

BOARDS OF DIRECTORS AND FIRMS' ENVIRONMENTAL PROACTIVITY

Francesco Calza *, Giorgia Profumo **, Ilaria Tutore *

* Department of Business Management, University of Naples "Parthenope", Italy

** Corresponding author, Department of Economics and Business Studies, University of Genoa, Italy

Contact information: Via Vivaldi 5, 16126 Genova, Italy



Abstract

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The present paper advances knowledge on the antecedents of firms' environmental proactivity, assessing the explanatory power of corporate governance issues. In particular, our aim is to explore the relationship between board structure and firms' proactive environmental strategies, within the agency theory and resource dependence theory frameworks, in order to outline if particular types of board members could represent a stimulating driver for firms' environmental proactivity. The theoretical analysis is completed by an empirical investigation, performed by two linear regression models, on a sample of European firms, belonging to different polluting industries that were included in the Carbon Disclosure Project questionnaire 2014. The industry choice is related to the increasing pressure for better environmental performance that polluting industries are nowadays experiencing because of stakeholders and legislation requests. The results show that board structure and composition matters in firms' environmental proactivity and have implications for managers, shareholders, and regulators who are interested in influencing firms' environmental proactivity.

Keywords: Environmental Proactivity, Board of Directors, Carbon Disclosure Project, Polluting Industries

1. INTRODUCTION

Antecedents of environmental proactivity are an increasingly important area of study for management scholars. In recent years, in fact, it has become evident that the success of a business is no longer defined only by monetary gains but also by the impact that the activities of an organization have on society as a whole. Achieving sustainability is, therefore, one of the most relevant challenges for society and firms.

In particular, companies may play a crucial role in order to reduce the global environmental impact of the present society (Carballo-Penela and Castromán-Diz, 2015); that's why the commitment to the natural environment has become an important variable within the current competitive scenarios (Gonzales-Benito and Gonzales-Benito, 2006) and environmental performance is increasingly considered a strategic issue for firms. This is particularly true for firms belonging to polluting industries which are more and more forced to change their attitude towards green issues (Bansal, 2005; Sharma and Enriques, 2005): the emerging

consumers' preference for greener products and services, together with the pressure operated by stringent governmental regulations and by stakeholders (Kassinis and Vafeas, 2006) and media are, in fact, requesting corporate managers to adopt better environmental behaviors (Kock *et al.*, 2012).

These behaviors, in particular, may range in a continuum between two extreme positions (Gonzales-Benito and Gonzales-Benito, 2006): a passive, or reactive, strategy, by which companies decide to perform only the necessary actions in order to meet regulatory requirements; a proactive conduct, specific of firms that voluntarily introduce policies and actions to prevent or decrease their impact on the natural environment.

As there is a growing evidence that a proactive environmental strategy may help firms to gain competitive advantage, such strategy, and in particular its drivers and impact on business performance, has been an object, in the last few years, of an ongoing debate (Russo and Fouts, 1997; Aragon-Correa and Sharma, 2003; Menguc *et al.*, 2010; Delmas *et al.*, 2011).

The Organizations and Natural Environment literature has, in fact, extensively developed on the drivers of firms' proactive environmental strategies, focusing on a variety of antecedents, such as: regulation (Ambec and Lanoie, 2008), stakeholder pressure (Henriques and Sadorsky, 1999), firm's ethical attitude (Bansal and Roth, 2000), industry structure (Claver *et al.*, 2007), geographic location, company's size, its position in the value chain (Gonzales-Benito and Gonzales-Benito, 2006) or the perception of new business opportunities (Bansal and Roth, 2000). A few studies have recently explored the influence of corporate governance mechanisms on firms' environmental performance and proactivity (Berrone and Gomez-Mejia, 2009; Earnhart and Lizal, 2006; Kock *et al.*, 2012; Ortiz-de-Mandojana *et al.*, 2012; Wu *et al.*, 2012a; Wu *et al.*, 2012b; Ortiz-de-Mandojana and Aragon-Correa, 2013; Calza *et al.*, 2016), trying to understand if there are mechanisms that may influence managers towards green practices, but the relationship between corporate governance, in particular board structure and composition, and firms' environmental proactivity has not been sufficiently investigated and the debate is still open. The few studies on the issue have provided fragmented and contradictory empirical evidence that makes theory building difficult (Walls *et al.*, 2012).

The present paper wants to contribute to the extant literature by analyzing the relationship between corporate board's structure and firm's environmental proactivity, in order to visualize if some types of directors (non-executive directors, independent directors or female directors) or particular features of the board (size and one tier or two tier system) could act as a stimulating driver for firms' proactive environmental strategies.

Using a sample of European firms belonging to polluting industries that responded to the Carbon Disclosure Project (CDP) 2014, this study highlights the importance of a firm's board in the development of companies' proactive environmental conducts, contributing to the understanding of the antecedents of such strategies in several ways.

Firstly, it focuses the attention on the understanding of the relationship between board structure and composition and firms' environmental proactivity, while most of the extant studies examined the linkage with environmental performance (Ortiz-de-Mandojana and Aragon-Correa, 2013; Walls *et al.*, 2012; de Villiers *et al.*, 2011). Moreover, while most of the studies investigating this issue are focused on Anglo-Saxon countries, in particular US (Berrone and Gomez-Mejia, 2009; de Villiers *et al.*, 2011; Kock *et al.*, 2012; Ortiz-de-Mandojana and Aragon-Correa, 2013; Cowden *et al.*, 2015; Post *et al.*, 2015) or single developing countries (Meng *et al.*, 2013; Earnhart and Lizal, 2006), our analysis is focused on companies belonging to different European non Anglo-Saxon countries (in particular France, Italy, Spain, Portugal, Austria and Switzerland).

Finally, as our measure of environmental proactivity covers other countries all over the world, our findings on the relationship between firms' board and PESs may have implications in other countries and could stimulate future comparative analyses.

The remainder of the paper is organized as follows: the next section reviews prior studies on the drivers of firms' proactive environmental strategies and, in particular, the relationship between corporate board structure and environmental proactivity, and it develops the research hypotheses. Section 3 presents the data and the adopted methodology. Section 4, instead, develops the descriptive statistics and the results of the analysis, together with a formal discussion of the implications of the results. Lastly, in the final part of the paper, the main findings and limitations of the study are summarized.

2. BOARDS OF DIRECTORS AND FIRMS' PROACTIVE ENVIRONMENTAL STRATEGIES: CONCEPTUAL FOUNDATIONS AND RESEARCH HYPOTHESES

The Organizations and the Natural Environmental scholars (Berry and Rondinelli, 1998; Sharma and Vredenburg, 1998) defined proactive environmental strategies (PES) as the reduction of a firm's environmental impact and the management of the relationship between business and nature beyond imposed compliance (Sharma, 2000; Aragon-Correa and Sharma, 2003; Gonzales-Benito and Gonzales-Benito, 2006). Thus, a firm that adopts a PES is trying to anticipate future regulations and trends, designing and managing new and alternative operations, processes, and products in order to prevent (instead of simply correct) negative environmental impacts (Aragon-Correa and Sharma, 2003).

A proactive environmental strategy may be ideally seen as the last stage of a firm's environmental efforts (Hunt and Auster, 1990) and it is usually characterized by the presence of four basic elements: (a) regulatory proactivity, (b) operational improvements, (c) organizational changes, and (d) environmental reporting (Delmas *et al.*, 2011). In other words, a proactive environmental strategy is not just a firm's reaction to regulation, but it implies the adoption of advanced environmental oriented organizational systems and measures in all management decision areas (Gonzales-Benito and Gonzales-Benito, 2006). Menguc *et al.* (2010) defined, in particular, a PES a construct that is composed of two dimensions: pollution prevention and management support of natural environmental issues.

Several studies have recognized that the introduction of environmental proactivity may be used by companies to gain competitive advantage toward competitors, enhancing their position in the market and developing the resources and capabilities in order to build a long-term profit potential (Bansal and Roth, 2000; Buysse and Verbeke, 2003; Aragon-Correa and Sharma, 2003). Firms with high environmental performance may, in fact, reduce operating costs, improve access to resources and take advantage of market opportunities created by an increasing demand for environmentally friendly goods and services (Berrone and Gomez-Mejia, 2009).

Consequently, a number of scholars from different fields of study, have tried to identify and analyze the drivers that may encourage a company to develop and sustain its environmental proactivity, together with its environmental performance.

Prior studies have classified environmental drivers in organizational, or internal, and contextual, or external (Ghobadian *et al.*, 1998; Gonzales-Benito and Gonzales-Benito, 2006; Claver *et al.*, 2007). Essentially, environmental regulation (Ambec and Barla, 2006; Bansal and Roth, 2000; Majumdar and Marcus, 2001) and stakeholder pressure (Buysse and Verbeke, 2003; Henriques and Sadosky, 1999; Garcés-Ayerbe *et al.*, 2012) represent the external factors, while companies' structural features, together with organisational resources and capabilities (Hunt and Auster, 1990; Gonzales-Benito and Gonzales-Benito, 2006), managerial attitude and motivation (Fernández *et al.*, 1996; Hunt and Auster, 1990), leadership capability (Azzone and Noci, 1998) and intellectual capital (Claver *et al.*, 2007) constitute the internal ones, all moderated by the presence and strength of ethical attitude (Husted, 2005).

Among the internal drivers, a recently growing stream of literature has examined the linkages between corporate governance issues and firms' PES, challenging the role of ownership structure as well as board composition, but the few studies on the issue have provided contradictory results and the relationship should be further exploited. A more developed literature is focused on the effects of corporate governance issues on corporate social responsibility and performance (Johnson and Greening, 1999; Dam and Scholtens, 2012; Fernandez Sanchez *et al.*, 2011; Ibrahim and Angelidis, 1995; Setò-Pamies, 2015), but in these studies the environment represents only a single dimension of the complex nature of CSR, leading the researchers to narrow the attention on environmental issues.

Most of the papers have their roots in the agency problem caused by the separation between management and ownership (Jensen and Meckling, 1976; Shleifer and Vishny, 1997) and are focused on "how some corporate governance mechanisms resolve the divergence of interests between firm owners (principal) and managers (agent) with respect to environmental practices" (Kock *et al.*, 2012, p. 493): in particular, the presence of blockholders or other types of owners (family members, state and market ownership, institutional ownership) (Berrone *et al.*, 2010; Craig and Dibrell, 2006; Darnall and Edwards, 2006; Earnhart and Lizal, 2006; Habbash, 2015; Calza *et al.*, 2016), executive compensation (Berrone and Gomez-Mejia, 2009; Cordeiro and Sarkis, 2008), the market for corporate control (Kock *et al.*, 2012), the composition of the board of directors (de Villiers *et al.*, 2011) and equity based incentive plans (Kock *et al.*, 2012).

As regards, in particular, the relation between boards and firms' environmental proactivity, we tried to summarize the most relevant studies on the issue in Table 1.

As reported in Table 1, the debate on board structure, composition and ties as potential drivers of firms' environmental issues is still open, with most of the studies focused on Anglo-Saxon countries, in particular U.S. (de Villiers *et al.*, 2011; Kock *et al.*, 2012; Ortiz-de-Mandojana and Aragon-Correa, 2013; Cowden *et al.*, 2015; Post *et al.*, 2015) and on environmental performance and disclosure, instead on firms' environmental proactivity.

Kassinis and Vafeas (2002) found, in particular, that board size and the presence of executive members on the board are positively related to environmental litigations, while Kock *et al.* (2012) reported a positive association between the environmental performance of a firm and the presence of pro-stakeholder directors in the board. A direct relationship was also found in case of presence of independent directors, legal experts and board size (de Villiers *et al.*, 2011).

Post *et al.* (2015) reinforced the previous results finding a positive relationship between the representation of women and independent directors on a firm's board and sustainability-themed alliances. Such alliances, in turn, positively contribute to corporate environmental performance. In the same direction, the analysis of Rao *et al.* (2012) found a significant positive relationship between the extent of environmental reporting and the proportions of independent and female directors on a board.

Few studies have also focused on the board's ability to create ties and relations with the external environment through board interlocks. The influence of director interlocks on the value generated by the social capital of the board may, in fact, improve corporate environmental performance (Ortiz-de-Mandojana and Aragon-Correa, 2013). Ortiz-de-Mandojana *et al.* (2012), in particular, reported that board interlocks may enhance or inhibit the adoption of PES: director interlocks with firms providing knowledge-intensive business services are beneficial for the adoption of PES, while those with fossil fuel suppliers and financial institutions are found to be negatively related. Moreover, such mechanisms seem also positively connected with environmental performance, especially when a firm is linked to a larger parent company and in cases of low and high levels of interlock diversity (Ortiz-de-Mandojana and Aragon-Correa, 2013).

As Hillman and Dalziel (2003) and de Villiers *et al.* (2011) pointed out, the resource dependence theory and the agency theory may provide the general theoretical frameworks for analysing how the size and the composition of the board can affect firms' environmental proactivity. Boards, in fact, have usually different functions (Gabrielsson and Huse, 2005), namely: providing information and other resources (asserted by the resource dependence theorists) and monitoring the management and aligning its interests to those of shareholders (followed by the agency theorists). Integrating the two perspectives will contribute to a complete understanding of how they may affect firms' proactive environmental strategies and "can help overcome current myopia within the two streams of research" (Hillman and Dalziel, 2003, p.383).

Table 1. Overview of the studies on the relationship between board of directors and firms' environmental issues

<i>Corporate Governance Issue</i>	<i>Study</i>	<i>Theory</i>	<i>Independent Variables</i>	<i>Dependent Variable(s)</i>	<i>Sample</i>	<i>Relationship</i>
Board	de Villiers <i>et al.</i> (2011)	Agency theory and Resource Dependence theory	Director independence, CEO-chair duality, directors appointed after CEO, CEO-director ownership, inside and outsider director ownership	Environmental performance (number of KLD environmental strengths)	2,151 observations from 1,216 firms on KLD Database	+/-/0
Board	Cowden <i>et al.</i> (2015)	Resource Dependence theory	Green corporate human capital, green regulatory human capital, green relational capital, cumulative green board capital	Environmental performance (number of KLD environmental strengths)	1,461 board members from 143 U.S. firms selected from the Standard & Poor's 500 list	+/0
Board	Post <i>et al.</i> (2015)	Upper Echelons theory, Resource Dependence theory	Women directors, independent directors (with the mediating role of sustainability-themed alliances)	Environmental performance (annual changes in the KLD indicators of a firm's environmental strength)	36 U.S. oil and gas firms that were listed in the 2009 Forbes.com Special Report, The Global 2000	+
Board	Kassinis and Vafeas (2002)	Stakeholder theory	Board size, director affiliation, director reputation, inside ownership and outside stakeholder pressure	Environmental litigations	362 firms out of which 209 with environmental violations	+/-
Board	Ben-Amar and McIlkenny (2015)	Agency theory	Board effectiveness	Voluntary Climate Change Disclosure	559 Canadian firm (included in the CDP questionnaire) year observations	+
Board	Li <i>et al.</i> (2017)	Upper Echelons theory	Board gender diversity (measure of Teachman, 1980), moderated by PLC of the industry	Environmental policy (KLD database)	865 publicly listed firms on the NYSE (U.S.)	+
Board/management	Walls and Hoffman (2013)	Behavioral governance approach	Environmental experience of the board, board network centrality	Positive environmental deviance (based on KLD data)	Unbalanced panel data set of 294 U.S. listed firms from 2000 to 2008, for a total of 1,881 observations	+/-
Board/management	Kock <i>et al.</i> (2012)	Stakeholder theory and Agency theory	Presence of stakeholders on the board, equity-based managerial incentives, market for corporate control, legal and regulatory system	Environmental performance (firm's amount of waste released - IRRC data)	568 observations from 337 U.S. firms	+/-
Board/management	Ortiz-de-Mandojana <i>et al.</i> (2012)	Resource Dependence theory	Director interlocks (with environmental green equipment suppliers, firms providing knowledge-intensive services, financial institutions, and fuel suppliers)	Firm's adoption of Proactive Environmental Strategies (PESs)	90 investor-owned U.S. electric utilities	+/-/0
Board/management	Ortiz-de-Mandojana and Aragon-Correa (2013)	Resource Based View (RBV) and Contingency Perspective of the social capital theory	Director interlocks (moderated by firm's business proactivity, size of parent company), industry's diversity interlock ties	Environmental performance (derived from the Global Warning Potential GWP- of the firm emissions)	93 investor-owned U.S. electric firms	+/0
Board/ownership	Rao <i>et al.</i> (2012)	Agency theory	Independent non-executive directors, female directors, board size, institutional investors, firm's independence (BVD factor)	Environmental disclosure	96 Australian listed companies	+/0
Board/ownership/management	Walls <i>et al.</i> (2012)	Fact-based exploratory study	Institutional ownership, investment turnover, shareholder activism and concentration, board independence, environmental committee, board diversity, board size, CEO duality, managerial control, CEO compensation	Environmental performance (using KLD dataset)	313 Standard & Poor's 500 firms (2,002 firm-years)	+/-/0

The resource dependence theory (Pfeffer, 1972; Pfeffer and Salancik, 1978) views organisations as operating in an open system and needing to exchange and acquire certain resources to survive, creating a dependency between firms and external environment. In this framework, boards are positively seen, as they may provide valuable expertise and capabilities, influence and aid in strategy formulation and help in connecting the firm with stakeholders (Ortiz-de-Mandojana and Aragon-Correa, 2013). Pfeffer and Salancik (1978), in particular, asserted that boards may provide four benefits: advice and counseling, legitimacy, channels of communication with the external organizations and preferential access to outside elements.

In this way, larger boards, with a variety of directors, may expand existing board member networks and contacts and help firms to better understand and respond to their stakeholders (Boyd, 1990), also in case of natural environmental issues. Boards with a high number of members, in fact, are more likely to include experts on specific topics such as environmental issues (de Villiers *et al.*, 2011), that could provide the expertise to manage green subjects and take advantage of environmental opportunities that may arise.

Therefore, following the results of de Villiers *et al.* (2011), that showed how environmental performance tends to be higher in firms with larger boards, we hypothesize that:

H1: Larger boards are positively related to firms' environmental proactivity.

Within the resource dependence theory, diversity in general, and differences in gender in particular may very likely enrich the resources and capabilities of a board, producing unique information available to management for better decision making. The more diverse a board is, the wider the variety of perspectives, the broader the knowledge and expertise, and the greater the access to different networks (Post *et al.*, 2015).

One considerably debated characteristic of board diversity is gender. Female directors are, in fact, likely to have different educational and professional backgrounds from those of male directors, bringing different perspectives to the board (Hillman *et al.*, 2002). In addition, women on boards tend to be more democratic and participative in decision-making processes, leading the board to achieve better decisions (Bear *et al.*, 2010).

A large body of research suggests that women's values are more closely aligned than men's with corporate social responsibility (Zhang *et al.*, 2013; Setò-Pamies, 2015) and, as corporate directors, they tend to possess certain psychological characteristics that may make them more sensitive to different stakeholders' claims. According to Ibrahim and Angelidis (1994), female directors exhibit greater responsibilities: in their analysis, they found that women are more philanthropically driven and less concerned with economic performance. Environmental, ethical, and caring values are likely to affect the decision-making process when women assume the power positions usually held by men (Post *et al.*, 2015).

Following the studies on CSR, some researchers found out that women have a more protective attitude towards the environment (Wehrmeyer and McNeil, 2000) and are more likely than males to be

ecologically conscious (Park *et al.*, 2012); subsequently, corporations with a higher proportion of women in the board showed better environmental performance (Walls *et al.*, 2012; Post *et al.*, 2015; Li *et al.*, 2017) and higher levels and quality of environmental reporting (Rao *et al.*, 2012).

Therefore, following the extant literature on the theme, we hypothesize that:

H2: A higher percentage of women on the board is positively related with firms' environmental proactivity.

Following the agency theory framework, the board of directors is an internal control mechanism used to ensure that management behaviour is consistent with the owners' interests (Jensen and Meckling, 1976; Shleifer and Vishny, 1997). Agency theorists, in fact, see the primary function of a board as monitoring the actions of managers (agents) in order to protect the interests of owners (principals). Such monitoring activity is important because of the potential costs that may incur when managers follow their own interests: vigilant directors could effectively reduce such costs, demanding explanations for managers' strategic paths and criticizing not clear initiatives.

A board should not only fulfill its responsibility in monitoring agents and protecting shareholders but also, more importantly, in managing stakeholders. Board's directors may, in fact, exert pressures over managers in order to have strategies and actions that satisfy shareholders (and stakeholders) interests. Therefore, they should be able to influence executive managers to adopt proactive environmental strategies that could help firms to obtain a sustainable competitive advantage. An effective control depends, in particular, on whether the directors are non-executive and independent (professional managers with expertise in monitoring activities, who have incentives to exercise control in order to maintain their reputational capital). Independent directors should be, in fact, primarily interested in aligning with stakeholder interests, being more responsive than insiders to stakeholder pressures, in order to maintain and enhance their reputation and obtain, in this way, new directorships. Moreover, they are more likely to be conscious about how corporate social issues may improve a firm's standing towards investors, government, and lenders (de Villiers *et al.*, 2011).

de Villiers *et al.* (2011) and Post *et al.* (2015) found, in fact, a positive relation between the presence of independent directors and firms' environmental performance, following other studies focused on corporate social responsibility (Ibrahim and Angelidis, 1995).

Rao *et al.* (2012), instead, showed that independent directors' representation is positively related to corporate environmental reporting. Thus, following the mainstream literature, we hypothesize that:

H3: A higher percentage of non-executive directors in the board is positively related with firms' environmental proactivity.

H4: A higher percentage of independent directors on the board is positively related with firms' environmental proactivity.

Board structures are not homogeneous across countries, and, even in the same country, it is

possible to adopt different governance systems (Weimer and Pape, 1999). The company law in many European nations allows, in fact, listed firms to adopt a two-tier board (as opposed to a unitary board) composed of a Management Board and a Supervisory Board. The dual board structure ensures the independence of the two boards by making sure that executives are not too powerful and the Supervisory Board has the duty of protecting stakeholders' interests. Such board, in particular, is usually composed by a different set of stakeholder representatives (employees, banks, other financial institutions, key clients, public officials, and so on), that could also be related to environmental and sustainability issues. Thus, the presence of a two-tier board seems to increase the environmental competencies of the different directors, enhancing firm's commitment to green issues, in comparison to those adopting a one-board system. The Supervisory Board, in fact, could represent an effective instrument for protecting social and environmental issues. Therefore, following the aforementioned argument, we hypothesize that:

H5: The adoption of a two-tier board is positively related with firms' environmental proactivity.

3. METHODOLOGY AND DATA COLLECTION

In order to test our hypotheses, we explain variations in firms' environmental proactivity using two OLS regression models, where board structure and composition constitute the primary explanatory variables. This methodology has already been used to predict the relationships between several variables and different metrics of environmental engagement or performance (Majumdar and Marcus, 2001; Surroca *et al.*, 2010; Habbash, 2015), so it appears to be an appropriate method of analysis.

Variables' measurement

The measurement of a proactive environmental strategy is always considered a difficult task. Previous researchers have used different types of indexes: qualitative measures based on mail surveys (Aragon-Correa, 1998; Craig and Dibrell, 2006; Gonzales-Benito and Gonzales-Benito, 2005; Garcés-Ayerbe *et al.*, 2012), environmental performance indicators provided by institutional agencies (Kock *et al.*, 2012), or the decision to invest in different environmental practices, such as renewable energy generation (Ortiz-de-Mandojana *et al.*, 2012).

As most of the employed indexes are subjective and are mostly related to environmental performance, we decided to employ an environmental proactivity index that could measure the extent of management commitment to environmental issues.

Following other studies in the environmental management literature (Weinhofer and Hoffmann, 2010; Kim and Lyon, 2011; Ben-Amar and McIlkenny, 2015; Calza *et al.*, 2016), we, therefore, decided to employ the Carbon Disclosure Score (CDS) as a proxy of firms' PES. Such index that may range from 0 to 100 is a specific measure of the extent of management commitment to climate change and environmental disclosure, and, consistent with the definition provided by Delmas *et al.* (2011), the

measure of firms' environmental disclosure could be considered a proxy of environmental proactivity.

The measure is calculated yearly by the Carbon Disclosure Project (CDP), an independent, not for profit organization that, among other reports, provides environmental and climate change data of worldwide companies and cities through an annual questionnaire.

Such questionnaire covers different topics, such as the emission reduction strategies adopted, technologies, products, processes or services the company develops or applies in response to climate change, the extent to which a company has measured its carbon emissions, and the frequency and relevance of disclosure to key corporate stakeholders.

A CDS smaller than 50 indicates limited or restricted ability to measure and disclose risks and opportunities that come from carbon emissions and environmental concerns. On the contrary, companies with a CDS higher than 70 show a deeper involvement in climate change issues. These companies identify environmental management as a tool for achieving strategic advantage and including climate change-related risks and opportunities into their core business.

We decided to assign the value 0 to the companies that do not have a score as they did not answer to the CDP questionnaire, or asked to not show the results, as a sign of low environmental proactivity.

In particular, we used the company's Carbon Disclosure Score (CDS) 2014, collected from different 2014 CDP climate change reports, as the dependent variable (i.e. firms' environmental proactivity).

As regards, instead, the independent variables related to firms' board structure and composition, we collected the data from the companies' annual reports and corporate governance reports 2013, together with Thomson Reuters Datastream Database. In particular, we considered the percentage of non-executive directors (NON-EX), independent directors (IND) and women (WOM), present in the board. We also considered board size (SIZE), as the total number of directors appointed to the board, and a dummy variable to measure the employed board structure in the firm (CGSYSTEM). The variable assumes value 1 for companies that have a two-tier board and 0 for firms that adopt a one-tier board.

To test the hypotheses we selected a set of control variables, already identified and used in extant literature as relevant drivers for firms' environmental proactivity. These are: the natural logarithm of the firm's annual capitalization (CAP) as a proxy for size (Gonzales-Benito and Gonzales-Benito, 2006); company's return on equity (ROE) as, following the slack resources theory, Waddock and Graves (1997) found that higher levels of CSR could be driven by higher financial conditions; company's longevity (LONG), as usually environmental performance and proactivity increase over time (Hass, 1996) and the Carbon Dioxide Emission (CDE) as a proxy of environmental regulatory stringency. Consistent with Kassinin and Vafeas (2006) and Berrone *et al.* (2010), it is supposed that country's CO₂ emissions are inversely related with regulatory stringency and, as a consequence, with environ-

mental performance. The definition and measurement of all the variables used in the analysis are summarized in Table 2.

Table 2. Definition and Measurement of the variables

<i>Group</i>	<i>Code</i>	<i>Variable</i>	<i>Measurement</i>	<i>Predicted sign</i>
<i>Dependent Variable</i>	CDS	Environmental Proactivity	Carbon Disclosure Score 2014	
<i>Independent Variables</i>				
	NON-EX	Non-Executive directors	% of non-executive directors on the board	+
	IND	Independent directors	% of independent directors on the board	+
	WOM	Gender diversity	% of women directors on the board	+
	SIZE	Board Size	Total number of board members	+
	CGSYSTEM	Board structure	Dummy variable: 1= two-tier board; 0= one-tier board	+
<i>Control Variables</i>				
	CAP	Market capitalization	Natural logarithm of market capitalization in 2014 (Euro)	+
	LONG	Company's age	No. of years since company's foundation	+
	ROE	Return on Equity	Company's Return on Equity in 2014	+
	CDE	Carbon Dioxide Emissions (CO ₂)	Country's CO ₂ emissions (metric tons per capita) in 2011	+

Sample

The sample used in the study consists of the European companies that were included in the Carbon Disclosure Project questionnaire 2014. We decided to focus the attention on the companies that the CDP selected in Switzerland and Austria (168), Italy (100), France (250), Spain and Portugal (125), as the largest in terms of market capitalization, because they all belong to non-Anglo-Saxon corporate governance systems and present comparable ownership and board structures. We in fact intentionally excluded all the companies belonging to countries where the ownership structure and board composition of firms are very specific, as in the case of Germany, in which large companies must follow the principles of the codetermination law in the composition of the two-tier boards.

We then selected only the companies operating in pollutant industries that are increasingly facing

pressure from stakeholders and media towards better environmental impact. In particular, we considered the firms belonging to the following environmentally sensitive industries: mining, oil, gas, chemicals, paper, iron, steel and other metals, electricity (with the exception of renewable energy producers), gas and water distribution.

Our final sample is therefore composed of 149 firms of different European countries (France, Italy, Spain, Switzerland, Austria, and Portugal).

4. RESULTS AND DISCUSSION

In order to test the hypotheses, we used two OLS regression models, where the Carbon Disclosure Score is the explained variable and board structure and characteristics constitute the primary explanatory variables. The Descriptive statistics, frequency and Pearson's correlation coefficients of the variables used in our analysis are presented in Tables 3 and Table 4.

Table 3. Frequency and descriptive statistics

	<i>Mean</i>	<i>Std Dev</i>	<i>%</i>	<i>Min</i>	<i>Max</i>
CDS	40.9597	42.4603		0	100
SIZE	9.1544	4.0332		1	23
NON-EX	0.6687	0.3326		0	1
IND	0.4428	0.3264		0	1
WOM	0.1234	0.1259		0	0.5
CGSYST ^b			14.80		
CAP	7.3367	1.7927		3.59	12.00
LONG	67.1477	59.5445		0.00	288.00
ROE	8.7228	24.34742		-148.31	160.36
CDE	5.6276	0.9810		4.60	7.80

^a n=149; ^b % of cases where CGSYSTEM=1

The average value of the Carbon Disclosure Score is 40.9597, with a standard deviation quite high of around 42.46. As regards the independent variables, the average size of the board of directors is 9 members, with a minimum size of 1 director and a maximum of 23 members.

Regarding board composition, the presence of non-executive directors is larger than the

independent ones: the average percentage of the first typology in the board is around 67%, while independent directors cover on average 44% of the total board members. Conversely, the presence of women in the board is quite low: only 12.34% of the board positions are, indeed, covered by women. A dual system of corporate governance is instead present in the 14.80% of the sample.

Table 4. Pearson Correlation

	CDS	SIZE	NON-EX	IND	WOM	CGSYST	CAP	LONG	ROE	CDE
CDS	1									
SIZE	.336**	1								
NON-EX	.198*	.599**	1							
IND	.344**	.375**	.706**	1						
WOM	0.070	.276**	.291**	0.102	1					
CGSYST	-0.080	-.600**	-.840**	-.576**	-.291**	1				
CAP	.576**	.367**	0.151	.327**	0.081	-0.005	1			
LONG	0.144	0.001	0.139	.164*	-0.007	-0.029	0.109	1		
ROE	0.077	0.051	0.075	-0.017	-0.071	-0.120	0.149	0.088	1	
CDE	-0.031	-0.139	-.433**	-.349**	-.251**	.405**	-0.019	-0.119	0.026	1

^a n=149 ** Significant at 0,01 (2-tails); * Significant at 0,05 (2-tails) (Pearson's index)

Board size presents a high correlation with the other board's characteristics. In particular, the larger is the board, the higher are the percentages of independent (0.375; p-value <0.01), non-executive (0.599; p-value <0.01) and woman (0.276; p-value <0.01) directors in the board and firms' capitalization (0.367; p-value <0.01). Conversely, board size is negatively related to board structure: the size of two-tier boards is significantly smaller (-0.6; p-value <0.01) than one-tier boards systems. Boards of directors with a higher percentage of women are those that have the higher percentage of non-executive directors (0.291; p-value <0.01). The higher presence of non-executive directors is related to two-tier systems (-0.840; p-value <0.01) and to a higher percentage of independent directors (0.706; p-value <0.01).

The Pearson correlations also reveal a significant positive correlation between the Carbon Disclosure Score (CDS) and board size (0.336; p-value <0.01), the percentage of non-executive directors (0.198; p-value <0.05) and independent directors (0.344; p-value <0.01). The CDS is also positively correlated with capitalization (0.576, p-value <0.01).

We then investigated the relationship that exists between board structure and composition and firms' environmental proactivity. We, therefore, developed two regression models (Table 5): the first model considers only the effect of board characteristics on CDS, while in the second model the control variables are inserted.

Regression results for Model 1 show that consistent with Hypothesis 1, board size (SIZE) has a significant positive impact on CDS, so the higher the number of directors in a board, the higher is the level of environmental proactivity. The result is consistent with the resource dependence theory and with the provisions of de Villiers *et al.* (2011). Such directors seem to effectively provide the expertise useful to manage environmental issues and take advantage of environmental opportunities that may arise. Large boards are more likely to possess the

bundle of competencies and expertise required to enhance environmental proactivity.

Moreover, consistent with Hypothesis 4 and following de Villiers *et al.* (2011) and Post *et al.* (2015), we found a positive relation between CDS and the percentage of independent directors in the board (IND). The result follows the agency theory and provides evidence of the monitoring role of the board. As board's independence increases, the ability of directors to control management's activities towards environmental issues tends to be higher.

The association between firms' PESs and the percentage of women (Hypothesis 2) in the board is instead not significant, even if correctly signed. We, therefore, failed to find any relationship between firms' environmental proactivity and gender diversity of the board (WOM), contrary to extant literature focused on corporate social responsibility (Setò-Pamies, 2013) and environmental performance (Walls *et al.*, 2012; Post *et al.*, 2015). This is probably due to the low percentage of female directors present in our sample: as reported by Bear *et al.* (2010), in fact, the effectiveness of women on boards tends to increase with the addition of female directors: minority voices are not easily expressed or heard in groups.

Our results are also not consistent with Hypothesis 3, as a higher percentage of non-executive directors in the board (NON-EX) is not related to a statistically significant increase of firms' environmental proactivity (CDS) and the coefficient is also not correctly signed. This finding does not follow the mainstream literature, like Johnson and Greening (1999): maybe, non-executive directors are still too closed to management and are not able to fully exploit their monitoring function. Finally, model 1 confirms that two-tier boards (CGSYST) are positively associated with CDS: the presence of a Supervisory Board is probably enhancing the protection of stakeholders' interests, also regarding environmental issues, leading the management to higher levels of environmental proactivity.

Table 5. Regression analysis results

Variable	Model	
	1	2
SIZE	4.736** (0.984)	2.291* (0.984)
NON-EX	-4.032 (20.744)	-4.787 (19.2961)
IND	57.448** (13.746)	27.969* (13.905)
WOM	8.000 (13.746)	-5.206 (25.0699)
CGSYST	50.538** (16.447)	15.708 (16.657)
CAP		10.508** (2.078)
LONG		0.085 (0.050)
ROE		-0.003 (0.123)
CDE		0.585 (3.363)
Constant	-33.890** (15.677)	-76.402** (25.389)
Observations	149	149
Adjusted R-Squared	0.245	0.376
F-Statistics	10.088**	10.381**
Robust standard errors in brackets		
**. Significant at 0,01 (2-tails); *. Significant at 0,05 (2-tails)		

When control variables have been inserted (model 2) the regression fit increased (Adjusted R-Squared = 0.376). Among control variables, just firm's capitalization, considered as a proxy of company's size (CAP =10.508), positively affects firm's environmental proactivity. However, the introduction of control variables reduces the effect of board structure and composition on CDS. In model 2, the positive and significant coefficients related to the percentage of board size (SIZE) and independent directors (IND) decrease in value, while the variable "board system" (CGSYST) becomes non-significant. It means that firm's size, longevity, profitability and environmental regulatory stringency seem to primarily affect company's environmental proactivity, partially neutralising the pressure exerted by the board.

5. CONCLUSIONS

The present paper addresses the nature and intensity of the relations existing between board structure and composition and firms' environmental proactivity.

In this regard, founding on agency theory and resource dependence theory assumptions, the manuscript investigates the role of board size, board composition (percentage of women, non-executive, and independent directors) and structure (two-tier or one-tier board) in affecting the proactive orientation towards environmental issues of a sample of non-Anglo-Saxon European firms belonging to pollutant industries.

Indeed, the results of the two OLS regression models provide evidence that boards do affect firms' PES. Our main findings suggest a positive relationship between board size or the presence of independent directors in the board and companies' environmental proactivity, measured by the Carbon Disclosure Score 2014; while the percentage of women and non-executive directors, together with the structure of the board (one-tier or two-tier board system), do not seem to be related to firms' proactive environmental strategies.

Our study presents some limitations that may be ironed out in future studies. The first limitation is related to the measurement of firms' environmental proactivity. We used the Carbon Disclosure Score generated by a voluntary self-reporting process (CDP). This is a reliable index, but it may lead to including in the analysis mainly companies that are already biased towards environmental proactivity and who may want to report it. Moreover, including in the sample non-respondent companies and firms that asked to not show their results with a CDS of 0, could raise problems regarding the continuous nature of CDS; future studies should evaluate the possibility to convert CDS in a categorical variable.

Finally, we investigated firms' environmental proactivity in a quite specific context: namely polluting industries operating in developed economies, that have both a strong environmental regulation and environmentally conscious consumers.

Despite such limitations, however, this contribution provides some valuable research implications, useful for researchers and academics,

but also for managers and public authorities, as the results allow to identify the characteristics of the board that may foster and enforce firms' environmental proactivity, as a mean for reaching sustainability. Companies, in fact, may play a significant role in the reduction of man activities'

impact on natural environment and in the promotion of a more ecologically sustainable world.

Moreover, socially responsible funds could find useful, for their portfolio allocation strategy, to know if there are types of more oriented to green issue.

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