Received 21 June 2022
Revised 27 October 2022
25 December 2022
Accepted 6 February 2023

Does corporate environmental performance affect corporate biodiversity reporting decision? The Finnish evidence

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Abstract

Purpose – This study aims to examine whether there exists any relationship between corporate biodiversity reporting decision (CBRD) and corporate environmental performance (CEP).

Design/methodology/approach – The primary sample contains 442 firm-year observations over a period of 13 years (2008–2020) for 34 listed Finnish companies. Based on both legitimacy theory and voluntary disclosure theory, 2 logit regression models are estimated to test the CBRD–CEP nexus. CBRD is a dichotomous variable. Three proxies for CEP, namely propensity to emit greenhouse gas (GHG), propensity to consume water and propensity to generate waste are employed.

Findings – This study finds that firms having higher propensity to consume water and generate waste are inclined to release biodiversity-related information. The findings support legitimacy theory suggesting that firms with inferior environmental performance may decide on reporting biodiversity information for legitimation purpose.

Research limitations/implications – The study uses Finnish data and hence, the results may lack in generalizability to other national contexts.

Practical implications – The results of this study should be valuable to policy makers for formulating mandatory biodiversity reporting standards to ensure disclosure of standard, extensive and authentic biodiversity-related information by companies. The results should also be valuable to corporate managers and eco-friendly investors.

Originality/value – Corporate biodiversity reporting (CBR) is an under-researched area of environmental accounting literature. Using the Finnish context, this paper extends the existing literature by investigating whether any association exists between CBRD and CEP, which has not been examined before.

Keywords Biodiversity, Ecosystem, Ecosystem services, Corporate biodiversity reporting, Corporate environmental performance, Finland

Paper type Research paper

1. Introduction

Corporate biodiversity reporting (CBR) is a subset of corporate environmental reporting (Bhattacharyya and Yang, 2019; Gaia and Jones, 2017; Hassan *et al.*, 2020) and a relatively under-researched area of environmental accounting literature (Bhattacharyya and Yang, 2019; Gaia and Jones, 2017; Hassan *et al.*, 2020; Rimmel and Jonäll, 2013; van Liempd and Busch, 2013). This study intends to examine whether there exists any association between corporate biodiversity reporting decision (CBRD) and corporate environmental performance (CEP) and thus to extend the existing literature.

The first author acknowledges the financial support from Suomen Arvopaperimarkkinoiden Edistämissäätiö.

Journal of Applied Accounting Research
Vol. 25 No. 1, 2024
pp. 24-41
Emerald Publishing Limited
0967-5426
DOI 10.1108/JAAR-06-2022-0148

Biodiversity is vital to human existence and economic progress. Because of its importance, biodiversity is a commonly debated issue in business, society and politics and often emphasized on the international agenda (GRI, 2007). The Convention on Biological Diversity (CBD), which is the main international convention promoting sustainable development and sustainable use of biodiversity, defines biological diversity or biodiversity as "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" [1]. This definition refers to the term "*ecosystem*" and three types of biodiversity, namely *diversity within species (or genetic diversity* [2]*)*, *diversity between species (or species diversity* [2]*)* and *diversity of ecosystems (or ecosystem diversity* [2]*)*, whose understanding provides the foundation for understanding the importance of biodiversity in human survival and economic development [3].

The CBD further defines ecosystem as "a dynamic complex of plant, animal and microorganism communities and their non-living environment interacting as a functional unit [1]". Examples of ecosystems include forest and woodlands, inland water, islands, drylands etc. Ecosystems provide ecosystem services, which are the "benefits people obtain from ecosystems" [4,5], on which both human life and economic growth are reliant; ecosystems deliver four types of ecosystem services such as *provisioning services* (e.g. fresh water, food, medicines, etc.), *supporting services* (e.g. soil formation, nutrient cycling etc.), *cultural services* (e.g. recreation and tourism facilities, esthetic values etc.) and *regulating services* (e.g. climate regulation, flood control, water purification etc.) [5]. Along with humans, every organization relies on at least one ecosystem service either directly or indirectly. For example, food is the most important ecosystem service for organizations involved in food processing and retail (GRI, 2007); organizations operating in the ecotourism industry are dependent on almost all types of ecosystem services, whereas agricultural firms heavily rely on most of the ecosystem services such as fresh water, genetic resources, pollination, water regulation and purification and natural hazard regulation [6]. Hence, healthy ecosystems are indispensable for ensuring the continued delivery of ecosystem services and the effective functioning of ecosystems is dependent on healthy biodiversity; thanks to healthy biodiversity, ecosystems can maintain oxygen levels in the air, provide habitats to animals and plants, develop the soil, regulate climate and minimize storm damage (GRI, 2007).

The afore-mentioned three types of biodiversity are the key to preserving ecosystems. Genetic diversity helps certain species or populations to adjust to changes in environmental conditions of ecosystems and thus develops their resistance to various diseases and epidemics; contrarily, insufficiency of genetic diversity may render a species (plant, animal or microorganism) vulnerable to new diseases and thus increase the probability of a species becoming extinct in the long run (GRI, 2007). Insufficiency of genetic diversity will prevent, for instance, farmers and breeders from selecting crops and animals that are high-yield, resistant to diseases, of good taste and environment-friendly (Mohammed, 2019). Species diversity or the number of flora and fauna species in a particular ecosystem is conducive to the efficient functioning of that ecosystem because of the interdependence of flora and fauna species (GRI, 2007). Any interruption in the life cycle of animal and plant species inhabiting an ecosystem can adversely affect the functioning of the entire ecosystem leading to the discontinuity of the delivery of ecosystem services (GRI, 2007). For instance, the disruption in the predator–prey relationship between big cats (lions and leopard) and olive baboons inhabiting different parts of Africa has interrupted the delivery of a regulating service like disease control. The decrease in the number of lions and leopards has resulted in population outbreaks and behavioral changes of olive baboons, brought them in contact with more people and caused the spread of intestinal parasites at a higher rate in both olive baboons and people [7]. Lastly, ecosystem diversity needs to be maintained to ensure uninterrupted supply of various ecosystem services as different ecosystems deliver different services. For example, marine ecosystem provides food, recreation facilities, nutrient cycling and climate regulation, whereas forest and woodlands deliver timber and fuel wood, disease regulation and esthetic and spiritual values. The failure to preserve different ecosystems will result in the cessation of their specific services (GRI, 2007).

Business organizations impact biodiversity both directly and indirectly. Organizations directly impact biodiversity through their activities or environmental performance (EP) such as greenhouse gas (GHG) emissions into air, consumption of surface water and generation of waste. Emissions of GHG cause climate change, which in turn affects habitats of different species leaving them vulnerable [8]; excessive consumption of surface water may lead to a scarcity of water and thus jeopardize the species of a certain area that rely on surface water (GRI, 2007). Wastes generated by organizations need to be dumped in landfills. Landfills need wild areas to be cleared and contaminate neighboring habitats through leachates, leading to the degradation of soil quality and habitat loss. Landfills also cause climate change by releasing landfill gas. In both cases, a loss of biodiversity occurs [9]. In essence, environmental performance of organizations directly affects all types of biodiversity and hence, ecosystem services. Indirect impacts on biodiversity stem either from the activities triggered by organizations' operations or from the activities or environmental performance of organizations' supply chain partners (GRI, 2007). For instance, products manufactured by one organization can be used as inputs by another manufacturing organization in its products and the inputs may directly impact biodiversity. Indirect impacts cannot be easily predicted and managed (GRI, 2007).

A decline in biodiversity at an accelerating rate is being noticed worldwide (Potdar *et al.*, 2016). Willison and Côté (2009) contend that the loss of biodiversity is one of the key environmental problems. They also argue in favor of preserving biodiversity in order to achieve sustainable development. It is also claimed that business organizations are playing a major role in the rapid loss of biodiversity through production of goods and services for human consumption (Potdar *et al.*, 2016). Business organizations can minimize the risks that their activities pose to biodiversity by improving on their environmental performance (e.g. reduction in water consumption and GHG emissions) and by taking measures to conserve biodiversity (Potdar *et al.*, 2016; GRI, 2007). Hence, business organizations are expected to be stewards of the natural environment (of which biodiversity is a part), undertake necessary initiatives to protect biodiversity (Potdar *et al.*, 2016) and remain accountable to their stakeholders for their impacts on the environment (Jones, 2003; Jones and Solomon, 2013). In addition, the society and interested stakeholders expect business organizations to provide information on the effect of their activities or environmental performance on species and natural habitats and also on their actions to manage this issue (Boiral, 2016; Jones, 2003), i.e. the society and interested stakeholders expect firms to engage in CBR. CBR, as an interface between companies and their stakeholders (and the society as well), can fulfill the information needs of the interested stakeholders (and the society as well) because companies can indicate through CBR the actions they are taking to conserve biodiversity as well as the level of their commitment towards biodiversity preservation. Hence, CBR is an important communication tool for business organizations, which, through supply of appropriate environmental information, enables the society and interested stakeholders to assess business organizations' environmental stewardship and thus allows firms to take necessary measures for the protection of biodiversity (Gaia and Jones, 2020; Jones, 1996; Jones and Solomon, 2013). Consequently, through CBR, firms can get greater recognition for their efforts, which in turn can restore the public faith in firms and thus fortify the relationship between firms and their stakeholders (Potdar *et al.*, 2016). Despite its immense importance, CBR is an under-explored area of environmental accounting literature and in particular, the relationship between CBR and CEP remains an unaddressed issue. This paper contributes to the scarce literature by examining whether CEP affects CBRD.

This paper enriches the current literature in three ways. First, it extends the environmental reporting literature by inquiring into CBR, a less-researched area of the existing literature. Prior studies mainly investigate either overall corporate environmental reporting practices (e.g. Al-Tuwaijri *et al.*, 2004; Andrikopoulos and Kriklani, 2013; Braam *et al.*, 2016; Clarkson *et al.*, 2008, 2011; Moroney *et al.*, 2012) or corporate carbon reporting practices, a subset of corporate environmental reporting practices (e.g. Chithambo and Tauringana, 2014; Choi *et al.*, 2013; Cotter and Najah, 2011; Giannarakis *et al.*, 2017, 2018; Luo, 2019), while CBR remains neglected (Bhattacharyya and Yang, 2019; Gaia and Jones, 2017; Hassan *et al.*, 2020; Rimmel and Jonäll, 2013; van Liempd and Busch, 2013). Second, this study empirically examines the relation between CBRD and CEP. Though a few studies (e.g. Adler *et al.*, 2018; Bhattacharyya and Yang, 2019; Gaia and Jones, 2020; Hassan *et al.*, 2020; Rimmel and Jonäll, 2013) inquire into the determinants of CBR, none of them assesses the association between CEP and CBRD or the level of CBR. Our study is the first one (based on authors' knowledge) to examine whether CEP has any influence on the corporate decision to report biodiversity-related information. Finally, this study is the first one to investigate Finnish companies' biodiversity reporting and thus makes a contextual contribution. Finland has achieved a number of successes in environmental protection; for instance, Finland has successfully reduced the levels of acidifying nitrogen emissions and sulfur emissions to only 40 and 12% of 1990 levels respectively, which has resulted in the excellent quality of air when compared internationally [10]. Moreover, Finland has succeeded in reducing eutrophication (Eutrophication is the "increase in the supply of organic matter to an ecosystem through nutrient enrichment" and it is "induced by excessive availability of nitrogen and phosphorus for primary producers (algae, cyanobacteria and benthic macro vegetation)" [11]) in water systems through enhancing purification of waste water from point sources [10]. This is an important achievement because eutrophication is the most common and evident environmental change affecting the water systems of Finland; numerous small and shallow water bodies of Finland are affected by eutrophication preventing people from utilizing these water bodies. Despite these successes in environmental protection, Finland's biodiversity is declining at an accelerating rate [10]. Between 2000 and 2021, Finland has seen a negative development of biodiversity in relation to the number of threatened species; for example, the situation of 263 species improved and of 461 species worsened during the period from 2010 to 2019 [10]. Presently, at least 2,663 species (almost 12%) of Finland face the threat of extinction [10,12]. Moreover, almost fifty percent of Finland's natural habitats (biotopes) are also endangered; for instance, all of Finland's rural meadows, which are important for biodiversity, are threatened [10]. This biodiversity degradation indicates Finland's failure to achieve ecologically sustainable development [10]. Consequently, Finland, together with other European Union (EU) member countries, committed itself to putting an end to biodiversity loss and the degradation of ecosystem services by 2020 under a strategy for the protection of biodiversity in the EU by 2020 [13]. This strategy was adopted by the European Commission in May 2011 [13]. Moreover, as a strong champion of sustainable development, Finland is committed to implementing the "UN 2030 Agenda for Sustainable Development" [14]. The "UN 2030 Agenda for Sustainable Development" has 17 Sustainable Development Goals (SDGs) for ending poverty, protecting the planet and ensuring peace and prosperity for all people by 2030 [15] and the protection of biodiversity is aligned with many of these SDGs. The SDG 15, for instance, directly concerns the protection of terrestrial ecosystems and biodiversity. Finland is a pioneer in putting in place national objectives, actions and a monitoring and assessing system for attaining the UN SDGs [16]. Nevertheless, Finland has not yet succeeded in achieving the target of halting biodiversity loss by 2020 and attaining this target is extremely doubtful even now [17]. Under these interesting circumstances, Finland serves as the relevant research context for this study.

The rest of this paper is planned as follows. Section 2 sheds light on prior research and develops the hypotheses based on relevant theories. Section 3 describes the research methods. Section 4 presents and discusses analysis results. Conclusions are drawn in section 5.

2. Review of literature and development of hypothesis

2.1 Prior research

Research into CBR practices is scarce (Bhattacharyya and Yang, 2019; Gaia and Jones, 2017; Hassan *et al.*, 2020; Rimmel and Jonäll, 2013; van Liempd and Busch, 2013). While a vast literature on corporate social and environmental accounting and reporting has developed, only a few studies have addressed the issue of biodiversity, which implies that the importance of biodiversity has not been generally acknowledged (Gaia and Jones, 2017).

Haque and Jones (2020) employ institutional theory and resource dependency theory to investigate the association between board gender diversity and biodiversity disclosures of European corporations over a fifteen-year period (from 2002 to 2016). The authors also examine whether the board gender diversity-biodiversity disclosures nexus is moderated by the EU biodiversity strategy and the Global Reporting Initiative (GRI) framework. Their findings suggest the existence of a positive association between board gender diversity and corporate biodiversity disclosures and that this relationship is positively moderated by the EU biodiversity strategy and the GRI framework. Hassan *et al.* (2020) use greenwashing theory to examine biodiversity disclosures by 200 Fortune Global companies over a three-year period and investigate the factors determining such disclosures. Their results confirm a poor quantity and quality of biodiversity disclosures by these companies. In addition, the findings also reveal that the level of biodiversity disclosures by the sample firms is positively affected by a wide range of factors namely, external assurance provided by Big 4 audit firms, winning an environmental award, riskiness of the biodiversity sector to which the sample company belongs, presence of biodiversity partners, country (developed vs developing) where the sample company is located and the number of specific biodiversity words published in the sample company's reports. Bhattacharyya and Yang (2019) assess the effect of the adoption of GRI's G4 guidelines and other institutional factors on the extent of biodiversity reporting of 41 Australian listed companies and find that biodiversity disclosures by the sample companies increase significantly during the G4 era as compared to the pre-G4 era. Moreover, media exposure and metals and mining industry membership of the sample companies are found to be positively associated with the level of CBR. As far as the Nordic context is concerned, van Liempd and Busch (2013) and Rimmel and Jonäll (2013) analyze the disclosure of biodiversity-related information by Danish and Swedish companies respectively. Both these studies report that CBR is inadequate in Denmark and Sweden. Boiral (2016) analyzes biodiversity reporting practices in global mining organizations that issue GRI reports (G3.1 version) for the period 2008–2010 and finds the dissemination of limited and biased biodiversity-related information by the sample companies. Gaia and Jones (2020) study the linkage between 351 English local councils' characteristics and disclosure of biodiversity-related information published in their official websites. They analyze the current nature and content of biodiversity disclosures and adopt a multi-theoretical framework to examine the factors affecting the extent of these councils' biodiversity reporting. Their findings show a poor quantity and quality of biodiversity disclosures and confirm that the extent of biodiversity disclosure is significantly affected by factors such as the population of local councils, local councils' visibility, the presence of councilors from environmentally oriented parties and environmental NGOs operating in the local council area and poor biodiversity management practices. Other empirical works relating to biodiversity reporting by local government authorities include the studies of

Schneider *et al.* (2014) and Barut *et al.* (2016) conducted in New Zealand and Australia respectively. Both studies show that most of the local government authorities of New Zealand and Australia do not disclose full information to their stakeholders and thus fail to discharge their accountability towards them.

None of the studies discussed in the preceding paragraph exclusively investigates the effect of CEP on CBR. This paper fills this gap in the existing literature by examining the impact of CEP on the corporate decision to disclose biodiversity-related information. The work of Hassan *et al.* (2020) is the only study that assesses the effect of CEP while inquiring into the determinants of biodiversity reporting of Fortune Global companies and finds no significant association between the level of CBR and CEP. Hassan *et al.* (2020) use *environmental well-being scores* (EWSs) as the measure of CEP but this measure suffers from at least three problems. Firstly, EWSs are available for countries, regions and income classes. Company-level EWSs are not available; hence, EWSs do not reflect the actual CEP. Secondly, EWSs are available for each country every two years. Consequently, EWSs cannot be used to measure CEP for a continuous sample period. For example, the sample period used by Hassan *et al.* (2020) includes the years 2012, 2014 and 2016 as EWSs are available for these even years and thus the authors are unable to include odd years such as 2011, 2013, 2015 and so on. Finally, based on the EWSs, Hassan *et al.* (2020) subjectively classify sample companies into poor performers (290 companies with EWSs between 0 and 2.9) and better performers (310 companies with EWSs between 3 and 5). Justifications for such classification are not provided and consequently, a change in the subjective criteria of classifying companies into two groups (poor and better performers) will lead to a change in the number of poor and better performers, which may in turn affect the results of the study. These problems, following the empirical work of Konar and Cohen (2001), are circumvented in this study by employing objective measures of CEP namely, propensity to emit GHG, propensity to consume water and propensity to generate waste. These measures reflect the actual environmental performance of sample companies and in addition, data on these measures are available for every year of the sample period for most of the companies under study.

2.2 Theoretical framework and hypothesis development

Corporations are drawing increasing public attention because of their role in environmental change through their EP such as GHG emissions, water consumption and waste production. Consequently, they are under constant pressure from a variety of stakeholders such as capital providers, environmental organizations [18] (e.g. Intergovernmental Panel on Climate Change (IPCC), United Nations Environment Program (UNEP), International Union for Conservation of Nature (IUCN) etc.) and inhabitants of densely populated areas [18]; this has led to the to the development of a tendency for corporations to disclose their EP-related information (Braam *et al.*, 2016). Companies that are poor environmental performers utilize dissemination of EP-related information as a management tool to seek corporate legitimacy without which the survival of such companies will be threatened. Conversely, companies with better EP release EP-related information in order to demonstrate their relatively better position in terms of EP and their commitment towards sustainable development to their stakeholders (Braam *et al.*, 2016). In sum, firms with two opposing types of EP engage in the reporting of environmental information for two different reasons. Therefore, prior researchers (e.g. Braam *et al.*, 2016; Luo and Tang, 2014; Deegan, 2002; Gray *et al.*, 1995) needed two different and contrasting theoretical perspectives, namely, legitimacy theory and voluntary disclosure theory, to explain the relationship between CEP and corporate environmental reporting. Legitimacy theory provides explanations on how firms with poor EP attempt to obtain corporate legitimacy for their continued existence through disclosure of corporate environmental information and on the other hand, voluntary disclosure theory offers explanations of why firms with relatively better EP send signal of their superiority in terms of EP to their stakeholders by reporting corporate environmental information. Hence, it is appropriate to use these two theories in illuminating the possible influence of CEP on corporate environmental reporting. Since CBR is a subset of corporate environmental reporting (Bhattacharyya and Yang, 2019; Gaia and Jones, 2017; Hassan *et al.*, 2020), the explanation of legitimacy theory and voluntary disclosure theory regarding the CEP-corporate environmental reporting nexus are applicable to CEP-CBR relationship as well.

Legitimacy theory predicts that CEP and corporate environmental reporting are inversely related, i.e. companies with poor environmental performance are likely to disclose a higher level of environmental information and vice versa (Braam *et al.*, 2016; Giannarakis *et al.*, 2017). Legitimacy theory suggests that an organization operates through a social contract in the society and requires legitimacy for its survival. Such legitimacy is achieved when a congruency between social values and organizational values exists. In other words, an organization needs to operate within values, norms and boundaries of the society of which it is a part; in case it fails to carry out its activities in a socially accepted manner, it attracts a higher level of public attention, faces increased public pressure and its legitimacy is threatened, which may lead to the cessation of its existence (Braam *et al.*, 2016; Giannarakis *et al.*, 2017; Patten, 2002). Corporate legitimacy is jeopardized because of poor CEP (Braam *et al.*, 2016). Consequently, firms with inferior CEP tend to divert public attention and alter social perceptions in order to lessen the negative impacts on their legitimacy by voluntarily disclosing more environmental information than companies with superior CEP (Boiral, 2013; Freedman and Patten, 2004; Gray *et al.*, 1995).

However, voluntary disclosure theory has an opposite prediction about the CEP-corporate environmental reporting nexus. This theory proffers that firms with healthier environmental performance are disposed to release a higher level of environmental information and vice versa (Braam *et al.*, 2016; Giannarakis *et al.*, 2017). According to this theory, firms with superior environmental performance report a higher level of environmental information in an attempt to separate themselves from firms with inferior environmental performance and thus they try to reap the benefits of reporting information on better environmental performance, which include reduced cost of equity capital and boosted corporate reputation (Braam *et al.*, 2016; Dhaliwal *et al.*, 2011; Giannarakis *et al.*, 2017; Luo and Tang, 2014). Contrarily, inferior environmental performers either abstain themselves from disclosing environmental information or report ambiguous or unverifiable information about their environmental performance (Braam *et al.*, 2016; Clarkson *et al.*, 2011; Giannarakis *et al.*, 2017).

It may be assumed from the discussion in the preceding paragraphs that firms doing poorly in terms of environmental performance are disposed to report biodiversity-related information in order to deflect public attention or pressure and maintain or reclaim their legitimacy (based on legitimacy theory), while firms with superior environmental performance tend to report biodiversity-related information to demonstrate their commitment and accountability towards the natural environment (based on voluntary disclosure theory). Hence, the following two hypotheses are formulated.

H1a. According to legitimacy theory, there is a significant negative relationship between CEP levels and CBRD.

H1b. According to voluntary disclosure theory, there is a significant positive relationship between CEP levels and CBRD.

3. Methods

3.1 Sample and data

The initial sample of this study consists of 442 firm-year observations over a period of thirteen years (2008–2020) for 34 listed Finnish companies. The number of sample firms and the sample period are dictated by the availability of data [19]. Due to missing data for different variables (used in the regression models) in different years, the number of observations is reduced to 266 and 243 firm-years for Models 1 and 2 respectively (model details appear in section 3.3). For this empirical research, data are collected from Thomson Reuters DataStream database.

3.2 Variables

3.2.1 Dependent variable. CBRD is the dependent variable for this study. It is a dichotomous variable that equals 1 if a company decides to disclose biodiversity information and 0 otherwise.

3.2.2 Independent variable. CEP is the only independent variable in this study. Since corporate emissions to air, corporate water consumption and corporate waste generation directly impact biodiversity (GRI, 2007), propensity to emit GHG (CEP_1), propensity to consume water (CEP_2) and propensity to generate waste (CEP_3) are used to measure CEP (Al-Tuwaijari *et al.*, 2004; Braam *et al.*, 2016; Cho and Patten, 2007; Clarkson *et al.*, 2008; Dutta, 2020). Higher propensities indicate higher amount of GHG emitted, water consumed and waste generated and hence, inferior CEP; lower propensities indicate lower amount of GHG emitted, water consumed and waste generated and hence, superior CEP (Braam *et al.*, 2016; Clarkson *et al.*, 2008, 2011). These three types of propensity represent size-adjusted or scaled measures of CEP. In line with prior literature (Al-Tuwaijari *et al.*, 2004; Braam *et al.*, 2016; Cho and Patten, 2007; Clarkson *et al.*, 2008; Dutta, 2020), we define these measures as follows.

$$\text{CEP}_1 = \text{total amount of GHG emitted/total revenue}$$

$$\text{CEP}_2 = \text{total amount of water consumed/total revenue}$$

$$\text{CEP}_3 = \text{total amount of waste generated/total revenue}$$

Compared to smaller companies, larger companies are expected to emit higher amount of GHG, consume higher volume of water and generate higher quantity of waste (Braam *et al.*, 2016). Consequently, absolute measures of CEP (for example, the total amount of waste generated) do not enable comparisons of CEP across companies and between different periods (Hoffmann and Busch, 2008) as they do not consider variations in the level of product and service outputs; such weakness can be overcome by replacing absolute measures of CEP by size-adjusted measures of CEP (Dutta, 2020; Luo and Tang, 2014). Hence, size-adjusted measures of CEP are employed in this study.

3.2.3 Control variables. Based on the existing literature, this study includes several control variables namely, firm size (*FSIZE*), profitability (*PROF*), leverage (*LEV*), industry (*IND*) and asset age (*ASST_AGE*). *FSIZE* is measured as the logarithm of year-end total assets (Al-Shaer and Zaman, 2018; Dutta, 2020; Haque and Jones, 2020; Hassan *et al.*, 2020; Jaggi *et al.*, 2018). The *FSIZE-CBRD* link is expected to be positive. *PROF* is proxied by the return-on-assets (ROA), which is computed by dividing the year-end net income by the year-end total assets (Al-Shaer and Zaman, 2018; Dutta, 2020; Hassan *et al.*, 2020; Gillet-Monjarret, 2015). A positive association between *PROF* and *CBRD* is predicted. *LEV* is proxied by the debt-to-equity ratio (Dutta, 2020; Jaggi *et al.*, 2018) and its impact on *CBRD* is expected to be positive. *IND* is a dichotomous variable that equals 1 for firms belonging to environmentally sensitive industries and 0 otherwise (Cho *et al.*, 2014; Dutta, 2020; Dutta and Dutta, 2021; Yunus *et al.*, 2016). The existing literature (Cho *et al.*, 2014;

Clarkson *et al.*, 2008; Dutta, 2020; Dutta and Dutta, 2021; Patten, 2002; Yunus *et al.*, 2016) suggests that chemicals, petroleum, energy, paper, metals, materials, pharmaceuticals, mining and extractive, telecommunication, utilities, industrials and transportation industries are environmentally sensitive industries. *IND* is expected to be positively connected to *CBRD*. *ASST_AGE* is computed by dividing net property, plant and equipment by gross property, plant and equipment (Clarkson *et al.*, 2008; Dutta, 2020). Higher *ASST_AGE* indicates newer assets and lower *ASST_AGE* indicates older assets. *ASST_AGE* is expected to be positively associated with *CBRD*. Finally, a variable named YEAR is also inserted in the models in order to control for the effect of time. YEAR is expected to be positively linked with *CBRD* as firms are expected to gradually undertake biodiversity reporting with the passage of time because of the events such as the adoption of a strategy by the EU in 2011 for the protection of biodiversity and the adoption of the 2030 Agenda for Sustainable Development by the UN member states in 2015 for promoting sustainable development in 2016–2030. YEAR takes the value of 1 for 2008, 2 for 2009, 3 for 2010 and so on (Moroney *et al.*, 2012).

3.3 Regression model

The following logit regression models are estimated in order to test the proposed hypotheses:

$$CBRD = \beta_0 + \beta_1 CEP_1 + \beta_2 CEP_3 + \beta_3 FSIZE + \beta_4 PROF + \beta_5 LEV + \beta_6 ASST\_AGE + \beta_7 IND + \beta_8 YEAR + \varepsilon_1 \quad (1)$$

$$CBRD = \beta_0 + \beta_1 CEP_2 + \beta_2 CEP_3 + \beta_3 FSIZE + \beta_4 PROF + \beta_5 LEV + \beta_6 ASST\_AGE + \beta_7 IND + \beta_8 YEAR + \varepsilon_2 \quad (2)$$

where *CBRD* = biodiversity reporting decision; CEP_1 = total amount of GHG emitted/total revenue; CEP_2 = total amount of water consumed/total revenue; CEP_3 = total amount of waste generated/total revenue; *FSIZE* = firm size; *PROF* = profitability; *LEV* = leverage; *ASST_AGE* = asset age and *IND* = industry. Table 1 presents the summary of these variables.

Table 1.
Description of the variables employed

Variable	Definition
CBRD	A dichotomous variable that equals 1 if a company decides to disclose biodiversity-related information and 0 otherwise
CEP_1	Total amount of GHG emitted/total revenue
CEP_2	Total amount of water consumed/total revenue
CEP_3	Total amount of waste generated/total revenue
FSIZE	The logarithm of the company's year-end total assets
PROF	Proxied by ROA determined by dividing the annual net income by the year-end total assets
LEV	Proxied by the debt-to-equity ratio
IND	A dichotomous variable that equals 1 if the company operates in an environmentally sensitive industry and 0 otherwise
ASST_AGE	Calculated by dividing net property, plant and equipment by gross property, plant and equipment
YEAR	A categorical variable that equals 1 for 2008, 2 for 2009, 3 for 2010, . . . and 13 for 2020

The Pearson correlations coefficients appear in Table 2. A value higher than 0.80 of the correlation coefficient between two independent variables indicates the existence of multicollinearity (Gujarati, 1995). Table 2 confirms the presence of multicollinearity between CEP_1 and CEP_2 as the correlation between CEP_1 and CEP_2 is 0.948. Furthermore, the variance inflation factor (VIF) amounts to 12.63 when CEP_1 and CEP_2 are included in the same regression model confirming the presence of multicollinearity between them. Consequently, a single model cannot accommodate them and two separate models (Model 1 and Model 2) are developed to accommodate all three measures of CEP. No multicollinearity is found to exist among the remaining independent and/or control variables as the correlations among them are less than 0.50.

4. Results and analysis

4.1 Descriptive statistics and correlation matrix

Descriptive statistics for the variables employed in this research appear in Table 2. The highlights of descriptive statistics are as follows. Table 2 reveals that only 30% of the sample companies have decided to disclose information relating to biodiversity. The phenomenon of a relatively small number of Finnish firms reporting biodiversity-related information could be attributed to the absence of mandatory requirement of corporate biodiversity disclosures in Finland. It is also probable that Finnish companies do not find that the benefits of disseminating biodiversity-related information are outweighing the cost of the same. As regards *CEP*, a wide variation is seen in two measures of CEP, namely CEP_2 and CEP_3. For example, the measure of CEP_2, ranging from 0.00 to 618.52, has a mean of 35.34 (and a standard deviation of 106.69) and the measure of CEP_3, ranging from 0.00 to 113.29, has a mean of 1.03 (and a standard deviation of 8.87). On the other hand, the measure of CEP_1, ranging from 0.00 to 7.80, has a mean of 0.39 (and a standard deviation of 0.97). Furthermore, the mean of *IND* indicates that about 82% of the sampled firms operate in environmentally sensitive industries. The average asset age is 0.45, which indicates that sampled firms possess moderately old assets.

The Pearson and Spearman correlation coefficients appear in Table 3. As evident from the table, all three proxies for *CEP* are positively and significantly correlated with *CBRD* indicating that firms that are poor environmental performers tend to take the CBRD. Among control variables, *FSIZE* and *ASST_AGE* have significant positive association with *CBRD*, whereas *PROF* is negatively and significantly linked with *CBRD*. *LEV* and *IND* are not found to have any significant correlation with *CBRD*.

Variable	N	Mean	Maxi	Mini	S.D.
CBRD	323	0.30			0.46
CEP_1	278	0.39	7.80	0.00	0.97
CEP_2	247	35.34	618.52	0.00	106.69
CEP_3	282	1.03	113.29	0.00	8.87
FSIZE	417	6.59	8.45	2.82	0.76
PROF	413	0.66	219.31	−3.03	10.89
LEV	417	0.75	19.17	−3.62	1.16
IND	442	0.82			0.38
ASST_AGE	415	0.45	1.00	0.12	0.18

Note(s): *CBRD* = corporate biodiversity reporting decision; *CEP* = corporate environmental performance (CEP_1 = total amount of GHG emitted/total revenue; CEP_2 = total amount of water consumed/total revenue; CEP_3 = total amount of waste generated/total revenue); *FSIZE* = firm size; *PROF* = profitability; *LEV* = leverage; *IND* = industry; *ASST_AGE* = asset age

Table 2.
Descriptive statistics

Table 3.
Pearson correlations

	CBRD	CEP_1	CEP_2	CEP_3	FSIZE	PROF	LEV	IND	ASST_AGE
CBRD	1								
CEP_1	0.367***	1							
CEP_2	0.355***	0.948***	1						
CEP_3	0.159***	0.153**	0.002	1					
FSIZE	0.116*	0.154**	0.200***	−0.137*	1				
PROF	−0.176***	−0.090	0.031	−0.247***	−0.144**	1			
LEV	0.088	0.034	0.075	0.057	−0.043	0.083	1		
IND	0.036	0.040	0.039	0.016	0.022	−0.012	−0.119*	1	
ASST_AGE	0.234***	0.381***	0.344***	0.298***	0.004	−0.012	0.269***	−0.401***	1

Note(s): *CBRD* = corporate biodiversity reporting decision; *CEP* = corporate environmental performance (CEP_1 = total amount of GHG emitted/total revenue; CEP_2 = total amount of water consumed/total revenue; CEP_3 = total amount of waste generated/total revenue); *FSIZE* = firm size; *PROF* = profitability; *LEV* = leverage; *IND* = industry; *ASST_AGE* = asset age; *** for $p < 0.01$; ** for $p < 0.05$; *for $p < 0.10$

4.2 Regression results

Logit regression results appear in Table 4. Model 1 presents the results based on CEP_1 and CEP_3, while Model 2 presents the findings based on CEP_2 and CEP_3. *CBRD* is the dependent variable in both models. The control variables included in both models are the same. The R^2 of Models 1 and 2 are 41% and 42% respectively. For each model, the likelihood ratio (LR) statistic is significant at the 1% level. The results in Table 4 demonstrate that CEP_3 is positively and significantly (at the 1% level) associated with *CBRD*, whereas CEP_2 has a positive but weak association (at the 10% level) with *CBRD* suggesting that firms consuming higher amount of water and generating higher amount of waste tend to report biodiversity information, i.e. poor environmental performers are inclined towards biodiversity reporting. CEP_1 is found to have a positive but statistically insignificant relationship with *CBRD*.

Among the control variables, *ASST_AGE* and *IND* are found to have a positive and significant association with *CBRD* at the 1% level but *ASST_AGE* is found to be significant in both models, while *IND* appears to be significant in Model 2 only. These results suggest that firms possessing newer equipment and operating in environmentally sensitive industries tend to report biodiversity-related information. These results could be attributed to the following facts: first, newer equipment are believed to be less polluting than older equipment and firms possessing newer equipment tend to inform their stakeholders of their contribution to the cleanliness of the environment through possession of cleaner technologies (Clarkson *et al.*, 2011). This result is consistent with that of Clarkson *et al.* (2011) and Moroney *et al.* (2012) but contrasts with Clarkson *et al.* (2008) and Dutta and Dutta (2021). Second, firms operating in environmentally sensitive industries are under higher public pressure for their polluting nature and face greater legitimacy threat and so, they are more likely to engage in CBR to exhibit their commitment to environmental protection and thus maintain their legitimacy (Braam *et al.*, 2016; Jaggi *et al.*, 2018). This result is in line with that of various previous studies such as Choi *et al.* (2013), Jaggi *et al.* (2018), Kılıç and Kuzey (2019) and Moroney *et al.* (2012) but contrasts with Braam *et al.* (2016). The remaining control variables (*FSIZE*, *PROF*, *LEV* and *YEAR*) are found to be insignificant.

Dependent variable CBRD Variable	Expected sign	Model 1	Model 2
Intercept		−7.94*** (−2.49)	−13.35*** (−3.35)
CEP_1	+/−	0.69 (1.20)	–
CEP_2	+/−	–	0.02* (1.77)
CEP_3	+/−	27.03*** (4.76)	27.27*** (4.23)
FSIZE	+	0.18 (0.59)	0.42 (1.23)
PROF	+	−1.54 (−0.45)	−0.54 (−0.14)
LEV	+	−0.30 (−0.50)	−0.38 (−0.53)
IND	+	2.04 (1.50)	4.96*** (2.84)
ASST_AGE	+	6.09*** (3.64)	7.99*** (3.84)
YEAR	+	0.07 (1.31)	0.06 (1.14)
R^2		0.41	0.42
Observations		266	243
LR statistic		142.44	136.28
Probability (LR statistic)		0.000000	0.000000

Note(s): *CBRD* = corporate biodiversity reporting decision; *CEP* = corporate environmental performance (CEP_1 = total amount of GHG emitted/total revenue; CEP_2 = total amount of water consumed/total revenue; CEP_3 = total amount of waste generated/total revenue); *FSIZE* = firm size; *PROF* = profitability; *LEV* = leverage; *IND* = industry; *ASST_AGE* = asset age; *** for $p < 0.01$; ** for $p < 0.05$; *for $p < 0.10$; *z*-statistics are in parentheses

Table 4.
Regression results

Based on legitimacy theory we hypothesize that firms with poor environmental performance are inclined to report biodiversity information (H1a), while based on voluntary disclosure theory we hypothesize that firms with superior environmental performance tend to report biodiversity information (H1b). Higher values of the three proxies for CEP (CEP_1, CEP_2 and CEP_3) indicate higher GHG emissions, water consumption and waste generation and hence, poor environmental performance. Contrarily, lower values of CEP_1, CEP_2 and CEP_3 confirm lower GHG emissions, water consumption and waste generation respectively and hence, superior environmental performance. Therefore, according to legitimacy theory, CEP_1, CEP_2 and CEP_3 should have a positive association with *CBRD* and they should have a negative association with *CBRD* in line with voluntary disclosure theory. The logit regression results reveal that the coefficients of all three proxies of CEP are positive and of these coefficients, those of CEP_2 and CEP_3 are significant at the 10% level and at the 1% level respectively supporting the hypothesis H1a. In other words, the results are supportive of legitimacy theory that firms with inferior environmental performance are at a greater risk of losing their legitimacy and hence, attempt to reclaim or maintain their legitimacy by engaging in the reporting of biodiversity-related information. These results are in line with various prior studies (e.g. Braam *et al.*, 2016; Cho and Patten, 2007; Clarkson *et al.*, 2011; Luo, 2019). However, the coefficient of CEP_1, though positive, is found to be statistically insignificant. Because this study is country-specific, a country effect may be responsible for this result. In other words, the insignificant coefficient of CEP_1 may result from the fact that Finnish companies that are poor environmental performers in terms of GHG emissions may try to minimize threats to their legitimacy by engaging in a more relevant disclosure activity such as GHG reporting, which is another important subset of corporate environmental reporting.

4.3 Robustness test

In this section, we assess the robustness of our findings by using the logarithmic values of the proxies for CEP [20]. More specifically, we define the new proxies for CEP as follows.

AMT_GHG = logarithm of the absolute amount of GHG emitted;

AMT_WTR = logarithm of the absolute amount of water consumed and

AMT_WST = logarithm of the absolute amount of waste generated.

Table 5 displays the results of the robustness check. These findings are mostly consistent with those reported in Table 4. For example, the coefficient of CEP in terms of GHG emissions is still insignificant, while the same for waste generation appears to be strongly significant in each model. Besides, *ASST_AGE*, like our earlier analyses, remains significant in both models at the 1% level. However, few contrasts are also observed in Table 5. For instance, the coefficient of CEP in terms of water consumption is no longer significant, although it was weekly significant in Table 4. In addition, *FSIZE* and *IND* now become statistically significant at conventional levels. Overall, our findings are robust in that waste generation emerges as the main predictor for CBRD regardless of the proxies used.

5. Summary and conclusions

This study examines whether environmental performance of a sample of Finnish companies affects their decision to report biodiversity-related information. Three proxies for CEP are used to investigate this association. The sample of this study includes 34 listed Finnish companies covering a period from 2008 to 2020. Our findings are summarized as follows.

We find a significant positive relationship between CBRD and two measures of CEP namely, propensity to consume water (CEP_2) and propensity to generate waste (CEP_3). Thus,

Dependent variable CBRD Variable	Expected sign	Model 1	Model 2
Intercept		−8.74*** (−3.10)	−10.63*** (−3.26)
AMT_GHG	+/−	0.38 (1.04)	
AMT_WTR	+/−		−0.03 (−0.11)
AMT_WST	+/−	1.80*** (4.53)	2.33*** (4.49)
FSIZE	+	−0.76* (−1.83)	−0.84* (−1.82)
PROF	+	−2.60 (−0.79)	−3.24 (−0.90)
LEV	+	−0.17 (−0.28)	−0.59 (−0.80)
IND	+	0.18 (0.16)	2.07 (1.31)
ASST_AGE	+	4.45*** (2.88)	6.11*** (3.52)
YEAR	+	0.07 (1.26)	0.05 (0.91)
R^2		0.38	0.38
Observations		266	243
LR statistic		131.27	121.57
Probability (LR statistic)		0.000000	0.000000

Note(s): *AMT_GHG* = logarithm of the absolute amount of GHG emitted; *AMT_WTR* = logarithm of the absolute amount of water consumed; *AMT_WST* = logarithm of the absolute amount of waste generated; refer to Table 1 for the description of the remaining variables; *** for $p < 0.01$; ** for $p < 0.05$; *for $p < 0.10$ and z-statistics are in parentheses

Table 5. Results of robustness test

in line with legitimacy theory, our results confirm that companies with poor environmental performance in terms of water consumption and waste generation are inclined to report biodiversity-related information to maintain or reclaim their legitimacy. However, the association between CBRD and propensity to emit GHG, another proxy for CEP, is found to be insignificant (though positive). This result could be attributed to the use of a country-specific sample of Finnish companies (so called "country effect") that may consider GHG emissions an important factor for engaging in a more relevant disclosure activity such as GHG reporting rather than embarking on the reporting of biodiversity information.

Our results have potential implications for corporate managers, policy makers and eco-friendly investors. Corporate managers are expected to do well in terms of environmental performance and proactively manage the business activities that have potential impacts on biodiversity. Hence, the results indicate that corporate managers can maintain transparency vis-à-vis their CEP as well as their initiatives to preserve biodiversity by engaging in the dissemination of authentic biodiversity-related information regardless of their CEP and thus exhibit their accountability towards the natural environment. Furthermore, the results are important for policy makers as they indicate the necessity for the formulation of mandatory biodiversity reporting standards that will ensure both CBR and uniformity in biodiversity reporting practices of companies irrespective of their CEP. In other words, the mandatory biodiversity reporting standards will require that companies, regardless of their CEP, will disclose extensive and authentic information on the biodiversity issues mandated by biodiversity reporting standards. Finally, these results provide evidence that the underlying CEP is not reflected in CBRD and hence, these results are important for eco-friendly investors, who opt for investing in companies that are concerned about preserving biodiversity and committed to environmental conservation. Eco-friendly investors, through their investment decisions, contribute to the preservation of biodiversity, the conservation of ecosystems and thus the sustained supply of numerous ecosystem services on which both humans and organizations rely.

The main limitation of this study is its country-specificity (as it uses Finnish data), which may lead to the problem of generalizability of the findings to other national contexts. However, this study opens avenues for future research. For example, future studies may contribute to the existing body of literature by extending the proposed model(s) through inclusion of additional control variables such as corporate governance characteristics, growth, research and development intensity and media exposure with a view to testing whether the association between CEP and CBRD continues to hold even after controlling for a relatively comprehensive list of variables. Moreover, future works could investigate whether the relationship between CEP and CBRD is moderated or mediated by other subsets of environmental disclosures (for example, climate change disclosures). Finally, future research may examine the claim found in the existing literature (e.g. Gonzalez-Gonzalez and Ramírez, 2016; De Villiers and Van Staden, 2006; Niskala and Pretes, 1995) that country-specific studies produce very different results for different countries as the disclosure of environmental information depends on the country under consideration.

Notes

1. We retrieve this information from https://www.cbd.int/doc/legal/cbd-en.pdf
2. We retrieve this information from https://www.aboutbioscience.org/topics/biodiversity/
3. The definition of biodiversity is fully comprehensive as it refers to the variability among living organisms from all sources and to different subcategories of diversity namely, genetic diversity, species diversity and ecosystem diversity. The understanding of biodiversity depends on a holistic understanding of completely different ecosystems (e.g. terrestrial, marine etc.) and of three different subcategories of diversity. Hence, making a reference to flora and fauna of a particular ecosystem (e.g. marine ecosystem) or to a particular type of diversity (e.g. genetic diversity) cannot be considered a reference to biodiversity as a whole but only a partial reference to the same.
4. We retrieve this information from https://biodiversitya-z.org/content/ecosystem-services
5. We retrieve this information from https://www.greenfacts.org/glossary/def/ecosystem-services.htm
6. We retrieve this information from https://www.oecd.org/greengrowth/Business,%20Biodiversity%20and%20Ecosystem%20Services.pdf
7. We retrieve this information from https://news.ucsc.edu/2011/07/apex-consumers.html
8. We retrieve this information from https://www.science.org.au/curious/earth-environment/climate-change-and-biodiversity
9. We retrieve this information from https://reducewastekingston.wordpress.com/impacts-on-biodiversity/
10. We retrieve this information from https://kestavakehitys.fi/en/-/state-of-nature-and-the-environment-biodiversity-continues-to-decline-several-successes-in-environmental-protection
11. We retrieve this information from http://stateofthebalticsea.helcom.fi/pressures-and-their-status/eutrophication/
12. We retrieve this information from https://kestavakehitys.fi/en/-/biodiversity-is-declining-effectiveness-of-environmental-protection-must-be-improved-1
13. We retrieve this information from https://ec.europa.eu/environment/pubs/pdf/factsheets/biodiversity_2020/2020%20Biodiversity%20Factsheet_EN.pdf
14. We retrieve this information from https://um.fi/agenda-2030-sustainable-development-goals#inFinland
15. We retrieve this information from https://www.undp.org/sustainable-development-goals?utm_source=EN&utm_medium=GSR&utm_content=US_UNDP_PaidSearch_Brand_English&utm_campaign=CENTRAL&c_src=CENTRAL&c_src2=GSR&gclid=EAIaIQobChMIldLWyLCm8QIV8AWiAx0Z5wV9EAAYAyAAEgKBAvD_BwE
16. We retrieve this information from https://kestavakehitys.fi/en/commitment2050

17. We retrieve this information from https://kestavakehitys.fi/en/-/finland-s-air-quality-is-good-but-its-biodiversity-is-diminishing
18. We retrieve this information from https://nbs.net/identify-prioritize-powerful-environmental-stakeholders/
19. The data required for this study were not completely available before 2008. We started writing this paper in the later period of 2021 when data till 2020 were available. Besides, at the time of writing this paper, a number of Finnish firms are yet to update the data for the year 2021. Due to these issues, our sample period spans from 2008 to 2020.
20. Braam *et al.* (2016) also consider similar logarithmic transformations.

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