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Abstract

This study examines how board gender diversity is associated with corporate biodiversity initiatives, and whether gender diversity reinforces the effects of the Global Reporting Initiatives (GRI) and the EU biodiversity strategic plan on corporate biodiversity. Using an integrated theoretical framework of institutional theory and resource dependency theory, our study is based on 4,013 firm-year observations from European listed firms covering a period from 2002 to 2016. We use panel regressions with country, time and industry dummy variables to analyse biodiversity management performance (BMP) and logit regressions to explain biodiversity impact assessment (BIA). We find that board gender diversity has a positive relationship with BMP and BIA of a firm. Moreover, the GRI framework and the EU Strategic plan show positive relationship with the BMP, rather than BIA, even though gender diversity positively moderates their relationships with both biodiversity indicators. Overall, our evidence suggests that a board with increased female representation is more responsive to the concerns of institutions and societal stakeholders, and respond to those concerns by influencing biodiversity initiatives of a firm. In addition, the GRI framework and the EU 2020 strategy appear to enhance management performance on biodiversity without influencing firms to assess their impacts on biodiversity.

Key words: Biodiversity initiatives, gender diversity, environmental management performance, GRI, EU biodiversity strategy

1. Introduction

The aim of this paper is to contribute to the small but growing literature on corporate biodiversity initiatives. The dangers of global climate change and its impact on environment and natural assets has drawn attention to corporate biodiversity as an emerging area of research. The Global Reporting Initiative (GRI, p.7-8) observes that all organisations make direct (through own activities) and indirect (though supply chain partners) use of biodiversity resources, and thus contribute to changes in the quantity and/or quality of biodiversity. Consequently, it is important to hold organisations, irrespective of the nature of their ownership (such as government, public, or private) accountable for their actions and for their contribution to the extinction of biological assets (Jones and Solomon, 2013). Following on from Jones's (1996, 2003) seminal work on natural inventory model, a growing body of literature (e.g., Cuckston, 2013; Samkin et al., 2014; Siddiqui, 2013; Tregidga, 2013; Jones, 2010; Boiral, 2014; Rimmel and Jonall, 2013; Gaia and Jones, 2017) examine biological assets and biodiversity accounting from a variety of perspectives.

However, available literature pays relatively less attention of firms' initiatives to address biodiversity challenges, and how these initiatives are influenced by institutional factors and a firm's corporate governance characteristics (e.g., board gender diversity). In particular, a little is known about a firm's (i) biodiversity management performance (BMP) such as policies, processes and actions to protect biodiversity and to reduce a firm's impact on biodiversity and (ii) biodiversity impact assessment (BIA) such as the initiatives to monitor a firm's actions on biodiversity. Both BMP and BIA provide alternative perspectives of biodiversity accounting by measuring the degree of commitment of a firm to meet biodiversity-related challenges.

The UN Convention on Biological Diversity (CBD), which was established in Rio de Janeiro in 1992, is the main driving force to mobilise national and firm-specific initiatives to protect biodiversity as part of broad-based global efforts to combat climate change. The CBD has set out the Aichi biodiversity targets in Nagoya in 2010, and adopted the Strategic Plan for Biodiversity 2011-2020 (CBD, 2010). Biodiversity has grown in importance since 2010. The UN declared 2011-2020 as the UN Decade on Biodiversity (CBD, 2010). However, as Siikamaki and Newbold (2012) observe, the CBD appears not to have shown noticeable success in reducing the rate of biodiversity loss. The European Union (EU), with its long-standing experience and many successful examples of biodiversity management, is showing its commitment to achieve the Aichi

targets. In 2011, the European Commission adopted the EU Biodiversity Strategy to 2020 with six operational targets and supporting action plans to halt the loss biodiversity and to restore ecosystem from 2011-2010 (EC, 2015a). The EU Strategy also emphasises the implementation of EU nature legislation and an action plan to make a comprehensive assessment of the economic and social benefits of biodiversity and ecosystem, and to integrate these benefits into reporting and accounting systems (EC, 2015a). This sets the context of the study in relation to the significance of addressing the institutional and firm-specific determinants of biodiversity initiatives of EU firms.

Meanwhile, self-regulatory institutions such as the GRI has been instrumental in promoting the triple bottom line (TBL) and sustainability reporting at the firm-level (Milne and Gray, 2013). Among other initiatives, the GRI has joined with other global institutions and national governments to influence corporate initiatives to report and manage their impacts on biodiversity (GRI 2007, p.8). The UK was the first country to have undertaken National Ecosystem Assessment (NEA) in 2011 to analyse economic, health and social values of diversity and ecosystem, and to develop strategies to halt the loss of biodiversity (JNCC and Defra, 2012).

Corporate governance mechanisms such as the board of directors play critical roles in monitoring a firm's engagement in environmental programmes and enhancing environmental disclosures (see Peters and Romi, 2014). The United Nations Global Compact (UNCG, 2012) highlights the significance of the board of directors in shaping a firm's sustainability agenda and addressing environmental concerns by integrating the issues of biodiversity and ecosystem into the operating guidelines, policies and practices of a firm. For UNGC, firms might be exposed to several biodiversity-related risks such as operational, regulatory and legal, reputational, market and financial risks, which might have a negative effect on a firm's competitiveness, profitability, and long-term viability. The notion of gender diversity is considered to be a critical consideration for addressing biodiversity-related challenges. The CBD and IUCN (CBD, 2010b) has recently recognised the significance of gender diversity in managing and conserving biodiversity, and the need to integrate a gender perspective into the biodiversity framework. For CBD (2015), the 2015-2020 Gender Plan of Action provides a mandate to address gender considerations to develop knowledge and capacity building for biodiversity policies and programmes. Nonetheless, as the CBD and IUCN highlights (CBB, ----), there is a dearth of gender-sensitive biodiversity research. Among others, Sullivan and Gouldson (2017) argue that external governance pressures, internal

governance conditions and corporate actions on climate change interact with and influence each other. Considering this, it would be interesting to see whether and how firm-level governance indicators such as board gender diversity individually and interactively (with institutional forces such as the GRI and the EU biodiversity strategy) influence corporate biodiversity initiatives.

The significance of addressing the linkage between board gender diversity and corporate biodiversity appears to be very relevant in the European context, given the EU's longstanding commitments to protect biodiversity and to promote gender diversity on corporate boards. In particular, regulators in several European countries such as Norway, Sweden, Spain, France, Netherlands, and more recently Italy, and the UK have shown increasing activism by adopting mandatory or voluntary initiatives to increase female representation on corporate boards (see, Rao and Tilt, 2016; Hollindale et al., 2017). Prior literature (for example, Liao et al., 2015; Singh et al., 2001; Ibrahim and Angelidis, 1994) suggests that the implementation of environment-related programmes is much more complex and difficult due to a greater conflict of interests among various stakeholders, and that female board members are more softened towards corporate social and environmental responsibilities.

However, to date, the existing empirical literature has failed to investigate the influence of gender diversity on corporate biodiversity initiatives. Moreover, as Boiral and Hras-Saizarbitoria (2017b) highlight, existing literature largely overlooks the organisational aspects of biodiversity management. Also, no studies to date address the effect of the interaction between the institutional context (such as GRI framework and the EU biodiversity strategy) and firm-specific governance indicators (i.e., board gender diversity) on corporate biodiversity initiatives. This sets the context for this study. We examine the following two research questions: (i) Does board gender diversity influence biodiversity management performance (BMP) and biodiversity impact assessment (BIA) of a firm? (ii) How does board gender diversity moderate the influence of the GRI framework and the 2020 EU biodiversity strategy on corporate biodiversity? For the purpose of this study, we use 4,013 firm-year observations from European listed firms covering 15 years (2002 and 2016). The analysis is carried out using three-way fixed-effect regressions (for BMP) and logit regressions (for BIA).

This paper makes a number of important contributions to the extant literature. *First*, to the best of our knowledge, this study is the first to addresses the relationship between board gender diversity and corporate biodiversity, and thus respond to the calls of the CBD and IUCN to

undertake more gender-specific biodiversity research. We also complement a growing body of gender-specific research (e.g., Liao et al., 2015; Ben-Amar et al., 2015; Hollindale et al., 2017, Bear et al., 2010; Mallin and Michelon, 2011) to confirm if available evidence of the effects of board gender diversity on environmental reporting and performance holds for biodiversity initiatives of a firm. Our evidence suggests that female board members can bring human and relational capital to influence and facilitate both biodiversity management performance and biodiversity impact assessment.

Second, unlike other studies, we examine how firm-specific corporate governance characteristics such as board gender diversity interact with institutional factors (such as the GRI framework and the EU 2020 biodiversity strategy) in shaping corporate biodiversity initiatives in a single empirical framework. Thus, we complement the very limited literature (such as Ntim and Soobaroyen, 2013) that outlines the significance of interactive effects in CSR. Our evidence suggests that board gender diversity reinforces the positive effects of the EU biodiversity strategy and the GRI framework on BMP and BIA. This evidence confirms a moderating role of board gender diversity in responding to normative or mimetic isomorphisms of these institutional factors and shaping their influence a firm's biodiversity initiatives.

Third, unlike the extant body of qualitative studies on biodiversity, this is one of the first quantitative studies to examine firm-level and institutional determinants of biodiversity management performance and biodiversity impact assessment of a firm. As GRI (2007) highlights, a biodiversity reporting framework requires both quantitative and narrative information to convey a full story about corporate biodiversity. For GRI, quantitative information helps us to evaluate underlying trends, drivers and facts. Hence, we extend a few recent studies (e.g., Boiral and Hras-Saizarbitoria, 2017, 2017b) that examine biodiversity management performance, and other qualitative studies on biodiversity accounting. We use a new dataset (such as Thomson Reuters Asset4 database) on European listed firms covering a longer time horizon (2002-2016).

Fourth, this study contributes towards the global and national framework (such as the UN and the EU strategic plan as well as the UK biodiversity framework) that requires efficient monitoring and recording of biodiversity obligations, activities and outcomes through evidence-based research (see also, JNCC and Defra, 2012). In addition, we contribute to public policy by supporting the EU's ongoing reform to promote gender diversity, and suggesting an alignment between gender-specific corporate governance reform and sustainable environmental regulations

such as the EU 2020 biodiversity strategy. *Overall*, our evidence contributes to an integrated framework of institutional theory and resource dependency theory in explaining both individual and interactive effects of gender diversity, GRI framework and the EU (UN) strategic plan on biodiversity management performance and biodiversity impact assessment of a firm.

The rest of the paper is structured as follows. Section 2 provides a critical review of theoretical and empirical literature, leading to the development of hypotheses. Section 3 outlines empirical specifications and data, and section 4 reports the empirical results and discussions. Finally, section 5 concludes the paper.

2. Literature review and hypothesis development

2.1. Theoretical literature

The extant literature on biodiversity uses a variety of theories to explore organisational as well as country-specific issues of biodiversity accounting. Jones (2003) and Siddiqui (2013) use environmental stewardship theory to operationalise biodiversity accounting, with Siddiqui applying Jones' natural inventory model (Jones, 1996, 2003) in the context of an emerging economy. Boiral (2014) uses an integrated theoretical framework of organizational legitimacy, impression management, and techniques of neutralisation to explain how mining organisations explain their impact on biodiversity. Boiral and Hras-Saizarbitoria (2017) use theories of self-regulation and social exchange to analyse biodiversity management issues in GRI-based sustainability reports of firms in mining and forestry sectors. Gaia and Jones (2017) use stakeholder theory to investigate the role played by UK local councils' Biodiversity Action Plans in raising stakeholders' awareness of biodiversity's importance. Samkin et al., (2014) develop a reporting and evaluation framework for biodiversity involving strategic planning, implementation and performance, and evaluation. Using institutional theory, Dögl and Behnam (2015) observe that regulatory, market and social institutions exert isomorphic (positive) influences, on corporate environmental practices and business outcomes of firms in developed and emerging economies. Hollindale et al., (2017) use institutional theory and board capital theory to examine the impact of women board members on carbon emissions of Australian firms. Following these studies, we use an integrated theoretical framework of institutional theory and resource dependency theory to examine corporate biodiversity initiatives of a firm.

Institutional theory suggests three forms of institutional isomorphism to explain how firms conform to the rules, norms and expectations of institutions and stakeholders so as to maintain and enhance corporate legitimacy (DiMaggio and Powell, 1983). For DiMaggio and Powell (1983), coercive isomorphism influences organisational structures and procedures through direct (e.g., government policies and regulations) and indirect (e.g., cultural expectations from the society) institutional pressures. Second, firms tend to emulate best practices of global corporations or successful industry peers in response to uncertainty in business environment, a process referred to as mimetic isomorphism. Finally, normative isomorphism takes place when powerful professional networks and trade associations shape organisational policies and practices. Drawing on from these arguments of DiMaggio and Powell's (1983, 1991), Scott (2001) argues that a firm's response to institutional pressure is driven by two motives: legitimisation (symbolic) and efficiency (substantive) (see Ntim and Soobaroyen, 2013). Scott highlights the notion of interplay among societal (global) institutions (e.g, multilateral organisations, professional associations, governments, religious institutions), organisation and industry peers, and actors and groups within organisation such as shareholders, managers, employee unions (Ntim and Soobaroyen, 2013). For Scott (2001), institutional pressures can affect (and are affected by) the forces of diffusion and/or imposition of institutional norms and practices (see, Ntim & Soobaroyen, 2013).

Hillman and Dalziel (2003) provide resource-dependency theory to explain the resource provisioning role of the board of directors. They argue that board capital affects monitoring function as well as the provision of resources. For example, an insider-outsider-dominated board might be less effective in monitoring managers, but they can provide critical advice and counselling. On the other hand, an outsider-dominated board as well as a board with unique experience and expertise might be better at both monitoring and providing resources (p. 384). For them, board members provide critical resources in the forms human and relational capital (e.g., legitimacy, advice, access to resources, and inter-firm linkages) that can enhance firm performance. Following this, de Villiers et al., (2011) and Mallin and Michelon (2011) examine how the resource-provisioning abilities of the board can influence a firm's social and environmental performance. For, Mallin and Michelon (2011), a number of reputational attributes of corporate boards can promote a firm's CSR performance and organisational legitimacy. These include, advice and counselling, organisational legitimacy, channels of communication between

the firm and external institutions, and preferential access to resources and support from important stakeholders.

In the context of this study, the relevance of institutional theory and resource dependency theory can be explained in several ways:

Firstly, institutional theory can explain corporate governance practices of a firm such as the appointment of female board members. Among others, Hollindale et al., (2017) use institutional theory to explain the motivations for appointing women board members. For them, a group of firms (referred to as late adopters) might make a symbolic appointment of female directors in response to corporate governance regulation in order to enhance the corporate legitimacy. Whilst some firms might appoint female board members as 'coercive isomorphism' as part of their compliance with corporate governance regulations, others might adopt this practice voluntarily to exhibit 'normative or memetic' isomorphism.

Secondly, as we explain later, women board members can bring unique human and relational capital, and thus play resource-provisioning roles in board decision-making process. For Hollindale et al., (2017), a group of firms might regard board gender diversity as an innovative organisational practice, which is intended to enhance firms' efficiency and competitive advantage due to the unique set of experience, skills and broader perspectives of women board members. From this perspective, resource dependence theory appears more appropriate to examine the influence of board gender diversity on a firm's response to climate related risks such as biodiversity. Ben-Amar et al., (2015) also use resource dependence theory to examine the relationship between gender diversity and corporate carbon disclosures. Whilst innovative organisational practices such as the selection of female board members can enhance corporate legitimacy, the distinctive human and relational capital of women board members can shape a firm's environmental strategies and performance, which in turn can cause greater efficiency and competitive advantage. Moreover, as Hillman and Dalziel (2003) argue, resource-provisioning role of the board enhances legitimacy of a firm. This makes the prediction of the institutional theory to be consistent with the resource dependence theory.

Thirdly, DiMaggio and Powell's 'institutional isomorphism' can explain the influence of the GRI framework and the UN biodiversity strategic plan on corporate biodiversity initiatives.Firms tend to follow these institutional actors in adopting culturally acceptable social and environmental practices (e.g., 'mimetic and normative isomorphisms' or mandatory reporting

guidelines such as the GRI-framework (e.g.,'coercive isomorphism'. As Perez-Batres et al., (2012) argue, the adherence to GRI guidelines or UNGC codes provides a firm with the 'normative pillar' and 'mimetic isomorphism' to adopt sustainable social and environmental practices of global institutions, professional associations, and industry peers. Comyns and Figge, (2015) argue that firms engage in social and environmental practices (such as GRI-based reporting, pollution control) to demonstrate that their operations are consistent with the expectations of society.

Several recent studies used similar theoretical arguments to explain corporate biodiversity. For example, Boiral and Hras-Saizarbitoria (2017) argue that the key motivations for biodiversity management include the significance of addressing ethical concerns, demonstrating good biodiversity practices and improving relationships with institutions and other stakeholders. Samkin et al., (2014) also argue that organisations are increasingly focusing on biodiversity-related reporting to avoid tension with stakeholder groups and institutions. For Jones (2003), the collection and publication of data on natural assets represents an organisation's social obligations, and hence, it will allow businesses to demonstrate their social legitimacy and organisational responsibility. Boiral and Hras-Saizarbitoria (2017) argue that an organisation's impact on biodiversity is likely to cause strong external pressures, which in turn damages an organization's reputation as well as the social licence to operate within society. Accordingly, they find that biodiversity management initiatives of firms in mining and forestry sectors are motivated by institutional pressures and the search for social and environmental legitimacy.

Altogether, contemporary literature highlights the significance of multiple theories in explaining corporate environmental practices, in general, and corporate biodiversity, in particular. Diego Pérez-López et al., (2015) also explain the need to have an integrated framework of institutional (macro-level) and operational (company-level) aspects to assess sustainable reporting and sustainability management practices. Therefore, this study builds on an integrated framework of institutional and resource dependence theories to explain the effects of gender diversity and its interactions with institutional forces (such as the GRI framework and the UN strategic plan for biodiversity) on biodiversity initiatives of a firm.

2.2. Empirical literature and hypotheses development

2.2.1. Board gender diversity

Board gender diversity has received considerable attention in academic and policy-oriented literature in recent times, especially in the context of the significance of female board members in shaping firm-specific polices and strategies towards the well-being of the society and the environment. A growing body of recent literature (such as, Mallin and Michelon, 2011; Haque, 2017) refer to several resource-provisioning roles of female directors with respect to human and relational capital that are critical to enhance the social and environmental performance of a firm and to mitigate global environmental challenges such as GHG emissions and loss of biodiversity.

Firstly, due to communal characteristics, women board members exhibit greater sensitivity towards relationship building and societal stakeholders' concerns such as biodiversity risks. They, therefore, engage in socially and environmentally responsible corporate initiatives so as to make a positive contribution to the society, the environment and sustainable development (see, Mallin and Michelon, 2011; Glass et al., 2016; Liao et al., 2015; Braun, 2010). For Nielsen and Huse (2010), "women may be particularly sensitive to – and may exercise influence on – decisions pertaining to certain organisational practices, such as corporate social responsibility and environmental policies" (p.138). *Secondly*, female directors encourage open discussion and greater participation, and thus, reduce the level of conflict in board decision-making process and enhance high quality board decisions, especially on CSR issues or climate related actions (Bear et al., 2010; Nielsen and Huse, 2010). Gender diversity also enhances information-sharing, joint decision-making and collaboration in board decision-making process (Li et al., 2017). For Hollindale et al. (2017), women board members increase board capital breadth through 'value attunement', and enhance a board's understanding of the ethical and social demands of stakeholders, especially on emerging strategic issue of climate change.

Thirdly, female board members are likely to be assigned to and accept responsibilities on sustainable corporate strategies and actions, and focus on a longer-term outlook as well as non-financial performance outcomes (Liao et al., 2015; Braun, 2010; Glass et al., 2016; Mallin and Michelon, 2011). Taken together, board gender diversity can bring critical advice and resources that can influence board decisions to adopt sustainable environmental policies and programmes so as to mitigate global environmental challenges such as the loss of biodiversity.

Empirically, several studies find a positive effect of board gender diversity on CSR performance and/or disclosures of a firm. For example, Glass et al., (2016) find that female board members promote innovative environmental policies and practices, which in turn lead to improved

environmental performance. Likewise, other related studies (such as, Bear et al., 2010; Mallin and Michelon, 2011; Liao et al., 2015; Ben-Amar et al., 2015) confirm that board gender diversity has a significant positive relationship on corporate social and environmental performance. However, Prado-Lorenzo and Garcia-Sanchez (2010) find no significant influence of gender diversity on carbon disclosures of S&P500 firms. Taking into consideration the arguments of resource-provisioning role of female board members and related empirical evidence, we develop the following hypothesis:

> Hypothesis 1: *Ceteris paribus*, board gender diversity is positively related to biodiversity management performance (BMP) and biodiversity impact assessment (BIA) of a firm.

2.2.2. GRI framework

The GRI, being one of the most influential self-regulatory institutions, provides an intellectual framework for global sustainable development through which the triple bottom line (TBL) and sustainability reporting are articulated at the firm-level (Milne and Gray, 2013, p.19). The GRI (2007) framework requires firms to report five performance indicators covering a firm's direct and indirect impacts on biodiversity, and firm-specific strategies and action plans to manage their impacts on biodiversity, so as to manage the expectations of global institutions and societal stakeholders (p.8). This framework has been instrumental in shaping sustainable organisational practices, establishing a 'normative pillar' (Scott, 2001) or moral base of organisational legitimacy, and providing 'mimetic isomorphism' (DiMaggio and Powell, 1991) for firms to imitate the actions of 'legitimate' industry peers (see Milne and Gray, 2013; Perez-Batres et al., 2012). Boiral and Hras-Saizarbitoria (2017b) highlight the significance of environmental self-regulation or voluntary codes of conduct in developing a biodiversity-specific environmental management system. The GRI framework facilitates biodiversity reporting by influencing managers to disclose more information on biodiversity (Boiral, 2014; Samkin et al., 2014). Empirically, Lokuwaduge and Heenetigala (2017) find that ESG reporting by Australian firms is highly influenced by GRI guidelines and listing regulations. For Galbreath (2010), externally codified rules, norms and laws tend to influence European firms to engage in climate change initiatives to gain corporate legitimacy.

Nevertheless, a related literature suggests that firms exhibit greater biodiversity disclosures and practices to enhance legitimacy but without improving actual performance in protecting biodiversity. For example, Boiral (2014) observes that that organisations use impression management techniques to defend their social legitimacy and environmental responsiveness. Jones (2003) also argues about the possibility of environmental impression management, as biodiversity reporting companies might disclose selective biodiversity data without better environmental management. Gaia and Jones (2017) show that both private- and public-sector organisations tend to adopt a pragmatic/instrumental approach in their biodiversity accounting and reporting practices. They find that UK local councils' narratives on biodiversity focus more on anthropocentric paradigms, such as human welfare ecology and resource conservation, and less on environmental stewardship, moral extensionism, and ecocentric philosophies. Similarly, Samkin et al., (2014) find that biodiversity disclosures of New Zealand's Department of Conservation reflect performance/implementation information, rather than evaluation framework. Boiral (2014) finds that mining sector firms focus on disclosures of successful rhetoric on biodiversity as part of the impression management, without showing clear and measurable accounts of biodiversity. Moneva et al., (2006) also observe GRI reporting helps firms legitimise management decisions and actions, rather than demonstrating an improvement in critical sustainability indicators.

Based on these contradictory theoretical arguments and empirical evidences, we expect that the adoption of GRI framework is likely to enhance a firm's biodiversity protection initiatives, but this is more pronounced for biodiversity management performance than for biodiversity impact assessment. Thus, we intend to test the following hypothesis:

> Hypothesis 2a: *Ceteris paribus,* adherence to GRI guidelines is positively associated with biodiversity initiatives of a firm, and this relationship is stronger for biodiversity management performance (BMP) than biodiversity impact assessment (BIA).

Following on from our discussion of board gender diversity, female board members are likely to be proactive in responding to normative or mimetic isomorphisms, and provide critical advice and resources to comply with the GRI's biodiversity framework as well as other good practices on biodiversity. Therefore, we develop the following hypothesis:

Hypothesis 2b: *Ceteris paribus,* board gender diversity reinforces a positive relationship between the GRI framework and biodiversity performance.

2.2.3. The UN Biodiversity Strategic Plan 2011-2020

Institutional pressures, such as the Kyoto Protocol and government regulations exert sanctions on firms to improve their social and environmental performance and disclosures so as to gain and/or maintain corporate legitimacy and good corporate citizenship (see, Freedman and Jaggi, 2005; Comyns and Figge, 2015, Hooghiemstra, 2000). This is broadly in line with the notion of 'coercive isomorphism' (DiMaggio & Powell, 1983). As part of the EU biodiversity strategic plan, the EU Business and Biodiversity Platform (B@B platform) was established to integrate the Strategy with firm specific policies and operations though several critical considerations such as sector-specific guidelines, natural capital accounting, innovation for biodiversity and business opportunities, financing for biodiversity (EC, 2015a, 2015b). The Biodiversity Indicators Working Group in the UK (Defra and JNCC) has developed several firm-specific indicators of biodiversity progress including the 'integration of biodiversity into business activity' and environmental (biodiversity) management system (DEFRA, 2014, p.4). The UNGC and the International Union for Conservation of Nature (IUCN) have developed a framework for corporate sustainability strategies to support corporate management to develop, implement and disclose biodiversity policies and practices (UNGC, 2012, p.5). Therefore, the Convention on Biological diversity (CBD) and the UN (and EU) strategies and action plan for biodiversity are likely to have a normative influence on firms to demonstrate greater activisms on biodiversity protection.

Available empirical literature addresses the impact of institutional pressure on environmental performance and disclosures. For example, Freedman and Jaggi (2011) find that firms from countries ratifying the Kyoto Protocol (i.e., EU countries, Canada and Japan) show higher GHG disclosures, as compared to firms from the US did not ratify the Protocol. Luo et al. (2012) also find that firms in countries that adopted an emission trading scheme exhibit greater carbon disclosures. Tauringana and Chithambo (2015) find that the DEFRA's guidance has a positive effect on the carbon disclosures of UK firms. Rankin et al., (2011) and Chang et al., (2015) also find similar evidence.

However, as discussed above, firms adopt an instrumental approach or impression management technique by demonstrating symbolic biodiversity management initiatives rather than

substantive engagements (see, Boiral, 2014; Gaia and Jones, 2017). Boiral and Hras-Saizarbitoria (2017; 2017b) observe that it is difficult to find organisations that adopt comprehensive and substantial biodiversity practices, since there is a lack of external pressures or regulatory requirements to implement substantial measures, and hence, most organisations adopt unique biodiversity practices to suit their needs. Gaia and Jones (2017) find that biodiversity disclosures of UK local councils are more in line with the interest of stakeholders (such as industry, landowners, farmer and workers), who are more concerned about the role of biodiversity in promoting commercial and industrial activities as well as economic development. Boiral (2014) finds that the biodiversity performance of organisations remains unaccountable, mainly because of the absence of clear indicators to measure biodiversity issues, and hence, accounting for biodiversity is driven by legitimation rhetoric based on socially acceptable arguments.

Considering these theoretical arguments and empirical findings, we argue that firms might respond to Convention on Biological diversity (CBD) as well as the Aichi target, and subsequent development of the UN (and EU) biodiversity strategy 2011-2020, by improving biodiversity management performance, instead of substantive demonstration of biodiversity impact assessment. However, as discussed earlier, the resource provisioning role of female board members is likely to strengthen a firm's effort to engage with these global and region-specific biodiversity initiatives. This might be more relevant in the context of initiatives of the CBD and IUCN to integrate gender perspective into biodiversity planning, conservation and management (CBD, ----). Thus, we test the following hypotheses:

> Hypothesis 3a: *Ceteris paribus,* The UN Biodiversity Strategy has a positive relationship with biodiversity initiatives of a firm, and this relationship is stronger for biodiversity management performance (BMP) than biodiversity impact assessment (BIA).

> Hypothesis 3b: *Ceteris paribus,* board gender diversity reinforces positive relationship between the UN Biodiversity Strategy and biodiversity performance.

3. Research design

3.1. Data and sample

We use a panel dataset of 4,013 firm-year observations from listed firms in 13 European countries covering a period from 2002 to 2016. Unlike other biodiversity-related studies, we use data over a longer time horizon, which is is likely to alleviate the concern about the reliability of accounting and corporate governance data (see Cornett et al., 2010). We use panel regressions with country, time and industry fixed effects to analyse biodiversity management performance (BMP) and logit regressions to explain biodiversity impact assessment (BIA). Table 1 shows the country- and industry-wise distribution of the sample. Our sample selection is based on the availability of biodiversity-related data from the Thomson Reuters Asset4 database, which is considered to be a leading global database on environmental, social and corporate governance (ESG) information (see also Trumpp et al., 2015). As shown in the Table, our sample comprises 2,246 firm-year observations from UK listed firms, and the remaining 1,767 firm -year observations from other European countries. The prime reason for the inclusion of many UK firms in our sample is the availability of biodiversity-related data from the Thomson Reuters Asset4 database. However, as we explain later, we use country dummy variables to control for country-specific influences in our estimation results.

Whereas the corporate governance and biodiversity data is collected from the Thomson Reuters Asset4 database, the financial data are gathered from the Worldscope database. The Asset4 database provides high quality ESG data covering fifteen sub-categories (three environmental, five governance and seven social categories) that include more than 750 individual data points and more than 250 key performance indicators (Thomson Reuters, 2013). It employs more than 120 analysts to compile ESG data on 4,600 firms worldwide from a variety of sources such as company reports and filings, CR reports, company and NGO websites, and reputable media outlets (Thomson Reuters, 2013). The data is then scrutinised to ensure consistency and reliability.

Insert Table 1 about here

3.2. Empirical model and variables

We use both univariate and multivariate analysis to examine the relationship between board gender diversity and corporate biodiversity. Univariate analysis is done through correlations and t-tests, whereas fixed effect and logit regression models are employed to conduct multivariate analysis. In order to analyse biodiversity management performance (BMP), we use three-way fixed

effect regressions by adopting the least square dummy variable (LSDV) model to control unobserved heterogeneity across countries, industries and time. Following the examples of Tauringana and Chithambo (2015) and Berrone and Gomez-Mejia (2009), we fixed effect regression models to examine the effects of gender diversity, the GRI framework (GRI), and the the EU biodiversity strategy on corporate biodiversity. Fixed effect models offer greater efficiency and consistency and more accurate inferences through controlling omitted variable problems, and capturing the unobserved heterogeneity among individual firms or over time (see, Hsiao 2007; Gallego-Alvarez et al., 2015).

Using biodiversity management performance (BMP) index as the dependent variable, we estimate the following empirical model:

$$BMP_{it} = \beta_0 + \beta_1 Diversity_{it} + \beta_2 GRI_{it} + \beta_3 Bio2020_{it} + \beta_4 B.Size_{it} + \beta_5 B.Exp_{it} + \beta_6 Connections_{it} + \beta_7 Independence_{it} + \beta_8 Separation_{it} + \beta_9 ESG_{it} + \beta_{10} CSR_{it} + \beta_{11} EMS_{it} + \beta_{12} Q_{it} + \beta_{13} Size_{it} + \beta_{14} Profitability_{it} + \beta_{15} Leverage_{it} + \beta_{16} Employees_{it} + \beta_{17} Shareholders_{it} + \beta_{18} Slack_{it} + \beta_{19I} Intensity_{it} + \beta_{20} Capex_{it} + \beta_{21} Growth_{it} + \beta_{22} Country_i + \beta_{23} Industry_i + \beta_{24} Year + u_{it} \quad (1)$$

In this model, BMP of firm i in the year t is a function of board gender diversity (diversity), GRI framework (GRI), the 2020 EU biodiversity strategy (Bio2020), ESG-related control variables, financial control variables and the error term u. This model also includes country, industry and time dummy variables, with one less dummy variables for all three categories being included in the model in order to avoid dummy variable trap or perfect multicollinearity (see, Craig et al. (2007). We use the following model to examine the effect of interactions of gender diversity with GRI reporting (Diversity*GRI) and the EU 2020 biodiversity strategy (Diversity*Bio2020):

$$BMP_{it} = \beta_0 + \beta_1 Diversity*GRI_{it} + \beta_2 Diversity*Bio2020_{it} + \beta_3 B.Size_{it} + \beta_4 B.Exp_{it} + \beta_5 Connections_{it} + \beta_6 Independence_{it} + \beta_7 Separation_{it} + \beta_8 ESG_{it} + \beta_9 CSR_{it} + \beta_{10} EMS_{it} + \beta_{11} Q_{it} + \beta_{12} Size_{it} + \beta_{13} Profitability_{it} + \beta_{14} Leverage_{it} + \beta_{15} Employees_{it} + \beta_{16} Shareholders_{it} + \beta_{17} Slack_{it} + \beta_{18} Intensity_{it} + \beta_{19} Capex_{it} + \beta_{20} Growth_{it} + \beta_{21} Country_i + \beta_{22} Industry_i + \beta_{23} Year + u_{it} \quad (2)$$

We use an overall measure of biodiversity management performance (BMP) Index, with higher BMP indicating greater management performance on biodiversity initiatives of a firm. Among others, Bhattacharyya and Cummings (2015) use environmental management performance (EMP) that captures several critical aspects of managements' response to environmental challenges. These include environmental policy, environmental accounting and auditing, stakeholder relations and, environmental issues in process/product design) . Boiral and Hras-Saizarbitoria (2017b) also propose a framework to distinguish two types of biodiversity practices: managerial and organisational actions and technical and operational actions.

Following this, we use a biodiversity management system (BMP) index based on eight indicators of biodiversity policies, processes, restoration or protection, disclosures, land use, and management monitoring (see dependent variables in Table 2). These indicators are related to a firm's management initiatives to protect native ecosystem or biodiversity, reduce the impact of a firm's operations on biodiversity, report overall biodiversity initiatives, and monitor firms' actions on biodiversity. These indicators are broadly in line with the GRI's biodiversity performance indicators covering a firm's impacts on biodiversity, together with firm-specific strategies and actions to mitigate negative impacts and to enhance positive impacts on biodiversity (GRI, 2007).

Biodiversity impact assessment (BIA) is a more explicit measure of biodiversity performance indicator that traces a firm's commitment to reduce its impact on biodiversity and overall progress on management actions. Therefore, we re-estimate Eq.(1) by replacing BMP with BIA, which is a proxy for biodiversity performance indicator. BIA is a dummy variable that equals 1 if the firm uses key performance indicators (KPI) or the balanced scorecard to monitor its impacts on biodiversity, and 0 otherwise. Trumpp et al., (2015) suggest that an effective environmental monitoring system depends on KPIs to review environmental operational performance and to take corrective actions. Since BIA is a dummy variable, we follow, among others, Matsumura et al., (2014) and Kim et al., (2012) in using a logit regression model.

Table 2 outlines the details of these indicators, alongside other variables of the empirical model. We outline three independent variables (gender diversity, GRI and Bio2020). The proportion of female board members (Diversity) is a measure of board gender diversity, which is predicted to be positively related to biodiversity initiatives. GRI is a dummy variable that measures if the firm's sustainability report is published in accordance with the GRI framework. Given that the European Commission adopted the 2020 EU biodiversity strategy in 2011, we also use

this(Bio2020) as a dummy variable that equals 1 if the data coverage ranges from 2011 to 2016, and 0 otherwise. This is intended to examine if the adoption of biodiversity strategy with specific operational targets has a positive effect on biodiversity performance of a firm. Both GRI and Bio2010 are expected to have positive relationships with biodiversity initiatives of a firm, and we expect this relationship is greater for biodiversity management performance (BMP) than biodiversity impact assessment (BIA).

Insert Table 2 about here

We follow among others de Villiers et al., (2011) and Haque (2017) in using a number of ESG-related indicators as control variables, which include board size (B.size), board experience (B.exp), board connections (Connections), board independence (Independence), and CEO-Chair separation (Separation) (see Table 2). Board size, board experience and board connections are measured by the natural logarithms of total board members, average tenure of the board members, and average corporate affiliations of board members, respectively. Board independence is measured by the proportion of independent board members, and separation is a dummy variable that equals 1 if the CEO and the Chair are different individuals, and 0 otherwise.

A large board might cause free-rider problems and greater conflicts in board decision making process, implying a poor response to environmental concerns (see, Prado-Lorenzo and Garcia-Sanchez, 2010). From the perspective of resource dependency theory, board experience and connections can be considered as distinctive capabilities that can help a firm to get engaged in biodiversity initiatives (see, Ortiz-de-Mandojana et al., 2012). An independent board is likely to influence executive management to improve social and environmental disclosures and performance to accommodate stakeholders' concerns and to enhance corporate legitimacy (see Ibrahim et al., 2003; Michelon and Parbonetti, 2012). The influence of the separation of CEO and board Chairperson on a firm's environmental performance seems inconclusive. We also use a number of stakeholder oriented measures that might drive a firm's biodiversity initiatives. These include environmental-social-governance (ESG) based compensation policy, the presence of CSR committee of the board (CSR), and the adoption of ISO14001 environmental management system (EMS). Peters and Romi (2014) contend that environmental committees tend to more proactive in social and environmental reporting to meet stakeholders' expectations. Haque (2017) finds a

positive association between ESG-based compensation policy and carbon performance of UK firms. Rankin et al. (2011) observe that the adoption of ISO14001-certified environmental management systems has a positive effect on sustainable reporting in Australian firms. Therefore, all three stakeholder-oriented measures are expected to be positively related to biodiversity indicators.

In order to control for other firm-specific determinants of biodiversity-related initiatives, we also follow among others de Villiers et al., (2011) in Liao et al., (2015) in using firm size, profitability, financial slack, leverage, firm valuation (Tobin's Q), number of shareholders, number of employees, capital intensity, capital expenditure, and growth prospect (market-to-book) as control variables (see financial control variables in Table 2). For Liao et al., (2015), large firms are likely to remain proactive on environmental matters due to increased social pressure and expectations. Firms with higher profitability and financial slack can afford additional economic recourses to engage in social and environmental projects (see, Qiu et al., 2014; de Villiers et al., 2011). Leverage is expected to have an inverse relationship with biodiversity, since an obligation to pay interest is likely to reduce free cash flow and financial resources that can be invested on environmental projects. Firms with higher market valuation and a higher number of shareholders are likely to be under intense scrutiny by the market, which in turn forces them to maintain improved environmental standards (de Villiers et al., 2011). Firms with a higher number of employees are likely to have an inverse effect on biodiversity performance, due to the need to occupy large area of lands and buildings. Firms with higher capital-intensive assets and higher capital expenditure are likely to employ clean and energy efficient technologies, which in turn improve the environmental performance of a firm (see, de Villiers et al., 2011; Luo et al., 2012). Finally, firms with higher market-to-book ratios demonstrate greater investment opportunity, and therefore, remain proactive in environmental matters so as to gain corporate reputation and competitive advantage (de Villiers et al., 2011). Finally, our regression models include country, industry and time dummy variables to control for the variations across countries, industries and years.

4. Empirical results

4.1. Descriptive statistics and univariate analysis

Table 3 shows summary statistics of all variables used in empirical models. It is shown that the BMP index has a mean value of 2.91 and a standard deviation of 1.95, on a scale of 0 to 8. The mean value indicates that the biodiversity management performance of the sampled firms is 36.38%, which seems a reasonably low percentage although there is no set benchmark on this in the absence of comparable studies.. However, a relatively higher standard deviation indicates that the BMP values firms are spread out from the mean value. The table also shows that the mean value of biodiversity impact assessment (BIA) is 0.026, indicating that only 2.6% of the sampled firms tend to adopt BIA, This suggests that a large majority of firms do not demonstrate substantial engagement in monitoring their impacts and actions on biodiversity through key performance indicators or a balance scorecard. As we discuss later, this is supportive of the arguments and evidences of Bioral (2014) and Gaia and Jones (2017) in relation to impression management and an instrumental approach to corporate biodiversity management.

Insert Table 3 about here

Table 3 also shows that the proportion of female board members is around 14%, with a standard deviation of 12.29, suggesting a greater variation from the mean distribution of women board members among the sampled firms. This suggests that the female board representation in European firms as a whole are relatively higher than that of 9% in UK firms, as reported by Liao et al., (2015). This trend is consistent with our country-specific estimation of mean values of gender diversity, which we show in Table 4 (also see below). In addition, 65% of the sampled firms adopt the GRI-framework, and 50% of the sampled firms follow the EU biodiversity strategic plan of 2020. It is also evident that the board size of the sample firms is around nine, with the proportions of independent directors being around 52 percent. This is comparable with the evidence of Liao et al., (2015) and Tauringana and Chithambo (2015). It is further shown that 68% of the sampled firms adopt ISO 14001 environmental management system, and that around 33% of the firms have ESG-based compensation policy. Among the financial indicators, we report some of the important control variables. Table 4 shows that average market value (Q) of the sampled firms is 0.93, and average profitability (ROA) and leverage are is 6.84% and 24.26%, respectively. It is also evident that the ratio of capital expenditure to sales (capex) is 7.64 and the

market to book value of equity (growth) is 462.75, although there are greater variations of these ratios among the sample firm.

Insert Table 4 about here

Table 4 shows the mean values of BMP, BIA and gender diversity across countries and industries. It is evident that firms in Italy and France demonstrate the greatest biodiversity management performance (BMP), followed by Spain, Netherlands, and Austria. In terms of board gender diversity Scandinavian countries play leading role with firms in Norway having the highest proportion of female board members (31.77%), followed by Sweden (24.59%), Finland (21.75%), and Denmark (14.13%). Surprisingly, firms of these Scandinavian countries do not seem to show greater activisms in biodiversity protection initiatives as compared to firms from other EU countries, with the mean values on BMP and BIA of the Danish firms being the lowest among the sampled countries. This evidence of Scandinavian firms having greater gender diversity and poorer biodiversity performance tends to contradict our hypothesised positive relationship between gender diversity and biodiversity, although it might not be appropriate to draw a conclusion on this without analysing inferential statistics such as t-tests and regressions. The table also shows that the utility sector (gas, water and electricity) firms demonstrate greater biodiversity performance, followed by the mining sector, construction materials sector, and Oil & Gas sector. This evidence suggests that firms in polluting industries tend to demonstrate an improved performance in both indicators of biodiversity, a finding that is largely consistent with the legitimisation aspect of the institutional theory.

Table 5 shows *t*-test results of the difference in BMP and BIA between five different categories:GRI and non-GRI compliant firms, pre-and post- Biodiversity strategy (2011-2020) periods, firms with and without board gender diversity, biodiversity sensitive- and insensitive industries, and EU and UK. It is evident that the GRI-compliant firms exhibit greater biodiversity management performance and bio-diversity impact assessment than the non-GRI compliant firms, and these results are significant at 1% level. This evidence supports the findings of Lokuwaduge and Heenetigala (2017) Galbreath (2010) in that the GRI enhances sustainable corporate initiatives. The table also shows statistically significant evidence that firms demonstrate greater activism in both biodiversity performance indicators during the post-Strategy2020 period, as

expected. This evidence corroborates Freedman and Jaggi (2011) and Chang et al., (2015), who find that the Kyoto Protocol and environmental policy have positive effects on environmental disclosures and performance. This is also comparable with the evidence of Gaia and Jones (2017) in relation to a positive effect of the International Year of Biodiversity on biodiversity disclosures of UK firm.

Insert Table 5 about here

Table 5 also shows statistically significant evidence that firms with at least one women board member exhibit greater biodiversity performance than their counterparts in term of both BMP and BIA, and thus confirm the prediction of Hypothesis 1. Moreover, biodiversity sensitive or polluted industries (such as utilities, mining, construction materials, oil & gas, and industrials) demonstrate improved biodiversity performance than those of other industries, and this difference is statistically significant at 1% level. This evidence is broadly in line with the institutional theory in that firms in polluted industry come under closer scrutiny from the various instructions and stakeholders, and hence, they demonstrate greater biodiversity performance to maintain or enhance corporate legitimacy. Finally, the Table shows that (non-UK) European firms as a whole exhibit greater activism than the UK firms in improving their biodiversity performance in terms of both BMP and BIA, and this evidence is statistically significant.

Table 6 shows bivariate correlations among biodiversity measures, independent and and some important control variables. It is evident that both BMP has moderate positive correlations with board gender diversity (diversity), GRI-framework (GRI), and EU biodiversity strategy (Bio2020), as expected, although BIA maintains weaker relationships with these variables. The latter might be due to the reluctance of a sizable proportion of the sampled firms to use balance scorecard to trace biodiversity impact and progress, as reported earlier. The table also shows that BMP and BIA have moderate positive correlations with board size (B.size), ESG-based compensation policy (ESG), CSR committee (CSR) and the adoption of environmental management system (EMS). We also compute correlations among all independent and control variables. Altogether, the correlations (not shown to conserve space) among these variables are relatively low, which suggests that we do not have any multicollinearity problem for the regression

analysis. Overall, our univariate and bivariate results are supportive of the main hypotheses with respect to positive effects of board gender diversity on GRI framework and the EU biodiversity strategy on biodiversity management performance. However, it is important to undertake multivariate analysis, before drawing a conclusive statistical inference.

Insert Table 6 about here

4.2. Multivariate results and discussion

Table 7 shows the results of three-way fixed effect regressions of biodiversity management performance (BMP) against three independent (e.g., board gender diversity, GRI framework, the EU biodiversity strategy) and all control variables specified in Eqs. (1)-(2). Eq.(1) outlines the influence of independent and control variables on BMP, whereas Eq.(2) spells out the influence of the interaction and control variables on BMP. Column 1 shows the results for board gender diversity (diversity), GRI-framework (GRI), the EU biodiversity strategy (Bio2020) and all control variables. It is shown that diversity, GRI and Bio2020 have positive associations with BMP, and these relationships are highly significant at 1% level. Among the control variables, ESG-based compensation policy (ESG), ISO14001 environmental management system (EMS), CSR committee (CSR), board independence (Independence), and board size (B.size) have positive relationships with BMP. In addition, firm size and capital intensity have positive relationships with BMP, whereas leverage has an opposite relationship. Columns 2 and 3 show estimation results of Eq.(2) for the interaction variables of board gender diversity with GRI-framework (Diversity*GRI) and the EU biodiversity strategy (Diversity*Bio2020), respectively as the main explanatory variables together with other corporate governance and firm-specific control variables. It is evident that both interactive variables have statistically significant positive associations with BMP, and that the estimation results of control variables remain unchanged.

In order to measure the influence of three independent variables (e.g., board gender diversity, GRI framework, the EU biodiversity strategy) on biodiversity impact assessment (BIA), we run logit regressions by replacing BMP with BIA in Eqs. (1) and (2). Table 8 shows the regression results of the regressions of BIA against three independent and all control variables Column 1 of the Table shows the estimation results of Eq.(1), and suggests that board gender diversity (Diversity) maintains a statistically significant positive association with BIA, as

expected. However, the GRI framework (GRI) and the biodiversity strategy (Bio2020) show statistically insignificant results as standalone variables. Columns 2 and 3 show estimation results of Eq.(2) for the two interaction variables. Interestingly, the interactions of diversity with GRI (Diversity*GRI) and Bio2010 (Diversity*Bio2020) show statistically significant positive relationships with BIA, as expected. Among the control variables, ESG-based policy, environmental management system, and CSR committee maintain positive relationships with BMP. In addition, capital intensity, capital expenditure and firm size have positive relationships, and financial slack has an inverse relationship, with BIA. Table 8 also shows likelihood ratio (LR) Chi-square statistics that test the null hypothesis of no self-selection bias. The LR values are statistically significant, suggesting that there is no self-selection bias in the estimation results.

Insert Table 8 about here

Overall, our estimation results confirm Hypothesis 1 that a board with greater female representation has a positive relationship with both biodiversity indicators (e.g., BMP and BIA) of a firm. This evidence corroborates with a growing body of empirical literature (e.g., Bear et al., 2010; Mallin and Michelon, 2011; Glass et al., 2016; Hollindale et al., 2017) that find board gender diversity has a significant positive relationship with corporate social and environmental strategies, disclosures and performance. This is also consistent with the resource provisioning role of female board members, who can bring human and relational capital to influence and facilitate sustainable corporate actions such as biodiversity policies, processes and disclosures, biodiversity impact assessment, implementation and integration of biodiversity initiatives, and sustainable relationships with powerful institutions and stakeholders.

Our estimation results (shown in Tables 7 and 8) further suggest that GRI framework and the EU (UN) strategic plan on biodiversity (2011-2020) have positive associations with BMP, but not with BIA, and hence, confirm Hypotheses 2a and 3a, respectively. This evidence tends to corroborate the evidence of related literature (such as, Isaksson and Steimle, 2009; Moneva et al., 2006; Boiral and Henri, 2012) in that the symbolic adherence to GRI guideline might help firms to legitimise management decisions and actions,but does not necessarily reflect an improvement in substantive or actual environmental performance. Our results are also consistent with the evidence of Gaia and Jones (2017), who find that the UK local councils' declaration of 2010 as the International Year of Biodiversity has a positive effect on biodiversity disclosures, even though

these disclosures focus more on anthropocentric paradigms, such as human welfare ecology and resource conservation, and less on environmental stewardship and moral extensionism, and ecocentric philosophies.

This is broadly in line with pragmatic or instrumental approach (Gaia and Jones, 2017) and impression management technique (Boiral, 2014) of corporate biodiversity management that is primarily intended respectively to protect and/or enhance environmental legitimacy and promote commercial interests. One likely reason for this trend might be a lack of external pressures or regulatory requirements to implement substantial biodiversity measures (Boiral and Hras-Saizarbitoria, 2017; 2017b), as institutional stakeholders (such as GRI and the EU strategic plan) tend to promote voluntary mode of biodiversity initiatives as opposed to mandatory requirements to demonstrate actual performance and/or progress with biodiversity.

Moreover, as previously discussed, one notable aspect of our estimation results is that a surprisingly low (2.6%) proportion of the sample firms adopt biodiversity impact assessment (BIA) or balance scorecard to measure firms' impact on (or improvement in) biodiversity. This percentage is, however, slightly higher after the declaration EU(UN) strategic plan in 2011 (4%), and for firms that adopt the GRI framework (3.7%), as shown in Table 5. Unlike BMP, BIA is a measure of a firm's biodiversity performance in relation to its substantive commitment to reduce its impact on biodiversity and the level of progress. This approach can be referred to as 'strategic planning' phase, rather than performance/implementation' and 'evaluation' phases, as outlined in the biodiversity framework of Samkin et al. (2014). Boiral (2014) finds that firms demonstrate symbolic commitments and successful rhetoric, rather than clear and measurable accounts, in their biodiversity reports. One possible interpretation is that good biodiversity management performance does not necessarily indicate good biodiversity operational performance in relation to a firm's biodiversity impact assessment by using a balanced scorecard or key performance indicators. Hence, firms tend to demonstrate the former, without demonstrating actual biodiversity performance (e.g., BIA) that can expose the degree of their engagements in these sensitive environmental practices.

Nonetheless, our empirical results suggest that the interactions of board gender diversity with GRI and the EU 2020 strategy have a positive relationship with both biodiversity indicators, and thus, confirm Hypotheses 2b and 3b. This indicates a moderating role of board gender diversity on the influence of these two institutional factors of a firm's biodiversity initiatives. Overall, this

suggests that female board members not only promote corporate sustainability and influence a board's decision by providing critical advice and resources on biodiversity policies and programmes, but also remain proactive in responding to normative or mimetic isomorphisms of institutional factors such as the GRI and the EU 2020 biodiversity strategy.

Altogether, our evidence supports an integrated framework of institutional and resource dependence theories in that a board with greater gender diversity recognises global and local institutions' concerns about the long-term consequence of a firm's actions on biodiversity, and influences board decisions to undertake biodiversity-related initiatives, which in turn mitigate biodiversity-related risks, and enhance corporate legitimacy as well as sustainable economic benefits for a firm.

Among the sustainability-oriented control variables, ESG-based compensation policy, ISO14001 environmental management system and the presence of CSR committee maintain positive relationship with both BMP and BIA, and thus support broad-based predictions of the institutional theory. These results are consistent with the evidence of Haque (2017) in relation to the effect of ESG-based compensation policy on carbon performance of UK firms, and with Rankin et al., (2011) with respect to the effect of ISO14001 on GHG disclosures of Australian firms. Moreover, firm size and capital intensity show positive associations with both biodiversity indicators. This evidence suggests that large firms tend to remain proactive to demonstrate improved biodiversity performance in order to mitigate greater social pressure. Whilst de Villiers et al., (2011) find similar evidence on firm size, they find an inverse relationship between capital intensity and environmental performance of US firms. Interestingly, board independence, board size and board experience have positive relationships with BMP, rather than BIA. The evidence on board independence and board size is comparable with de Villiers et al., (2011) and Liao et al. (2015), as both studies find similar evidence in the context of environmental performance of UK firms and GHG disclosures of UK firms, respectively.

5. Conclusion

This study examined how firm-level governance characteristics (such as board gender diversity) and institutional factors (such as the Global Reporting Initiatives and the EU strategic plan for biodiversity) individually and interactively influence two biodiversity performance indicators of a firm: biodiversity management performance (BMP) and biodiversity impact

assessment (BIA). We used three-way fixed effect regressions and logistic regression models to analyse an unbalanced panel dataset of 4,013 firm-year observations from European listed firms from 2002-2016. Overall, our estimation results suggest that board gender diversity shows a positive association with BMP and BIA of a firm, and reinforces the positive effect of GRI reporting framework and the EU Strategy on both biodiversity indicators. Whilst the GRI framework and the EU Strategic plan show a positive relationship with BMP, their relationship with BIA is statistically insignificant as standalone variables.

Overall, our results suggest that the GRI guidelines and the EU biodiversity strategy tend to enhance management performance on biodiversity without influencing firms to assess their impact on biodiversity or operational performance on biodiversity. This evidence suggests that these institutional factors influence firms to improve policies, processes and disclosures on biodiversity, without putting pressure on firms to undertake comprehensive measure of their impacts on biodiversity. This indicates a more symbolic, rather than a substantive engagement of biodiversity initiatives, and thus confirms legitimisation aspect of the institutional theory as well as impression management or an instrumental approach to corporate biodiversity management.

Nonetheless, our estimation results suggest that board gender diversity tends to play a resource provisioning role by improving both biodiversity performance indicators of a firm, and moderating the effects of the institutional forces on a firm's biodiversity initiatives. Our evidence further suggests that a board with greater gender diversity is more responsive to the concerns of institutions and societal stakeholders such as the GRI framework and the EU biodiversity Strategy, especially in relation to adverse consequences of a firm's actions on biodiversity and ecosystems. Therefore, women board members tend to remain proactive to respond to those concerns by influencing executive management to design and implement biodiversity initiatives. They also provide critical advice and support for those initiatives. This eventually mitigates biodiversity-related risks of a firm and enhances corporate legitimacy as well as sustainable economic benefits for a firm. In addition, firm-level governance characteristics such as gender diversity and the macro-level institutional framework (such as GRI and the EU Strategy) play complementary roles in influencing the biodiversity management performance of a firm. Altogether, this is supportive of a notion of complementarity between resource-dependence theory and institutional theory.

Overall, our evidence provides support for an integrated theoretical framework of institutional theory and resource dependence theory. On the one hand, good corporate governance

and sustainability practices of a firm such as the appointment of female board members, the adoption GRI-based biodiversity reporting guidelines and the compliance with the EU biodiversity strategy, are consistent with coercive as well as normative or mimetic isomorphisms of the institutional theory. On the other hand, female board members can play resource-provisioning role in the board decision-making process by bringing unique human and relational capital, and thus improve biodiversity management performance and biodiversity impact assessment of a firm. Whilst good corporate governance and sustainability practices enhance corporate legitimacy, a resource-provisioning role of women board members and a subsequent improvement in biodiversity performance are likely to help firms to gain both legitimacy and efficiency or competitive advantage. As a whole, this makes some of predictions of the institutional theory to be consistent or complementary with those of the resource dependence theory.

Our evidence has several policy implications. *First*, a gender-diverse board not only provides critical support and advice to develop firm-specific biodiversity initiatives but also influences corporate boards to respond to global and national institutional expectations. Therefore, our results confirm the significance of an integrated framework of gender diversity and biodiversity, a notion that has been advocated by the CBD and the IUCN. In other words, gender diversity is likely to play a critical role in influencing and promoting corporate sustainability initiatives such as the management and conservation of biodiversity, and hence, policy makers should align gender diversity and corporate biodiversity policies as part of mitigating the challenges of the loss of biodiversity. *Second*, our evidence suggests an interactive effect of gender diversity and institutional factors such as GRI framework and the EU 2020 strategy on biodiversity initiatives, suggesting an interdependence between internal corporate governance factors and external institutional factors. Hence, policymakers could enhance an alignment between gender-specific corporate governance reform and sustainable environmental regulations to combat biodiversity losses. *Third*, our statistically insignificant results of the effects of GRI and Bio2002 on KPI suggest that the adoption of voluntary reporting guidelines such as GRI or a generic biodiversity strategic plan (such as the EU 2020 strategy) is unlikely to influence firms to show their impact on biodiversity or to demonstrate a measurable account of their success in reducing loss of biodiversity. Therefore, the policymakers should enact mandatory regulations on biodiversity with explicit industry-and firm-specific guidelines and verifiable sustainable targets on biodiversity impacts and improvements.

One of the caveats of this study is that it does not include explicit biodiversity operational performance indicators (other than BIA performance measure). Future research can address the effects of broad-based corporate governance variables such as ownership, board structure and executive compensation on the actual outcome of a firm's biodiversity performance. Second, future analysis can also address the linkage between biodiversity reporting and actual biodiversity performance, by capturing detailed accounts a firm's biodiversity initiatives and performance based on content analysis of annual report and other published documents. Third, further research can based on a comparative study between shareholder-based corporate governance system (such as US, UK and Australia) that focuses on shareholder value maximisation or other market-centric measures, and stakeholder-based system (such as Continental Europe and Japan) that holds stakeholders' welfare maximisation as the main objective of a firm. Fourth, future studies might consider in-depth case studies and interviews with board members, executives, shareholders, and other stakeholders to examine their views on corporate biodiversity initiatives.

References

Alberto Gomez, A. and Rodriguez, M, A. 2011. The effect of ISO 14001 certification on toxic emissions: an analysis of industrial facilities in the north of Spain. *Journal of Cleaner Production* **19**: 1091-1095

Arena, C., Bozzolan, S. & Michelon, G. (2015). Environmental Reporting: Transparency to Stakeholder Manipulation? An Analysis of Disclosure Tone and the Role of the Board of Directors. *Corporate Social Responsibility and Environmental Management*, *22*, 346-361.

Bear, S., Rahman, N., & Post, C. (2010). The impact of board diversity and gender composition on corporate social responsibility and firm reputation. *Journal of Business Ethics* 97(2), 207–221.

Ben-Amar, W. and McIlkenny, P. 2015. Board effectiveness and the voluntary disclosure of climate change information. *Business Strategy and the Environment* **24**, 704–719.

Ben-Amar, W., Chang, M., & McIlkenny, P. (2015). Board Gender Diversity and Corporate Response to Sustainability Initiatives: Evidence from the Carbon Disclosure Project. *Journal of Business Ethics*, 1-15, DOI 10.1007/s10551-015-2759-1.

Berrone, P. and Gomez-Mejia, L., (2009). Environmental performance and executive compensation: an integrated agency-institutional perspective. *Academy of Management Journal* 52 (1), 103–126.

Bhattacharyya, A. and Cummings, L. (2015). Measuring Corporate Environmental Performance – Stakeholder Engagement Evaluation, Business Strategy and the Environment, 24, 309–325

Boiral, O. (2014) Accounting for the Unaccountable: *Biodiversity Reporting and Impression Management*, Journal of Bus Ethics DOI 10.1007/s10551-014-2497-9.

Boiral, O. and Henri, J-F. 2012. Modelling the impact of ISO 14001 on environmental performance: A comparative approach. *Journal of Environmental Management* **99**: 84-97.

Boiral, O. and Hras-Saizarbitoria, I. (2017) Corporate commitment to biodiversity in mining and forestry: Identifying drivers from GRI reports, Journal of Cleaner Production 162, 153-161

Boiral, O. and Hras-Saizarbitoria, I. (2017b) Best practices for corporate commitment to biodiversity: An organizing framework from GRI reports, Environmental Science and Policy 77, 77–85

Braun, P. (2010). Going green: Women entrepreneurs and the environment. *International Journal of Gender and Entrepreneurship, 2(3)*, 245–259.

CBD (….) Gender and Biodiversity, Convention on Biological Diversity. https://www.cbd.int/gender/doc/fs_cbd_biodiversity.pdf [22 August 2017]

CBD (2010) Strategic Plan for Biodiversity 2011–2020 and the Aichi Targets, Convention on Biological Diversity https://www.cbd.int/doc/strategic-plan/2011-2020/Aichi-Targets-EN.pdf

CBD (2010b) Biodiversity, Gender and Climate Change, Convention on Biological Diversity, https://www.cbd.int/climate/doc/biodiversity-gender-climate-change-en.pdf [22 August 2017]

CBD (2015) Gender Perspectives on Biodiversity, Convention on Biological Diversity, https://www.cbd.int/gender/doc/fs-gender-perspectives-en.pdf [22 August 2017]

Chang, L., Li, W. and Lu, X. (2015) Government Engagement, Environmental Policy, and Environmental Performance: Evidence from the Most Polluting Chinese Listed Firms, Business Strategy and the Environment, 24, 1–19

Comyns, B. and Figge, F. (2015). Greenhouse gas reporting quality in the oil and gas industry. *Accounting, Auditing & Accountability Journal* 28(3), 403 – 433.

Cong, Y. and Freedman, M. (2011) Corporate governance and environmental performance and disclosures, Advances in Accounting, incorporating Advances in International Accounting 27, 223–232.

Cornett, M. M., Guo, L., Khaksari, S. and Tehranian, H. (2010). The impact of state ownership on performance differences in privately-owned versus state-owned banks: An international comparison. Journal on Financial Intermediation 19, 7-94.

Craig, B.R., Jackson, W.E. III and Thomson, J.B. (2007). Small firm finance, credit rationing, and the impact of SBA-guaranteed lending on local economic growth. Journal of Small Business Management, 45(1), 116-132.

Cuckston, T. (2013), "Bringing tropical forest biodiversity conservation into financial accounting calculation", Accounting, Auditing & Accountability Journal, Vol. 26 No. 5, pp. 688-714.

de Villiers, C., Naiker, V., & van Staden, C. J. (2011). The effect of board characteristics on firm environmental performance. Journal of Management 37(6), 1636–1663.

DEFRA (2014) UK biodiversity indicators 2014: Measuring progress towards halting biodiversity loss, Department for Environment, Food and Rural Affairs, UK.

Diego Pérez-López, D., Moreno-Romero, A., and Barkemeyer, R. (2015) Exploring the Relationship between Sustainability Reporting and Sustainability Management Practices, Business Strategy and the Environment, 24, 720–734.

DiMaggio, P. J. and Powell, W. W. 1983. The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review* **48(2)**: 147-160.

DiMaggio, P. J., and Powell, W. W. (1991). Introduction. In W. W. Powell and P. J. DiMaggio (Eds.), The new institutionalism in organizational analysis (pp. 1–38). Chicago, IL: University of Chicago Press.

Dögl, C. and Behnam, M. (2015) Environmentally Sustainable Development through Stakeholder Engagement in Developed and Emerging Countries, Business Strategy and the Environment, 24, 583–600.

EC (2015a) EU Assessment of progress in implementing the EU Biodiversity Strategy to 2020, Part 1/3, European Commission, Brussels. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015SC0187 [22 August 2017]

EC (2015b) EU Assessment of progress in implementing the EU Biodiversity Strategy to 2020, Part 1/3, European Commission, Brussels. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015SC0187 [22 August 2017]

Eleftheriadis, I. M. and Anagnostopoulou, E. G. 2015. Relationship between Corporate Climate Change Disclosures and Firm Factors. *Business Strategy and the Environment* **24**, 780–789.

Freedman, M. and Jaggi, B. (2011). Global Warming Disclosures: Impact of Kyoto Protocol Across Countries. Journal of International Financial Management and Accounting 22(1), 46-90.

Freedman, M. and Jaggi, B. 2005. Global warming, commitment to the Kyoto protocol, and accounting disclosures by the largest global public firms from polluting industries. The *International Journal of Accounting* **40(3)**: 215-232.

Gaia, S. and Jones, M. J. (2017). UK local councils reporting of biodiversity values: a stakeholder perspective. *Accounting, Auditing and Accountability Journal*. https://doi.org/10.1108/AAAJ-12-2015-2367

Galbreath, J. 2010. Corporate Governance Practices that Address Climate Change: an Exploratory Study. *Business Strategy and the Environment Business Strategy and the Environment* **19**: 335–350.

Gallego-Alvarez, I. Segura, L., Martínez-Ferrero, J. (2015). Carbon emission reduction: the impact on the financial and operational performance of international companies. Journal of Cleaner Production 103, 149-159

Glass, C., Cook, A., and Ingersoll, A. R. (2016) Do Women Leaders Promote Sustainability? Analyzing the Effect of Corporate Governance Composition on Environmental Performance. Business Strategy and the Environment, 25, 495–511.

GRI. (2007) Biodiversity - A GRI Reporting Resource, Global Reporting Initiatives. The Netherlands, ISBN 978-90-8866-001-6

Haque, F. 2017. The effects of board characteristics and sustainable compensation policy on carbon performance of UK firms. *The British Accounting Review* **49(3)**: 347–364.

Hart, S. L. (1995). A natural resource based view of the firm. Academy of Management Review, 20(4), 986-1014.

Hillman, A. J., & Dalziel, T. (2003). Boards of directors and firm performance: integrating agency and resource dependence perspectives. Academy of Management Review 28(3), 383–396.

Hollindale, J., Kent, P., Routledge, J. and Chapple, L. (2017), Women on boards and greenhouse gas emission disclosures. Account Finance. DOI: 10.1111/acfi.12258

Hooghiemstra, R. (2000). Corporate communication and impression management – new perspectives why companies engage in corporate social reporting. Journal of Business Ethics 27(1/2), 55-68.

Hsiao, C. (2007). Panel data analysis advantages and challenges. Test 16(1), 1-22.

Ibrahim, N. A., & Angelidis, J. P. (1994). Effect of board members' gender on corporate social responsiveness orientation. Journal of Applied Business Research 10(1), 35–41.

Ibrahim, N. A., Howard, D. P., & Angelidis, J. P. (2003). Board members in the service industry: an empirical examination of the relationship between corporate social responsibility orientation and directorial type. Journal of Business Ethics 47(4), 393–401.

Isaksson, R., and Steimle, U. 2009. What does GRI-Reporting tell us about corporate sustainability? *The TQM Journal* **21(2)**: 168-181. http://dx.doi.org/10.1108/17542730910938155

JNCC and Defra (2012). UK Post-2010 Biodiversity Framework. Joint Nature Conservation Committee, Peterborough, UK. ISBN 978-1-86107-624-3. Available from: http://jncc.defra.gov.uk/page-6189.

Jones, M. J. (1996). Accounting for biodiversity: A pilot study. The British Accounting Review, 28(4), 281–303.

Jones, M. J. (2003). Accounting for biodiversity: operationalising environmental accounting. Accounting, Auditing and Accountability Journal, 16(5), 762–789.

Jones, M. J., & Solomon, J. F. (2013). Problematising accounting for biodiversity. Accounting, Auditing and Accountability Journal, 26(5), 668–687.

Jones, M.J. (2010), "Accounting for the environment: towards a theoretical perspective for environmental accounting and reporting", Accounting Forum, Vol. 34, pp. 123-138.

Landry, E.E., Bernardi, R.A. & Bosco, S.M. (2014). Recognition for Sustained Corporate Social Responsibility: Female Directors Make a Difference. *Corporate Social Responsibility and Environmental Management, 23*, 27–36.

Li, J., Zhao, F., Chen, S., Jiang, W., Liu, T., and Shi, S. (2017) Gender Diversity on Boards and Firms' Environmental Policy, Business Strategy and the Environment, 26, 306–315.

Liao, L., Luo, L. & Tang, Q. (2015). Gender diversity, board independence, environmental committee and greenhouse gas disclosure. The British Accounting Review, 47(4), 409-425.

Lokuwaduge, C. S. D. S. and Heenetigala, K. (2017) Integrating Environmental, Social and Governance (ESG) Disclosure for a Sustainable Development: An Australian Study, Business Strategy and the Environment, 26, 438–450

Luo, L., Lan, Yi-Chen, and Tang, Q. 2012. Corporate incentives to disclose carbon information: Evidence from CDP Global 500 report. *Journal of International Financial Management and Accounting* ***23*****(2)**: 93-120.

Mallin, C.A. and Michelon, G. 2011. Board reputation attributes and corporate social performance: an empirical investigation of US Best Corporate Citizens. *Accounting and Business Research* **41(2)**: 119-144.

Matsumura, E. M., Prakash, R. and Vera-Mu˜noz, S. C. (2014). Firm-Value Effects of Carbon Emissions and Carbon Disclosures. The Accounting Review 89(2), 695-724.

Michelon, G., & Parbonetti, A. (2012). The effect of corporate governance on sustainability disclosure. Journal of Management and Governance 16(3), 477–509.

Milne, M., and Gray, R. 2013. W(h)ither Ecology? The Triple Bottom Line, the Global Reporting Initiative, and Corporate Sustainability Reporting. *Journal of Business Ethics* **118(1)**: 13-29. http://dx.doi.org/10.1007/s10551-012-1543-8

Moneva, J. M., Archel, P., and Correa, C. 2006. GRI and the camouflaging of corporate unsustainability. *Accounting Forum* **30(2)**: 121–137.

Nielsen, S. & Huse, M. (2010). The contribution of women on boards of directors: going beyond the surface. *Corporate Governance: An International Review, 18*, 136–148.

Ntim, C. G., and Soobaroyen, T. 2013. Corporate governance and performance in socially responsible corporations: New empirical insights from a neo-institutional framework. *Corporate Governance: An International Review* 21(5): 468–494.

Ortiz-de-Mandojana, N., Aragón-Correa, J. A., Javier Delgado-Ceballos, J. and Ferrón-Vílchez, V. (2012). The Effect of Director Interlocks on Firms' Adoption of Proactive Environmental Strategies. Corporate Governance: An International Review 20(2): 164–178.

Perez-Batres, L. A., Doh, J. P., Miller, V. V., and Pisani, M. J. (2012). Stakeholder pressures as determinants of CSR strategic choice: Why do firms choose symbolic versus substantive self-regulatory codes of conduct? *Journal of Business Ethics 110*(2): 157–172.

Perez-Batres, L. A., Doh, J. P., Miller, V. V., and Pisani, M. J. (2012). Stakeholder pressures as determinants of CSR strategic choice: Why do firms choose symbolic versus substantive self-regulatory codes of conduct? *Journal of Business Ethics 110*(2): 157–172.

Peters, G. F. and Romi, A. M. (2014). Does the Voluntary Adoption of Corporate Governance Mechanisms Improve Environmental Risk Disclosures? Evidence from Greenhouse Gas Emission Accounting. Journal of Business Ethics 125, 637–666.

Prado-Lorenzo, J.-M., & Garcia-Sanchez, I.-M. (2010). The role of the board of directors in disseminating relevant information on greenhouse gases. Journal of Business Ethics 97(3), 391–424.

Qiu, Y. Shaukat, A. Tharyan, R. (2014). Environmental and social disclosures: Link with corporate financial performance. The British Accounting Review, 1-15.

Rankin, M., Windsor, C., and Wahyum, D. 2011. An investigation of voluntary corporate greenhouse gas emissions reporting in a market governance system Australian evidence. *Accounting, Auditing and Accountability Journal* 24(8): 1037-1070.

Rao, K. and Tilt, C. (2016) Board Composition and Corporate Social Responsibility: The Role of Diversity, Gender, Strategy and Decision Making, Journal of Business Ethics, 138, pp. 327–347.

Rimmel, G. and Jonall, K. (2013). Biodiversity reporting in Sweden: corporate disclosure and preparers' views. Accounting, auditing and accountability journal 26(5), 746-778.

Roger L Burritt, Lome S Cummings, (2002) "Accounting for Biological Assets - the Experience of an Australian Conservation Company", Asian Review of Accounting, Vol. 10 Issue: 2, pp.17-42, https://doi.org/10.1108/eb060756

Samkin, G., Schneider, A. and Dannielle Tappin, D. (2014),"Developing a reporting and evaluation framework for biodiversity", Accounting, Auditing & Accountability Journal, Vol. 27(3), 527 – 562.

Scott, W.R. 2001. *Institutions and Organizations* 2nd edn. Sage: Thousand Oaks.

Siddiqui, J. (2013). Mainstreaming biodiversity accounting: Potential implications for a developing economy. Accounting, Auditing and Accountability Journal, 26(5), 5-5.

Siikamaki, J. and Newbold, S. C. (2012) Potential Biodiversity Benefits from International Programs to Reduce Carbon Emissions from Deforestation, Ambio, 41:78–89

Singh, V., Vinnicombe, S., & Johnson, P. (2001). Women directors on top UK boards. Corporate Governance: An International Review 9(3), 206–216.

Sullivan, R. and Gouldson, A. (2017) The Governance of Corporate Responses to Climate Change: An International Comparison, Business Strategy and the Environment, 26, 413–425.

Tauringana, V. and Chithambo, L. 2015. The effect of DEFRA guidance on greenhouse gas disclosure. *British Accounting Review* 47(4**)**: 425–444.

Thomson Reuters (2013) Corporate Responsibility Ratings (TRCRR): Rating and Ranking Rules and Methodologies, Thomson Reuters. https://financial.thomsonreuters.com/content/dam/openweb/documents/pdf/tr-com-financial/methodology/corporate-responsibility-ratings.pdf (Accessed: 19 November 2017)

Tregidga, H. (2013), "Biodiversity offsetting: problematisation of an emerging governance regime", Accounting, Auditing & Accountability Journal, Vol. 26 No. 5, pp. 806-832.

Trumpp C., Endrikat, J. Zopf, C. and Guenther, E. (2015). Definition, Conceptualization, and Measurement of Corporate Environmental Performance: A Critical Examination of a Multidimensional Construct. Journal of Business Ethics 126, 185–204.

UN Global Compact – UNGC (2012) A Framework for Corporate Action on Biodiversity and Ecosystem Services. UN Global Compact and IUCN. ISBN: 978-2-8317-1501-8

Ziegler, A., Busch, T., & Hoffmann, V. H. (2011). Disclosed corporate responses to climate change and stock performance: An international empirical analysis. Energy Economics 33(6), 1283–1294.

Tables

Table 1: Distribution of sample based on country and industry

Country	Obs	Percent	Industry	Obs	Percent
Austria	62	1.54	Aerospace_Defence	204	5.08
Belgium	44	1.10	Construction_Materials	493	12.29
Denmark	96	2.39	Food_producers	254	6.33
Finland	171	4.26	Gas_Water_Utilities	242	6.03
France	287	7.15	Healthcare	309	7.70
Germany	187	4.66	IT&Electronics	156	3.89
Italy	66	1.64	Industrials	558	13.90
Netherlands	142	3.54	Mining	225	5.61
Norway	122	3.04	Oil&Gas	450	11.21
Spain	151	3.76	Retailers	326	8.12
Sweden	170	4.24	Services	796	19.84
Switzerland	269	6.70			
UK	2246	55.97			
Total	4013	100	Total	4013	100

Table 2: Variable definitions

Variables	*Symbols*	*Descriptions*
Dependent variables		
Biodiversity Management Performance	BMP	This variable is calculated by adding 1 if the answer is yes to the questions 1–8 and 0 otherwise: (1) Does the company have a policy for reducing the impact of its operations on biodiversity? (2) Does the company describe, claim to have or mention processes in place to reduce its impact on biodiversity? (3) Does the company report on initiatives to restore or protect native ecosystems or the biodiversity of protected and sensitive areas? (4) Does the company report on initiatives to reduce its impact on native ecosystems and biodiversity? (5) Does the company monitor its impacts on biodiversity? (6) Does the company report on initiatives to reduce or phase out toxic chemicals or substances that damage biodiversity? (7) Does the company report its initiatives to recycle, reduce or phase out total waste, hazardous waste or wastewater that damage biodiversity? (8) Does the company report on initiatives to reduce the environmental impact on land owned, leased or managed for production activities or extractive use?
Biodiversity impact assessment	BIA	A dummy variable that equals 1 if the firm uses key performance indicators (KPI) or the balanced scorecard to monitor its impacts on biodiversity?
Independent variables		

Board gender diversity	diversity	Percentage of female directors on board
GRI reporting	GRI	A dummy variable that equals 1 if the firm's sustainability report is published in accordance with the GRI guidelines and 0 otherwise.
EU Biodiversity Strategy 2020	Bio2020	A dummy variable that equals 1 if the data covers a period from 2011 to 2016 and 0 otherwise.
ESG-related Control variables		
Board size	B.size	Natural log of the number of board members
Board experience	B.exp	Natural log of the average tenure of the board members
Board affiliation	Connections	Natural log of the average corporate affiliations of board members
CEO-Chair separation	Separation	A dummy variable that equals 1 if the CEO and board chairperson are two different individuals, and 0 otherwise
Board independence	Independence	Percentage of independent directors on board
CSR committee	CSR	A dummy variable that equals 1 if the firm has a CSR committee on the board, and 0 otherwise.
ESG-based compensation	ESG	A dummy variable that equals 1 if the firm has an environmental-social-governance (ESG) related compensation policy, and 0 otherwise
Environmental management system	EMS	A dummy variable that equals 1 if the firm has adopted an ISO14001 certified environmental management system, and 0 otherwise.
Financial control variables		
Firm size	Size	Natural log of total assets of a firm
Return on Assets	Profitability	Return on Assets
Slack	Slack	The ratio of cash and equivalents to total assets.
Leverage	Leverage	The ratio of total debt to total assets
Firm value	Q	Ratio of total assets minus book value of equity plus market value of equity to total assets.
Shareholders	Shareholders	The natural log of the number of shareholders of the firm.
Employees	Employees	The natural log of the number of employee of the firm.
Capital intensity	Intensity	The ratio of property, plant and equipment to total assets.
Capital expenditure	Capex	The ratio of capital expenditure to sales.
Market-to-book	MTBT	The ratio of market to book value of equity.
Country dummies	Country	Each country dummy variable equals one if the firm belongs to a particular country and zero otherwise

Industry dummies	Industry	Each industry dummy variable equals one if the observation corresponds to a particular industry and zero otherwise
Year dummies	Year	Each year dummy variable equals one if the observation corresponds to a particular year and zero otherwise

Table 3: Summary statistics of the variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent variables:					
BMP	4013	2.91	1.95	0.00	8.00
BIA	4013	0.026	0.16	0.00	1.00
Independent variables:					
Diversity	4013	14.12	12.29	0.00	66.67
GRI	4013	0.65	0.48	0.00	1.00
Bio2020	4013	0.50	0.50	0.00	1.00
ESG-related control variables					
B.size (n)	4013	9.30	1.38	1.99	25.03
B.exp	4013	1.72	0.44	-2.53	3.08
Connections	4013	0.27	0.77	-2.81	2.84
Independence	4013	52.32	24.30	0.00	100.00
Separation	4013	0.84	0.37	0.00	1.00
ESG	4013	0.33	0.47	0.00	1.00
CSR	4013	0.63	0.48	0.00	1.00
EMS	4013	0.68	0.46	0.00	1.00
Financial control variables:					
Q	4013	0.93	0.59	0.03	8.45
Size	4013	15.41	1.60	8.01	19.98
Profitability	4013	6.84	8.90	-116.48	106.82
Leverage	4013	24.26	16.34	0.00	126.12
Employees	4013	7.69	0.97	1.10	8.67
Shareholders	4013	12.46	1.45	4.91	17.09
Slack	4013	0.11	0.10	0.00	0.93
Intensity	4013	0.58	0.39	0.00	3.14
Capex	4013	7.64	14.90	0.00	266.85
Growth	4013	462.75	245.25	1.00	1123.00

Notes: Please see Table 2 for variable definitions.

Table 4: Mean values of important variables across countries and industries

Country	BMP	BIA	Gender Diversity	Industry	BMP	BIA	Gender Diversity
Austria	3.33	0.049	7.13	Aerospace_Defence	2.92	0.000	9.89
Belgium	2.42	0.040	11.38	Construction_Materials	3.68	0.068	12.95
Denmark	1.98	0.000	14.13	Food_producers	2.60	0.028	14.91
Finland	2.90	0.009	21.75	Gas_Water_Utilities	4.49	0.092	13.67
France	4.23	0.000	16.75	Healthcare	2.29	0.012	13.57
Germany	2.85	0.022	9.81	IT&Electronics	1.62	0.000	8.71
Italy	4.33	0.166	10.66	Industrials	2.53	0.006	13.53
Netherlands	3.28	0.013	11.75	Mining	4.01	0.060	9.98
Norway	2.31	0.011	31.77	Oil&Gas	3.08	0.034	14.43
Spain	3.62	0.079	10.20	Retailers	2.23	0.010	16.47
Sweden	2.92	0.046	24.59	Services	1.83	0.007	11.70
Switzerland	2.01	0.044	7.67				
UK	2.48	0.018	11.49				
Total	2.78	0.027	13.07	Total	2.78	0.027	13.07

Table 5 T-test results showing the difference in biodiversity management performance (BMP) and biodiversity impact assessment (BIA) across several categories of sub-samples.

Variables		Sample	Mean	Difference	t-statistics	Pr(T > t) (H_A: diff > 0)
Panel A: *GRI and non-GRI compliant firms:*						
BMP	GRI=1	2258	3.048	0.672***	12.61	0.000
	GRI=0	3410	2.375			
BIA	GRI=1	2280	0.037	0.023***	5.34	0.000
	GRI=0	3416	0.013			
Panel B: *Pre- and post-Bio2020 Strategy periods:*						
BMP	Post-Bio2020	2436	3.346	0.993***	19.15	0.000
	Pre- Bio2020	3232	2.353			
BIA	Post- Bio2020	2448	0.040	0.023***	5.34	0.000
	Pre- Bio2020	3248	0.017			
Panel C: F*irms with and without board gender diversity:*						
BMP	FemDir=1	3802	3.185	1.223***	22.633	0.000
	FemDir=0	1855	1.963			
BIA	FemDir=1	3824	0.036	0.027***	5.872	0.000
	FemDir=0	1861	0.009			
Panel D: *Biodiversity-sensitive and biodiversity-insensitive industries:*						
BMP	Bio-sensitive ind	2897	3.342	1.151***	22.702	0.000
	Bio-insensitive ind	2771	2.191			
BIA	Bio-sensitive ind	2923	0.044	0.034***	7.938	0.000
	Bio-insensitive ind	2773	0.010			
Panel E: *UK and other European countries:*						
BMP	EU	2930	3.063	0.581***	11.082	0.000
	UK	2766	2.482			
BIA	EU	2930	0.036	0.018***	4.123	0.000
	UK	2766	0.018			

Notes: *** indicates statistical significance at 1% level. Post-Bio2020 indicates a period from 2011 to 2016.FemDir is a dummy variable that equals 1, if a firm has at least one female board member, and 0 otherwise. Bio-sensitive industries include five industrial sectors such as gas & utilities, mining, construction materials, oil & gas, and industrials.

Table 6 Correlation matrix

Variables	BMP	BIA	Diversity	GRI	Bio2020	B.size	B.exp	Independence	Separation	ESG	CSR	EMS
BMP	1.00											
BIA	0.30	1.00										
Diversity	0.26	0.06	1.00									
GRI	0.17	0.07	0.03	1.00								
Bio2020	0.25	0.07	0.36	0.06	1.00							
B.size	0.35	0.12	0.04	0.04	-0.02	1.00						
B.exp	0.05	0.04	-0.01	0.04	0.09	0.09	1.00					
Independence	0.06	0.02	0.06	0.01	-0.07	-0.22	-0.08	1.00				
Separation	-0.12	-0.02	-0.06	0.07	0.00	-0.18	-0.17	0.05	1.00			
ESG	0.24	0.07	0.15	0.08	0.27	-0.01	-0.02	0.08	0.10	1.00		
CSR	0.49	0.09	0.29	0.21	0.36	0.15	0.02	0.05	-0.01	0.29	1.00	
EMS	0.34	0.08	0.05	0.06	0.10	0.22	0.03	0.02	-0.07	0.08	0.23	1.00
Size	0.55	0.14	0.13	0.04	0.05	0.59	-0.02	0.01	-0.16	0.12	0.29	0.33

Note: Please see Table 2 for variable definitions.

Table 7 Three-way least square dummy variable (LSDV) regression (Reg.) of Biodiversity Management Performance (BMP) index against gender diversity, institutional and control variables

Variables	(1) Reg with diversity and Bio2020	(2) Reg with interaction between diversity and GRI	(3) Reg with interaction between diversity and Bio2020
Diversity	0.0146***		
	(0.00224)		
GRI	0.239***		0.210***
	(0.0490)		(0.0490)
Bio2020	0.297***		
	(0.0480)		
B.size	0.276***	0.361***	0.259***
	(0.0947)	(0.0947)	(0.0946)
B.exp	0.114**	0.0950*	0.123**
	(0.0518)	(0.0505)	(0.0520)
Connections	-0.0363	0.0263	-0.0506
	(0.0346)	(0.0343)	(0.0346)
Independence	0.00312***	0.00282***	0.00311***
	(0.00100)	(0.00102)	(0.00101)
Separation	-0.0839	-0.0825	-0.0986
	(0.0729)	(0.0711)	(0.0731)
ESG	0.238***	0.202***	0.268***
	(0.0517)	(0.0517)	(0.0516)
CSR	0.854***	0.654***	0.917***
	(0.0526)	(0.0554)	(0.0520)
EMS	0.225***	0.178***	0.219***
	(0.0552)	(0.0547)	(0.0556)
Q	0.0568	0.0719*	0.0399
	(0.0385)	(0.0396)	(0.0378)
Size	0.447***	0.460***	0.448***
	(0.0269)	(0.0266)	(0.0270)
Profitability	0.00344	0.00434*	0.00283
	(0.00258)	(0.00252)	(0.00255)
Leverage	-0.00544***	-0.00539***	-0.00571***
	(0.00156)	(0.00154)	(0.00156)
Employees	-0.00554	-0.00167	-0.00459
	(0.0210)	(0.0207)	(0.0211)
Shareholders	0.0345	0.0305	0.0400
	(0.0248)	(0.0245)	(0.0248)
Slack	-0.239	-0.451**	-0.208
	(0.210)	(0.207)	(0.211)
Intensity	0.645***	0.700***	0.654***
	(0.0687)	(0.0683)	(0.0694)
Capex	-0.000155	-0.00143	-0.000566
	(0.00231)	(0.00224)	(0.00234)
Growth	-0.000178*	-6.90e-05	-0.000142
	(9.28e-05)	(9.19e-05)	(9.24e-05)
Diversity*GRI		0.0107***	
		(0.00212)	
Diversity*Bio2020			0.0170***
			(0.00192)
Constant	-6.416***	-7.676***	-6.333***
	(0.463)	(0.513)	(0.464)
Country dummies	Yes	Yes	Yes
Year dummies	No	Yes	No
Industry Dummies	Yes	Yes	Yes
Observations	4,013	4,013	4,013
R-squared	0.544	0.562	0.540

Notes: Please see Table 2 for variable definitions. ***, ** and * indicate statistical significance at 1, 5 and 10% levels, respectively. The figures in parentheses are the heteroskedasticity-adjusted robust standard errors.

Table 8 Logit regression (Reg.) of biodiversity impact assessment (BIA) against gender diversity, institutional and control variables

Variables	(1) Reg with diversity and Bio2020	(2) Reg with interaction between diversity and GRI	(3) Reg with interaction between diversity and Bio2020
Diversity	0.0294***		
	(0.0113)		
GRI	0.462		0.493*
	(0.295)		(0.300)
Bio2020	0.381		
	(0.278)		
B.size	1.373**	1.191*	1.363**
	(0.631)	(0.649)	(0.627)
B.exp	0.471	0.551	0.437
	(0.356)	(0.378)	(0.357)
Connections	0.0103	-0.0191	-0.0132
	(0.172)	(0.174)	(0.173)
Independence	0.00411	0.00246	0.00390
	(0.00457)	(0.00513)	(0.00453)
Separation	0.0999	0.131	0.0675
	(0.288)	(0.305)	(0.288)
ESG	0.506*	0.570**	0.584**
	(0.269)	(0.277)	(0.261)
CSR	-0.242	-0.212	-0.0926
	(0.346)	(0.429)	(0.328)
EMS	1.315***	1.280***	1.291***
	(0.401)	(0.369)	(0.400)
Q	0.0930	-0.163	0.0152
	(0.199)	(0.255)	(0.227)
Size	0.282**	0.309**	0.294**
	(0.134)	(0.142)	(0.134)
Profitability	-0.0139	-0.0126	-0.0159
	(0.0119)	(0.0119)	(0.0116)
Leverage	-0.000576	0.00106	-0.000733
	(0.00809)	(0.00861)	(0.00812)
Employees	0.221	0.213	0.211
	(0.138)	(0.140)	(0.137)
Shareholders	0.100	0.127	0.0918
	(0.121)	(0.121)	(0.122)
Slack	-7.164***	-6.941***	-6.682***
	(2.141)	(2.163)	(2.072)
Intensity	1.003***	1.051***	1.022***
	(0.298)	(0.319)	(0.296)
Capex	0.00928**	0.0107***	0.00927**
	(0.00409)	(0.00406)	(0.00414)
Growth	-0.000128	0.000180	-5.39e-05
	(0.000538)	(0.000535)	(0.000544)
Diversity*GRI		0.0361***	
		(0.0108)	
Diversity*Bio2020			0.0233**
			(0.0107)
Constant	-19.86***	-17.62***	-19.42***
	(2.585)	(2.628)	(2.601)
Country dummies	Yes	Yes	Yes
Year dummies	No	Yes	No
Industry Dummies	Yes	Yes	Yes
LR Chi^2	398.46***	429.23***	397.95***
Pseudu R^2	0.306	0.318	0.301
Observations	3,177	3,078	3,177

Notes: Please see Table 2 for variable definitions. ***, ** and * indicate statistical significance at 1, 5 and 10% levels, respectively. The figures in parentheses are the heteroskedasticity-adjusted robust standard errors.