakeholders are aware of the risk that the disclosed figures may not truly reflect the carbon performance of companies. In fact, the most polluting companies are always under scrutiny, and disclosing and disseminating positive environmental results arouses suspicion and the risk of being labelled as "greenwashers" [108]. The diversity of stakeholders is another possible motive. While some groups (mainly investors) perceive carbon emission disclosure as informationally valuable [109], others consider such information as incomplete [110], too complex or symptomatic of potential costs not fully addressed [9], and thus react negatively.

Having a CSR committee, another sign of true commitment to sustainability, is surprisingly not significant (H6). A stand-alone sustainability board is thought to "be in a better position to address environmental issues from the perspective of opportunities and commitments to stakeholders" [12], but according to the results of this study, stakeholders fail to recognize its relevance. Similarly, publishing CSR reports does not enhance legitimacy (H7), rather the contrary. While they are currently an acceptable way to disseminate such data, CSR reports are not exempt from criticism for many reasons: (1) no consensus exists on what standards or metrics should be used, and a growing number of organizations try to fill this gap, such as the GRI [111]; (2) sustainability reporting provides firm-biased, low-quality information, and therefore lacks credibility [92]; (3) they are aimed at a few stakeholders, mainly financial analysts and NGOs, which intensively analyse the information provided to grant or withdraw support [112]. Standardized reporting is particularly useful for financial stakeholders but could be puzzling or meaningless for non-financial not specialized stakeholders, such as clients. So, stakeholders search for other sources of information with the potential to depict the actual behaviour of the company, not only regarding sustainability but with regard the whole behaviour of the firm. Another possible explanation is that, as firms increasingly present sustainability reports, this stops being a distinctive competitive advantage, and the added value of the information disclosed remains only for those stakeholders who have the knowledge to draw conclusions from these reports, so stakeholders participate more with those more social media-active firms. Furthermore, stakeholders legitimate firms not only for the quantitative information disclosure, but also for the initiatives, actions and outcomes of such initiatives that firms publicize in social media, which it is perceived as a signal of environmental commitment. If companies only rely on disclosing (mandatory or not) quantitative

structured data to show their advances in carbon mitigation, it may signal to stakeholders that such companies are only concerned about looking "green" rather than being sustainable [113,114].

6. Conclusions, Limitations and Suggestions

Stakeholders are increasingly worried about how companies face climate risks by setting carbon mitigation policies and how these policies are embedded into the corporate sustainability and global strategy. In fact, regulatory and stakeholder pressure, and not economic reasons, have been identified as the main drivers forcing companies to integrate sustainability into their global strategy [24,115]. Stakeholders must be aware of corporate activities to manage carbon issues properly, as it is one of the many sources of information for conceding legitimacy. Under the threat of losing legitimacy, firms react by engaging in sustainable initiatives and disclosing their environmental performance.

This research takes carbon and sustainability information from the CDP 2016 report on European and North American participants to analyse how such data contribute to create corporate legitimacy. The results are summarized as follows. First, holding a CCP and disclosing an internal carbon price are significantly and positively linked to legitimacy. These factors are critical in anticipating future carbon-linked issues, and signal to stakeholders a firm's real commitment not only with carbon mitigation, but also with the long-term viability of the company [8,60,61]. Second, the relationship between setting a target and having a CSR report with legitimacy is significant and negative, that is, stakeholders perceive such factors as a mere way to "look green". Companies are tempted to misuse carbon information to promote a greener image [32] and reach legitimacy, rather than engaging in costly sustainability initiatives [115], especially if they are bad environmental performers [14] or their legitimacy is threatened [17,116]. Third, data on emissions and having a CSR are factors not related to legitimacy [62,63], which can be explained by the diversity of needs, expectations and access to information of stakeholders [117], the different relevance of some data varies from one group to another [118], or the inherent biases exhibited by stakeholders, which lead them to filter or skim relevant information [119,120]. Summing up, the match between what the company says and does is truly relevant. Stakeholders try to distinguish between a mere sustainable posture based on smoke and mirrors and a true commitment to sustainability, which in turn enhances or damages corporate legitimacy [28,29].

Researchers and practitioners may find useful the findings of this study. From the theoretical point of view, it contributes to extend the literature on legitimacy theory, and allows researchers to move forward with regard to the influence of CCP and that of the dissemination of carbon information on stakeholders' decisions to grant or withdraw corporate legitimacy. It also provides a new approximation to measure legitimacy, considering a new stream of research that focuses on the benefits of using social media engagement. For practitioners, effective management of social media is essential to achieve higher levels of legitimacy. Identifying which data exerts a greater influence on stakeholders is key to improving legitimacy. It is also important that firms reciprocate and show commitment to their stakeholders, improving their interaction with users and responding quickly to their comments, thus enhancing the corporate image and reputation and, in doing so, reaching legitimacy. However, two major issues are emerging that challenge legitimacy, impeding that the CSR data disseminated through social media is of equal use to all stakeholders. First, companies disseminate CSR information in an unstructured way, hindering the necessary homogeneity to compare data from different sources. Secondly, as the Securities and Exchange Commission [121] pointed out, social media can take the form of different platforms, so companies should advise stakeholders that relevant information is being disseminated via new channels and make them aware of important disclosures, such as registering or subscribing.

This research is not exempt from limitations that could lead to improvements of this work. First, the sample is based on respondents of the CDP annual survey, which is enlarged in terms of the number of participants with every version. However, other initiatives (even analyses of CSR reports) could be considered to extend the research. Second, in order to guarantee homogeneity, the study

has been limited exclusively to companies headquartered in Europe, the United States and Canada. Nonetheless, other regions are included in the CDP annual survey, so this work could be extended to include these. A third limitation is the dummy nature of most of the external variables, being necessary to incorporate more continuous variables and external cutting. Fourth, and regarding the period of study, this one-year research, although quite robust, could be extended to include a wider period to provide a greater vision of how online participation varies over time. Additionally, as stated by Meixner et al. [122], not all internal and external stakeholders are reachable via social media, and this could have represented a major bias in measuring corporate legitimacy through social media stakeholder engagement. Finally, a major limitation is that all Facebook posts have been considered to measure legitimacy, not only CSR-based posts, so we were not able to measure a specific component of legitimacy: sustainability legitimacy. Analysing only posts mentioning sustainability issues could yield interesting results.

Further improvements could come from many different approaches. A deeper analysis of the relationship between establishing a CCP and the evolution of carbon-related data could be performed over several years, including the influence that meeting the goals could exert on different measures of profitability. Adding new carbon variables is also proposed, as well as new proxies to corporate legitimacy. Clustering stakeholders (even getting data from other specialized social media networks such as LinkedIn), since heterogeneity is probably the main cause of the negative or non-existent impacts obtained [24], or clustering firms depending on their sustainability strategy [38] or their pollution intensity [108], would provide new opportunities to extend this research. Although industry did not prove to be a significant variable, results could change if other regions were considered or if time-series data were part of the analysis. Previous works have examined the link between stakeholder pressure and CCP on environmental performance, so linking this perspective with that posited in this work, that is, an analysis of the complete effect of all three variables (stakeholder pressure, environmental performance and legitimacy) could provide new insights. Finally, given that CSR information disclosure is now mandatory in Europe but not in the USA and other countries, an opportunity arises to check differences in corporate legitimacy between these two different frameworks.

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Appendix A

Table A1. Firms included in the study.

European companies (N = 94)					
Company	**GICS Sector**	**Country**	**Company**	**GICS Sector**	**Country**
A2A	Utilities	Italy	J Sainsbury Plc	Consumer Staples	United Kingdom
Abengoa	Industrials	Spain	JCDecaux SA	Consumer Discretionary	France
ACCIONA S.A.	Utilities	Spain	JD Sports Fashion	Consumer Discretionary	United Kingdom
Air France—KLM	Industrials	France	Kering	Consumer Discretionary	France
AkzoNobel	Materials	Netherlands	Kingspan Group PLC	Industrials	Ireland
Anglo American	Materials	United Kingdom	Koninklijke KPN NV	Telecom Services	Netherlands
Arçelik A.S.	Consumer Discretionary	Turkey	Lundin Petroleum	Energy	Sweden
Atos SE	Information Technology	France	Magyar Telekom Nyrt.	Telecom Services	Hungary
Aviva plc	Financials	United Kingdom	Marks and Spencer Group plc	Consumer Discretionary	United Kingdom
Balfour Beatty	Industrials	United Kingdom	Marshalls	Materials	United Kingdom
Banco Popular Español S.A.	Financials	Spain	Michelin	Consumer Discretionary	France
Barclays	Financials	United Kingdom	MOL Nyrt.	Energy	Hungary
BASF SE	Materials	Germany	Mondi PLC	Materials	United Kingdom
BMW AG	Consumer Discretionary	Germany	Morgan Advanced Materials	Industrials	United Kingdom
BNP Paribas	Financials	France	National Grid PLC	Utilities	United Kingdom
Bouygues	Industrials	France	Nestlé	Consumer Staples	Switzerland
BP	Energy	United Kingdom	Nordea Bank	Financials	Sweden
BT Group	Telecom. Services	United Kingdom	Novartis	Health Care	Switzerland
CaixaBank	Financials	Spain	Piraeus Bank	Financials	Greece
Carlsberg Breweries A/S	Consumer Staples	Denmark	PUMA SE	Consumer Discretionary	Germany
Carrefour	Consumer Staples	France	Renault	Consumer Discretionary	France
Centrica	Utilities	United Kingdom	Renishaw	Information Technology	United Kingdom
Commerzbank AG	Financials	Germany	Royal DSM	Materials	Netherlands

Table A1. *Cont.*

European companies (N = 94)					
Credit Suisse	Financials	Switzerland	Royal Dutch Shell	Energy	Netherlands
Crest Nicholson PLC	Consumer Discretionary	United Kingdom	Saint-Gobain	Industrials	France
Danone	Consumer Staples	France	SAS	Industrials	Sweden
Danske Bank A/S	Financials	Denmark	Severn Trent	Utilities	United Kingdom
Deutsche Bank AG	Financials	Germany	Snam S.P.A.	Utilities	Italy
Domino's Pizza Group plc	Consumer Discretionary	United Kingdom	Societe Generale	Financials	France
EDF	Utilities	France	Solvay S.A.	Materials	Belgium
Enagas	Utilities	Spain	Spire Healthcare	Health Care	United Kingdom
Endesa	Utilities	Spain	Statoil ASA	Energy	Norway
ENEL SpA	Utilities	Italy	Stora Enso Oyj	Materials	Finland
ENGIE	Utilities	France	SUEZ	Utilities	France
Eni SpA	Energy	Italy	T.Garanti Bankasi A.S.	Financials	Turkey
Ferrovial	Industrials	Spain	Terna	Utilities	Italy
Fortum Oyj	Utilities	Finland	ThyssenKrupp AG	Materials	Germany
Galp Energia SGPS SA	Energy	Portugal	Total	Energy	France
Gas Natural SDG SA	Utilities	Spain	Travis Perkins	Industrials	United Kingdom
Glencore plc	Materials	Switzerland	Unilever plc	Consumer Staples	United Kingdom
Groupe Eurotunnel	Industrials	France	United Utilities	Utilities	United Kingdom
HeidelbergCement AG	Materials	Germany	VEOLIA	Utilities	France
Hill & Smith Holdings	Materials	United Kingdom	Verbund AG	Utilities	Austria
Iberdrola SA	Utilities	Spain	Vodafone Group	Telecom Services	United Kingdom
Inditex	Consumer Discretionary	Spain	Volkswagen AG	Consumer Discretionary	Germany
Int. Cons. Airlines Group, S.A.	Industrials	Spain	Whitbread	Consumer Discretionary	United Kingdom
North American companies (N = 52)					
Company	**GICS Sector**	**Country**	**Company**	**GICS Sector**	**Country**
Adobe Systems, Inc.	Information Technology	United States	Encana Corporation	Energy	Canada
Aimia Inc.	Consumer Discretionary	Canada	Eversource Energy	Utilities	United States

Table A1. *Cont.*

European companies (N = 94)					
Air Canada	Industrials	Canada	Exxon Mobil Corporation	Energy	United States
Ameren Corporation	Utilities	United States	General Electric Company	Industrials	United States
ARC Resources Ltd.	Energy	Canada	General Motors Company	Consumer Discretionary	United States
Archer Daniels Midland	Consumer Staples	United States	Goldman Sachs Group Inc.	Financials	United States
Autodesk, Inc.	Information Technology	United States	Hess Corporation	Energy	United States
Bank of Montreal	Financials	Canada	Hormel Foods	Consumer Staples	United States
Barrick Gold Corporation	Materials	Canada	Monsanto Company	Materials	United States
Biogen Inc.	Health Care	United States	NRG Energy Inc.	Utilities	United States
BNY Mellon	Financials	United States	Ormat Technologies Inc	Utilities	United States
Campbell Soup Company	Consumer Staples	United States	Owens Corning	Industrials	United States
Canadian Natural Resources Limited	Energy	Canada	Parker-Hannifin Corporation	Industrials	United States
Capital Power Corporation	Utilities	Canada	PG&E Corporation	Utilities	United States
Cenovus Energy Inc.	Energy	Canada	Rogers Communications Inc.	Telecom Services	Canada
Chevron Corporation	Energy	United States	Stanley Black & Decker, Inc.	Industrials	United States
ConocoPhillips	Energy	United States	Suncor Energy Inc.	Energy	Canada
Covanta Energy Corporation	Industrials	United States	Teck Resources Limited	Materials	Canada
Cummins Inc.	Industrials	United States	Tennant Company	Industrials	United States
Dean Foods Company	Consumer Staples	United States	The Dow Chemical Company	Materials	United States
Delta Air Lines	Industrials	United States	TransAlta Corporation	Utilities	Canada
DTE Energy Company	Utilities	United States	TransCanada Corporation	Energy	Canada
Duke Energy Corporation	Utilities	United States	Walt Disney Company	Consumer Discretionary	United States
E.I. du Pont de Nemours and Company	Materials	United States	Waste Management, Inc.	Industrials	United States
Eastman Chemical Company	Materials	United States	WEC Energy Group Xcel Energy Inc.	Utilities	United States
EMC Corporation	Information Technology	United States	Wells Fargo & Company	Financials	United States

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