Probal Dutta

Essays on Corporate Environmental Performance and Reporting

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Tiivistelmä

Tämä väitöskirja koostuu kolmesta esseestä, joissa tarkastellaan ympäristösuorituskyvyn ja ympäristöraportoinnin eri näkökulmia.

Ensimmäisessä esseessä tutkitaan yritysten ympäristösuorituskyvyn ja vapaaehtoisen kestävän kehityksen varmennuksen välistä yhteyttä. Tulokset osoittavat, että yritykset, jotka ovat suhteellisesti ympäristöystävällisempiä veden kulutuksen ja kasvihuonekaasupäästöjen suhteen, hankkivat useammin ulkoisen kestävyysvarmennuksen.

Toisessa esseessä tarkastellaan mahdollisia yhteyksiä ulkoisen varmennuksen ja yritysten ilmastonmuutosta koskevien tietojen julkistamisen tason välillä, joka on osa yritysten ympäristöraportointia. Tulokset osoittavat, että ulkoinen varmennus liittyy merkittävästi ja positiivisesti yritysten ilmastonmuutosta koskevien tietojen julkistamisen tasoon. Tulokset osoittavat lisäksi, että yritysten ilmastonmuutosta koskevien tietojen tasoon ei vaikuta varmennusten tarjoajien tyyppi (tilintarkastusyhteisöt vs. ei-tilintarkastusyhteisöt) eikä tilintarkastajien tyyppi (Big4-tilintarkastajat vs. ei-Big4-tilintarkastajat).

Kolmannessa ja viimeisessä esseessä tarkastellaan, liittyykö yritysten ympäristösuorituskyvyn taso niiden biodiversiteettiraportointipäätöksiin. Yritysten biodiversiteettiraportointi on eräs yritysten ympäristöraportoinnin alaryhmä. Tulokset vahvistavat, että yritykset, joilla on suurempi taipumus kuluttaa vettä ja tuottaa jätettä (kaksi korvikemuuttujaa yritysten ympäristösuorituskyvyn tasolle), raportoivat useammin biodiversiteettiin liittyviä tietoja. Tulokset osoittavat lisäksi, että taipumus päästää kasvihuonekaasuja (kolmas korvikemuuttuja yritysten ympäristösuorituskyvyn tasolle) ei vaikuta päätökseen raportoida biodiversiteettiin liittyviä tietoja, koska se mahdollisesti vaikuttaa merkityksellisempien tietojen, kuten yritysten ilmastonmuutokseen liittyvien tietojen julkistamiseen.

Asiasanat: Yritysten ympäristösuorituskyky, yritysten ympäristöraportointi, kestävän kehityksen varmistaminen, ilmastonmuutos, biodiversiteetti.

Abstract

This doctoral dissertation consists of three essays that examine different aspects of corporate environmental performance and corporate environmental reporting.

The first essay investigates the association between corporate environmental performance and the adoption of voluntary sustainability assurance. The results reveal that companies, which are relatively better environmental performers in terms of water consumption and greenhouse gas (GHG) emissions, tend to purchase external sustainability assurance.

The second essay explores the existence of any linkage between external assurance and the level of corporate climate change disclosures, a subset of corporate environmental reporting. The results indicate that external assurance is significantly and positively associated with the level of corporate climate change disclosures. The results demonstrate further that the level of corporate climate change disclosures is affected neither by the type of assurance providers (accounting firms vs non-accounting firms) nor by the type of financial auditors (Big4 financial auditors vs non-Big4 financial auditors).

The third and final essay examines whether corporate environmental performance is associated with the corporate biodiversity reporting decision. Corporate biodiversity reporting is another subset of corporate environmental reporting. The findings confirm that companies with higher propensity to consume water and generate waste (two proxies for measuring corporate environmental performance) tend to report biodiversity-related information. The findings show further that propensity to emit GHGs (the third proxy for measuring corporate environmental performance) does not affect the decision to report biodiversity-related information as it possibly affects the disclosure of more relevant information such as corporate climate change-related information.

Keywords: Corporate environmental performance, corporate environmental reporting, sustainability assurance, climate change, biodiversity.

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Vaasa, September 2024

Probal Dutta

This work is dedicated to my parents Panna Lal Dutta and Chandra Lekha Dutta; to all my teachers; to Farhana Kabir, Dr. Anupam Dutta, Aditi Acharyya, Ayushmita Dutta and Shahan Iqbal Aayan; and to the people of Finland.

Contents

Publications

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Dutta, P., & Dutta, A. (2024). Does corporate environmental performance affect corporate biodiversity reporting decision? The Finnish evidence. *Journal of Applied Accounting Research*, Vol. 25, No. 1, pp. 24-41. https://doi.org/10.1108/JAAR-06-2022-0148. Copyright © 2023, Probal Dutta and Anupam Dutta. Published by Emerald Publishing Limited under the Creative Commons Attribution (CC BY 4.0) licence.

1 INTRODUCTION

This doctoral dissertation comprising three essays examines different aspects of corporate environmental performance and corporate environmental reporting. The first essay investigates if corporate environmental performance is associated with the adoption of voluntary sustainability assurance. The second essay examines the linkage between external assurance and corporate climate change disclosure level, while the third and final essay assesses whether corporate environmental performance is linked with the corporate biodiversity reporting decision.

According to the existing literature (e.g., Dutta, 2018; Jones, 2010), corporations are responsible in large part for inflicting damage on the natural environment through their activities or environmental performance. The damages caused by companies result in environmental crises such as biodiversity loss, global warming, global water crisis and so on (Dutta, 2018; Sahay, 2004). Hence, it has become essential to integrate the management of environmental responsibilities into business operations (Sahay, 2004). In addition, people are becoming increasingly aware of corporations' role in the deterioration of the environmental conditions (Braam et al., 2016). Consequently, corporate stakeholders (e.g., investors, lenders, suppliers, customers, environmental organizations, local communities etc.) are expecting companies to be more accountable and more responsible for the effects of their activities or environmental performance (as well as decisions) on the natural environment (Braam et al., 2016; Sahay, 2004). This has given rise to stakeholders' demand for information transparency about companies' environmental performance (Meng et al., 2014) and companies can satisfy such demand by implementing corporate environmental reporting practices, which are a subcategory of corporate social and environmental reporting practices. Lodhia (2006, p. 65) defines corporate environmental reporting as a process through which "companies often disclose environmental information to their stakeholders to provide evidence that they are accountable for their activities and the resultant impact on the environment". For the purpose of meeting stakeholders' need for information relating to corporate environmental performance, companies are increasingly adopting corporate environmental reporting practices (Dutta, 2018; Braam et al., 2016).

Though corporations are progressively undertaking corporate environmental reporting practices, previous studies (e.g., Braam et al., 2016; Luo et al., 2012) indicate a major problem relating to corporate environmental reporting by suggesting that the adoption of corporate environmental reporting practices may

not suffice to gain public trust because corporate environmental reporting can be used by corporations as a tool for manipulating public opinions. For instance, companies that are relatively better environmental performers inform their stakeholders of their excellence in environmental performance through corporate environmental reporting and contrarily, companies with comparatively inferior environmental performance manipulate public views by concealing their actual environmental performance and by disclosing discretionary environmental information, which is not easily verifiable (Braam et al., 2016; Luo and Tang, 2014; Clarkson et al., 2008). In particular, companies often report environmental information as an attempt at 'green marketing' and they often provide "confusing" statistics in a "self-congratulating manner" (Azzone et al.,1996, p. 70). In other words, companies use corporate environmental reporting as a device for impression management and thus render the trustworthiness and dependability of the reported information doubtful (Cho et al., 2012). Hence, in order to gain public trust, corporations must improve their environmental performance in addition to disclosing their environmental performance-related information to stakeholders. To put it another way, the environmental performance-related information disclosed through corporate environmental reporting by corporations must reflect their actual environmental performance.

Earlier studies (e.g., Simnett et al., 2009a; Braam et al., 2016; Al-Shaer and Zaman, 2018) contend that independent third-party verification of corporate environmental reports underpins the trustworthiness of the disseminated environmental information. Consequently, as a way of restoring stakeholders' confidence in the reported environmental information and thus winning public trust, companies are increasingly implementing external assurance for their environmental information (Al-Shaer and Zaman, 2018; Braam et al., 2016). Azzone et al. (1996, p. 79) contends that the use of corporate environmental performance indicators in corporate environmental reporting is a precondition for "verifiable reporting to stakeholders". Skillius and Wennberg (1998) complement Azzone et al. (1996) by arguing that the use of objective measures of corporate environmental performance in corporate environmental disclosures facilitates the verification of the completeness and truthfulness of the account of environmental performance provided by companies.

It is evident from the preceding discussion that corporate environmental performance, irrespective of its nature (i.e., inferior or superior), plays a vital role in corporate environmental reporting and in order to be trustworthy, corporate environmental information disclosed through corporate environmental reporting needs to be verified by independent assurance providers. This situation gives rise to the conjecture that a relationship may exist between corporate environmental

performance and the adoption of voluntary sustainability assurance. But the standing literature (e.g., Al-Shaer and Zaman, 2018; Peters and Romi, 2015; Ruhnke and Gabriel, 2013) confirms that such relationship has not been explored before. Hence, the objective of the first essay is to offer an insight into the corporate environmental performance-voluntary sustainability assurance adoption linkage and thereby contribute to the existing body of knowledge.

Corporate climate change disclosure is an important subcategory of corporate environmental reporting (Luo, 2019; Haque and Deegan, 2010; Stanny and Ely, 2008). Climate change, which has serious consequences for human lives and ecosystems (Giannarakis et al., 2017), is, to a great degree, a result of the emissions of greenhouse gases (GHGs) (Giannarakis et al., 2017; Liao et al., 2015). Companies are in large measure responsible for contributing to severe climate change through emissions of GHGs (Liao et al., 2015). Because of the severity of its consequences, climate change is different from other environmental problems that corporations contribute to (Luo, 2019). Consequently, stakeholders expect companies to be more active in combatting climate change (Hossain et al., 2017) and call for better information transparency for issues relating to climate change (Liao et al., 2015). As a result, corporate climate change disclosures have become a unique and important subset of environmental disclosures (Luo, 2019). In response to stakeholders' demand for such information, companies are increasingly making climate change disclosures (e.g., volume of GHG releases, climate change policy, measures for decreasing GHG releases etc.) along with other types of environmental disclosures (e.g., biodiversity information) (Giannarakis et al., 2017; Braam et al., 2016). But corporations' tendency to use corporate environmental reporting (and also climate-change disclosure) as an impression management tool renders their stakeholders doubtful about the credibility, dependability and precision of the reported environmental information (Cho et al., 2012). Hence, companies, with a view to dissipating their stakeholders' doubts, tend to have their ecological information externally assured (Al-Shaer and Zaman, 2018; Braam et al., 2016).

Furthermore, the growing importance of corporate climate change disclosures has led to an increased international demand for assurance of such disclosures. The introduction of a distinct carbon assurance standard titled ISAE 3410 Assurance Engagements on Greenhouse Gas Emissions by the International Auditing and Assurance Standards Board (IAASB) corroborates the significance of and increasing public demand for external assurance of climate change-related information (Green and Taylor, 2013). There are two types of assurance provider that perform sustainability assurance (of which carbon assurance is a part) services: accounting firms (e.g., Big4 (KPMG, PricewaterhouseCoopers, Ernst &

Young and Deloitte) and other financial auditors) and non-accounting firms (e.g., specialist consulting firms). The difference between these two types of assurance provider lies in their expertise. Accounting firms are highly experienced in providing financial assurance services but they lack necessary expertise for the provision of sustainability assurance (of which carbon assurance is a part) (Green et al., 2017). Contrarily, non-accounting firms have necessary skills for the provision of carbon and/or sustainability assurance but they are not adequately experienced in the provision of financial assurance services. Nevertheless, the sustainability assurance market is controlled by accounting firms and more precisely, by Big4 accounting firms (Fernandez-Feijoo et al., 2018). While prior literature (e.g., Hassan et al., 2020; Fernandez-Feijoo et al., 2018; Braam et al., 2016; Zorio et al., 2013; Moroney et al., 2012) offers insights into the determinants of the broader subject-matters of sustainability or environmental disclosures, the association of external assurance with the quantity of corporate climate change disclosures remains under-explored. Hence, the objective of the second essay is to examine how external assurance, type of assurance provider and type of financial auditor are linked with the level of corporate carbon disclosures.

Corporate biodiversity reporting is another subdivision of corporate environmental reporting (Hassan et al., 2020; Bhattacharyya and Yang, 2019; Gaia and Jones, 2017). Both human existence and economic growth depend on biodiversity. Biodiversity plays a key role in protecting ecosystems. Islands, drylands, inland water, forest and woodlands are some of the examples of ecosystems.

Ecosystems provide a lot of benefits that are known as “ecosystem services”, which can be of four types, namely, provisioning services (e.g., fresh water and food), supporting services (e.g., soil formation), cultural services (e.g., recreation and tourism facilities) and regulating services (e.g., flood control) . Both humans and business organizations are dependent directly or indirectly on at least one of these ecosystem services. For instance, fresh water and natural hazard regulation are two important ecosystem services on which agricultural firms are dependent (GRI, 2007).

Healthy ecosystems, which depend on healthy biodiversity, guarantee sustained provision of ecosystem services; because of healthy biodiversity, ecosystems remain functional in a number of ways, for example, by sustaining oxygen levels in the air, controlling climate and delivering habitats to plants and animals (GRI, 2007). Business organizations directly affect biodiversity through their environmental performance such as emissions of GHGs, use of surface water and production of wastes. For instance, excessive use of surface water may result in

shortage of water that can in turn endanger certain species (dependent on surface water) (GRI, 2007). Business establishments also affect biodiversity indirectly but indirect effects cannot be easily assessed (GRI, 2007).

However, a rapid degradation of biodiversity, which is one of the main ecological problems of today's world, is occurring globally (Potdar et al., 2016; Willison and Coté, 2009). Business organizations are contributing heavily to the quick decline in biodiversity by producing products for humans (Potdar et al., 2016). Hence, stakeholders expect business establishments to lessen their adverse impacts on biodiversity by improving on their environmental performance and also by taking necessary initiatives to protect biodiversity (Potdar et al., 2016; GRI, 2007). Stakeholders also expect business establishments to engage in corporate biodiversity reporting and disclose information on the effects of their environmental performance on biodiversity as well as on their initiatives to curb those effects (Boiral, 2016; Jones, 2003). Despite corporations' contribution to the rapid loss of biodiversity, the growing public awareness of the consequences of decline in biodiversity and the increasing demand of stakeholders for biodiversity-related information, research into corporate biodiversity reporting practices is still at the incipient stage (Hassan et al., 2020; Bhattacharyya and Yang, 2019; Gaia and Jones, 2017) and especially, the corporate environmental performance-corporate biodiversity reporting association remains unexamined. Therefore, the objective of the third essay is to fill in this lacuna in the standing literature by examining the corporate environmental performance-corporate biodiversity reporting decision linkage.

In summary, the objective of this doctoral dissertation is to explore a few under/un-explored areas in the environmental accounting and reporting literature. One of these topics is corporate environmental performance and the other one is corporate environmental reporting. While the first and second essays investigate the topics of corporate environmental performance and corporate environmental reporting respectively, the third essay examines both of them. Findings of the essays constituting this doctoral dissertation are important for policy-makers, regulators, managers and eco-friendly investors. For instance, policymakers can use the findings of the second essay to develop standards for corporate climate change reporting. Eco-friendly investors can use the findings of the third essay to preserve biodiversity by investing in environment-friendly organizations and thus to facilitate the uninterrupted delivery of various ecosystem services on which human existence and economic progress are dependent. Regulators can use the findings of the first essay to play the role of watchdogs on the transparency of companies' environmental disclosures. Finally,

corporate managers can use the findings of the second essay to be attentive to the dissemination of accurate, dependable and credible ecological information.

The remaining part of the introductory chapter is structured as follows. The next section describes the contributions of the dissertation. The third section discusses the theoretical framework of the dissertation. The fourth section contains a brief discussion on the research methods used in this dissertation. The fifth section summarizes the three essays that constitute the dissertation. Finally, the sixth section points out the limitations of the dissertation and provides future research directions.

2 CONTRIBUTION OF THE DISSERTATION

This dissertation contributes to the environmental accounting and reporting literature through three inter-related essays on corporate environmental performance and different aspects of corporate environmental disclosures.

The first essay makes a significant contribution to the environmental accounting and reporting literature by investigating whether corporate environmental performance is associated with the implementation of voluntary sustainability assurance of sustainability reports.

Since corporations are largely responsible for environmental degradation through their environmental performance (Dutta, 2018; Braam et al., 2016; Jones, 2010), corporate stakeholders want corporations to assume more responsibility and be more accountable for the effects of their environmental performance on the natural environment (Braam et al., 2016; Sahay, 2004) and at the same time they demand that companies be transparent regarding information on their environmental performance (Meng et al., 2014). Companies meet stakeholders' demand for environmental performance-related information through corporate environmental reporting. But corporations' tendency to use corporate environmental reporting as an impression management device raises doubts about the precision, dependability and trustworthiness of the disclosed environmental information (Braam et al., 2016; Luo et al., 2012; Cho et al., 2012; Azzone et al., 1996). Prior studies (e.g., Simnett et al., 2009a, b; Braam et al., 2016; Al-Shaer and Zaman, 2018) document that such doubts can be dissipated by implementing independent third-party verification of corporate environmental or sustainability reports because independent external assurance increases the trustworthiness of the reported environmental information as well as restores stakeholders' confidence in the same.

Stakeholders' doubts dispel if independent external assurance confirms that the environmental information provided by corporate environmental reporting reflects actual environmental performance. Azzone et al. (1996, p. 79) argue that the use of objective corporate environmental performance measures in corporate environmental disclosures is a prerequisite for "verifiable reporting to stakeholders". The objective corporate environmental performance measures help independent assurance providers easily evaluate whether companies are providing the account of their environmental performance thoroughly and truthfully (Skillius and Wennberg, 1998). The arguments presented in the standing literature lead to the surmise that corporate environmental performance and the adoption of voluntary sustainability assurance may be associated but no prior study has

examined the potential for such an association. Hence, the first essay contributes to the corporate social and environmental reporting literature by examining the corporate environmental performance-voluntary sustainability assurance nexus. In other words, this is the first study to test the association between corporate environmental performance and the implementation of voluntary sustainability assurance.

The second essay makes four contributions to the environmental accounting and reporting literature. First, while prior research primarily tests the influence of external assurance on the overall subject-matters of sustainability or environmental disclosure (e.g., Hassan et al., 2020; Braam et al., 2016; Moroney et al., 2012), the linkage between carbon assurance and the quantity of corporate climate change disclosures remains almost unexplored. Hence, this essay advances the literature by exclusively investigating the link between carbon assurance and the level of corporate climate change disclosures. This is a significant contribution because carbon assurance and climate change disclosures (as a subset of environmental disclosures) have gained importance subsequent to the introduction of a separate carbon assurance standard titled ISAE 3410 Assurance on a Greenhouse Gas Statement by the International Federation of Accountants (IFAC) (Datt et al., 2019). Climate change has a long-term and potential continuous effect on human life (Datt et al., 2019; Lash and Wellington, 2007). Given that corporate business and assets largely contribute to increasingly severe climate change (Liao et al., 2015), dissemination of carbon information has become unique among all types of ecological disclosures (Luo, 2019).

Second, this essay extends the study of Giannarakis et al. (2018) in mainly two ways: (1) while Giannarakis et al. (2018) use cross-sectional data of 2014 in order to test the effect of government ownership, corporate environmental performance and independent assurance on corporate carbon disclosures, they also highlight the necessity of longitudinal research to find out any persistent effect of external assurance on corporate climate change-related disclosures over an extended sample period. The second essay addresses the need for further research as underlined by Giannarakis et al. (2018) by employing panel data encompassing an extended sample period. (2) The second essay also advances the current literature by examining the influence of type of assurance provider (professional accounting firms or consulting firms) and type of financial auditor (Big4 or non-Big4 accounting firms) on corporate climate change disclosures.

Third, on the theoretical front, the second essay advances the current literature by applying stakeholder-agency theory (proposed by Hill and Jones (1992)) to comprehend the association between external assurance and corporate climate

change reporting. Through the lens of stakeholder-agency theory, the second essay views, for the first time, external assurance as a monitoring structure (the concept developed by Hill and Jones (1992)) in order to comprehend its effect on the level of corporate climate change disclosures. This is an important contribution as stakeholder-agency theory explains the mechanism by which external assurance increases the quantity of climate change disclosures and thus reduces the information asymmetry between managers and non-managers. For instance, as a monitoring structure, external assurance improves the processes of collecting climate change-related data, (Jones and Solomon, 2010; O'Dwyer et al., 2011), identifies material errors in climate change-related information prepared by reporting companies, discovers any omissions of the climate change-related information prepared and thus increases the quantity of the disclosed information (Hodge et al., 2009) and diminishes information asymmetry between managers and non-managers (Watts and Zimmerman, 1986; Wallace, 1987; Carey et al., 2000).

Fourth, this study is among the initial ones to use (based on authors' knowledge), as a proxy for the level of corporate climate change disclosures, both letter and numeric scores awarded by the Carbon Disclosure Project (CDP) to companies responding to a standard questionnaire prepared by the CDP for conducting a survey of corporate carbon emissions. Till 2015, the CDP used to award both letter and numeric scores. In 2016, subsequent to the adoption of a new scoring methodology, the CDP started awarding only letter scores to companies participating in the survey. Prior to 2016, numeric scores used to measure the level of corporate climate change disclosures, while letter scores used to measure corporate environmental performance (CDP, 2008; Guenther et al., 2016). Since 2016, the letter score measures both corporate carbon performance and climate change disclosures (CDP, 2016). While prior research uses either numeric scores (e.g., Luo, 2019) or letter scores (e.g., Giannarakis et al., 2018) awarded before 2016 as a proxy for the level of corporate climate change disclosures, this study employs numeric scores for the sample period 2008–2015 and letter scores for the sample period 2016–2018 (in the additional analysis). The use of both letter and numeric scores facilitates the verification of the robustness of the findings of the study.

There are mainly three contributions of the third and final essay. First, this study is among the initial works (based on authors' knowledge) to examine the corporate environmental performance-corporate biodiversity reporting decision association. While a handful of empirical works (e.g., Adler et al., 2018; Bhattacharyya and Yang, 2019; Gaia and Jones, 2020; Hassan et al., 2020) explore the determinants of corporate biodiversity reporting, the corporate environmental performance-

corporate biodiversity reporting decision linkage or link between corporate environmental performance and the level of corporate biodiversity reporting remains unexamined and the third essay addresses this issue by empirically examining the corporate environmental performance-corporate biodiversity reporting decision linkage.

Second, this empirical work enriches the standing literature by investigating corporate biodiversity reporting, an under-explored area of the environmental reporting literature. While previous empirical works mainly study either overall corporate environmental reporting practices (e.g., Braam et al., 2016; Clarkson et al., 2008, 2011; Moroney et al., 2012) or corporate carbon reporting practices as a subdivision of corporate environmental reporting (e.g., Giannarakis et al., 2017, 2018; Luo, 2019 etc.), corporate biodiversity reporting attracts less research attention (Bhattacharyya and Yang, 2019; Gaia and Jones, 2017; Hassan et al., 2020; Rimmel and Jonäll, 2013; van Liempd and Busch, 2013). Hence, by exclusively examining corporate biodiversity reporting, the third essay advances the environmental reporting literature.

Finally, the third essay has a contextual contribution as it is the first study investigating Finnish companies' biodiversity reporting.

3 THEORETICAL FRAMEWORK

Since corporations play a vital role in affecting the natural environment and social conditions, the idea that companies should be accountable for their activities impacting the physical environment and social conditions was often expressed (Charreaux and Desbrières, 2001) and the absence of any reporting about these effects was also condemned for many years (Chen et al., 2021). Consequently, it was necessary to meet the demands of shareholders and other stakeholders for corporate social and environmental information. In response to these demands, corporate social and environmental reporting emerged over last fifty years and quickly became a global phenomenon (Wukich et al., 2023). Researchers have adopted a number of theoretical perspectives to understand and explain the phenomenon of corporate social and environmental reporting (Simoni et al., 2020). Since theories are abstractions of reality and developed to aid in understanding the world, a particular theory is not likely to explain fully a particular phenomenon or behaviour and consequently, it is sometimes worthwhile to consider the views delivered by other theories (Deegan, 2023). This might be the reason why different researchers have studied corporate social and environmental reporting practices from different theoretical perspectives. The following subsections discuss in detail the most commonly applied theories in the studies relating to corporate social and environmental reporting.

3.1 Legitimacy theory

The notion of 'legitimacy' is central to legitimacy theory. 'Legitimacy' is defined in several ways but the most commonly cited definition of 'legitimacy' in the academic literature has been given by Suchman (1995, p. 574): 'legitimacy' is "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions." Another popular definition of 'legitimacy' has been provided by Lindblom (1994, p. 2), who defines 'legitimacy' as "a condition or status which exists when an entity's value system is congruent with the value system of the larger social system of which the entity is a part." Both definitions imply that an organization is part of a larger social system and legitimacy results from the compliance on the part of the organization with the value system of that larger social system.

Legitimacy theory is founded on the concept of a 'social contract' with which the notion of 'legitimacy' is directly associated. An organization relies on a variety of resources (e.g., natural resources, human resource etc.) for its existence and it uses

these resources to produce goods and services as well as wastes that it releases to the general environment (Mathews, 1993). But an organization has no inherent rights to these resources as well as to survive and in order for it to exist and use the resources of the society which it is a part of, its actions need to be considered legitimate by the society (Deegan, 2002) and this is where the concept of a 'social contract' comes into play. According to legitimacy theory, corporations depend on a social contract existing between them and the society in which they operate in order to obtain their legal standing and attributes, own and use a variety of resources and continue their existence (Mathews, 1993). Under a social contract, the society in which corporations operate will allow their existence if the benefits of their actions exceed the costs of their actions to the society (Mathews, 1993). In case an organization does not operate in a legitimate manner (i.e., if it breaches its social contract), its contract to pursue its operations will be rescinded by society and the rescission of the contract by society may be reflected, for instance, in the declining consumer demand for the goods and services of the business, discontinuance of the supply of factors of production by relevant factor suppliers (e.g., labor, capital to business etc.) and increasing fines and taxes on the actions that are incongruent with the value system of society (Deegan, 2002). In other words, the existence of an organization will be jeopardized in case of a breach of its social contract.

Pursuant to legitimacy theory, legitimacy is a resource that is vital to the endurance of an organization (Dowling and Pfeffer, 1975) and like any other resources, the supply of legitimacy can also be discontinued (Deegan, 2002). To put it another way, legitimacy is not static. The concept of legitimacy changes with the changes in society's expectations. Society's expectations constantly evolve and if corporations fail to adapt and change with ever-evolving societal expectations, a 'legitimacy gap' can arise (Deegan, 2023; Maroun, 2018). Sethi (1978) identifies two major sources of a legitimacy gap: first, changes in societal expectation may give rise to a legitimacy gap even if the corporation is changing in order to meet societal expectations; it happens because the pace at which the corporation is changing is slower than the pace at which societal expectations are changing. Second, a legitimacy gap may arise if previously unknown information about the corporation becomes known to the public and such unknown information (also known as 'organisational shadows' (Deegan, 2023, p. 432)) may be disclosed "either accidentally or through the activities of an activist group or a journalist" (Nasi et al., 1997, p. 301). Alrazi et al. (2016) note that a legitimacy gap may have multiple implications: for instance, a legitimacy gap may result in the boycott of products by consumers, difficulties in obtaining bank loans or removal of investments by stockholders. Consequently, it is of the utmost importance to corporations to manage their legitimacy. Corporations use various legitimation

tactics to gain, maintain or repair legitimacy. The situation of gaining legitimacy arises when a corporation enters a new area of operations in which it does not have any previous experience; moving into a new area of operations gives it the 'liability of newness' (Ashforth and Gibbs, 1990). For the purpose of gaining legitimacy, the corporation has to be proactive and adhere to the rules or conventions that are already present and generally accepted (Suchman, 1995). Maintaining situation is easier than gaining legitimacy (Ashforth and Gibbs, 1990). A firm, which has already established its legitimacy, needs to maintain legitimacy when it faces changes in societal expectations (Deegan, 2023). For maintaining legitimacy, the firm will either predict forthcoming changes or protect past accomplishments (Suchman, 1995). Finally, the situation of repairing legitimacy arises when there are unforeseen and immediate crises (Suchman, 1995). A corporation can adopt proactive strategies if a crisis is in the evolutionary stage (O'Donovan, 2002). For instance, a corporation can inform its stakeholders that it has made changes in its activities and performance so as to bring them in line with societal values and expectations (Deegan, 2023).

Legitimacy theory has been employed in many studies to understand the corporate social and environmental reporting practices. The researchers using legitimacy theory to study the corporate social and environmental reporting practices contend that corporate social and environmental reporting practices by corporations are part of corporate strategies to gain, maintain or repair their legitimacy (Deegan, 2023). For instance, Hogner (1982) examines corporate social and environmental reporting in the annual reports of the US Steel Corporation for the period from 1901 to 1980, analyzes the data for year-to-year variation and finds year-to-year changes in the level of corporate social and environmental reporting. The researcher ascribes the year-to-year changes in the level of corporate social and environmental reporting to the corporation's attempt to adapt to changes in societal expectations of corporate behavior. In other words, US Steel Corporation maintained its legitimacy by varying the level of its year-to-year corporate social and environmental reporting. In another study, Patten (2002) tests the corporate environmental performance-corporate environmental reporting nexus, while controlling for firm size and industry type and finds that bigger companies operating in environmentally sensitive industries are exposed to increased public scrutiny. Patten also finds that companies with poor environmental performance disclose more environmental information in order to fill the actual or perceived legitimacy gap. Finally, in a more recent study, Islam and Deegan (2010) examine two prominent multinational companies, namely, Nike and Hennes and Mauritz that source their products from developing countries. They find a positive relationship between the degree of news media coverage given to specific social issues and the level of social disclosures. Their findings suggest that when global

news media were exposing poor working conditions and the use of child labor in developing countries, the multinational companies started providing disclosures on the various initiatives that they were undertaking to ensure that they did not source their products from factories that had poor working conditions and used child labor. Islam and Deegan find that the expectations of Western consumers were being influenced by the campaign run by global news media and the companies were facing a legitimacy problem. The multinational companies were addressing the legitimacy problem by disclosing social information in their annual reports focusing on the issues of work conditions and use of child labor.

3.2 Stakeholder theory

A corporation has a wide range of stakeholders (e.g., shareholders, suppliers, customers, employees, communities, governments, civil societies etc.). These stakeholders are persons or groups that affect or are affected by the corporation (Mahajan et al., 2023; Clarkson, 1995). Clarkson (1995) classifies stakeholders into two groups: (i) primary stakeholders and (ii) secondary stakeholders. Primary stakeholders are those stakeholders "without whose continuing participation" the company will cease to exist as a going concern, while secondary stakeholders are those who affect or are affected by the corporation but they are not involved in transactions with the corporation and are not essential for its existence (Clarkson, 1995). Primary stakeholders include shareholders and investors, suppliers, customers, employees, governments and communities (Clarkson, 1995, p. 106); media groups are an example of secondary stakeholders (Clarkson, 1995, p. 107). Goals of different stakeholders are different and their views about how a corporation should operate are also very different. Pursuant to stakeholder theory, a corporation is expected to undertake activities that are considered appropriate by its wide range of stakeholders and achieve their multiple goals (An et al., 2011; Guthrie et al., 2006). To put it another way, while corporations are traditionally expected to maximize shareholders' wealth, they should also be accountable to non-shareholder stakeholders (as stakeholder theory suggests).

Stakeholder theory and legitimacy theory are overlapping theories because both theories view corporations as part of a broader social system within which they operate (Deegan, 2023). The difference between these two theories lies in their approach to describing the relationship between a corporation and the society of which it is a part. Legitimacy theory assumes the existence of a single social contract between corporations and the society in which they operate, while stakeholder theory assumes that a corporation has a social contract with each of its stakeholders within society because each stakeholder has a different view about

how a corporation should operate within a society (Deegan, 2023). To put it another way, a corporation has a number of social contracts with a wide range of stakeholders, rather than a single contract with society in general (Deegan, 2023).

Stakeholder theory has an 'ethical' (also called 'moral') branch and a 'managerial' (also called 'instrumental') branch suggesting how corporations discharge accountability to different stakeholders.

The ethical branch of stakeholder theory contends that all stakeholders have intrinsic rights (e.g., employees' right to fair pay) that should not be violated by corporations; corporations should undertake business activities for the benefit of all stakeholders (Deegan, 2023; An et al., 2011; Guthrie et al., 2006). According to the ethical branch of stakeholder theory, corporate managers must give equal importance to the interests of all stakeholders instead of giving importance only to shareholders' interest (i.e., maximization of shareholders' wealth) and in case of conflict of interests, they must manage the business in such a way so that an optimal balance of interests is attained (Hasnas, 1998).

The managerial branch of stakeholder theory argues that though a corporation has a wide range of stakeholders with different expectations, corporate management will not attend equally to the expectations of all stakeholders, but rather will attend to the expectations of powerful stakeholders (Deegan, 2023). Stakeholders' power depends on their degree of control over resources (e.g., finance, labor, materials) required for the survival of the corporation (Watts and Zimmerman, 1986). Hence, the probability that the corporation will address the demands of a particular stakeholder increases with an increase in the criticality of that stakeholder's resources to the sustainability and success of the corporation (Deegan, 2023). To put it another way, the demands of the most powerful stakeholders will be satisfied first (Nasi et al., 1997). In brief, in order to be successful, a corporation has to fulfill the demands of a variety of powerful stakeholders because they provide the resources on which its survival depends (Ullmann, 1985).

Researchers have used stakeholder theory to explain corporate disclosures. Pursuant to stakeholder theory, corporations are expected to engage in activities that are considered appropriate by stakeholders and to be accountable to the stakeholders for their activities and such accountability can be discharged through disclosure of information on the activities undertaken even if the stakeholders do not use the disclosed information (Deegan, 2023; Guthrie et al., 2006). Stakeholder theory emphasizes that corporate accountability should not be confined to financial performance only. In addition to disclosing information relating to financial performance (and other mandatory information), corporations should voluntarily disclose social and environmental information in

order to meet stakeholder expectations (Guthrie et al., 2006). According to the ethical branch of stakeholder theory, corporate disclosure is driven by responsibility rather than being driven by stakeholders' demand (Gray et al., 2014). Corporations provide information to stakeholders because they have a right to know how corporations are impacting them (Deegan, 2023). On the other hand, under the managerial perspective of stakeholder theory, corporate disclosures are a tool to serve the interests and to manage the influence of powerful stakeholders in order to advance the interests of the corporation (Deegan, 2023).

In the context of corporate social and environmental reporting, stakeholder theory has been empirically tested on many occasions. For instance, Roberts (1992) applies stakeholder theory to test stakeholders' ability to affect corporate social disclosures and finds that stakeholder power and their information needs are positively associated with levels and types of corporate social disclosures. In another study, Neu et al. (1998) use stakeholder theory to analyze the annual reports of several listed Canadian companies operating in environmentally sensitive industries for a ten-year period from 1982 to 1991. They test the effect of stakeholder power on the quantity of environmental disclosures and find that the companies satisfy the demands of financial stakeholders and government regulators and give less importance to the demands of environmentalists. This finding is consistent with the managerial branch of stakeholder theory that suggests that when the interests of stakeholders' conflict, companies will provide information to more powerful stakeholders as companies' survival depends on them.

3.3 Institutional theory

Institutional theory elucidates the reasons for the tendency of organizations to become similar in forms, practices, and processes within society (Deegan, 2023). Institutional theory is built around the concept of 'institution' (Deegan, 2023). Since the term 'institution' has multiple meanings and applications, there is no "definitive all-inclusive definition" of the term (Deegan, 2023, p. 472). Different researchers define 'institution' in different ways. For instance, while Venter and De Villiers (2013) define institutions as acceptable and expected ways of doing things, Greenwood and Suddaby (2006) define institutions as taken-for-granted assumptions and rationalized myths. These institutions, as Institutional theory asserts, put pressure on organizations within a field to become similar in forms, practices and processes (DiMaggio and Powell, 1983) and the process of becoming similar is known as 'isomorphism'. In other words, the adoption of organizational forms, practices and processes is not necessarily a function of the managerial

decision for ameliorating profits but rather a function of institutional pressures that are known as 'isomorphic pressures' (DiMaggio, 1983).

DiMaggio and Powell (1983) identify three isomorphic pressures namely, coercive pressure, mimetic pressure and normative pressure (also known as coercive, mimetic and normative isomorphism). Coercive isomorphism is related to stakeholder power and results from pressures exerted on organizations by stakeholders upon whom the organization depends; such pressures may also stem from cultural expectation in the society within which the organization operates (DiMaggio and Powell, 1983). Mimetic isomorphism is the second isomorphic process. There are organizations that appear to be successful, are viewed as leaders in their sectors and their actions are considered to be good practices; mimetic isomorphism arises when other organizations facing the same environmental conditions try to become like the most successful organizations by imitating their 'good' practices (DiMaggio and Powell, 1983; Meyer and Rowan, 1977). In brief, motivated by the performance of the most successful organizations, the less successful organizations try to become like them simply by copying their behaviour or actions and thus mimetic isomorphism results. Normative isomorphism is the third and final isomorphic process. Normative isomorphism arises when organizations comply with industry norms, ethical standards, codes of best practice or generally accepted practices so as to gain or sustain legitimacy (Farooq and Maroun, 2018).

Institutional theory is being increasingly applied to analyze corporate social and environmental reporting practices (Deegan, 2023). For instance, De Villiers et al. (2014) apply institutional theory to study how isomorphic processes play a key role in the institutionalization of corporate social and environmental reporting practices of South African mining companies and find that mimetic isomorphism plays a key role in shaping the corporate social and environmental reporting practices of smaller mining companies that imitate the reporting format of larger mining companies and disseminate the equal amount of environmental information. In another study, De Villiers and Alexander (2014) use institutional theory to examine and compare the corporate social and environmental reporting practices of Australian and South African mining companies; they discover similarities in the corporate social and environmental reporting practices of these companies and ascribe these similarities to the institutionalization of corporate social and environmental reporting within the mining industry across the globe.

There are studies that examine the impact of coercive pressures on corporate social and environmental reporting practices. For instance, Perego and Kolk (2012) examine the upward trend in corporate social and environmental reporting

practices in France and Japan and ascribe the rising popularity of corporate social and environmental reporting practices in these countries to the introduction of government regulations and stock exchange listing requirements that oblige companies to disclose social and environmental information.

Finally, the introduction of sustainability reporting and assurance standards and guidelines (e.g., Global Reporting Initiative (GRI) standards and AA1000AS) can be viewed as the source of normative pressures because companies provide indication of the quality and trustworthiness of their sustainability reports by complying with these standards and thus gain legitimacy (Farooq and Maroun, 2018). When industry leaders adopt certain sustainability reporting and assurance standards, these standards become a source of normative pressures for less successful members of the industry and they start imitating the industry leaders by adopting the same sustainability reporting and assurance standards (Farooq and Maroun, 2018; De Villiers et al., 2014).

3.4 Voluntary disclosure theory and signaling theory

Verrecchia (1983) and Dye (1985), the proponents of voluntary disclosure theory, suggest that corporations are better informed about their own activities and achievements, while their stakeholders (other than corporate managers) are the less informed counterpart and this leads to the existence of an information asymmetry between corporations and their stakeholders. In order to reduce the information asymmetry, corporations voluntarily disclose information about their achievements (Verrecchia, 1983; Dye, 1985). Though this theory has been mainly applied to understand and explain the disclosure of financial information, it is also pertinent to the disclosure of corporate social and environmental information (Clarkson et al., 2011). In the context of corporate social and environmental reporting, voluntary disclosure theory expects a positive association between corporate environmental performance and the level of corporate environmental reporting. In other words, corporations that are better environmental performers will voluntarily disseminate more environmental information compared to corporations that have poor environmental performance. According to voluntary disclosure theory, better environmental performers will disclose easily verifiable, objective environmental information that is difficult to replicate by inferior environmental performers; on the other hand, inferior environmental performers will either abstain from disclosure or opt for disclosure of vague environmental information that cannot be easily verified and can be imitated by any firm irrespective of its environmental performance (Braam et al., 2016; Clarkson et al., 2008; 2011). Pursuant to voluntary disclosure theory, companies with relatively

better environmental performance voluntarily disclose more ecological information in order to stand apart from corporations that are relatively poor environmental performers (Clarkson et al., 2008; 2011) because through voluntary disclosures of environmental information, better environmental performers will gain a number of competitive advantages over poor environmental performers; such competitive advantages include improved public image, access to governmental support for protecting the natural environment (Meng et al., 2014), enhanced reputation and reduced cost of capital (Braam et al., 2016).

Signaling theory is considered to be an extension of voluntary disclosure theory (Ching and Gerab, 2017). Signaling theory assumes the existence of two actors: the signaler and the receiver; the signaler sends signals and the receiver receives and interprets the signals (Connelly et al., 2011). In the context of corporate social and environmental reporting, the reporting firm is the signaler that discloses corporate social and environmental information and its stakeholders are the receivers, who interpret and use that information. According to signaling theory, companies, which are superior environmental performers, tend to disclose more objective, easily confirmable and hard to mimic corporate social and environmental information as a signal of their behavior as good corporate citizens (Buallay, 2022; Ching and Gerab, 2017). Since the credibility of the reported information increases its effectiveness, the reporting companies have their corporate social and environmental information verified by an independent third party assurance provider so as to enhance the credibility of the reported information (Ching and Gerab, 2017; KPMG, 2013).

3.5 Agency theory

Corporations are characterized by a separation of ownership and control. Shareholders, who are corporate owners, elect directors for managing operations and monitoring performance on their behalf and this is how shareholders delegate decision-making authority to directors. Agency theory views the relationship between shareholders and directors (who are part of the corporate management) as an agency relationship wherein shareholders are the principals and corporate managers are the agents, who are expected to act on the instructions and in the interests of the principals (De Villiers and Hsiao, 2018; Quinn and Jones, 1995; Jensen and Meckling, 1976). Agency theory also suggests the existence of conflicts inherent in agency relationships, based on the assumptions of economic rationality and self-interest (De Villiers and Hsiao, 2018).

The assumptions of economic rationality and self-interest suggest that individuals are highly rational and try to maximize their expected utility; they make their choices intentionally and opportunistically (Merkl-Davies and Brennan, 2011). In a corporate context, shareholders or principals and managers or agents are also economically rational and self-interested and consequently, in circumstances where their interests diverge, agents will behave opportunistically and try to maximize their own utility without taking into consideration the effect of their actions on the principals (Fama and Jensen, 1983). In other words, the agency relationship will result in agency problems and agency costs when there are conflicts of interests between principals and agents (De Villiers and Hsiao, 2018).

The separation of ownership and control gives rise to an agency problem called 'information asymmetry'. Information asymmetry exists because managers possess superior information about financial and non-financial matters of the company as compared to shareholders (Karaman et al., 2018). In order to maximize their own utility, corporate managers can exploit this information gap by disclosing, hiding or distorting information. Agency theory suggests that corporations will implement various monitoring mechanisms in order to reduce agency problems. Voluntary disclosure is a monitoring mechanism that reduces information asymmetry between corporate managers and shareholders through delivery of incremental information and enables shareholders to supervise managerial actions (De Villiers and Hsiao, 2018). However, corporate managers can exploit the information asymmetry and use voluntary disclosures as a tool for self-serving purposes. Since corporate managers are economically rational and self-interested, they will tend to disclose information relating to positive performance more clearly and hide information relating to negative performance (De Villiers and Hsiao, 2018). This is the way they will try to manipulate shareholders' perceptions of corporate performance as their remuneration is dependent on corporate performance (De Villiers and Hsiao, 2018). The possibility of using voluntary disclosures as a device for impression management by corporate managers raises concerns about the trustworthiness of the disclosed information in the presence of information asymmetry and such concerns give rise to the demand for assurance of voluntarily disclosed information. Shareholders and creditors are not in the position of observing management behavior. Hence, external assurance of information enhances the trustworthiness of the information disclosed by managers. Therefore, external assurance not only reduces information asymmetry but also mitigates agency costs relating to information asymmetry (De Villiers and Hsiao, 2018).

Corporate social and environmental reporting is done mostly on a voluntary basis. Though several sets of Corporate social and environmental reporting standards

exist, they are applied only on an elective basis (Wukich et al., 2023). Corporate social and environmental reporting produces incremental information about companies' environmental performance; companies also undertake sustainability assurance for the purpose of enhancing the credibility of the reported social and environmental information. Agency theory has been used to understand the phenomena of Corporate social and environmental reporting and the implementation of sustainability assurance. For instance, by employing agency theory, Karaman et al. (2018) study the impact of sustainability reporting in the global aviation industry on firm performance and find that sustainability reporting does not have any significant effect on the enhancement of firm performance. As regards the implementation of sustainability assurance, Simnett et al. (2009b) report that companies belonging to socially or environmentally sensitive industries possess a higher tendency to implement external assurance for their social and environmental information. Ruhnke and Gabriel (2013) find that lager companies with greater dispersion of share ownership tend to buy sustainability assurance. This finding suggests that agency costs play a pivotal role in deciding on the purchase of sustainability assurance.

3.6 Stakeholder-agency theory

Hill and Jones (1992) propose stakeholder-agency theory by integrating the concept of stakeholder with agency theory. Stakeholder-agency theory is an enhancement of agency theory (Donaldson and Preston, 1995). While agency theory views managers as the agents of shareholders, stakeholder-agency theory views managers as the agents of all stakeholders (i.e., including shareholders). It is known from the discussions in precedent subsections that a corporation has a variety of stakeholders from whom the firm receives different types of resources. All these stakeholders have expectations against the resources that they provide to the firm. According to stakeholder-agency theory, a firm is a nexus of contracts (both implicit and explicit contracts) among these stakeholders and managers are unique among all the stakeholders because only they have contractual relations with all the remaining stakeholders (hereafter non-management stakeholders). Hence, managers work as their 'agents'. Consequently, managers directly control the decision-making process of the firm and have control over critical information that they are able to screen or even alter before disclosing to non-management stakeholders (Hill and Jones, 1992). This causes an information asymmetry between managers and non-management stakeholders. Due to the afore-mentioned information asymmetry, it becomes difficult for non-management stakeholders to evaluate if managers are working to fulfil the expectations of non-management stakeholders. In order to overcome this situation, non-management

stakeholders can monitor managerial performance themselves through collection of essential information on management activities, but such monitoring process may be excessively costly. Therefore, stakeholder-agency theory suggests that such a situation can be overcome by establishing institutional structures referred to as "monitoring structures" by Hill and Jones (1992). In the context of financial and non-financial disclosures, external assurance can serve as a "monitoring structure" (Simnett et al., 2009a, b). The existing literature claims that external assurance enhances the trustworthiness of reported information and restores stakeholders' confidence by diminishing information asymmetry between managers and non-managers (Hodge et al., 2009; Simnett et al., 2009a, b; Carey et al., 2000).

In the context of corporate social and environmental reporting, stakeholder-agency theory has been applied on few occasions. For instance, Moroney et al. (2012) apply stakeholder-agency theory to test if external assurance has any influence on the quality and quantity of environmental disclosures of the listed companies in Australia and find that external assurance positively (and significantly) affects the quality and quantity of environmental disclosures.

3.7 Theories used in this doctoral dissertation

The discussion in the preceding subsections sheds light on the theories applied in corporate social and environmental reporting literature. In this doctoral dissertation, three theories have been used in the three constituting essays that examine various aspects of corporate environmental performance and corporate environmental reporting. For instance, the first essay uses legitimacy theory, the second essay applies stakeholder-agency theory and the third essay employs both legitimacy theory and voluntary disclosure theory for examining the relationships that these essays are aimed at and for explaining the findings.

Essays 1 and 3 apply legitimacy theory. Legitimacy theory contends the existence of a 'social contract' between corporations and the society in which they operate (Deegan, 2023). In order to conform to the social contract, corporations are required to operate within the bounds of a socially constructed and acceptable value system (Dowling and Pfeffer, 1975). Violation of the social contract on the part of corporations will threaten their organizational legitimacy and imperil their existence (Sethi, 1979). Hence, companies attempt to comply with the socially acceptable norms and values in order to keep the social contract intact (Yunus et al., 2016). In case companies' norms and values are not congruent with the norms and values of the society and thus a legitimacy gap arises, corporations may seek

to gain, maintain or repair legitimacy (O'Donovan, 2002). Dissemination of relevant information by companies is a strategy of gaining, maintaining or repairing corporate legitimacy (Deegan et al., 2000). In the context of increasing public awareness of the environmental problems (e.g., loss of biodiversity, global warming etc.) to which companies contribute to a great degree, business organizations are expected to adopt environmentally responsible practices (Kılıç¸ and Kuzey, 2019) and inform society in general of their eco-friendly behavior and commitment towards the natural environment (Yunus et al., 2016). Corporations can and do satisfy such expectations by disclosing environmental information (e.g., biodiversity information) in their annual and/or sustainability reports (Kılıç¸ and Kuzey, 2019) and thus gain, maintain or repair their organizational legitimacy (Deegan et al., 2000). However, the existing literature hints at the possible corporate use of corporate environmental reporting as a tool for manipulating stakeholders' perceptions by concealing information relating to actual environmental performance (Braam et al., 2016; Luo et al., 2012); this may render stakeholders doubtful about the precision, trustworthiness and dependability of the reported environmental information (Cho et al., 2012) leading to a potential legitimacy threat for the reporting organization. Earlier studies (e.g., Gillet-Monjarret, 2015; Kolk and Perego, 2010) suggest that purchase of external sustainability assurance strengthens organizational legitimacy. Consequently, companies are increasingly having their environmental and other sustainability information externally assured (Al-Shaer and Zaman, 2018; Braam et al., 2016). Essay 1 investigates the association between corporate environmental performance and the adoption of voluntary sustainability assurance and essay 3 examines the corporate environmental performance-corporate biodiversity reporting decision nexus. Hence, both these essays provide an appropriate setting for applying legitimacy theory.

Essay 2 utilizes stakeholder-agency theory as an explanatory theory. Essay 2 tests the impact of external assurance on the level of corporate climate change disclosures. According to stakeholder-agency theory, managers work as the 'agents' of all other stakeholders (or 'non-management' stakeholders, e.g., shareholders, lenders, creditors, customers etc.) and hence, managers directly control the decision-making process of the firm and have a control over critical information which they can hide or even alter before releasing to non-management stakeholders (Hill and Jones, 1992). This causes an information asymmetry between managers and non-managers which makes it problematic for non-managers to evaluate managers' performance towards the fulfilment of their (non-management stakeholders') expectations. In order to reduce the information asymmetry, stakeholder-agency theory suggests the introduction of monitoring devices which Hill and Jones (1992) call "monitoring structures". Previous

research (e.g., Hodge et al., 2009; Simnett et al., 2009a, b) suggests that external assurance can serve as a monitoring structure in the context of financial and non-financial disclosures. As a monitoring structure, external assurance improves the environmental data collection processes (e.g., data on carbon emissions) (O'Dwyer et al., 2011), discovers material errors in and omissions of the environmental information collected (including data relating to carbon emissions) and thus raises the level of environmental disclosures (Hodge et al., 2009). The existing literature also claims that external assurance enhances the trustworthiness of the reported information and restores stakeholders' confidence by diminishing information asymmetry between managers and non-managers (Hodge et al., 2009; Simnett et al., 2009a, b; Carey et al., 2000). Moreover, prior studies suggest a positive linkage between external assurance and the level of non-financial information (Braam et al., 2016; Moroney et al., 2012). Since corporate climate change disclosures are non-financial disclosures and essay 2 examines the association between external assurance and the level of corporate climate change disclosures, the second essay provides an excellent setting for the application of stakeholder-agency theory.

Essay 3 employs voluntary disclosure theory along with legitimacy theory as an explanatory theory. Voluntary disclosure theory suggests that environmental performance and the level of corporate environmental reporting are positively linked (Clarkson et al., 2008). According to voluntary disclosure theory, while companies with relatively better environmental performance tend to voluntarily disclose more environmental performance-related information to their stakeholders, companies with relatively poor environmental performance either disseminate less amount of information or ambiguous information that is not easily verifiable and could be disseminated by any firm irrespective of its environmental performance or remain silent on their environmental performance (Braam et al., 2016; Clarkson et al., 2011; Clarkson et al., 2008). Superior environmental performers may enhance their reputation and potentially reduce their cost of capital by voluntarily reporting environmental performance-related information (Clarkson et al., 2008; Luo, and Tang, 2014). On the other hand, inferior environmental performers may be identified by stakeholders as 'average' (rather than poor) environmental performers either by disclosing ambiguous information relating to environmental performance (and in less amount) or by completely abstaining from disclosure of any environmental performance-related information (Clarkson et al., 2008). Because corporate environmental performance affects biodiversity (GRI, 2007), companies with good environmental performance (according to voluntary disclosure theory) and companies with bad environmental performance (according to legitimacy theory) will tend to decide on biodiversity reporting. Therefore, essay 3 provides an appropriate setting for using voluntary disclosure theory along with legitimacy theory.

4 RESEARCH METHODS

4.1 Sample and data

This section describes the sample used in this doctoral dissertation and the sources from which data relating to sample companies are collected. Sample companies include the Finnish companies listed on the Nasdaq Helsinki. Since the dissertation consists of three essays, the sample period of one essay differs from that of another. For instance, while the sample period for essay 1 ranges from 2008 to 2015, the sample period for essay 2 is from 2008 to 2018. On the other hand, the sample period for essay 3 spans from 2008 to 2020. For all three essays, the sample size and the sample period are dictated by the availability of data.

Data are collected from three secondary data sources: (1) corporate sustainability/environmental/social responsibility reports, (2) Thomson Reuters DataStream database, and (3) CDP climate change reports on Nordic countries. For example, firm-specific data for all three essays are collected from the Thomson Reuters DataStream database. Data relating to biodiversity reporting decision for essay 3 are also collected from the Thomson Reuters DataStream database. On the other hand, data on corporate climate change disclosure for essay 2 and data relating to external assurance for essays 1 and 2 are collected from CDP climate change reports on Nordic countries and corporate sustainability/environmental/ social responsibility reports respectively.

4.2 Justification for the sample selection

Finland is the geographical area of interest for the three constituent essays of this doctoral dissertation. With a strong commitment towards sustainable development, Finland is a pioneer in implementing the "UN 2030 Agenda for Sustainable Development". The "UN 2030 Agenda for Sustainable Development" had been launched with a view to promoting sustainable development across the globe by 2030 and eliminating all forms of poverty. Finland also plays a very important role in the formulation of climate change policies at the national, European Union and international levels. For instance, in 2015, Finland introduced the national Climate Change Act (609/2015) with a view to diminishing GHG emissions by at least 80% by the year 2050, compared to 1990. In addition, Finland agreed to the United Nations Framework Convention on Climate Change and the Kyoto Protocol in 1994 and 2002 respectively. Both United Nations Framework Convention on Climate Change and Kyoto Protocol aim at reducing GHG emissions of the countries that are parties to them.

Finland has significantly improved its carbon performance between 1990 and 2020 and brought down the level of CO2 emissions by 34 percent within this period. By 2020, Finland has also lowered the emissions levels of acidifying nitrogen and sulfur to 40 percent and 12 percent of the levels of 1990 respectively and this has led to the excellent air quality, compared to international levels (Dutta and Dutta, 2024). In addition, Finland has successfully reduced eutrophication (the most common environmental change affecting water bodies of Finland) in water systems. Eutrophication prevents Finnish people from using water bodies (Dutta and Dutta, 2024).

However, despite these remarkable achievements and solid commitments towards the natural environment, Finland is faced with severe effects of global climate change and the rapid loss of biodiversity (Dutta and Dutta, 2024). Climate change is causing extreme weather events such as heavy rainfall during winters, summer droughts, and winter storms to occur more frequently in different parts of Finland. A growth in rainfall in winters is not only causing erosion but also increasing the risk of winter floods along the waterways in Central and Southern Finland6. Another effect of climate change is the rise in the average temperature of Finland by 10C over the period of more than hundred years, while the average global temperature has risen by 0.850C. The rise in the average temperature is resulting in the warming of the Baltic Sea and in the decrease in the salinity of the surface water8 and thereby affecting marine ecosystems6.

In addition to severe climate change, Finland is also experiencing rapid biodiversity degradation. Approximately 12 percent of the species of Finland are in the risk of becoming extinct (Dutta and Dutta, 2024). Finland has seen a negative growth in biodiversity over the ten-year period from 2010 to 2019. During these ten years, the condition of 263 species bettered and the condition of 461 species deteriorated (Dutta and Dutta, 2024). Moreover, the rise in the average temperature is causing the Baltic Sea and inland waters to remain frozen for shorter periods endangering many species such as seals and microscopic organisms that are dependent on the ice6. Furthermore, nearly half of Finland's natural habitats are threatened making the preservation of biodiversity more difficult (Dutta and Dutta, 2024). Especially, sea ice falls into the category of a "threatened habitat type" in Finland6.

The facts discussed in the preceding paragraphs make Finland the geographical area of interest for this doctoral dissertation because they have important implications for Finnish companies. In the current situation of harsh climate change and rapid biodiversity loss, Finnish companies should try to reduce energy consumption, which would in turn cut greenhouse gas emissions and contribute to

the preservation of biodiversity. In addition to improving energy efficiency, Finnish companies should make an attempt to increase efficiency in using natural resources and develop sustainable agriculture. Such sustainable corporate practices across different sectors would play a pivotal role in curbing the negative impacts of climate change as well as in conserving biodiversity. Moreover, Finnish companies should promote sustainable innovations and introduce eco-friendly products on a large scale as such products are now receiving much attention from both consumers and investors. The Finnish companies are also expected to provide complete and truthful disclosures of their environmental performance and the green initiatives that they undertake to protect the natural environment.

5 SUMMARIES OF THE ESSAYS

5.1 Determinants of voluntary sustainability assurance: the importance of corporate environmental performance

The first essay examines the relationship between corporate environmental performance and the adoption of voluntary sustainability assurance.

While environmental degradation is occurring throughout the world, corporate stakeholders hold corporations more and more responsible for worsening the condition of the natural environment through their activities. Corporate stakeholders demand corporations' accountability for their actions and decisions that impact the natural environment and companies meet such demand through disclosure of different types of ecological information in their annual and/or environmental or sustainability reports (Braam et al., 2016). Previous empirical works (e.g., Luo et al., 2012) suggest that companies with superior environmental performance may send signals to their stakeholders about their good environmental performance through corporate environmental reporting. On the contrary, companies with inferior environmental performance may try to influence public perceptions through corporate environmental reporting by concealing real environmental performance. Put differently, companies may use corporate environmental reporting as a tool for impression management, which brings into question the authenticity of environmental performance-related information reported in corporate sustainability reports (Cho et al., 2012). Consequently, companies increasingly tend to have their sustainability reports verified by external assurance providers in order to increase the trustworthiness of the reported information (Al-Shaer and Zaman, 2018; Braam et al., 2016; Simnett et al., 2009b).

The current literature on voluntary sustainability assurance is slowly evolving and reports somewhat mixed results (Al-Shaer and Zaman, 2018; Gillet-Monjarret, 2015; Ruhnke and Gabriel, 2013). The existing research identifies firm size, country of domicile, legal environment (Simnett et al., 2009b), media pressure (Gillet-Monjarret, 2015), sustainability reporting scope, presence of a sustainability department (Kolk and Perego, 2010), sustainability governance characteristics (Peters and Romi, 2015) and audit committee characteristics (Al-Shaer and Zaman, 2018) as the determinants of adopting the voluntary sustainability assurance. However, the linkage between corporate environmental performance and the implementation of voluntary sustainability assurance is

unexamined, which gives rise to a gap in the standing literature. This essay fills in this gap by examining the corporate environmental performance-voluntary sustainability assurance adoption link.

In order to fill the void in the existing literature, this essay performs empirical analyses using the sample of listed Finnish companies that issued sustainability reports during the sample period (2008-2015). The sample used in this essay consists of 176 firm-year observations covering an eight-year period (2008-2015). A logistic regression model has been estimated to examine the relationship between corporate environmental performance and the adoption of voluntary sustainability assurance. The dependent variable voluntary sustainability assurance is a binary variable, whereas corporate environmental performance, the variable of interest, has been measured based on the existing literature (for example, Braam et al., 2016; Clarkson et al., 2008; Azzone et al., 1996 etc.) in terms of propensity to emit greenhouse gas (ratio of total greenhouse gas emissions to total revenue), propensity to produce waste (ratio of waste production to total revenue) and propensity to consume water (ratio of water consumption to total revenue). In addition, the estimated model also includes a number of control variables.

The findings indicate that companies with relatively better environmental performance (in terms of greenhouse gas emissions and water consumption) have their sustainability reports verified by independent assurance providers. The results also reveal that bigger companies and companies with new assets are more likely to implement third-party verification of their sustainability reports. On the other hand, high-leverage companies are less inclined to have their sustainability reports verified by independent assurance providers. The findings are found to be robust and may be of importance to eco-friendly investors, regulators and managers.

5.2 Impact of external assurance on corporate climate change disclosures: new evidence from Finland

The second essay investigates if external assurance is associated with the quantity of corporate climate change disclosures.

Climate change has become an issue of growing concern as it has several impacts on ecosystems and lives of humans (Giannarakis et al., 2017). Corporations are held largely responsible for severe climate change through their activities (Liao et al., 2015). Consequently, stakeholders expect them to greatly contribute to the stabilization of climate change (Hossain et al., 2017) and simultaneously,

stakeholders demand increased information transparency from corporations about their initiatives to lessen their impacts on the climate (Liao et al., 2015). In response to stakeholders' expectation and demand, companies have adopted different environment-friendly strategies (e.g., initiatives for reducing GHG emissions) to curb their effect on the natural environment (of which climate is a part) and started disclosing climate change-related information along with other environmental information in their annual reports or stand-alone environmental or sustainability reports (Braam et al., 2016; Giannarakis et al., 2017).

It is argued in the standing literature that companies may use corporate environmental disclosures (of which climate change disclosures are a part) to manipulate stakeholders' perceptions either by sending positive signals to stakeholders about their commitment towards the natural environment if they are relatively superior environmental performers or by disseminating only positive environmental performance-related information to seek legitimacy for their existence if they are relatively inferior environmental performers (Braam et al., 2016; Braam and Peeters, 2018; Cho et al., 2012). Companies' tendency to manage stakeholders' perceptions instead of reporting information on actual environmental performance (e.g., the actual quantity of GHGs emitted, waste generated and water consumed) raises doubts about the truthfulness, trustworthiness and dependability of the information reported. Such doubts have led reporting companies to purchase independent assurance services for their environmental information (Braam and Peeters, 2018; Junior et al., 2014) because independent assurance enhances the trustworthiness of non-financial disclosures (environmental disclosures and hence, climate change disclosures are also non-financial disclosures) and thereby builds corporate reputation (Giannarakis et al., 2018; Reimsbach et al., 2018; Moroney et al., 2012; Pflugrath et al., 2011). Moreover, independent assurance increases the quantity of non-financial disclosures as well as enhances the quality thereof (by reducing information asymmetry between managers and other stakeholders) (Coram et al., 2009; Moroney et al., 2012; Braam et al., 2016). In addition, an increased demand for assurance of corporate climate change disclosures has been noticed worldwide because of several factors such as the development of carbon pricing and emission trading schemes and the introduction of ISAE 3410 Assurance Engagements on Greenhouse Gas Emissions by the IAASB (Green and Taylor, 2013).

However, in the face of the emergent demand for independent assurance of climate change disclosures, there is a dearth of research into the association between independent assurance and the level of corporate climate change disclosures (Giannarakis et al., 2018) though a few studies have been found to investigate the link between external assurance and overall environmental disclosures (e.g.,

Moroney et al., 2012; Braam et al., 2016). Given that external assurance raises the level of non-financial disclosures, this empirical work is based on the hypothesis that a significantly positive association between external assurance and the level of corporate climate change disclosures exists.

The empirical analyses are performed by primarily using 228 firm-year observations over the period 2008–2015 for listed Finnish companies. Additionally, 67 firm-year observations over the period 2016-2018 for listed Finnish companies are used for further analysis. The sample of the essay consists of the listed Finnish companies that have issued sustainability reports and responded to the CDP questionnaire at least once during the sample period. A panel regression analysis is conducted to study the linkage between external assurance and the level of corporate climate change disclosures. The level of corporate climate change disclosures is the dependent variable and is measured by CDP carbon disclosure score, whereas external assurance (the variable of interest) is a binary variable that takes the value of 1 if the sustainability or environmental report is externally assured and 0 otherwise. The estimated model also includes a number of control variables. Additional analyses for testing the relationships between the type of assurance provider and the level of corporate climate change disclosures as well as the type of financial auditor and the level of corporate climate change disclosures are performed. Finally, a Tobit regression model is estimated to check the robustness of the results.

The empirical results of this essay attest that external assurance and the quantity of corporate climate change disclosures are significantly and positively associated with each other. Other factors influencing the quantity of corporate climate change disclosures include firm size and asset age, two of the control variables used in the estimated model. Moreover, the additional analysis suggests that neither the type of assurance providers not the type of financial auditors have any influence on the level of climate change disclosures of assured companies. The reported results are found to be robust and may have important implications for policy makers, regulators, investors and managers.

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

The third essay explores the whether any relationship exists between corporate environmental performance and corporate biodiversity reporting decision.

Biodiversity is indispensable for human existence and economic development. Biodiversity is essential for the effective functioning of different ecosystems. Ecosystems provide many ecosystem services on which businesses as well as humans rely. For instance, fresh water is one of the important ecosystem services for agricultural firms, whereas food is considered to be the main ecosystem service for the food processing industry (GRI, 2007).

However, biodiversity is rapidly declining worldwide (Potdar et al., 2016). Companies largely contribute to the rapid loss of biodiversity through their EP and hence, interrupt the delivery of ecosystem services (Potdar et al., 2016; GRI, 2007). For example, companies directly affect biodiversity through use of surface water (GRI, 2007) because excessive use of surface water may result in a shortage of water that can in turn endanger the species that depend on surface water (GRI, 2007).

Companies can minimize their negative impacts on biological diversity by bettering their environmental performance (e.g., reduction in waste generation) and by taking initiatives to preserve biodiversity (Potdar et al., 2016; GRI, 2007). Therefore, stakeholders expect corporations to take necessary actions to preserve biodiversity (Potdar et al., 2016) and repot on the impact of their activities or environmental performance on species and ecosystems as well as on their initiatives to manage this issue (Boiral, 2016; Jones, 2003). In other words, corporations are expected to engage in corporate biodiversity reporting. Corporate biodiversity reporting is an important communication tool through which companies can indicate their actions to save biodiversity as well as their commitment towards preservation of biodiversity and thus fulfil stakeholders' information needs. Since corporate environmental performance greatly affects biodiversity, this empirical work postulates that corporate environmental performance has an impact on corporations' decision to engage in corporate biodiversity reporting.

Prior studies examine the factors influencing the extent of corporate biodiversity reporting and report, for example, a positive effect of board gender diversity (Haque and Jones, 2020), winning an environmental award (Hassan et al., 2020) and adoption of Global Reporting Initiative's (GRI) G4 guidelines (Bhattacharyya and Yang, 2019) on the extent of corporate biodiversity reporting. Other studies examine the corporate biodiversity reporting practices in Australia (Barut et al., 2016), Denmark (van Liempd and Busch, 2013), New Zealand (Schneider et al., 2014) and Sweden (Rimmel and Jonäll, 2013) and document an inadequacy of corporate biodiversity reporting in these countries. However, despite severe impacts of corporate environmental performance on biodiversity as well as

stakeholders' increasing expectation of companies taking necessary initiatives to protect biodiversity and reporting information on their actions, the relationship between corporate environmental performance and corporate biodiversity reporting remains unexamined. This essay contributes to the existing body of knowledge by exploring the relationship between corporate environmental performance and the corporate decision to engage in corporate biodiversity reporting.

The empirical analyses are implemented by using 442 firm-year observations over a period of 13 years (2008-2020) for 34 listed Finnish companies. Drawing on both legitimacy theory and voluntary disclosure theory, two logit regression models are estimated to examine the association between corporate environmental performance and corporate biodiversity reporting decision. Corporate biodiversity reporting decision, which is the dependent variable, is a binary variable that takes the value of 1 if a firm engages in corporate biodiversity reporting and 0 otherwise. Corporate environmental performance is the variable of interest. Corporate environmental performance is measured in terms of propensity to emit greenhouse gas (ratio of total greenhouse gas emissions to total revenue), propensity to generate waste (ratio of waste production to total revenue) and propensity to consume water (ratio of water consumption to total revenue). The estimated models also include a number of control variables.

The results reveal that companies using higher volume of water and producing higher quantity of wastes are more likely to engage in corporate biodiversity reporting. In other words, companies with poor environmental performance decides to disclose information on biodiversity. The corporate environmental performance in terms of GHG emissions is found to be insignificant. Asset age and industry type are the two control variables that have a positive and significant association with corporate biodiversity reporting decision. The reported results are found to be robust and may be of importance to policy makers, eco-friendly investors and corporate managers.

6 LIMITATIONS OF THE DISSERTATION AND DIRECTIONS FOR FUTURE RESEARCH

6.1 Limitations of the dissertation

This doctoral dissertation has a few limitations. For instance, for the first two essays of the dissertation, the sample consisted of the companies that had published sustainability reports. Hence, the companies that do not publish sustainability reports but disseminate environmental information to some extent through other media such as corporate websites and press releases were not included in the sample. The exclusion of such companies from the sample increases the probability of limiting the findings to a certain degree. Second, the samples used in this doctoral dissertation included only Finnish listed companies. The existing literature suggests that prior country-specific research on corporate environmental reporting produced very different results for different countries (Gonzalez-Gonzalez and Ramírez, 2016; Niskala and Pretes, 1995). Consequently, the findings of this dissertation may not be generalizable for other national contexts. Third, corporate environmental performance is a "quite broad and multi-dimensional construct" (Luo, 2019, p. 1236) and hence, all companies are not expected to measure their environmental performance using the same method. Therefore, the list of proxies for corporate environmental performance employed in this dissertation may not be exhaustive and consequently, this may have affected the results. Finally, it cannot be asserted with certainty that the list of relevant control variables included in the estimated models is exhaustive.

6.2 Directions for future research

The limitations discussed in the previous section and the review of the existing literature open avenues for future research. First, an investigation can be made into the claim in the current literature that (e.g., Gonzalez-Gonzalez and Ramírez, 2016; De Villiers and Van Staden, 2006; Niskala and Pretes, 1995) results generated by country-specific studies relating to environmental reporting practices vary according to national contexts because the dissemination of environmental information depends on the country under consideration. Second, future research can examine whether one subcategory of corporate environmental reporting (e.g., corporate biodiversity disclosures) moderates or mediates the relationship between corporate environmental performance and another subcategory of corporate environmental reporting (e.g., corporate climate change disclosures). Moreover, future studies may test if external assurance moderates or

mediates the connection between corporate environmental performance and a subset of corporate environmental reporting. Finally, future research may extend the models proposed in this dissertation by including supplementary control variables (e.g., corporate governance characteristics) with a view to examining whether the relationships tested throughout the dissertation remain steady subsequent to the inclusion of a longer list of control variables.

References

Adler, R., Mansi, M. and Pandey, R. (2018), "Biodiversity and threatened species reporting by the top Fortune Global companies", Accounting, Auditing and Accountability Journal, Vol. 31 No. 3, pp. 787-825.

Alrazi, B., De Villiers, C. and Van Staden, C. J. (2016), "The environmental disclosures of the electricity generation industry: a global perspective", Accounting and Business Research, Vol. 46 No. 6, pp. 665–701.

Al-Shaer, H. and Zaman, M. (2018), "Credibility of sustainability reports: the contribution of audit committees", Business Strategy and the Environment, Vol. 27 No. 7, pp. 973-986.

An, Y., Davey, H. and Eggleton, I. R. C. (2011), "Towards a comprehensive theoretical framework for voluntary IC disclosure", Journal of Intellectual Capital, Vol. 12 No. 4, pp. 571-585.

Ashforth, B. E. and Gibbs, B. W. (1990), "The double-edge of organisational legitimation", Organization Science, Vol. 1 No. 2, pp. 177–194.

Azzone, G., Manzini, R., Noci, G., Welford, R. and Young, C.W. (1996), "Defining environmental performance indicators: an integrated framework", Business Strategy and the Environment, Vol. 5 No. 2, pp. 69-80.

Barut, M., Raar, J. and Azim, M.I. (2016), "Biodiversity and local government: a reporting and accountability perspective", Managerial Auditing Journal, Vol. 31 No. 2, pp. 197-227.

Bhattacharyya, A. and Yang, H. (2019), "Biodiversity disclosure in Australia: effect of GRI and institutional factors", Australasian Journal of Environmental Management, Vol. 26 No. 4, pp. 347-369.

Boiral, O. (2013), "Sustainability reports as simulacra? A counter-account of A and A+ GRI reports", Accounting, Auditing and Accountability Journal, Vol. 26 No. 7, pp. 1036-1071.

Boiral, O. (2016), "Accounting for the unaccountable: biodiversity reporting and impression management", Journal of Business Ethics, Vol. 35 No. 4, pp. 751-768.

Braam, G. and Peeters, R. (2018), "Corporate sustainability performance and assurance on sustainability reports: diffusion of accounting practices in the realm of sustainable development", Corporate Social Responsibility and Environmental Management, Vol. 25 No. 2, pp. 164-181.

Braam, G.J.M., Weerd, L.U., de Hauck, M. and Huijbregts, M.A.J. (2016), "Determinants of corporate environmental reporting: the importance of environmental performance and assurance", Journal of Cleaner Production, Vol. 129, pp. 724-734.

Brammer, S. and Pavelin, S. (2006), "Voluntary environmental disclosures by large UK companies", Journal of Business Finance and Accounting, Vol. 33 Nos 7 and 8, pp. 1168-1188.

Buallay, A. M. (2022), "Relevant theories to sustainability reporting", International Perspectives on Sustainability Reporting, pp. 61-76, Emerald Publishing Limited.

Carbon Disclosure Project (2008), "Carbon disclosure project report 2008, global 500", available at: https://www.pwc.co.uk/building-public-trust-awards/assets/pdf/cdp_global_500_report_2008.pdf

Carbon Disclosure Project (2016), "Scoring introduction 2016", available at: https://b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/guidance_docs/pdfs/000/000/233/original/Scoring-Introduction-2016.pdf?1458064225

Carey, P., Simnett, R. and Tanewski, G. (2000), "Voluntary demand for internal and external auditing by family business", Auditing: A Journal of Theory and Practice, Vol. 19, Supplement, pp. 37-51.

Charreaux, G. and Desbrières, P. (2001), "Corporate governance: stakeholder value versus shareholder value", Journal of Management and Governance, Vol. 5 No. 2, pp. 107-128.

Chen, M., von Behren, R. and Mussalli, G. (2021), "The unreasonable attractiveness of more ESG data", The Journal of Portfolio Management, Vol. 48 No. 1, pp. 147-162.

Ching, H. Y. and Gerab, F. (2017), "Sustainability reports in Brazil through the lens of signaling, legitimacy and stakeholder theories", Social Responsibility Journal, Vol. 13 No. 1, pp. 95-110.

Chithambo, L. and Tauringana, V. (2014), "Company specific determinants of greenhouse gases disclosures", Journal of Applied Accounting Research, Vol. 15 No. 3, pp. 323-338.

Cho, C.H., Guidry, R.P., Hageman, A.M. and Patten, D.M. (2012), "Do actions speak louder than words? An empirical investigation of corporate environmental reputation", Accounting, Organizations and Society, Vol. 37 No. 1, pp. 14-25.

Clarkson, M. B. E. (1995), "A stakeholder framework for analyzing and evaluating corporate social performance", Academy of Management Review, Vol. 20 No. 1, pp. 92-117.

Clarkson, P.M., Li, Y., Richardson, G.D. and Vasvari, F.P. (2008), "Revisiting the relation between environmental performance and environmental disclosure: an empirical analysis", Accounting, Organizations and Society, Vol. 33 Nos 4/5, pp. 303-327.

Clarkson, P.M., Overell, M.B. and Chapple, L. (2011), "Environmental reporting and its relation to corporate environmental performance", Abacus, Vol. 47 No. 1, pp. 27-60.

Connelly, B. L., Certo, S. T., Ireland, R. D. and Reutzel, C. R. (2011), "Signaling theory: a review and assessment", Journal of Management, Vol. 37 No. 1, pp. 39-67.

Coram, P.J., Monroe, G.S. and Woodliff, D.R. (2009), "The value of assurance on voluntary nonfinancial disclosure: an experimental evaluation", Auditing: A Journal of Practice and Theory, Vol. 28 No. 1, pp. 137-151.

Cormier, D., Magnan, M. and Van Velthoven, B. (2005), "Environmental disclosure quality in large German companies: economic incentives, public pressures or institutional conditions?", European Accounting Review, Vol. 14 No. 1, pp. 3-39.

Datt, R.R., Luo, L. and Tang, Q. (2019), "The impact of legitimacy threat on the choice of external carbon assurance: evidence from the US", Accounting Research Journal, Vol. 32 No. 2, pp. 181-202.

Deegan, C. (2002), "The legitimizing effect of social and environmental disclosures – a theoretical foundation", Accounting, Auditing & Accountability Journal, Vol. 15 No. 3, pp. 282–311.

Deegan, C. (2023). Financial Accounting Theory. Cengage Learning Australia Pty Limited.

Deegan, C., Rankin, M. and Voght, P. (2000), "Firms' disclosure reactions to major social incidents: Australian evidence", Accounting Forum, Vol. 24 No. 1, pp. 101-130.

De Villiers, C. J. and Alexander, D. (2014), "The institutionalisation of corporate social responsibility reporting", The British Accounting Review, Vol. 46 No. 2, pp. 198–212.

De Villiers, C. J., Low, M. and Samkin, G. (2014), "The institutionalisation of mining company sustainability disclosures", Journal of Cleaner Production, Vol. 84, pp. 51–58.

De Villiers, C. and Hsiao, P. K. (2018), "Why organizations voluntarily report – agency theory", In C. De Villiers and W. Maroun, Sustainability Accounting and Integrated Reporting (1st ed., pp. 49-56). New York: Routledge.

De Villiers, C., Naiker, V. and Van Staden, C.J. (2011), "The effect of board characteristics on firm environmental performance", Journal of Management, Vol. 37 No. 6, pp. 1636-1663.

De Villiers, C. and Van Staden, C. (2006), "Can less environmental disclosure have a legitimizing effect? Evidence from Africa", Accounting, Organizations and Society, Vol. 31 No. 8, pp. 763-781.

DiMaggio, P. J. (1983), “State expansion and organization fields”, In R. H. Hall and R. E. Quinn, Organization theory and public policy (1st ed., pp. 147-161). Beverly Hills, CA: Sage.

DiMaggio, P. and Powell, W. (1983), “The Iron Cage revisited: institutional isomorphism and collective rationality in organizational fields”, American Sociology Review, Vol. 48 No. 2, pp. 147–160.

Donaldson, T. and Preston, L. E. (1995), ‘‘The stakeholder theory of the corporation: concepts, evidence, and implications’’, Academy of Management Review, Vol. 20 No. 1, pp. 65-91.

Dowling, J. and Pfeffer, J. (1975), ‘‘Organisational legitimacy: Social values and organizational Behaviour’’, Pacific Sociological Review, Vol. 18 No. 1, pp. 122-136.

Dutta, P. (2018), “Corporate environmental reporting practices in Finland: a review and agenda for future research”, Corporate Ownership & Control, Vol. 15 No. 3 (1), pp. 260-267.

Dutta, P. and Dutta, A. (2024), "Does corporate environmental performance affect corporate biodiversity reporting decision? The Finnish evidence", Journal of Applied Accounting Research, Vol. 25 No. 1, pp. 24-41.

Dye, R. A. (1985), “Disclosure of non-proprietary information”, Journal of Accounting Research, Vol. 23 No. 1, pp. 123-145.

Fama, E. F. and Jensen, M. C. (1983), “Separation of ownership and control”, The Journal of Law & Economics, Vol. 26 No. 2, pp. 301–325.

Farooq, M. B. and Maroun, W. (2018), “Why organizations voluntarily report – institutional theory and institutional work”, In C. De Villiers and W. Maroun, Sustainability Accounting and Integrated Reporting (1st ed., pp. 49-56). New York: Routledge.

Fernandez-Feijoo, B., Romero, S. and Ruiz, S. (2018), “Financial auditor and sustainability reporting: does it matter?”, Corporate Social Responsibility and Environmental Management, Vol. 25 No. 3, pp. 209-224.

Gaia, S. and Jones, M.J. (2017), “UK local councils reporting of biodiversity values: a stakeholder perspective”, Accounting, Auditing and Accountability Journal, Vol. 30 No. 7, pp. 1614-1638.

Gaia, S. and Jones, M. (2020), “Biodiversity reporting for governmental organisations: evidence from English local councils”, Accounting, Auditing and Accountability Journal, Vol. 33 No. 1, pp. 1-31.

Giannarakis, G., Zafeiriou, E. and Sariannidis, N. (2017), “The impact of carbon performance on climate change disclosure”, Business Strategy and the Environment, Vol. 26 No. 8, pp. 1078-1094.

Giannarakis, G., Zafeiriou, E., Arabatzis, G. and Partalidou, X. (2018), “Determinants of corporate climate change disclosure for European firms”,

Corporate Social Responsibility and Environmental Management, Vol. 25 No. 3, pp. 281-294.

Gillet-Monjarret, C. (2015), "Assurance of sustainability information: a study of media pressure", Accounting in Europe, Vol. 12 No. 1, pp. 87-105.

Gonzalez-Gonzalez, J.M. and Ramírez, C.Z. (2016), "Voluntary carbon disclosure by Spanish companies: an empirical analysis", International Journal of Climate Change Strategies and Management, Vol. 8 No. 1, pp. 57-79.

Gray, R., Adams, C. A. and Owen, D. (2014), Accountability, Social Responsibility and Sustainability, Harlow, UK: Pearson Education.

Green, W. and Taylor, S. (2013), "Factors that influence perceptions of greenhouse gas assurance provider quality", International Journal of Auditing, Vol. 17 No. 3, pp. 288-307.

Green, W., Taylor, S. and Wu, J. (2017), "Determinants of greenhouse gas assurance provider choice", Meditari Accountancy Research, Vol. 25 No. 1, pp. 114-135.

Greenwood, R. and Suddaby, R. (2006), "Institutional entrepreneurship in mature fields: the Big Five accounting firms", Academy of Management Journal, Vol. 49 No. 1, pp. 27–48.

GRI (2007), Biodiversity – A GRI Reporting Resource, GRI, Amsterdam.

Guenther, E., Guenther, T., Schiemann, F. and Weber, G. (2016), "Stakeholder relevance for reporting: explanatory factors of carbon disclosure", Business and Society, Vol. 55 No. 3, pp. 361-397.

Guthrie, J., Petty, R. and Wells, R. (2006), "The voluntary reporting of intellectual capital: comparing evidence from Hong Kong and Australia", Journal of Intellectual Capital, Vol. 7 No. 2, pp. 254-271.

Haque, S. and Deegan, C. (2010), "Corporate climate change-related governance practices and related dislosures: evidence from Australia", Australian Accounting Review, Vol. 55 No. 20, pp. 317-333.

Haque, F. and Jones, M.J. (2020), "European firms' corporate biodiversity disclosures and board gender diversity from 2002 to 2016", The British Accounting Review, Vol. 52 No. 2, 100893.

Hasnas, J. (1998), "The normative theories of business ethics: a guide for the perplexed", Business Ethics Quarterly, Vol. 8 No. 1, pp. 19–42.

Hassan, A., Elamer, A.A., Fletcher, M. and Sobhan, N. (2020), "Voluntary assurance of sustainability reporting: evidence from an emerging economy", Accounting Research Journal, Vol. 33 No. 2, pp. 391-410.

Hill, C.W.L. and Jones, T.M. (1992), "Stakeholder-agency theory", Journal of Management Studies, Vol. 29 No. 2, pp. 131-154.

Hodge, K., Subramaniam, N. and Stewart, J.D. (2009), "Assurance of sustainability reports: impact on report users' confidence and perceptions of information credibility", Australian Accounting Review, Vol. 19 No. 3, pp. 178-194.

Hogner, R. H. (1982), "Corporate social reporting: eight decades of development at US Steel", Research in Corporate Performance and Policy, Vol. 4, pp. 243–50.

Hossain, M., Farooque, O.A., Momin, M.A. and Almotairy, O. (2017), "Women in the boardroom and their impact on climate change related disclosure", Social Responsibility Journal, Vol. 13 No. 4, pp. 828-855.

Islam, M. A. and Deegan, C. (2010), "Media pressures and corporate disclosure of social responsibility performance information: a study of two global clothing and sports retail companies", Accounting and Business Research, Vol. 40 No. 2, pp.131–48.

Jensen, M. C. and Meckling, W. H. (1976), "Theory of the firm: managerial behavior, agency costs and ownership structure", Journal of Financial Economics, Vol. 3 No. 4, pp. 305–360.

Jones, M. and Solomon, J. (2010), "Social and environmental report assurance: some interview evidence", Accounting Forum, Vol. 34 No. 1, pp. 20-31.

Jones, M.J. (2003), "Accounting for biodiversity: operationalising environmental accounting", Accounting, Auditing and Accountability Journal, Vol. 16 No. 5, pp. 762-789.

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

Junior, R.M., Best, P.J. and Cotter, J. (2014), "Sustainability reporting and assurance: a historical analysis on a world-wide phenomenon", Journal of Business Ethics, Vol. 120 No. 1, pp. 1-11.

Karaman, A. S., Kilic, M. and Uyar, A. (2018), "Sustainability reporting in the aviation industry: worldwide evidence", Sustainability Accounting, Management and Policy Journal, Vol. 9 No. 4, pp. 362-391.

Kılıç, M. and Kuzey, C. (2019), "The effect of corporate governance on carbon emission disclosures: evidence from Turkey", International Journal of Climate Change Strategies and Management, Vol. 11 No. 1, pp. 35-53.

Kolk, A. and Perego, P. (2010), "Determinants of the adoption of sustainability assurance statements: an international investigation", Business Strategy and the Environment, Vol. 19 No. 3, pp. 182-198.

KPMG (2013), The KPMG survey result of corporate responsibility reporting: executive summary, KPMG.

Lash, J. and Wellington, F. (2007), "Competitive advantage on a warming planet", Harvard Business Review, Vol. 85 No. 3, pp. 94-102.

Liao, L., Luo, L. and Tang, Q. (2015), "Gender diversity, board independence, environmental committee and greenhouse gas disclosure", The British Accounting Review, Vol. 47, pp. 409-424.

Lindblom, C. K. (1993), "The implications of organisational legitimacy for corporate social performance and disclosure", paper presented at the Critical Perspectives on Accounting Conference, New York.

Lodhia, S. (2006), "The World Wide Web and its potential for corporate environmental communication: A study into present practices in the Australian minerals industry", The International Journal of Digital Accounting Research, Vol. 6 No. 11, pp. 65-94.

Luo, L., Lan, Y.C. and Tang, Q. (2012), "Corporate incentives to disclose carbon information: evidence from the CDP global 500 report", Journal of International Financial Management & Accounting, Vol. 23 No. 2, pp. 93-120.

Luo, L. and Tang, Q. (2014), "Does voluntary carbon disclosure reflect underlying carbon performance?", Journal of Contemporary Accounting & Economics, Vol. 10 No. 3, pp. 191-205.

Luo, L. (2019), "The influence of institutional contexts on the relationship between voluntary carbon disclosure and carbon emission performance", Accounting and Finance, Vol. 59 No. 2, pp. 1235-1264.

Mahajan, R., Lim, W. M., Sareen, M., Kumar, S. and Panwar, R. (2023), "Stakeholder theory", Journal of Business Research, Vol. 166, pp. 1-16.

Maroun, W. (2018), "Why organizations voluntarily report – legitimacy theory", In C. De Villiers and W. Maroun, Sustainability Accounting and Integrated Reporting (1st ed., pp. 49-56). New York: Routledge.

Mathews, M. R. (1993), Socially Responsible Accounting, London: Chapman & Hall.

Meng, X. H., Zeng, S. X., Shi, J. J., Qi, G. Y., and Zhang, Z. B. (2014), "The relationship between corporate environmental performance and environmental disclosure: An empirical study in China", Journal of Environmental Management, Vol. 145, pp. 357-367.

Merkl-Davies, D. M. and Brennan, N. M. (2011), "A conceptual framework of impression management: new insights from psychology, sociology and critical perspectives", Accounting and Business Research, Vol. 41 No. 5, pp. 415–437.

Meyer, J. W. and Rowan, B. (1977), "Institutionalized organizations: formal structure as myth and ceremony", American Journal of Sociology, Vol. 83 No. 2, pp. 340–363.

Moroney, R., Windsor, C. and Aw, Y.T. (2012), "Evidence of assurance enhancing the quality of voluntary environmental disclosures: an empirical analysis", Accounting and Finance, Vol. 52 No. 3, pp. 903-939.

Nasi, J., Nasi, S., Phillips, N. and Zyglidopoulos, S. (1997), "The evolution of corporate social responsiveness – an exploratory study of Finnish and Canadian forestry companies", Business and Society, Vol. 38 No. 3, pp. 296–321.

Neu, D., Warsame, H. and Pedwell, K. (1998), "Managing public impressions: environmental disclosures in annual reports", Accounting, Organizations and Society, Vol. 25 No. 3, pp. 265–82.

Niskala, M. and Pretes, M. (1995), "Environmental reporting in Finland: a note on the use of financial reports", Accounting, Organizations and Society, Vol. 20 No. 6, pp. 457-466.

O'Donovan, G. (2002), "Environmental disclosures in the annual report: extending the applicability and predictive power of legitimacy theory", Accounting, Auditing & Accountability Journal, Vol. 15 No. 3, pp. 344-371.

O'Dwyer, B., Owen, D. and Unerman, J. (2011), "Seeking legitimacy for new assurance forms: the case of assurance on sustainability reporting", Accounting, Organizations and Society, Vol. 36 No. 1, pp. 31-52.

Patten, D. M. (2002), "The relation between environmental performance and environmental disclosure: a research note", Accounting, Organizations and Society, Vol. 27 No. 8, pp. 763–773.

Perego, P. and Kolk, A. (2012), "Multinationals' accountability on sustainability: The evolution of third-party assurance of sustainability reports", Journal of Business Ethics, Vol. 110 No. 2, pp. 173–190.

Peters, G.F. and Romi, A.M. (2015), "The association between sustainability governance characteristics and the assurance of corporate sustainability reports", Auditing: A Journal of Practice & Theory, Vol. 34 No. 1, pp. 163-198.

Pflugrath, G., Roebuck, P. and Simnett, R. (2011), "Impact of assurance and assurer's professional affiliation on financial analysts' assessment of credibility of corporate social responsibility information", Auditing: A Journal of Practice and Theory, Vol. 30 No. 3, pp. 239-254.

Potdar, A., Gautam, R., Singh, A., Unnikrishnan, S. and Naik, N. (2016), "Business reporting on

biodiversity and enhancement of conservation initiatives", International Journal of Biodiversity

Science, Ecosystem Services and Management, Vol. 12 No. 3, pp. 227-236.

Quinn, D. P. and Jones, T. M. (1995), "An agent morality view of business policy", Academy of Management Review, Vol. 20 No. 1, pp. 22–42.

Reimsbach, D., Hahn, R. and Gürtürk, A. (2018), "Integrated reporting and assurance of sustainability information: an experimental study on professional investors' information processing", European Accounting Review, Vol. 27 No. 3, pp. 559-581.

Rimmel, G. and Jonäll, K. (2013), "Biodiversity reporting in Sweden: corporate disclosure and preparers' views", Accounting, Auditing and Accountability Journal, Vol. 26 No. 5, pp. 746-778.

Roberts, R. W. (1992), "Determinants of corporate social responsibility disclosure: an application of stakeholder theory", Accounting, Organizations and Society, Vol. 17 No. 6, pp. 595–612.

Ruhnke, K. and Gabriel, A. (2013), "Determinants of voluntary assurance on sustainability reports: an empirical analysis", Journal of Business Economics, Vol. 83 No. 9, pp. 1063-1091.

Sahay, A. (2004), "Environmental reporting by Indian corporations", Corporate Social Responsibility and Environmental Management, Vol. 11 No. 1, pp. 12-22.

Schneider, A., Samkin, G. and Davey, H. (2014), "Biodiversity reporting by New Zealand local authorities: the current state of play", Sustainability Accounting, Management and Policy Journal, Vol. 5 No. 4, pp. 425-456.

Sethi, S. P. (1978), "Advocacy advertising – the American experience", California Management Review, Vol. 11, pp. 55–67.

Sethi, S. P. (1979), "A conceptual framework for environmental analysis of social issues and evaluation of business response patterns", Academy of Management Review, Vol. 4 No. 1, pp. 63-74.

Simnett, R., Nugent, M. and Huggins, A. (2009a), "Developing an international assurance standard on greenhouse gas statements", Accounting Horizons, Vol. 23 No. 4, pp. 347-363.

Simnett, R., Vanstraelen, A. and Chua, W.F. (2009b), "Assurance on sustainability reports: an international comparison", The Accounting Review, Vol. 84 No. 3, pp. 937-967.

Simoni, L., Bini, L. and Bellucci, M. (2020), "Effects of social, environmental and institutional factors on sustainability report assurance: evidence from European countries", Meditari Accountancy Research, Vol. 28 No. 6, pp. 1059-1087.

Skillius, A. and Wennberg, U. (1998), "Continuity, credibility and comparability: key challenges for corporate environmental performance measurement and communication", IIIEE.

Stanny, E. and Ely, K. (2008), "Corporate environmental disclosures about the effects of climate change", Corporate Social Responsibility and Environmental Management, Vol. 15 No. 6, pp. 338-348.

Suchman, M. C. (1995), "Managing legitimacy: strategic and institutional approaches", Academy of Management Review, Vol. 20 No. 3, pp. 571–610.

Ullmann, A. (1985), "Data in search of a theory: a critical examination of the relationships among social performance, social disclosure, and economic performance of US firms", Academy of Management Review, Vol. 10 No. 3, pp. 540–57.

Van Liempd, D. and Busch, J. (2013), "Biodiversity reporting in Denmark", Accounting, Auditing and Accountability Journal, Vol. 26 No. 5, pp. 833-872.

Venter, E. and De Villiers, C. (2013), "The accounting profession's influence on academe: South African evidence", Accounting, Auditing & Accountability Journal, Vol. 26 No. 8, pp. 1246–1278.

Verrechia, R.E. (1983), "Discretionary disclosure", Journal of Accounting and Economics, Vol. 5 No. 3, pp. 179-194.

Wallace, W.A. (1987), "The economic role of the audit in free and regulated markets: a review", Research in Accounting Regulation, Vol. 1, pp. 7-34.

Watts, R.L. and Zimmerman, J.L. (1986), Positive Accounting Theory, Prentice-Hall, Englewood Cliffs, NJ.

Willison, J.H.M. and Coté, R.P. (2009), "Counting biodiversity waste in industrial eco-efficiency: fisheries case study", Journal of Cleaner Production, Vol. 17 No. 3, pp. 348-353.

Wukich, J. J., Neuman, E. L. and Fogarty, T. J. (2023), "Show me? Inspire me? Make me? An institutional theory exploration of social and environmental reporting practices", Journal of Accounting & Organizational Change, forthcoming.

Yunus, S., Elijido-Ten, E. and Abhayawansa, S. (2016), "Determinants of carbon management strategy adoption: evidence from Australia's top 200 publicly listed firms", Managerial Auditing Journal, Vol. 31No. 2, pp. 156-179.

Zorio, A., García-Benau, M.A. and Sierra, L. (2013), "Sustainability development and the quality of assurance reports: empirical evidence", Business Strategy and the Environment, Vol. 22 No. 7, pp. 484-500.

Determinants of Voluntary Sustainability Assurance: The Importance of Corporate Environmental Performance

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Abstract

Purpose: The purpose of this study is to investigate whether corporate environmental performance exerts any significant influence on the voluntary external assurance of sustainability reports.

Design/methodology/approach: The sample of this study includes 176 firm-year observations covering an 8-year period (2008-2015) for listed Finnish companies that have issued sustainability reports during the sample period. As the dependent variable 'voluntary external assurance' is a binary variable, a logistic regression model has been estimated to observe the effect of corporate environmental performance on the dependent variable. In addition, a number of control variables have also been included in the empirical model.

Findings: The results of this study exhibit that Finnish firms with superior environmental performance in terms of GHG emissions and water consumption have their sustainability reports externally assured. Additionally, among the control variables, firm size, leverage and asset age are found to have significant impact on the adoption of voluntary sustainability assurance. These results are robust as they do not change substantially when conducting sub-sample analyses.

Originality/value: The literature on voluntary sustainability assurance is evolving slowly paying very little attention to the association between corporate environmental performance and voluntary sustainability assurance. This empirical research aims to extend such scant literature. The results are of paramount importance to users of environmental information, managers and regulators.

Keywords: Voluntary external assurance; Corporate environmental performance; Legitimacy theory; Sustainability reports; Propensity to emit GHG; Propensity to consume water; Propensity to produce waste.

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1. Introduction

This study examines the importance of corporate environmental performance (CEP) as a determinant of voluntary external assurance on sustainability reports issued by corporations. Against the backdrop of environmental degradation (e.g., global warming), all kinds of stakeholders (i.e., shareholders and other stakeholders) have become critical of corporations for their role in inflicting damage (through their activities) on the natural environment. Consequently, corporations are increasingly under pressure from these stakeholders to become more environmentally responsive, more serious about sustainable development and more accountable for their decisions and activities affecting the environment; in response to stakeholders' demand for greater accountability for environmental issues, companies are voluntarily and increasingly disclosing different types of environmental information in their sustainability reports (Braam *et al*., 2016). But prior research (e.g., Braam *et al*., 2016; Cho & Patten, 2007; Luo *et al*., 2012; Cormier *et al*., 2005) suggests that firms may use environmental reporting (ER) as a communication strategy; for instance, firms with superior CEP may use ER to send signals to their stakeholders about their relatively good CEP. On the other hand, poor environmental performers may use ER to manipulate public perceptions by hiding actual CEP. The potential use of ER as an impression management tool by companies raises concerns about the reliability and credibility of the reported information in corporate sustainability reports (Cho et al., 2012). In the face of the potential loss of stakeholders' confidence in the credibility of the disclosed environmental information, companies are showing a heightened tendency to have their sustainability reports externally assured in order to enhance the credibility of the reported information, restore stakeholders' confidence in the same and thus build corporate reputation (Simnett *et al*., 2009; Braam *et al*., 2016; Al-Shaer and Zaman, 2018).

The existing literature suggests that there are only a few studies on the factors influencing the implementation of voluntary external assurance on sustainability reports (Ruhnke & Gabriel, 2013; Gillet-Monjarret, 2015; Al-Shaer and Zaman, 2018). In addition, conclusions of the studies investigating the determinants of voluntary sustainability assurance (VSA) are somewhat mixed (Ruhnke and Gabriel, 2013). For instance, Simnett *et al*. (2009) analyze the sustainability reports produced by 2,113 companies of 31 countries over the period from 2002 to 2004 in order to identify the determinants of VSA and confirm that company-, industry- and country-related factors influence firms' decision to have their sustainability reports externally assured. As regards company and industry-related factors, larger companies belonging to environmentally or socially sensitive industries are more likely to purchase external assurance for their sustainability reports. As far as country-related factors are concerned, companies domiciled in countries that are stakeholder-oriented (code law countries where attention is paid to all stakeholders including shareholders) and have a rigorous legal environment tend strongly to have their sustainability reports externally assured. In contrast to Simnett *et al*. (2009), Kolk and Perego (2010) find that a company's VSA demand is negatively and significantly associated with the legal environment of the company's country of domicile; the company size is not found to have any significant influence on a company's choice to purchase external assurance as well. However, Kolk and Perego (2010) find a greater demand for VSA in code law countries. Ruhnke and Gabriel (2013) investigate the determinants of external assurance on sustainability reports issued by companies in Germany, the Netherlands and Great Britain and report that companies' decision to purchase VSA is linked with the type and scope of the sustainability reporting, the existence of a sustainability department, and the size of the company. They reveal further that corporate demand for VSA is highest in Great Britain. Gillet-Monjarret (2015) examines the impact of media pressure on the implementation of

VSA by 120 French listed companies over the period of four years (2007-2010) and finds that media pressure explains the implementation of VSA by companies. Peters and Romi (2015) investigate the impact of sustainability governance characteristics on VSA of listed US companies (from 2002 to 2010). They reveal that the presence of a Chief Sustainability Officer (CSO) on the board of directors is positively linked with the adoption of VSA by US companies. In addition, if the CSO has sustainability expertise the likelihood of adopting VSA increases. Furthermore, companies that have environmental committees consisting of directors with sustainability expertise tend to demand for VSA. Al-Shaer and Zaman (2018) find that audit committee characteristics such as audit committee independence, number of audit committee meetings and financial expertise of audit committee members have an impact on the adoption of VSA but the size of the audit committee is not associated with the demand for VSA. The preceding discussion on prior research shows the scarcity of studies investigating the association between CEP and VSA. This research, drawing on legitimacy theory, addresses this gap by exploring the association between CEP and VSA and thus contributes to the emerging literature on VSA.

Legitimacy theory posits that companies are members of society and tap into the scarce resources of society (Luo and Tang, 2014). Consequently, it is expected that the actions of companies will be "desirable, proper or appropriate within some socially constructed system of norms, values, beliefs and definitions" (Suchman, 1995, p. 274). In other words, companies are expected to operate within the bounds of an acceptable value system in order to continue its existence in society (Dowling and Pfeffer, 1975; Gray *et al*., 1995). In case of failure to meet societal expectations on the part of a company, its organizational legitimacy will be threatened and its survival will be in question (Sethi, 1979). According to legitimacy theory, a "social contract" exists between companies and the larger social system within which they operate and hence, they will

continuously seek to conform to the social contract so that their legitimacy is not threatened (Deegan and Rankin, 1996; Yunus *et al*., 2016). The growing public attention on environmental issues persuades firms to engage in environmentally responsible practices (Kılıç and Kuzey, 2019). In order to keep the social contract intact and maintain legitimacy, firms need to inform society in general that they are taking their environmental responsibilities seriously (Yunus *et al*., 2016) and one way of doing this is to disclose information about their environmentally responsible practices via sustainability reports (Kılıç and Kuzey, 2019). Gillet-Monjarret (2015) contends that since independent assurance legitimizes the actions of the company, organizational legitimacy is strengthened further if the reliability of the information disseminated via corporate sustainability reports is ensured by an independent assurance provider. Kolk and Perego (2010) add further that companies are adopting VSA for obtaining legitimacy and their assertion is reflected in the increased number of businesses implementing VSA over the years (O'Dwyer and Owen, 2005). The standing literature suggests that both superior and inferior environmental performers tend to provide information about their EP on two different grounds. Firms with good EP voluntarily disclose information about their performance in order to distinguish themselves from firms with poor EP and thus avoid the problem of adverse selection (Belkaoui and Karpik, 1989; Clarkson *et al*., 2008; Luo and Tang, 2014). This argument is in line with voluntary disclosure theory (Clarkson *et al*., 2008; Luo and Tang, 2014; Giannarakis *et al*., 2017). On the other hand, poor environmental performers face threatened organizational legitimacy. As a legitimacy repairing strategy, firms with poor EP make increased discretionary environmental disclosures so that public perceptions about their actual EP are changed (Clarkson *et al*., 2008; Luo and Tang, 2014). This argument is consistent with the premise of legitimacy theory (Clarkson *et al*., 2008; Luo and Tang, 2014; Giannarakis *et al*., 2017). Irrespective of their 'EP type', firms tend to have their sustainability

reports externally assured as assurance establishes the reliability and enhances the credibility of the reported environmental information (Simnett *et al*., 2009; Moroney *et al*., 2012; Gillet-Monjarret, 2015; Braam *et al*., 2016).

Given that both superior and inferior environmental performers tend to provide environmental disclosures and seek to establish the reliability and improve the credibility of the disseminated information, it is expected that an association between CEP and VSA exists and hence, the following non-directional hypothesis is formulated:

> *Hypothesis: Corporate environmental performance has a significant impact on voluntary external assurance of sustainability reports.*

The remainder of the paper is organized as follows. The next section describes the sample and methodology used. The results are presented and discussed in section three. Finally, section four concludes the paper.

2. Methods

2.1. Sample and data

The sample of this study includes 176 firm-year observations covering an 8-year period (2008-2015) for listed Finnish companies that have issued sustainability reports during the sample period. The availability of data dictates the sample size and the sample period. Finland has been used as the research context because of the country's strong commitment to sustainable development. Finland is one of the forerunners to implement the 'UN 2030 Agenda for Sustainable Development'.[†] The 'UN 2030 Agenda for Sustainable Development' aims at ensuring sustainable

[†] This information is sourced from the website https://um.fi/agenda-2030-sustainable-development-goals#inFinland.

development in all dimensions: economy, the environment and well-being.[‡] The UN 2030 Agenda includes 17 goals and 169 targets; there are 200 global indicators supplemented by national indicators of individual countries for monitoring progress. Finland is not only one of the first countries to put in place national objectives, actions and a monitoring and assessment system for attaining the goals of the UN, but also an active participant in the international monitoring of the UN 2030 Agenda. At the national level, Finland has introduced 'Society's Commitment to Sustainable Development', a key instrument for implementing the UN 2030 Agenda through which the state along with other actors in society such as local governments, companies, corporations, civil society and citizens can contribute to the implementation of the world's common development plan.[§] Finland is also committed to assume global responsibility to extend the effect of this contribution beyond its national borders. In this empirical research, data on external assurance are retrieved from the sustainability reports of the sampled firms and firm-specific data are extracted from Thomson Reuters DataStream database.

2.2. Variables

2.2.1. Dependent variable

Voluntary sustainability assurance is the binary dependent variable that takes a value of 1 if the corporate sustainability report is externally assured and 0 otherwise (Simnett *et al*., 2009; Kolk & Perego, 2010; Ruhnke & Gabriel, 2013; Gillet-Monjarret, 2015; Braam *et al*., 2016; Al-Shaer & Zaman, 2018).

[‡] This information is sourced from the website https://um.fi/documents/35732/0/UAM_Kesta%CC%88va%CC%88-kehitys_A4_EN_18102018%20%281%29.pdf/1a236110-e890-85e2-1aea-e68b2a9df486?t=1540750202357.
[§] This information is sourced from the website https://kestavakehitys.fi/en/commitment2050.

2.2.2. Independent variable

CEP appears to be the only independent variable in this study. As suggested by previous research (Al-Tuwaijari *et al*., 2004; Cho and Patten, 2007; Clarkson *et al*., 2008; Luo and Tang, 2014; Braam *et al*., 2016), scaled measures of CEP have been used. These measures include (i) the ratio of total greenhouse gas (GHG) emissions to total revenue (or propensity to emit GHG), (ii) the ratio of waste production to total revenue (or propensity to produce waste) and (iii) the ratio of water consumption to total revenue (or propensity to consume water) (Braam *et al*., 2016). Higher propensities imply increased amount of GHG emissions, waste production and water consumption and thereby inferior EP (Clarkson *et al*., 2011). Scaled measures of CEP have edge over absolute measures of CEP (e.g., the total amount of water consumed) because scaled measures consider variations in the output of products and services (Luo and Tang, 2014) and thus facilitate comparisons of EP across companies and between different periods (Hoffmann and Busch, 2008).

2.2.3. Control variables

Consistent with previous studies, this paper controls for the effect of a number of variables namely, firm size (FSIZE), profitability (PROF), leverage (LEV), industry (IND) and asset age (ASST_AGE). Larger companies are more visible and subject to greater social pressure to operate in an environmentally responsible way (Patten, 2002a; Gonzalez-Gonzalez and Ramírez, 2016). This will, according to legitimacy theory, lead them to make a higher level of disclosures about their EP to avoid legitimacy threat (Mobus, 2005) and hence they are more likely to purchase VSA to increase the reliability and credibility of the reported information. Hence a positive association between FSIZE and VSA is expected. FSIZE is calculated as the natural logarithm of year-end total assets (Gillet-Monjarret, 2015; Ruhnke & Gabriel, 2013; Jaggi *et al*., 2018; Al-Shaer and

Zaman, 2018). More profitable companies are financially more capable of making sustainability decisions such as sustainability investments and purchase of sustainability assurance (Ruhnke & Gabriel, 2013). Therefore, a positive linkage between PROF and VSA is anticipated. PROF is measured by the return-on-assets (ROA), which is calculated as the ratio of year-end net income to year-end total assets (Ruhnke & Gabriel, 2013; Gillet-Monjarret, 2015; Peters and Romi, 2015; Al-Shaer and Zaman, 2018). Given that the relationship between LEV and VSA is inconclusive (Simnett *et al*., 2009; Ruhnke & Gabriel, 2013; Gillet-Monjarret, 2015; Peters and Romi, 2015; Al-Shaer and Zaman, 2018), it is not possible to anticipate whether LEV and VSA are positively or negatively linked (Ruhnke & Gabriel, 2013). Therefore, only a significant association between LEV and VSA is assumed. Debt-equity ratio is used as the proxy for LEV (Jaggi *et al*., 2018). Firms belonging to environmentally sensitive (ES) industries face greater public pressures related to environmental issues (Kolk and Perego, 2010; Gillet-Monjarret, 2015; Peters and Romi, 2015) and respond to such pressures by providing sustainability information (Gillet-Monjarret, 2015). In order to offer reliability and credibility to their sustainability information, ES firms tend to purchase VSA (Kolk and Perego, 2010; Gillet-Monjarret, 2015; Peters and Romi, 2015). Following prior studies (Patten, 2002b; Clarkson *et al.*, 2008; Cho *et al*., 2014; Yunus *et al*., 2016), energy, utilities, transportation, pharmaceuticals, materials, mining and extractive, paper, chemicals, petroleum, metals, utilities and telecommunication industries are considered ES industries. IND is a dummy variable taking a value of 1 for ES firms and 0 otherwise (Cho *et al*., 2014; Yunus *et al*., 2016). Finally, this study controls for ASST_AGE as firms investing in newer and cleaner technologies are likely to cause less environmental pollution and tend to inform their stakeholders of such fact through increased environmental disclosures (Clarkson *et al.*, 2008; Moroney *et al*., 2012). In order to increase stakeholders' confidence in their sustainability reports,

they are also likely to implement VSA. Consequently, a positive relationship is expected between ASST_AGE and VSA. ASST_AGE is measured as the ratio of net properties, plant and equipment to gross properties, plant and equipment (Clarkson *et al.*, 2008).

2.3. Regression model

To test the proposed hypothesis, the following pooled logistic regression models are estimated:

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

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

where *VSA* = voluntary sustainability assurance; *CEP* = corporate environmental performance (CEP_1 = the ratio of total GHG emitted to total revenue; CEP_2 = the ratio of total water consumed to total revenue; CEP_3 = the ratio of total waste produced to total revenue); *FSIZE* = firm size; *PROF* = profitability; *LEV* = leverage; *IND* = industry; *ASST_AGE* = asset age. **Table 1** provides the summary of the variables used in this study.

Table 2 presents the Pearson correlations coefficients for the variables used in this study. According to Gujarati (1995), multicollinearity exists if the value of the correlation coefficient between two independent variables exceeds 0.80. **Table 2** shows a correlation of 0.955721 between CEP_1 and CEP_2. On the other hand, the correlations among other independent and/or control variables are less than 0.50. This clearly indicates the existence of multicollinearity between CEP_1 and CEP_2. In addition, the variance inflation factor (VIF) between CEP_1 and CEP_2 amounts to 10.42 which also confirms the presence of multicollinearity between these two measures of corporate environmental performance. As a result, it is not possible to accommodate all three proxies for CEP in a single model.

3. Results and Discussion

3.1. Descriptive statistics

Table 3 presents descriptive statistics for the total sample. The mean of VSA is 0.57 indicating that about 57% of the sustainability reports have been externally assured. As far as CEP measures are concerned, a considerable variation is seen in cases of CEP_1 and CEP_2. For example, the mean of CEP_1 is 0.48 with minimum and maximum of 0.01 and 5.60 respectively; the mean of CEP_2 is 46.44 with minimum and maximum of 0.01 and 618.52 respectively. On the other hand, CEP_3 has a mean of 0.07 with minimum and maximum 0.00 and 0.58, respectively. LEV has a mean of 0.47 and PROF has a mean of 0.05. The mean of FSIZE is 6.69 with minimum and maximum of 5.68 and 7.58 respectively implying that the sample includes both medium and large firms. The mean of IND is 0.77 revealing that around 77% of the sampled firms belong to environmentally sensitive industries. The mean of ASST_AGE is 0.43 indicating that firms are in possession of older assets.

3.2. Regression results

The regression results are presented in ***Table 4***. Two different models have been estimated to observe the impact of CEP on the adoption of VSA. In Model 1, CEP is measured as the ratios of total GHG emissions to total revenues (CEP_1) and total waste produced to total revenues (CEP_3); whereas in Model 2, the ratios of total water consumed to total revenues (CEP_2) and CEP_3 are used as the indicators of CEP.

Model 1 demonstrates that CEP_1 is negatively and significantly linked to VSA ($p<0.01$) indicating that firms with better environmental performance (EP) in terms of GHG emissions tend to demand for VSA. In addition, FSIZE, a firm-specific control variable, has a significant and positive

relationship with VSA (p<0.01) suggesting that larger firms are more likely to implement VSA. CEP_3 and the remaining firm-specific control variables are found to have no linkage with VSA.

Model 2 exhibits a highly significant inverse relationship between CEP_2 and VSA (p<0.01) but CEP_3 is still found to be insignificant suggesting that firms with better EP in terms of water consumption have a tendency to demand for VSA. In addition, except PROF and IND, other firm-specific control variables are found to be significant at different conventional levels of significance. For instance, FSIZE, ASST_AGE and LEV are statistically significant at 1%, 5% and 10% respectively, which indicates that larger firms, firms with less polluting new assets and low-leverage firms are more inclined to have their sustainability reports externally assured. Model 2 also shows an improvement in the model fit (R^2 improves from 0.30 to 0.43).

Overall, these findings provide support for the proposed hypothesis that corporate environmental performance influences the adoption of voluntary assurance of sustainability reports. Gillet-Monjarret (2015) asserts that corporate legitimacy can be strengthened if independent assurance providers recognize the reliability of the environmental information provided in corporate sustainability reports. Therefore, the results of this study are supportive of legitimacy theory suggesting that superior environmental performers (companies with lower propensity to emit GHG and consume water in this research) show their commitment to maintain and protect the natural environment through disclosures of reliable information about their relatively good EP in sustainability reports and thus maintain legitimacy. The robustness of legitimacy theory is also confirmed by the significant and positive FSIZE-VSA nexus as well as ASST_AGE-VSA nexus. Larger firms, due to their higher visibility and greater public scrutiny, are subject to external pressure to report information about their EP; consequently, they are likely to disclose more environmental information (Yunus *et al*., 2016; Kılıç and Kuzey, 2019). In addition, firms with

newer and less polluting assets are likely to voluntarily provide more environmental information to send signals to the market and society in general about their seriousness towards environmental responsibilities (Clarkson *et al*., 2008; Moroney *et al*., 2012). In both cases, disclosing firms are likely to obtain VSA to increase the reliability and credibility of the reported information and thus strengthen the legitimacy of their continued existence in society (Deegan and Gordon, 1996). A plausible explanation why the propensity to produce waste does not affect the adoption of VSA may be that Finnish companies may not yet consider the generation of waste an important indicator of EP.

3.3. Robustness check

For robustness check, sub-sample analyses have been conducted. In doing so, the whole sample has been split into two subsamples: the first subsample covers the period from 2008 to 2011, while the second one spans from 2012 to 2015. The results of the subsample analysis are presented in Tables 5 and 6. These findings mirror those reported in Table 4. For instance, CEP_1 and CEP_2 remain highly significant at conventional levels indicating that these measures have emerged as the main determinants of VSA irrespective of the time periods used. However, few discrepancies are also observed. For example, while CEP_3 is found to have no impact on VSA when performing the full period analysis, it has now become significant at 10% level in Model 2. Besides, for each sub-sample, the R^2 statistic improves substantially. To sum up, the results of this empirical research are quite robust as they do not change substantially depending on the time periods considered.

4. Conclusions, Implications and Limitations

This study advances the literature on voluntary sustainability assurance, which is considered important for establishing the reliability and enhancing the credibility of the environmental

information disclosed in corporate sustainability reports and thus strengthening organizational legitimacy. The literature on voluntary sustainability assurance is evolving slowly paying very little attention to the relationship between corporate environmental performance and voluntary sustainability assurance. This empirical work provides initial evidence of the impact of corporate environmental performance on the implementation of voluntary assurance of corporate sustainability reports. Drawing on legitimacy theory, the association between different measures (propensities to emit GHG, consume water and produce waste) of corporate environmental performance and the adoption of voluntary sustainability assurance is tested.

The results of this study exhibit that Finnish firms with superior environmental performance in terms of GHG emissions and water consumption have their sustainability reports externally assured. Conforming to legitimacy theory the findings suggest that superior environmental performers provide information about their environmental performance in sustainability reports with a view to showing their commitment to environmental protection, increase the reliability and credibility of the disclosed environmental performance information by adopting voluntary sustainability assurance and thus strengthen organizational legitimacy.

The findings of this study have implications for users of environmental information, managers and regulators. The results will enable users of environmental information to judge the reliability and credibility of the information (disseminated via corporate sustainability reports) about corporate environmental performance of reporting firms. The external assurance reduces corporate management's opportunity to utilize environmental reporting as a management tool to divert public attention from actual environmental performance and hence restores environmental information users' confidence in the credibility of sustainability reports. On the other hand, corporate managers will be benefited from the findings of this research by paying attention to the

provision of reliable environmental information to relevant publics. The supply of reliable information to relevant publics will keep them informed that companies are operating within the bounds of an acceptable value system. This will help companies maintain legitimacy and ensure their continued existence in society. Finally, the results will be important for regulators, who may keep an eye on the transparency of firms' voluntary environmental disclosures. In case companies fail to provide reliable and credible information about their environmental performance, regulators may develop stringent rules and regulations for complementing voluntary sustainability assurance by mandatory requirements for sustainability disclosures and assurance.

This research is subject to certain limitations. First, it is not likely that all companies use the same method for measuring their environmental performance and hence the measures of corporate environmental performance used in this research may not be exhaustive. In addition, the estimated models may not have included all the control variables that can affect the adoption of voluntary sustainability assurance. Second, the sample includes only the companies that have published sustainability reports. Third, this research is based solely upon Finnish data, which may inhibit the generalization of the findings in other contexts but this limitation can be overcome in future research by utilizing bigger samples that will include both local and international firms to provide greater understanding of how corporate environmental performance affects the adoption of voluntary sustainability assurance. Furthermore, country-specific studies can also be conducted to facilitate the comparisons of findings.

References

Al-Shaer, H. & Zaman, M. 2018. Credibility of sustainability reports: the contribution of audit committees. *Business Strategy and the Environment,* 27 (7): 973-986.

Al-Tuwaijri, S.A., Christensen, T.E. & Hughes II, K.E. 2004. The relations among environmental disclosure, environmental performance, and economic performance: a simultaneous equations approach. *Accounting, Organizations and Society*, 29 (5-6): 447-471.

Belkaoui, A. & Karpik, P.G. 1989. Determinants of the corporate decision to disclose social information. Accounting, Auditing & Accountability Journal, 2 (1): 36–51.

Braam, G. J. M., Weerd, L. U. de, Hauck, M. & Huijbregts, M. A. J. 2016. Determinants of corporate environmental reporting: the importance of environmental performance and assurance. *Journal of Cleaner Production*, 129: 724-734.

Cho, C.H. & Patten, D.M. 2007. The role of environmental disclosures as tools of legitimacy: a research note. *Accounting, Organizations and Society*, 32 (7-8): 639-647.

Cho, C.H., Guidry, R.P., Hageman, A.M. & Patten, D.M. 2012. Do actions speak louder than words? An empirical investigation of corporate environmental reputation. *Accounting, Organizations and Society*, 37 (1): 14-25.

Cho, C. H., Michelon, G., Patten, D. M. & Roberts, R. W. 2014. CSR report assurance in the USA: an empirical investigation of determinants and effects. *Sustainability Accounting, Management and Policy Journal*, 5 (2): 130-148.

Clarkson, P.M., Li, Y., Richardson, G.D. & Vasvari, F.P. 2008. Revisiting the relation between environmental performance and environmental disclosure: an empirical analysis. *Accounting, Organizations and Society*, 33 (4-5): 303-327.

Clarkson, P.M., Overell, M. B. & Chapple, L. 2011. Environmental reporting and its relation to corporate environmental performance. *Abacus*, 47 (1): 27-60.

Cormier, D., Magnan, M. & Van Velthoven, B. 2005. Environmental disclosure quality in large German companies: economic incentives, public pressures or institutional conditions? *European Accounting Review*, 14 (1): 3-39.

Deegan, C. & Gordon, B. 1996. A study of the environmental disclosure practices of Australian corporations. *Accounting and Business Research*, 26 (3): 187-199.

Deegan, C. & Rankin, M. 1996. Do Australian companies report environmental news objectively? *Accounting, Auditing and Accountability Journal*, 9 (2): 50-67.

Dowling, J. & Pfeffer, J. 1975. Organizational legitimacy: Societal values and organizational behaviour. *Pacific Sociological Review,* 18 (1): 122-136.

Giannarakis, G., Zafeiriou, E. & Sariannidis, N. 2017. The Impact of Carbon Performance on Climate Change Disclosure. *Business Strategy and the Environment*, 26 (8): 1078–1094.

Gillet-Monjarret, C. 2015. Assurance of sustainability informaiton: a study of media pressure. *Accounting in Europe*, 12 (1): 87-105.

Gonzalez-Gonzalez, J. M., & Ramírez, C. Z. 2016. Voluntary carbon disclosure by Spanish companies: an empirical analysis. *International Journal of Climate Change Strategies and Management*, 8 (1): 57-79.

Gray, R., Kouhy, R. & Lavers, S. 1995. Corporate social and environmental reporting: A review of the literature and a longitudinal study of UK disclosure. *Accounting, Auditing & Accountability Journal*, 8(2): 47-77.

Guajarati D.N. 1995. Basic Econometrics. McGraw-Hill: New York.

Hoffmann, V.H. & Busch, T. 2008. Corporate carbon performance indicators: carbon intensity, dependency, exposure, and risk. *Journal of Industrial Ecology*, 12 (4): 505–520.

Jaggi, B., Allini, A., Macchioni, R. & Zagaria, C. 2018. The Factors Motivating Voluntary Disclosure of Carbon Information: Evidence Based on Italian Listed Companies. *Organization & Environment*, 31(2): 178–202.

Kılıç, M. & Kuzey, C. 2019. The effect of corporate governance on carbon emission disclosures: Evidence from Turkey. *International Journal of Climate Change Strategies and Management,* 11 (1): 35-53.

Kolk A. & Perego, P. 2010. Determinants of the adoption of sustainability assurance statements: an international investigation. *Business Strategy and the Environment*, 19 (3):182–198.

Luo, L., Lan, Y.C. & Tang, Q. 2012. Corporate incentives to disclose carbon information: evidence from the CDP Global 500 Report. *Journal of International Financial Management & Accounting*, 23 (2): 93-120.

Luo, L. & Tang, Q. 2014. Does voluntary carbon disclosure reflect underlying carbon performance? *Journal of Contemporary Accounting & Economics*, 10 (3): 191-205.

Mobus, J.L. 2005. Mandatory environmental disclosures in a legitimacy theory context. *Accounting, Auditing & Accountability Journal*, 18 (4): 492-517.

Moroney, R., Windsor, C. & Aw, Y.T. 2012. Evidence of assurance enhancing the quality of voluntary environmental disclosures: an empirical analysis. *Accounting and Finance*, 52 (3): 903-939.

O'Dwyer, B. & Owen, D. L. 2005. Assurance statement practice in environmental, social and sustainability reporting: A critical evaluation. *The British Accounting Review*, 37(2): 205–229.

Patten, D.M. 2002a. Media exposure, public policy pressure, and environmental disclosure: an examination of the impact of TRI Data availability. *Accounting Forum*, 26 (2): 152-171.

Patten, D. M. 2002b. The relation between environmental performance and environmental disclosure: A research note. *Accounting, Organizations and Society*, 27 (8): 763-773.

Peters, G. F. & Romi, A. M. 2015. The association between sustainability governance characteristics and the assurance of corporate sustainability reports. *Auditing: A Journal of Practice & Theory*, 34 (1): 163-198.

Ruhnke, K. & Gabriel, A. 2013. Determinants of voluntary assurance on sustainability reports: an empirical analysis. *Journal of Business Economics*, 83 (9): 1063–1091.

Sethi, S. 1979. A conceptual framework for environmental analysis of social issues and evaluation of business response patterns. *Academy of Management Review*, 4 (1): 63-74.

Simnett, R., Vanstraelen, A. & Chua, W. F. 2009. Assurance on sustainability reports: an international comparison. *The Accounting Review,* 84 (3): 937–967.

Suchman, M.C. 1995. Managing legitimacy: strategic and institutional approaches. *The Academy of Management Review*, 20 (3): 571-610.

Yunus, S., Elijido-Ten, E. & Abhayawansa, S. 2016. Determinants of carbon management strategy adoption: evidence from Australia's top 200 publicly listed firms. *Managerial Auditing Journal*, 31 (2): 156-179.

Table 1: Definitions of the variables used

Variable	Definition
VSA	A dummy variable which takes the value of 1 if the corporate sustainability report is externally assured and 0 otherwise.
CEP_1	The ratio of total GHG emitted to total revenue.
CEP_2	The ratio of total water consumed to total revenue.
CEP_3	The ratio of total waste produced to total revenue.
FSIZE	The natural logarithm of the company's year-end total assets.
PROF	Return on assets measured by dividing the year-end net income by the year-end total assets.
LEV	Debt-equity ratio measured by dividing total liabilities by total shareholders' equity.
IND	A dummy variable which takes the value of 1 if the company operates in an environmentally sensitive industry and 0 otherwise.
ASST_AGE	Measured by dividing net properties, plant and equipment by gross properties plant and equipment.

Table 2: Pearson correlations

	VSA	CEP_1	CEP_2	CEP_3	FSIZE	PROF	LEV	IND	ASST_AGE
VSA	1.000000								
CEP_1	-0.040849 (0.668)	1.000000							
CEP_2	-0.049241 (0.605)	0.955721 (0.000)	1.000000						
CEP_3	0.301587 (0.001)	0.238503 (0.011)	0.254024 (0.007)	1.000000					
FSIZE	0.480907 (0.000)	0.413395 (0.000)	0.430682 (0.000)	0.381817 (0.000)	1.000000				
PROF	-0.241136 (0.110)	0.147061 (0.120)	0.196042 (0.037)	-0.229287 (0.015)	-0.025959 (0.785)	1.000000			
LEV	0.056238 (0.554)	0.186165 (0.048)	0.192651 (0.041)	0.391599 (0.000)	0.148350 (0.117)	-0.483101 (0.000)	1.000000		
IND	-0.011639 (0.903)	0.235478 (0.012)	0.195521 (0.038)	0.283016 (0.002)	-0.083723 (0.378)	-0.096494 (0.309)	0.253414 (0.007)	1.000000	
ASST_AGE	0.109114 (0.250)	0.471873 (0.000)	0.471209 (0.000)	-0.140997 (0.136)	0.129303 (0.172)	0.067691 (0.476)	-0.189806 (0.044)	-0.065007 (0.494)	1.000000

Note: *VSA* = voluntary sustainability assurance; *CEP* = corporate environmental performance (CEP_1 = the ratio of total GHG emitted to total revenue; CEP_2 = the ratio of total water consumed to total revenue; CEP_3 = the ratio of total waste produced to total revenue); *FSIZE* = firm size; *PROF* = profitability; *LEV* = leverage; *IND* = industry; *ASST_AGE* = asset age; *p*-values are given in parentheses.

Table 3: Descriptive statistics

Total sample (N = 176)				
Variable	Mean	Maxi.	Min.	Std. Dev.
VSA	0.57			0.50
CEP_1	0.48	5.60	0.01	1.05
CEP_2	46.44	618.52	0.01	128.14
CEP_3	0.07	0.58	0.00	0.13
FSIZE	6.69	7.58	5.68	0.43
PROF	0.05	0.20	-0.09	0.06
LEV	0.47	2.21	0.02	0.31
IND	0.77			0.42
ASST_AGE	0.43	0.70	0.20	0.12

Note: *VSA* = voluntary sustainability assurance; *CEP* = corporate environmental performance (CEP_1 = the ratio of total GHG emitted to total revenue; CEP_2 = the ratio of total water consumed to total revenue; CEP_3 = the ratio of total waste produced to total revenue); *FSIZE* = firm size; *PROF* = profitability; *LEV* = leverage; *IND* = industry; *ASST_AGE* = asset age.

Table 4: Regression results for the full sample

Dependent variable VSA					
Variable	Expected Sign	Model 1		Model 2	
		Coefficient	Standard Error	Coefficient	Standard Error
Intercept		-28.29***	6.12	-31.68***	7.06
CEP_1	+/-	-1.05***	0.33		
CEP_2	+/-			-0.01***	0.004
CEP_3	+/-	1.46	3.03	17.45	11.83
FSIZE	+	4.13***	0.90	4.46***	0.99
PROF	+	-5.76	4.98	-10.48	6.90
LEV	+/-	-0.30	0.91	-2.20*	1.21
IND	+	0.57	0.66	0.92	0.76
ASST_AGE	+	3.47	2.40	7.51**	3.04
R^2		0.30		0.43	
LR statistic		52.06***		69.85***	

Note: *VSA* = voluntary sustainability assurance; *CEP* = corporate environmental performance (CEP_1 = the ratio of total GHG emitted to total revenue; CEP_2 = the ratio of total water consumed to total revenue; CEP_3 = the ratio of total waste produced to total revenue); *FSIZE* = firm size; *PROF* = profitability; *LEV* = leverage; *IND* = industry; *ASST_AGE* = asset age. *** p<0.01; ** p<0.05; * p<0.10.

Table 5: Regression results for sub-sample I

Dependent variable VSA					
Variable	Expected Sign	Model 1		Model 2	
		Coefficient	Standard Error	Coefficient	Standard Error
Intercept		-28.38***	10.39	-35.97***	11.92
CEP_1	+/-	-1.45**	0.57		
CEP_2	+/-			-0.02***	0.01
CEP_3	+/-	4.55	3.54	20.37*	12.34
FSIZE	+	3.70***	1.36	4.42***	1.49
PROF	+	-4.90	7.52	-6.83	8.92
LEV	+/-	-2.94	1.89	-5.51*	2.98
IND	+	1.26	1.37	2.23	1.49
ASST_AGE	+	10.45**	4.47	17.33***	6.29
R^2		0.33		0.51	
LR statistic		26.48***		38.20***	

Note: This table presents the results for sub-sample I which covers the period from 2008 to 2011. *VSA* = voluntary sustainability assurance; *CEP* = corporate environmental performance (CEP_1 = the ratio of total GHG emitted to total revenue; CEP_2 = the ratio of total water consumed to total revenue; CEP_3 = the ratio of total waste produced to total revenue); *FSIZE* = firm size; *PROF* = profitability; *LEV* = leverage; *IND* = industry; *ASST_AGE* = asset age. *** p<0.01; ** p<0.05; * p<0.10.

Table 6: Regression results for sub-sample II

Dependent variable VSA					
Variable	Expected Sign	Model 1		Model 2	
		Coefficient	Standard Error	Coefficient	Standard Error
Intercept		-70.61***	26.52	-111.92**	56.51
CEP_1	+/-	-2.49*	1.38		
CEP_2	+/-			-0.04**	0.02
CEP_3	+/-	47.27	35.95	133.80*	69.82
FSIZE	+	11.54***	4.37	19.58*	10.02
PROF	+	-24.16*	12.84	-78.34*	44.07
LEV	+/-	0.68	1.98	-6.81*	3.63
IND	+	-0.09	1.30	-1.58	2.54
ASST_AGE	+	-7.44	7.62	-17.55**	16.53
R^2		0.55		0.68	
LR statistic		47.41***		55.40***	

Note: This table presents the results for sub-sample II which covers the period from 2012 to 2015.*VSA* = voluntary sustainability assurance; *CEP* = corporate environmental performance (CEP_1 = the ratio of total GHG emitted to total revenue; CEP_2 = the ratio of total water consumed to total revenue; CEP_3 = the ratio of total waste produced to total revenue); *FSIZE* = firm size; *PROF* = profitability; *LEV* = leverage; *IND* = industry; *ASST_AGE* = asset age. *** p<0.01; ** p<0.05; * p<0.10.

Impact of external assurance on corporate climate change disclosures: new evidence from Finland

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Abstract

Purpose: The purpose of this research is to examine the impact of external assurance on the level of voluntary corporate climate change disclosures by Finnish firms.

Design/methodology/approach: The sample of this study includes 228 firm-year observations over the period 2008-2015 for listed Finnish companies that have issued sustainability reports and responded to the Carbon Disclosure Project (CDP) questionnaire at least once during the sample period. We conduct a panel regression analysis to study the afore-mentioned linkage. In addition, the Tobit regression model is also estimated to check the robustness of our findings.

Findings: The findings suggest that assurance has a highly significant positive impact on the level of corporate climate change disclosures even after controlling for the effect of a number of control variables. Moreover, among the control variables, firm size and asset age are found to have significant effect on the extent of carbon emissions disclosure. Furthermore, the additional analysis reveals that the type of assurance providers (accounting firms vs non-accounting firms) and the type of financial auditors (Big4 financial auditors vs non-Big4 financial auditors) do not influence the level of climate change disclosure of assured companies.

Research limitations/implications: This research is subject to certain limitations. First, the source of the data used in this research is the CDP database which has limitations in that it is a voluntary disclosure process where all the observations collected are self-reported by the responding firms. This may bias the reported findings.

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Second, our sample includes only listed companies and hence the results might have limited explanatory capacity for unlisted firms.

Practical implications: By using the results of this research, corporate managers will be able to reduce the information asymmetry between various stakeholders and them through disclosure of accurate, reliable and credible environmental information. Such disclosures will, in turn, allow socially responsible investors to choose eco-friendly investments and will thus enable them to make appropriate investment decisions.

Originality/value: Research on the external assurance-corporate climate change disclosure nexus is scarce. This study addresses this gap in the nonfinancial disclosure assurance literature by demonstrating that external assurance increases the level of voluntary corporate climate change disclosure. Drawing on stakeholder-agency theory, this study views external assurance as a monitoring structure that potentially curbs the monitoring problem between corporate managers and other stakeholders and increases the amount of climate change disclosures making a possible avenue for the reduction of the information asymmetry between them.

Keywords: External assurance; Climate change disclosure; Stakeholder-agency theory; Monitoring structure; Environmental disclosure; CDP.

1. Introduction

Corporate climate change disclosure practices are a subset of corporate environmental disclosure practices (Haque & Deegan, 2010; Luo, 2019; Stanny & Ely, 2008). Corporate climate change disclosure has become particularly important as it can meet the information-need of various stakeholder groups, who are increasingly demanding that companies publicly disclose the impacts of their business practices on climate change (Cotter & Najah, 2011; Haque & Deegan, 2010). For instance, Stanny & Ely (2008, p. 338) report that in October 2007, a group of stakeholders (consisting of state officials and institutional investors representing more than 1.5 trillion USD in assets) petitioned the US Securities and Exchange Commission to issue an interpretive release 'clarifying that material climate-related information must be included in corporate disclosures under existing law'; Stanny and Ely (2008, p. 338) inform further that this group called not only for disclosure by high-emission firms "but also for low-emission firms to disclose information about estimated future physical and regulatory risks from climate change". This incident corroborates the growing concern over the issue of climate change as well as the development of environmental consciousness of the public.

The plausible reason for the growing concern over the issue of climate change may be the numerous impacts of climate change on ecosystems and subsequently on human lives (Giannarakis *et al*., 2017). Climate change is exacerbated by global warming (Jones, 2010) and global warming is believed to be principally caused by greenhouse gas (GHG) emissions (Giannarakis *et al*., 2017; Liao *et al*., 2015). Corporations are expected to play an important role in stabilizing climate change (Hossain *et al*., 2017) as corporate business and assets are in large part responsible for increasingly severe climate change (Liao *et al*., 2015). The growing public concern over the issue of climate change has led firms to adopt environment-friendly strategies (e.g., initiation of green practices)

contributing to the global target of reducing GHG emissions (Giannarakis *et al*., 2017) and created the demand for increased information transparency for the climate change issue (Liao *et al*., 2015); failure to meet this demand on the part of organizations will prevent various stakeholders from assessing the risks that climate change poses to the respective organizations (Haque & Deegan, 2010). In order to meet the information-need of stakeholders, companies are voluntarily and increasingly, in their annual reports or stand-alone environmental or sustainability reports, disclosing environmental information that also includes climate change-related information (*e.g.*, climate change policy, amount of GHG emissions, initiatives for reducing GHG emissions, initiatives for improving energy efficiency, use of clean energy sources such as biofuel etc.) (Braam *et al*., 2016; Giannarakis *et al*., 2017).

Braam *et al*. (2016) claim that companies may use corporate environmental disclosure as a management tool and argue that through disclosure of environmental information, good environmental performers may send signals to stakeholders about their success in environmental performance (EP) and seriousness towards sustainable development; on the other hand, poor environmental performers may seek legitimacy of their business activities through such disclosures. Further, Braam *et al*. (2016) contend that companies may try to change public perceptions rather than disclose actual EP by providing environment-related information; for example, companies with poor EP may self-servingly prefer to disclose information about only good EP rather than provide information on both good and bad EP in a balanced report (Braam & Peeters, 2018, Cho *et al*., 2012). The results of the study undertaken by Braam *et al*. (2016) confirm that companies with poorer environmental performance in terms of GHG emissions tend to disclose more environmental information than companies that emit lower amount of greenhouse gases in order to gain legitimacy. The tendency of companies to manage public perceptions rather

than reveal actual EP through environmental disclosures raises a great concern about the accuracy, reliability and credibility of the EP information disclosed (Braam *et al*., 2016). In response to such concern, companies are increasingly inclined to have their environmental information assured by independent assurance providers (Braam & Peeters, 2018; Junior *et al*., 2014).

As far as assurance of corporate climate change disclosures is concerned, there is an increased international demand for such assurance; the release of *ISAE 3410 Assurance Engagements on Greenhouse Gas Emissions* by the International Auditing and Assurance Standards Board (IAASB) (International Federation of Accountants (IFAC), 2012) and the development of carbon pricing and emission trading schemes (ETS)-such as the *European Union ETS*, *New Zealand ETS* and the *Australian Carbon Pricing Mechanism* have escalated the demand for verification and assurance of carbon-related disclosures (Green & Taylor, 2013). Moreover, previous studies confirm that independent third-party assurance enhances the credibility of non-financial disclosures (e.g., corporate climate change disclosures) and subsequently builds corporate reputation (Giannarakis *et al*., 2018; Moroney *et al*., 2012; Pflugrath *et al*., 2011; Reimsbach et al., 2018; Simnett *et al*., 2009). Giannarakis *et al*. (2018) suggest that independent assessment of environmental initiatives prevents companies from manipulating the dissemination of climate change information; furthermore, external assurance plays an important role in the evaluation of risks and concerns relating to climate change and thus improves environmental reporting transparency on the adoption of climate change mitigation strategies. Despite the importance of and the growing demand for external assurance of GHG emissions information, there has been little research investigating the relationship between external assurance and the level of climate change-related disclosures (Giannarakis *et al*., 2018). This study, using a sample of 228 observations from 37 listed Finnish companies during the period 2008-2015, addresses this lacuna

by examining the impact of external assurance on corporate climate change disclosures in a voluntary context.

For this research, Finland remains the geographical area of interest for two reasons. First, Finland has an active role in climate change policy. Climate change policies are being made at the international, European Union (EU) and national levels. At the international level, Finland has ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1994 and the Kyoto Protocol (KP) in 2002 together with other EU countries. The KP supplements the UNFCCC and specifies the obligations in decreasing GHG emissions of the countries that are parties to it. In addition, Finland being a member state of the EU is also committed to the EU's policy objectives on climate change. Furthermore, Finland has a strong national climate change policy which is based on international and EU climate change policies. The national Climate Change Act (609/2015) of Finland entered into force on June 1, 2015 and was followed by the introduction of the first medium-term climate change policy plan "Towards Climate-Smart Day-to-Day Living" on September 14, 2017. The medium-term climate change policy plan was adopted by the Parliament in March 2018. The national Climate Change Act (609/2015) has set the long-term target of reducing all types of GHG emissions by at least 80% by 2050, compared to 1990; on the other hand, the medium-term climate change policy plan aims at reducing GHG emissions by 16% in the non-emissions trading sectors (compared to 1990) and by 21% in the emissions trading sectors (compared to 2005) by 2020[‡]. Every year Finland obligatorily reports to the European Commission and the UNFCCC Secretariat on progress made in the reduction of GHG emissions.

[‡] This information is sourced from http://www.ym.fi/en-US/The_environment/Climate_and_air/Mitigation_of_climate_change/National_climate_policy.

Second, Finland is severely affected by global climate change[§]. Finland's climate is warming at a faster rate; within the last hundred years, the country has experienced an increase in the average temperature by one degree Celsius, mainly due to global climate change whereas the global average temperature is 0.85^0C higher than it was in the late 19th century[**]. According to the Arctic Climate Impact Assessment (ACIA), the annual average temperature in the Arctic region (including Finland) has increased at almost twice the rate of the rest of the world. As a consequence, in Finland by 2025 the average temperature is projected to rise slightly over 2°C relative to 1961-1990. The analysis also indicates that the average temperature is projected to rise by 4°C to 6°C and average precipitation by 15 to 25 per cent by the 2080s compared to the period 1961-1990. Temperatures will rise the most in winter and precipitation also increases especially in winter. Forsius *et al.* (2013), for example, also document that climate change predictions for Finland indicate an increase in precipitation of 5–40% and in air temperature of 2°C–7°C by the 2080s[††]. The impacts of changes in the climate are already visible in Finland[§]. For example, many northern and southern species that inhabit Finland are affected by climate change; in winter, many snow and ice-dependent species are at risk of disappearing altogether and in the spring and summer, the probability of forest fires increases[‡]; there is also a probability that river, lake and sea ice will break up earlier[‡‡]. Besides, Palsa mires in Lapland may be destroyed and hence, snow-

[§] This information is sourced from http://www.ymparistotiedonfoorumi.fi/puheenvuorot/ilmastonmuutos-haastaa-perinteisen-luonnonsuojelun/.

[**] This information is sourced from https://ec.europa.eu/clima/change/causes_en.

[††] In order to lessen the adverse impact of traditional energy usage on climate change, the Finnish government policy aims to increase the use of renewable energy to 38% of energy consumption by 2020 and to 60% by 2050 (Climate and Energy Strategy 2008).

[‡‡] This information is sourced from http://www.environment.fi/en-US/Maps_and_statistics/The_state_of_the_environment_indicators/Climate_change_and_energy/Average_temperature_in_Finland_up_by_one(28736).

related winter tourism suffers in southern Finland. In addition, need for energy for cooling of buildings increases in summer as well.

This paper has several contributions. First, it exclusively focuses on the impact of external assurance on the level of corporate climate change disclosure in a voluntary context. Climate change is a global phenomenon with a long-term and probably perpetual impact (Datt *et al.*, 2019; Lash & Wellington, 2007). Corporate business and assets are in large part responsible for increasingly severe climate change (Liao *et al*., 2015). The phenomenon of climate change is mainly caused by GHG emissions (Giannarakis *et al*., 2017; Liao *et al*., 2015) that are subject to different regulations (Luo, 2019). All these issues differentiate climate change from other environmental problems companies contribute to and make disclosure of climate change-related information unique among environmental disclosures (Luo, 2019). In addition, companies increasingly signal their green credentials through climate change disclosures (Chithambo & Tauringana, 2014; Rankin *et al*., 2011; Peters & Romi, 2015). Furthermore, the development of a separate carbon assurance standard (titled *ISAE 3410 Assurance on a Greenhouse Gas Statement*) by the IFAC through its *International Auditing and Assurance Standards Board* (IAASB), emphasizes the probability that corporate climate change disclosure and assurance of such disclosure may become a standard practice in a low-carbon economy and facilitate stakeholders' decision-making (Datt *et al.*, 2019). Nevertheless, prior studies have not paid much attention to the linkage between carbon assurance and the level of voluntary climate change disclosure and have principally examined the effect of external assurance on the broader subject-matters of sustainability or environmental disclosure (e.g., Hassan *et al*., 2019; Braam *et al*., 2016; Moroney *et al*., 2012). Our study fills this gap in the existing literature.

Second, this study addresses the need for further research highlighted by Giannarakis *et al*. (2018), the only study that examines the effect of external assurance (in addition to other factors such as government ownership and corporate environmental performance) on corporate climate change disclosure. Using cross-sectional data of 2014, Giannarakis *et al*. (2018) find a positive influence of external assurance and government ownership and a negative effect of corporate environmental performance on climate change disclosure. While these findings provide important insights into the determinants of corporate voluntary climate change disclosure, Giannarakis *et al*. (2018) underline the importance of longitudinal research to discover any potentially continued impact of external assurance on corporate carbon disclosures over a longer time period. This empirical research complements the work of Giannarakis *et al*. (2018) by using panel data covering a longer time period in order to understand whether external assurance has a sustained influence on the dissemination level of climate change-related information when multiple time periods are considered. Furthermore, this research supplements Giannarakis *et al*. (2018) by investigating the impact of type of assurance provider (professional accounting firms or consulting firms) and type of financial auditor (Big4 or non-Big4 accounting firms) on corporate voluntary carbon disclosures.

Third, based on authors' knowledge this is the initial study to use, as a proxy for the level of corporate climate change disclosures, both numeric and letter scores awarded (by the Carbon Disclosure Project (CDP)) to companies responding to a standard questionnaire set by the CDP. The CDP uses the questionnaire in order to conduct a survey investigating corporate carbon emissions. In 2016, the CDP adopted a new scoring methodology and started awarding only letter scores instead of both numeric and letter scores (as it used to award till 2015) to companies that participated in the survey. Before 2016, numeric scores would merely measure corporate climate

change disclosures whereas letter scores were a measure of both corporate environmental performance in terms of corporate carbon emissions and corporate climate change disclosures (CDP, 2008; Guenther *et al*., 2016). The letter score introduced in 2016 measures both corporate carbon performance and climate change disclosures (CDP, 2016). Previous studies have considered either numeric scores (e.g., Luo, 2019) or letter scores (e.g., Giannarakis *et al*., 2018) awarded before 2016 as a proxy for the level of corporate climate change disclosures in their analyses. In contrast to earlier studies, this empirical research uses both numeric scores (for the period 2008-2015) and letter scores (for the period 2016-2018 in the additional analysis).

Fourth, on the theoretical front, this study adds to the sustainability assurance literature by employing stakeholder-agency theory to understand the impact of external assurance on corporate voluntary climate change reporting. Tyson & Adams (2020) suggest that prior research has applied several organizational theories (namely, agency, contingency, gatekeeping, institutional, legitimacy, stakeholder, strong structuration, and transformational leadership) to provide insights into the phenomenon of sustainability assurance. But drawing on stakeholder-agency theory, this empirical work views, for the first time (to the best of the authors' knowledge), external assurance as a *monitoring structure* (the concept developed by Hill & Jones (1992) in their proposed theory) in order to understand its impact on the extent of corporate voluntary climate change disclosure.

Finally, the results of this Finnish study may be valid for other EU countries given that all the EU countries are affected by the EU's recommendations for fighting climate change. Besides some EU countries have financial markets and legal systems similar to those of Finland as well.

This paper proceeds as follows. The next section attempts to contain a comprehensive literature review. Section 3 discusses the relevant theory for this research and subsequently, the hypothesis

is developed. Section 4 outlines the research methods. Our empirical results are discussed in Section 5. The final section concludes the paper.

2. Literature Review

Recent years have witnessed a worldwide increase in the publication of sustainability reports (Radhouane *et al*., 2020; Sellami *et al*., 2019; Jones *et al*., 2015; KPMG, 2013). The growth in the publication of such reports can be attributed to stakeholders' increasing interest in sustainability information (of which climate change-related information is a part) (Datt *et al.*, 2019; Wong *et al*., 2016) and the consequent awareness of companies of their responsibility for sustainability (Gillet-Monjarret, 2018; Jones *et al.*, 2015). Keeping pace with the growing public interest in companies' commitment towards the broader issues of sustainability, the societal concern regarding global climate change (resulting from the increase in average temperature of the Earth's surface due to the concentration of GHGs in the atmosphere) has also escalated because of its potential adverse impact on human life and the natural environment (Giannarakis et al., 2017; Martinov-Bennie, 2012) and such concern has emphasized the need for disclosure of climate change-related information by companies (Datt *et al.*, 2019; Zhou *et al.*, 2016; Martinov-Bennie, 2012; Thornton & Hsu, 2001). In addition, corporate climate change-related information has become extremely important to stakeholders' decision-making processes (Datt *et al.*, 2019; Green *et al.*, 2017; Stanny & Ely, 2008; Thornton & Hsu, 2001). This has led to an increase in both voluntary and mandatory carbon emissions disclosure (Green *et al.*, 2017).

However, stakeholders tend to mistrust the disclosed information relating to climate change because the discretionary nature of carbon emissions disclosure, managerial incentives to manipulate such disclosure and the lack of an internationally recognized protocol make the quality

and reliability of corporate climate change-related disclosures questionable (Datt *et al.*, 2019; Kolk *et al.*, 2008). The existing literature suggests that the procurement of external assurance (by an independent third party) of nonfinancial information (including climate change-related information along with other sustainability information) adds credibility and reliability to the disclosed information and enhances stakeholders' confidence therein (Wong *et al*., 2016; Zhou *et al.*, 2016; Gillet-Monjarret, 2012; Manetti & Toccafondi, 2012; Moroney *et al*., 2012; Pflugrath *et al*., 2011). Hence, in order to increase stakeholders' trust in the credibility of disclosed nonfinancial information (Radhouane *et al*., 2020; Clarkson *et al*., 2019; Datt *et al.*, 2019; Zhou *et al.*, 2016; Gillet-Monjarret, 2018, 2015; Green & Li, 2012; Huggins *et al.*, 2011; Simnett *et al.*, 2009), companies are increasingly procuring assurance of two types of nonfinancial disclosure: assurance of the broad-ranging subject matter of sustainability disclosure and assurance of an organization's disclosure of climate change-related information (Zhou *et al.*, 2016; Cohen & Simnett, 2015).

The escalating demand for external assurance of nonfinancial disclosure has attracted much research attention that has recently led to an increase in the number of studies exploring such kind of assurance (Rossi & Tarquinio, 2017). Several of these studies have examined the impact of external assurance on firm valuation and cost of equity capital of disclosing firms (e.g., Radhouane *et al*., 2020; Clarkson *et al*., 2019; Hassan *et al*., 2019; Weber, 2018; Fazzini & Maso, 2016; Cho et al., 2014 and so on). On the contrary, only a handful of studies (e.g., Hassan *et al*., 2019; Giannarakis *et al*., 2018; Braam *et al*., 2016; Moroney *et al*., 2012) have investigated the effect of external assurance on the level of dissemination of nonfinancial information (that includes climate change-related information and other sustainability information).

Although the empirical research on the effect of external assurance on firm valuation and cost of equity capital has produced mixed results, the outcomes of the studies examining the impact of external assurance on the disclosure of nonfinancial information have converged confirming that external assurance positively affects the level of nonfinancial disclosure.

As far as corporate nonfinancial information is concerned, corporate climate change-related information differs from other sustainability information (e.g., information relating to environmental issues other than the issue of climate change) because it includes GHG information, which is more similar (when compared to other nonfinancial information) to financial information due to its quantifiable nature (Zhou *et al.*, 2016). Given the uniqueness and distinctiveness of corporate climate change-related information and the growth in demand for assurance of such information, the IAASB issued a separate assurance standard titled *ISAE 3410 Assurance Engagements on Greenhouse Gas Emissions* (IFAC, 2012) even in the presence of *ISAE 3000 (Revised) Assurance Engagements Other Than Audits or Reviews of Historical Financial Information*, which is applicable to the assurance of general sustainability information (Zhou *et al.*, 2016). The *ISAE 3410* emphasizes the need for the carrying out of the assurance of carbon emissions disclosure either as part of the assurance of a sustainability report/annual report or on a standalone GHG report (Datt *et al.*, 2019).

It is noteworthy that regardless of the growth in the demand for assurance of carbon emissions disclosure and the release of the *ISAE 3410* by the IAASB, only one study (Giannarakis *et al*., 2018) has been found inquiring into the impact of external assurance on the level of corporate climate change disclosure, while other studies (Hassan *et al*., 2019; Braam *et al*., 2016; Moroney

et al., 2012) have examined the effect of external assurance on the level of the broader subject matter of sustainability disclosure or environmental disclosure[§§].

However, Giannarakis *et al*. (2018) has used cross-sectional data relating to the year 2014 for 215 European companies in order to examine the influence of the broad-ranging environmental assurance on the dissemination level of corporate climate change-related information. The companies studied by Giannarakis *et al.* (2018) have purchased environmental assurance, which is intended for enhancing the credibility of environmental disclosures, a broader subject matter that includes corporate climate change disclosures (Luo, 2019; Haque & Deegan, 2010; Stanny & Ely, 2008). Consequently, in case the environmental assurance process has covered only specific sections of corporate sustainability/environmental/social responsibility reports, it is possible that the assurance scope may have missed out climate change disclosures. Furthermore, the use of cross-sectional data by Giannarakis *et al.* (2018) demonstrates that external assurance positively affects corporate climate change disclosure level during a single time period; but this result does not confirm that external assurance has a sustained influence on the dissemination level of climate change-related information when multiple time periods are considered. In other words, there is a lack of evidence that the outcome of Giannarakis *et al.* (2018) holds true over a longer period of time with external assurance impacting the evolution of corporate climate change disclosure (in terms of increase in the quantity of such disclosure) over time.

Hence, a unique opportunity exists to examine the impact of external assurance on the level of carbon emissions disclosure given that external assurance covers, at a minimum, climate change-

[§§] Due to the growing concern about the issue of climate change, a number of studies have been undertaken analyzing corporate climate change disclosures. These studies broadly fall into two groups: while one group of research has examined the company specific determinants of corporate climate change disclosures, another group of studies has investigated the effect of different corporate governance characteristics on the dissemination of climate change information (Kılıç & Kuzey, 2019). ***Table 1*** summarizes notable works from both groups. The summaries in ***Table 1*** witness the scarcity of research investigating the impact of voluntary external assurance on the extent of corporate climate change disclosures.

related information. We use panel data covering a period of eight years (2008-2015) and extend the prior research by investigating whether external assurance has a continued effect on the extent of GHG disclosure. Additionally, in order to gain a holistic understanding of the phenomenon of third-party assurance, we inquire into the linkage between the types of assurance provider (accountant versus non-accountant assurance provider and in case the assurance provider is an accounting firm, whether it is a *Big4* auditing firm) and the level of corporate climate change disclosure.

Furthermore, it is also evident from the summaries in ***Table 1*** that climate change disclosure practices in Nordic countries remain under-researched, albeit Nordic countries are committed to tackling the climate crisis and advocate for a carbon-neutral society.[***] Niskala & Pretes (1995) and Gonzalez-Gonzalez & Ramírez (2016) assert that the provision of environmental information is dependent on the country under consideration because prior country-specific studies have produced very different results for different countries (e.g., Roberts, 1991; Gray *et al.*, 1995; De Villiers & Van Staden, 2006). Therefore, Nordic countries deserve special research attention vis-à-vis carbon disclosures and this empirical work, being the first of its kind to exclusively use the Finnish context (Finland being one of the five Nordic countries), addresses this issue.

3. Theoretical Framework and Hypothesis Development

A firm has a number of stakeholders that include shareholders, managers, employees, customers, suppliers, lenders, local communities and the general public (Hill & Jones, 1992). Different stakeholders provide different types of resources to the firm and have different expectations in

[***] This Information is sourced from https://www.environment.fi/en-US/Climate_and_air/Nordic_countries_agree_on_closer_coopera(49105).

exchange of the resources supplied. For example, shareholders provide capital to the firm in the hope that the return on their investment will be maximized; managers and employees serve the firm as human capital and expect fair income and appropriate working conditions in return; local communities provide locations and a local infrastructure to the firm and the general public, through payment of taxes, provides a national infrastructure to the firm and both of these stakeholders want the firm either to enhance the quality of life or to abstain from causing harm to the same through its business activities (Hill & Jones, 1992). In case stakeholders' interests are not served, they may refuse to provide resources to the firm (*e.g.*, shareholders may sell their shares in case of poor financial performance of the firm; employees and managers may leave the firm if they do not receive fair pay and have appropriate working conditions; the local communities may refuse to provide locations and local infrastructures to the firm for continuing its business operations if its business activities cause damage to the quality of life etc.) and thus threaten its survival.

Stakeholder-agency theory suggests that a firm is a nexus of implicit and explicit contracts among all these stakeholders; managers are unique stakeholders as they are at the center of the nexus of contracts (i.e., managers have contractual relationships with all kinds of stakeholders and thus work as 'agents' for them.) and have a 'direct control over the decision-making apparatus of the firm' (Hill & Jones, 1992, p. 134). Therefore, it is imperative that managers make strategic decisions and allocate resources in a way that serves the interests of other stakeholders.

Managers also have control over critical information and consequently, they are able to filter or even distort the type of information they release to other stakeholders. This gives rise to an information asymmetry between managers and other stakeholders making it difficult for stakeholders to assess whether managers are working to serve their interests. As an obvious response to this situation, stakeholders can undertake their own monitoring of management

performance by collecting themselves necessary information on management activities, but the cost of gathering such information may be exorbitant. This is particularly true in a situation termed 'stakeholder diffusion' (Hill & Jones, 1992), where many individuals or entities constitute a stakeholder group (that excludes managers) and no one of them has control over a substantial portion of the group's total resources. Under these circumstances, no single stakeholder (of the stakeholder group) may be able to sponsor the substantial task of collecting and analyzing information required for the significant reduction of the information asymmetry between managers and stakeholders. Consequently, stakeholders (of the stakeholder group) may have to bear an increased residual loss as stakeholder diffusion confers on managers greater discretionary control over the use of the firm's resources. This situation calls for the establishment of institutional structures, which Hill & Jones (1992) refer to as 'monitoring structures', for monitoring management performance. Examples of monitoring structures include mandatory requirements of the publication of audited consolidated financial statements by public companies and evolution of non-profit monitoring organizations such as Consumer Watch and labor unions that keep an eye on the extent to which managers serve the interests of certain stakeholders (Hill & Jones, 1992, p. 140).

As far as dissemination of climate change-related information is concerned, external assurance can serve as a useful control mechanism or 'monitoring structure' (Simnett *et al*., 2009). Prior studies (*e.g.*, Abdel-khalik, 1993; Blackwell *et al*., 1998; Dixon *et al*., 2004; Hasan *et al*., 2003; Hodge *et al*., 2009; Simnett *et al*., 2009) confirm that the assurance function undertaken by an independent third party plays the role of a control mechanism by enhancing the credibility of disclosed information and engendering greater trust of stakeholders. Given that climate change disclosures (like other items of sustainability disclosures) are mostly voluntary and guided by limited reporting

guidelines (Hodge *et al*., 2009), stakeholders are likely to lack faith in the disseminated carbon-related information. As such, the third-party verification of the carbon emissions information can restore stakeholders' confidence in the information released.

Moreover, the growing public concern over environmental issues such as climate change has led to the emergence of a number of new stakeholders (*e.g.*, environmental NGOs, green investment funds and green consumers), who pressure companies to become more responsible for the impact of their operations on the natural environment and disseminate credible and reliable information on their environmental activities (Hodge *et al*., 2009; Moroney *et al*., 2012). Furthermore, traditional stakeholders such as shareholders have also become concerned about corporate EP along with corporate financial performance, a fact that is evidenced by the growth and emergence of sustainable investment funds and superannuation funds (Van der Laan *et al*., 2008; Moroney *et al*., 2012). The existing literature also indicates that independent assurance reduces information asymmetry between managers and other stakeholders (Watts & Zimmerman, 1986; Wallace, 1987; Carey *et al*., 2000). Hence external assurance of environmental disclosures can be viewed as a 'monitoring structure' (as referred to by Hill & Jones, 1992) that aids in reducing the information asymmetry between managers and other stakeholders and thus increases the credibility of the reported environmental information including climate change-related information and engenders stakeholders' confidence. Therefore, stakeholder-agency theory appositely explains the association between external assurance and the extent of corporate climate change disclosures.

As a monitoring structure, external assurance not only improves the processes of collecting data relating to environmental issues such as carbon emissions (Jones & Solomon, 2010; O'Dwyer *et al*., 2011) but also discovers material errors in and omissions of the environmental information prepared including climate change-related information and thus increases the quantity of the

disclosed information (Hodge *et al*., 2009). The standing literature provides evidence in support of the existence of a positive link between external assurance and the level of non-financial disclosures (*e.g.*, environmental disclosures including climate change disclosures, social disclosures etc.): for example, based on a sample of 74 observations of Australian listed companies between 2003 and 2007, Moroney *et al*. (2012) report a positive association between external assurance and the quality and quantity of environmental disclosure. In addition, Braam *et al*. (2016) examine the effect of external assurance on the variation in the level of environmental disclosure of Dutch companies for the period from 2009 to 2011 and confirm that external assurance positively affects the level of environmental disclosures.

Furthermore, Giannarakis *et al*. (2018), using a sample of 215 observations of European companies of Bloomberg European 500 Index for the economic year 2014, investigate the impact of independent assurance on the extent of corporate climate change disclosure. Their results reveal a positive connection between independent assurance and corporate climate change disclosure. As such, independent third-party verification enhances the quality of non-financial disclosures by reducing information asymmetry between managers and other stakeholders (Coram *et al*., 2009; Moroney *et al*., 2012) and potentially allows stakeholders to make more informed decisions while building trust (Mock *et al*., 2007). Therefore, it is expected that companies aiming for reduction of the information asymmetry (between management and other stakeholders) relating to carbon emissions and enhancement of the credibility of the reported climate change-related information, would like to have their climate change information assured, which would result in an increased level of corporate climate change disclosures. The above discussion leads to the formulation of the following hypothesis:

H_1: External assurance of environmental information increases the level of corporate climate change disclosures.

4. Research Methods

4.1. Sample and data

For the purpose of testing the hypothesis, our sample includes 228 firm-year observations covering an eight-year period (2008-2015) for Finnish companies that were listed on the Nasdaq Helsinki at least for one year during this eight-year period and that responded to the CDP questionnaire at least once during the sample period. The total number of firm-year observations over the eight-year period included in the original sample was 296. The observations were screened on the basis of the availability of necessary data (e.g., CCDS, external assurance). As a result of this selection process, the final sample consists of 228 observations in total. The number of observations by year is provided in ***Table 2***. The lowest number of observations is 19 in 2008 and the highest number of observations is 36 in 2014. The CDP questionnaire underwent substantial changes during the period from 2003 to 2006; moreover, sustainability professionals were doubtful about the reliability of the information provided (Guenther *et al*., 2016; Kolk *et al*., 2008). As a result, the CDP had to further develop the climate-change questionnaire for enhancing the reliability of the data and the questionnaire did not undergo major changes after 2008 (Guenther *et al*., 2016). Hence, our sample period starts in 2008. The sample period ends in 2015 as the CDP has migrated from number score system to letter score system in 2016 (CDP, 2016). From 2016, the responding companies, based on their assessment across four consecutive levels namely, (a) disclosure; (b) awareness; (c) management; and (d) leadership, are awarded any of the eight letter scores that range from A to D- (CDP, 2016). According to the new scoring system, a company receiving A or

A- will be in the *Leadership* level and on the other hand, a company receiving D or D- will be in the *Disclosure* level (for details, please see *Scoring Introduction 2016*, CDP).

Data on climate change disclosure are extracted from CDP climate change reports on Nordic countries. Firm specific data are retrieved from *Thomson Reuters DataStream* database. The data on external assurance are retrieved from the corporate sustainability/environmental/social responsibility reports of the sampled firms.

4.2. Variables

4.2.1. Dependent variable

The Carbon Disclosure Project (CDP) is currently the main global reference as regards corporate climate change disclosure (Lee *et al.*, 2015; Luo *et al.*, 2012; Matisoff *et al.*, 2012). In line with previous studies, we employ the CDP carbon disclosure score as a proxy for climate change disclosure score (*CCDS*) (Guenther *et al*., 2016; Prado-Lorenzo & Garcia-Sanchez, 2010; Reid & Toffel, 2009; Stanny, 2013). Globally over 4,000 companies are currently responding to the CDP questionnaire (Gonzalez-Gonzalez & Ramírez, 2016). Based on the information provided by companies regarding four aspects of their climate change management namely, (i) risk and opportunities; (ii) emission accounting, verification, and trading; (iii) performance; and (iv) governance, companies are given a score that ranges from 0 (for no answers given) to 100 (for complete disclosure) (Gonzalez-Gonzalez & Ramírez, 2016; Guenther *et al*., 2016). Any company that scores above 70 points is considered to have maintained transparency of the information provided and believed to be committed to the fight against climate change (Gonzalez-Gonzalez & Ramírez, 2016). But the disclosure score measures only disclosure, not performance; for example, a company is awarded points for disclosing its GHG emissions, but not for the amount of emissions

and hence, the carbon disclosure score is not affected by the actual amount of emissions (CDP, 2008; Guenther *et al*., 2016).

4.2.2. Independent variable

External assurance (*EX_ASSUR*) is the variable of interest in this research. *EX_ASSUR* is coded 1 for companies with independent third-party assurance of, at a minimum, climate change-related information and 0 for companies with unassured climate change-related information (Giannarakis *et al*., 2018; Braam *et al*., 2016; Moroney *et al*., 2012).

4.2.3. Control variables

In line with previous studies, this paper controls for the effect of a number of variables namely, *firm size* (*FSIZE*), *profitability* (*PROF*), *leverage* (*LEV*), *industry* (*IND*), *asset age* (*ASST_AGE*), *growth* (*GRWTH*) and *research and development intensity* (*RNDINT*).

Because larger firms have higher visibility than smaller ones (Udayasankar, 2008), they face increased public pressure and are subject to greater public scrutiny to show enhanced environmental responsiveness (Choi *et al*., 2013; Yunus *et al*., 2016). Consequently, they face an increased stakeholder demand for information on their environmental and social activities that affect the stakeholders' welfare (Andrikopoulos & Kriklani, 2013). Hence, a number of previous studies used *FSIZE* as a proxy for organizational visibility in order to explain voluntary environmental disclosure (Brammer & Pavelin, 2006; Choi *et al*., 2013; Henriques & Sadorsky, 1999; Sharma & Nguan, 1999). A positive association, as earlier studies suggest (for example, Déjean & Martinez, 2009; Giannarakis *et al*., 2017; Monteiro & Guzmán, 2010), is expected between *FSIZE* and *CCDS*. *FSIZE* is measured as the natural logarithm of total assets (Jaggi et al., 2018; Kılıç & Kuzey, 2019).

Previous research suggests that firms in better financial condition (profitable firms) are more likely to voluntarily disclose environmental information because such disclosures are a means of portraying themselves as environmentally responsive (Cormier *et al.*, 2005). In addition, Choi *et al*. (2013) argue that profitable firms afford to pay the costs of identifying, collecting and reporting the information relating to carbon emission. Therefore, a positive association is expected between *PROF* and *CCDS*. *PROF* is measured by return on assets (*ROA*) and calculated as the ratio of net income before extraordinary items to total assets (Clarkson *et al*., 2008; Jaggi *et al*., 2018).

The cases of the Exxon Valdez and BP oil spills, the Union Carbide chemical disaster, and American Electric Power's emissions litigation (Deegan *et al*., 2000; Smith *et al.*, 2011) provide evidence on the fact that firms' financial stability may be affected by environmental issues. Moreover, firms are increasingly dependent on creditor funding (Rankin *et al*., 2011; Neu *et al*., 1998) and hence, creditors would expect highly leveraged firms to be socially and environmentally responsive and provide more extensive disclosure on their social and environmental activities (Roberts, 1992). Therefore, *LEV* is expected to be positively connected to *CCDS*. *LEV* is measured by the debt to equity ratio (Jaggi *et al*., 2018).

The findings of prior research reveal that firms in highly polluting industries (or environmentally sensitive industries) are likely to disclose more environmental information than those in low polluting industries (Chithambo & Tauringana, 2014; Cho & Patten, 2007; Peters & Romi, 2015). Therefore, a positive linkage is expected between *IND* and *CCDS*. Following the existing literature (Patten, 2002a; Clarkson *et al.*, 2008; Cho *et al*., 2014; Yunus *et al*., 2016), energy, utilities, transportation, pharmaceuticals, materials, mining and extractive, paper, chemicals, petroleum, metals, industrials and telecommunication industries are considered highly polluting industries.

IND is a dichotomous variable that takes the value of 1 if a firm operates in a highly polluting industry and 0 otherwise (Cho *et al*., 2014; Yunus *et al*., 2016; Jaggi *et al*., 2018).

In the existing literature, arguments are found in favor of controlling for the effect of the age of assets. It is argued that newer assets are more environment friendly as they are less polluting (or cleaner) (Clarkson *et al*., 2008; De Villiers *et al*., 2011; De Villiers & Van Staden, 2011). Therefore, firms owning newer assets will be better environmental performers than those with older assets (Clarkson et al., 2008; Cormier & Magnan, 1999; Cormier *et al*., 2005). Hence, Cormier *et al*., (2005) argue further that the age of assets may be considered to be a proxy for corporate environmental performance. In line with this argument, it is expected that firms with newer assets will have a higher level of climate change disclosures. The *ASST_AGE* is calculated by the ratio of net property, plant and equipment to gross property, plant and equipment (Clarkson *et al*., 2008).

Clarkson *et al.* (2011) assert that firms with superior management capabilities are innovative and pursue proactive environmental strategies in order to avoid non-compliance with environmental regulations and associated environmental costs in the presence of intense environmental regulations. For example, innovative firms would add social and environmental attributes to their products for the purpose of product differentiation, and this process may require them to invest in research and development (R&D) projects (Elsayed & Paton, 2005; McWilliams & Siegel, 2001). This study controls for innovation and employs *RNDINT* as a proxy for innovation and expects a positive association between *RNDINT* and *CCDS*. *RNDINT* is calculated as the ratio of total R&D expenditures to annual net sales (Elsayed & Paton, 2005). In addition, prior studies confirm that stakeholders and the market expect that fast-growing companies would investment more in environmental innovations (Al-Tuwaijri et al., 2004; Porter & van der Linde, 1995, Skinner &

Sloan, 2002). Consequently, this study controls for the effect of *GRWTH* and expects a positive relationship between *GRWTH* and *CCDS*. *GRWTH* is computed as a year-to-year percentage change in sales (Clarkson *et al.*, 2011).

4.2.4. Regression model

In this research the following regression model has been estimated:

$$CCDS_{i,t} = \beta_0 + \beta_1 EX\_ASSUR_{i,t} + \beta_2 FSIZE_{i,t} + \beta_3 PROF_{i,t} + \beta_4 LEV_{i,t} + \beta_5 ASST\_AGE_{i,t} + \beta_6 RNDINT_{i,t} + \beta_7 GRWTH_{i,t} + \beta_8 IND_{i,t} + \beta_9 YEAR_{i,t} + \varepsilon_{i,t} \quad (1)$$

where, *CCDS*=climate change disclosure score (the CDP carbon disclosure score), *EX_ASSUR*=external assurance, *FSIZE*=firm size, *PROF*=profitability, *LEV*=leverage, *GRWTH*=growth, *ASST_AGE*=asset age, *RNDINT*=research and development intensity and *IND*=industry. We also control for year effects in our regression model. ***Table 3*** presents the summary of the variables that are used in the regression model.

5. Results and Discussion

5.1. Descriptive statistics and correlation matrix

The descriptive statistics, reported in ***Table 4***, reveals that *CCDS* has an average value of 71.12 and it ranges from 0 to 100 indicating a significant variation across the sample. The mean of the independent variable *EX_ASSUR* is 0.42 which suggests that about 42% of the firms belonging to our sample have purchased external assurance for their sustainability reports. The average values for the control variables *ASST_AGE*, *FSIZE*, *RNDINT*, *LEV*, *GRWITH* and *PROF* appear to be 0.40, 6.42, 0.02, 2.39, 0.01 and 0.06 respectively. Moreover, the mean of the remaining control

variable *IND* equals 0.71 implying that around 71% of the sample firms belong to the environmentally sensitive industry.

Table 5 exhibits the correlations among the variables under study. These numbers suggest that the highest correlation is observed between *CCDS* and *EX_ASSUR*. More importantly, the association appears to be positive. Similar connections are also detected for the *CCDS-FSIZE* and *CCDS-RNDINT* pairs. Additionally, a significant negative linkage is seen between *CCDS* and *ASST_AGE*. We also find that the correlations between *CCDS* and other control variables are found to be insignificant. It is noteworthy that the correlations between assurance and different control variables are low. This is also true when pair-wise correlations among the control variables are taken into account. The variance inflation factors (VIF) for these variables further indicate the nonexistence of multicollinearity.

5.2. Regression Analysis

Table 6 displays the estimates of our proposed model. Our findings reveal that *EX_ASSUR* emerges as a major determinant of climate change disclosures as the corresponding coefficient is found to be statistically significant at 1% level[†††]. It is further observed that *EX_ASSUR* has a positive impact on *CCDS* which supports our hypothesis about the association between external assurance and the level of climate change disclosures. This result implies that firms having their

[†††] In order to examine the role of external assurance in explaining the level of climate change disclosure, we have estimated two additional models as well. One of these two models includes only *EX_ASSUR* as the independent variable, whereas the second model involves only the control variables. These findings, not reported here, indicate that the R^2 statistic tends to increase substantially when *EX_ASSUR* is included in the model. For instance, as suggested by the results of the first model, *EX_ASSUR* alone can explain 24% of the total variation in the dependent variable. For the other model, on the other hand, all the control variables account for only 11% of the total variation in *CCDS*. Moreover, as shown in ***Table 6***, the R^2 statistic for the estimated model amounts to 32%. The results of additional models are available on request.

climate change-related and other environmental information externally assured tend to have a higher level of carbon emissions disclosure.

This finding is consistent with that documented by Braam *et al*. (2016), Giannarakis *et al*. (2018), Hassan *et al*. (2019) and Moroney *et al*. (2012) and can be explained in the light of stakeholder-agency theory (Hill & Jones, 1992). Stakeholder-agency theory suggests that an information asymmetry exists between corporate managers and other stakeholders because corporate managers have control over critical information of the firm and they are able to filter or distort such information before they communicate it to other stakeholders. Consequently, other stakeholders require a control mechanism that will enable them, through provision of an increased level of authentic, accurate and reliable information, to identify whether corporate managers are serving their (other stakeholders') interest. Such a situation necessitates the evolution of a wide range of institutional structures, which Hill & Jones (1992) term 'monitoring structures' (Hodge *et al*., 2009; Jones & Solomon, 2010; O'Dwyer *et al*., 2011). In the context of corporate climate change disclosures, external assurance can be seen as a monitoring structure that can prevent companies from manipulating diffusion of climate change information (hiding information about failure to formulate strategies to reduce GHG emissions, for example) (Giannarakis *et al*., 2018), improve the processes of collecting data relating to carbon emissions (Jones & Solomon, 2010; O'Dwyer *et al*., 2011), discover material errors in and omissions of climate change-related information and thus increase the quantity of the information disclosed (Hodge *et al*., 2009).

The results of this study also indicate that external assurance potentially serves as an effective monitoring structure for Finnish companies causing them to disclose a high level of climate change-related information. This increasing trend towards climate change disclosure indicates that Finnish companies defer to the pressure of their stakeholders to be more accountable for the impact

of their activities on the climate and that external assurance, as a monitoring structure, is likely to play a crucial role in making companies incorporate in their environmental/sustainability report all climate change-related disclosure items that are valuable to all stakeholder groups (both shareholders and non-shareholders) leading to an increase in the level of climate change disclosures[‡‡‡].

Among the control variables, only *FSIZE* seems to have a significant effect on *CCDS*. Other control variables appear to be insignificant. *FSIZE* has a positive coefficient that is statistically significant at 10% level. The positive coefficient of *FSIZE* suggests that larger firms, in comparison to smaller ones, disclose more information relating to climate change. This finding is consistent with prior research (e.g., Chithambo & Tauringana, 2014; Eleftheriadis & Anagnostopoulou, 2015; Freedman & Jaggi, 2005; Gonzales-Gonzales & Ramírez, 2016; Luo *et al*., 2012; Prado-Lorenzo *et al*., 2009; Stanny & Ely, 2008). Larger firms are under greater stakeholder scrutiny (Patten, 2002b) because they undertake more activities that affect the natural environment and contribute to climate change (Knox *et al.*, 2006). Consequently, stakeholders expect a higher level of disclosures from larger firms about their carbon performance and initiatives or strategies to limit the adverse effects of their business activities on the climate. Failure on the part of corporations to meet stakeholders' information need may cause stakeholders to doubt whether their interests are being served by corporate managers. This may, as stakeholder-agency theory suggests (Hill & Jones, 1992), give rise to the possibility of stakeholders' exit from the contractual relationships with corporate managers; in other words, stakeholders may withdraw

‡‡‡ Given that climate change-related disclosures should be prepared before seeking external assurance service of such disclosures, we reproduce the analysis of Table 6 by incorporating a lag of the independent variable (*EX_ASSUR*). These findings, exhibited in Table A2, are consistent with those reported in Table 6. The only discrepancy is that *ASST_AGE* is now significant, albeit at 10% level.

critical resources from firms and thus threaten their survival. Larger companies, due to the exit threat of stakeholders and subsequent loss of access to critical resources, disclose more climate change-related information compared to smaller firms.

5.3. Results of endogeneity test

One would expect that *EX_ASSUR* might be influenced by *FSIZE*, *PROF* and *LEV*. We attempt to address this endogeneity problem by employing an instrumental variable in a two-stage least square regression. In the first stage, we regress *EX_ASSUR* on *FSIZE*, *PROF* and *LEV* and then store the residuals (*RESID_EX_ASSUR*). In the second stage, the residuals are used in the main regression model instead of the actual values of *EX_ASSUR*.

The results of the endogeneity test, exhibited in ***Table 7***, suggest that the coefficient of *RESID_EX_ASSUR* is still positive and statistically significant at 1% level. In addition, the Wu-Hausman test confirms that there is no endogeneity problem in our analysis.

5.4. Robustness test

For robustness check, the Tobit regression model has been employed. The Tobit regression can be utilized in this study as our dependent variable *CCDS* only ranges from 0 to 100 (Luo and Tang, 2014).

The results of the Tobit regression are shown in ***Table 8***. These findings mirror those reported in ***Table 6***. For instance, *EX_ASSUR* remains highly significant at 1% level and its impact on the level of *CCDS* is still positive. In addition, *FSIZE* still has a significant positive effect on *CCDS*. One striking finding is the emergence of *ASST_AGE* as an influential variable that has a negative impact on *CCDS* (statistically significant at 1% level). Older assets cause more pollution than

newer assets. Therefore, the age of assets is a proxy for corporate environmental performance (Cormier *et al*., 2005).

The inverse relationship of *ASST_AGE* with *CCDS* indicates that firms with older assets (poor environmental performers) reveal more information relating to climate change compared with those with newer assets (better environmental performers). Since firms possessing older assets are more responsible for climate change (Liao *et al*., 2015), they are under greater stakeholder scrutiny (Patten, 2002b). Consequently, stakeholders expect a higher level of climate change-related disclosures from these firms. Stakeholder-agency theory (Hill & Jones, 1992) suggests that firms that are greater contributors to climate change (because of their poor environmental performance) may jeopardize their survival by failing to meet the information need of stakeholders because such failure may cause stakeholders to withdraw critical resources from these firms. Hence, firms with poor environmental performance in terms of actions against climate change (e.g., initiatives for reducing GHG emissions, initiatives for improving energy efficiency, use of clean energy sources etc.) are more likely to disclose a higher level of climate change-related information. This finding is consistent with earlier studies (e.g., Clarkson *et al.*, 2008; Stanny & Ely, 2008).

We observe further that the R^2 statistic amounts to 60%. Our results are robust as they are not sensitive to the models used.

5.5. Additional tests

5.5.1. Logit regression analysis for the period 2016-2018

As mentioned earlier, our sample period ends in 2015 due to the fact that the CDP has migrated from the number score system to the letter score system in 2016 (CDP, 2016). From 2016, the responding companies, based on their assessment across four consecutive levels namely, (a)

disclosure; (b) awareness; (c) management; and (d) leadership, are awarded any of the eight letter scores that range from A to D- (CDP, 2016). According to the new scoring system, a company receiving A or A- will be in the Leadership level and on the other hand, a company receiving D or D- will be in the Disclosure level (for details, please see Scoring Introduction 2016, CDP)[§§§].

For the period 2016-2018, we estimate the ordered logit regression model to examine the impact of *EX_ASSUR* on the level of *CCDS*. The number of firm-year observations amounts to 67 for the ordered logit regression. We have adopted this model, as the observed dependent variable (i.e., *CCDS*) takes different values representing ordered or raked categories[****]. We define our dependent variable *CCDS* as follows:

$$CCDS = \begin{cases} 1, if\ the\ company\ receives\ D\ or\ D- \\ 2, if\ the\ company\ receives\ C\ or\ C- \\ 3, if\ the\ company\ receives\ B\ or\ B- \\ 4, if\ the\ company\ receives\ A\ or\ A- \end{cases}$$

The results of our additional analyses are exhibited in ***Table 9***. These findings are also in line with those reported in ***Table 6***. For instance, *EX_ASSUR* exerts a positive impact on the level of *CCDS* and such effect remains statistically significant at 1% level. Besides, the coefficient of *FSIZE* is positive and weakly significant at 10% level. Overall, the findings of various regression analyses lead to the conclusion that there exists a positive linkage between *EX_ASSUR* and the level of *CCDS*, which suggests that companies having their environmental information externally assured seem to have a higher level of corporate climate change disclosures than those which have not.

[§§§] Please see Appendix A for more details.

[****] Giannarakis *et al*. (2018) also employ the ordered logistic regression approach.

Hence, our results are robust as the analyses based on different sample periods lead to the same conclusion.

5.5.2. Impact of 'type of assurance provider' and 'type of financial auditor'

Carbon assurance is part of the broad-ranging sustainability assurance (Datt *et al.*, 2019). Like the sustainability assurance market, the carbon assurance market is also comprised of two types of assurance providers (APs): accounting firms (ACCFs that include Big4 (KPMG, PricewaterhouseCoopers, Ernst & Young and Deloitte)and other financial auditors) and non-accounting firms (NACCFs that include, for example, specialist consulting firms) (Green *et al.*, 2017; Wong *et al.*, 2016; *Zhou et al.*, 2016; Cohen & Simnett, 2015; Green & Taylor, 2013; Huggins *et al.*, 2011).

These two groups of APs differ in expertise (Wong *et al.*, 2016). For instance, ACCFs do not have specific scientific and engineering knowledge required for providing carbon and/or sustainability assurance (Green *et al.*, 2017; Huggins *et al.*, 2011; Delfgaauw, 2000) but they have a greater level of experience of providing assurance services. On the contrary, NACCFs have requisite knowledge and skills to provide GHG and/or sustainability assurance but they lack sufficient experience of providing assurance services. This important difference allows companies to choose between two types of APs (Green *et al.*, 2017). But it is also noteworthy that Big4 accounting firms are currently controlling the sustainability assurance market (Fernandez-Feijoo *et al.*, 2018; KPMG, 2013; Suddaby *et al.*, 2007). Furthermore, it is evident from the existing literature that the level of sustainability disclosure is higher when the AP is a Big4 accounting firm (Fernandez-Feijoo *et al.*, 2018; Zorio *et al.*, 2013).

Therefore, in this section, we further our analysis by investigating the impact of two more variables on the level of climate change disclosure of assured firms. One of them is the 'Type of Assurance Provider' indicated by *ASSUR_PRVDR*, which is coded 1 for companies that have their carbon emissions disclosures assured by an ACCF (e.g., a Big4 or a non-Big4 financial auditor) and 0 for companies that purchase assurance from an NACCF (e.g., a specialist consulting firm). The second one is 'Type of Financial Auditor' represented by *BIG4*, which takes the value of 1 for companies that have hired one of the Big4 financial auditors to assure their carbon emissions disclosures and 0 otherwise. To serve this purpose, we estimate the following regression model:

$$CCDS_{i,t} = \beta_0 + \beta_1 ASSUR\_PRVDR_{i,t} + \beta_2 BIG4_{i,t} + \beta_3 FSIZE_{i,t} + \beta_4 PROF_{i,t} + \beta_5 LEV_{i,t} + \beta_6 ASST\_AGE_{i,t} + \beta_7 RNDINT_{i,t} + \beta_8 GRWTH_{i,t} + \beta_9 IND_{i,t} + \beta_{10} YEAR_{i,t} + \varepsilon_{i,t} \quad (2)$$

Table 10 and ***Table 11*** display the estimates of this analysis suggesting that neither *ASSUR_PRVDR* nor *BIG4* has any impact on *CCDS* as the parameters are found to be insignificant at conventional levels. These results are consistent with the Moroney *et al.* (2012) study that reports no association between the level of environmental disclosure and type of APs. But the outcomes contradict those reported by Fernandez-Feijoo *et al.* (2018) and Zorio *et al.* (2013) that confirm higher levels of sustainability disclosure when such disclosure is assured by a Big4 financial auditor.

5.5.3. Impact of industry dummies

So far, our empirical analyses show that the control variable 'Industry (*IND*)' does not exert any significant effects on *CCDS*. It is worth mentioning that *IND* has been used as a dichotomous

variable, taking the value of 1 if a company operates in a highly polluting industry and 0 otherwise. Now, in order to check the robustness of this finding, we classify the industry variable further and these new classifications include financials (*FIN*), consumer discretionary (*CONDIS*), consumer staples (*CONSTPL*), information technology (*IT*), telecommunications services (*TEL*), materials (*MAT*), industrials (*INDUST*), utilities (*UTL*), and energy (*NRG*). Given that the number of observations appears to be very few for *FIN*, *CONSTPL*, *TEL*, *UTL* and *NRG* sectors, these segments form a new category named 'Others', which is used as a reference category. We then estimate the following regression to observe the impacts of these new industry dummies on *CCDS*:

$$CCDS_{i,t} = \beta_0 + \beta_1 EX\_ASSUR_{i,t} + \beta_2 FSIZE_{i,t} + \beta_3 PROF_{i,t} + \beta_4 LEV_{i,t} + \beta_5 ASST\_AGE_{i,t} + \beta_6 RNDINT_{i,t} + \beta_7 GRWTH_{i,t} + \beta_8 CONDIS_{i,t} + \beta_9 IT_{i,t} + \beta_{10} MAT_{i,t} + \beta_{11} INDUST_{i,t} + \beta_{12} YEAR_{i,t} + \varepsilon_{i,t} \quad (3)$$

Table 12 displays the estimates of *equation 3*. It is evident from these findings that all the industry dummies except for *CONDIS* are found to be insignificant at conventional levels. *CONDIS*, however, appears to be significant only at 10% level. The results also reveal that *EX_ASSUR* and *FSIZE* still remain significant at 1% and 5% levels of significance, respectively. This finding could probably explain the insignificant effect of the control variable *IND* on *CCDS* shown in ***Table 6***. The finding that *IND* does not influence *CCDS* could be attributed to the fact that our sample includes companies from various sectors (both high- and low-polluting sectors as defined in the existing literature) and hence, the weakly significant (negative) impact of *CONDIS* may be cancelled out by the joint insignificant effect of the remaining sectors resulting ultimately in the insignificant effect of *IND* on *CCDS*. Notably, this result is in line with prior studies such as Moroney *et al.* (2012) and Braam *et al.* (2016) that also document an insignificant impact of the

industry dummy on the level of voluntary environmental disclosures. However, this finding contradicts that of Jaggi *et al.* (2018).

6. Conclusion and Policy Implications

With the growing public awareness and concern about the global climate change, the demand for disclosure of information about climate change risks and climate change mitigation strategies by companies is also increasing. In order to enhance the reliability and credibility of the information reported and thus win stakeholders' confidence and subsequently build corporate reputation, companies are increasingly inclined to have their environmental information assured by independent assurance providers. While external assurance seems to impact the level of corporate climate change disclosures significantly, investigations of such association have not received much attention from researchers. In order to fill this vacuum in the existing literature, this research, using the lens of stakeholder-agency theory, examines the effect of external assurance on the extent of corporate climate change disclosures by Finnish firms.

The findings of our empirical analysis suggest that firms that have their environmental information externally assured have a higher level of climate change disclosures than firms that have not purchased such assurance. In other words, external assurance has a significant positive impact on the level of corporate climate change disclosures. A probable explanation for such an association between external assurance and the level of corporate climate change disclosures can be found in stakeholder-agency theory, which suggests that different institutional structures, referred to as monitoring structures, evolve in response to the tackling of the problem of information asymmetry between corporate managers and other stakeholders; in the context of corporate climate change disclosures, external assurance plays the role of such monitoring structure. As an effective

monitoring structure, external assurance can improve companies' climate change-related data collection processes, can discover material errors in and omissions of the climate change-related information prepared, can prevent companies from manipulating diffusion of carbon information and thus can increase the level of corporate climate change disclosures (Hodge *et al*., 2009), which may potentially result in the reduction of information asymmetry between corporate managers and other stakeholders as far as climate change-related information is concerned. A number of control variables are used in this study and among them, mainly firm size and asset age are found to have significant effects on the level of corporate climate change disclosures.

The results of this study have implications for managers, investors, policy makers and regulators. By using the results of this research, corporate managers will be able to reduce the information asymmetry between various stakeholders and them through disclosure of accurate, reliable and credible environmental information. Such disclosures will, in turn, allow socially responsible investors to choose eco-friendly investments and will thus enable them to make appropriate investment decisions. Standardized carbon reports, which are produced in the presence of mandatory carbon reporting requirements, can provide extensive and reliable carbon information necessary for making investment decisions. Therefore, the findings of this study have implications for public policy-makers who may, in the absence of mandatory reporting requirements, develop standards for reporting corporate climate change-related information. Finally, the results of this study are important for regulators, who may serve as a watchdog on the transparency of firms' voluntary climate change-related disclosures. In case of companies' failure to disseminate accurate, reliable and credible climate change-related information, regulators may develop stringent rules and regulations to ensure that reliable disclosures are made by companies.

This research is subject to certain limitations. First, the source of the data used in this research is the CDP database which has limitations in that it is a voluntary disclosure process where all the observations collected are self-reported by the responding firms. This may bias the reported findings. Second, our sample includes only listed companies and hence the results might have limited explanatory capacity for unlisted firms. Third, the sample includes only the companies that have published sustainability reports. Fourth, this research is based solely upon Finnish data, which may inhibit the generalization of the findings in other contexts but this limitation can be overcome in future research by utilizing bigger samples that will include both local and international firms to provide greater understanding of how the voluntary adoption of external assurance affects the level of corporate climate change disclosures. Furthermore, country-specific studies can also be conducted to facilitate the comparison of findings. Finally, in the future, longitudinal studies could be undertaken to examine whether external assurance has any significant effect on the improvement of EP (in terms of carbon emissions) over time. Since external assurance is sought for enhancing reliability and credibility of the disclosed environmental information (e.g., climate change-related information) and thereby increasing stakeholders' confidence, the examination of direct impact of external assurance on EP may not be meaningful. Instead, future longitudinal studies could either assess whether the impact of corporate climate change disclosures on carbon emissions-related performance is moderated by external assurance or if external assurance has any influence, mediated by corporate climate change disclosures, on corporate carbon performance.

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References

Abdel-khalik, A. R. 1993. Why do private companies demand an audit? A case for organizational loss of control. *Journal of Accounting, Auditing & Finance*, 8 (1): 31-52.

Al-Tuwaijri, S., Christensen, T.E., & Hughes II, K.E. 2004. The relations among environmental disclosure, environmental performance, and economic performance: a simultaneous equations approach. *Accounting, Organizations and Society*, 29 (5-6): 447–471.

Andrikopoulos, A., & Kriklani, N. 2013. Environmental Disclosure and Financial Characteristics of the Firm: The Case of Denmark. *Corporate Social Responsibility and Environmental Management*, 20 (1): 55–64.

Appuhami, R., & Tashakor, S. 2017. The impact of audit committee characteristics on CSR disclosure: an analysis of Australian firms. Australian Accounting Review, 27 (4): 400-420.

Ben-Amar, W., & McIlkenny, P. 2015. Board effectiveness and the voluntary disclosure of climate change information. *Business Strategy and the Environment*, 24 (8): 704-719.

Ben-Amar, W., Chang, M., & McIlkenny, P. 2017. Board gender diversity and corporate response to sustainability initiatives: evidence from the carbon disclosure project. *Journal of Business Ethics*, Vol. 142 (2): 369-383.

Blackwell, D. W., Noland, T. R., & Winters, D. B. 1998. The value of auditor assurance: Evidence from loan pricing. *Journal of Accounting Research*, 36 (1): 57-70.

Brammer, S., & Pavelin, S. 2006. Voluntary environmental disclosures by large UK companies. *Journal of Business Finance & Accounting, 33*(7&8): 1168-1188.

Braam, G. J. M., Weerd, L. U. de, Hauck, M., & Huijbregts, M. A. J. 2016. Determinants of corporate environmental reporting: the importance of environmental performance and assurance. *Journal of Cleaner Production*, 129: 724-734.

Braam, G., & Peeters, R. 2018. Corporate Sustainability Performance and Assurance on Sustainability Reports: Diffusion of Accounting Practices in the Realm of Sustainable Development. *Corporate Social Responsibility and Environmental Management*, 25 (2): 164–181.

Carbon Disclosure Project. (2008). *Carbon Disclosure Project Report 2008, Global 500*. Retrieved from https://www.pwc.co.uk/building-public-trust-awards/assets/pdf/cdp_global_500_report_2008.pdf

Carbon Disclosure Project. 2016. *Scoring introduction 2016*. Retrieved from https://b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/guidance_docs/pdfs/000/000/233/original/Scoring-Introduction-2016.pdf?1458064225

Carbon Disclosure Project. 2016. *CDP Climate Change Report 2016 Nordic edition.* Retrieved from http://www.ds-norden.com/public/dokumenter/CDPNordicclimatechangereport2016.pdf

Carey, P., Simnett, R., & Tanewski, G. 2000. Voluntary demand for internal and external auditing by family business. *Auditing: A Journal of Theory & Practice*, 19 (Supplement): 37-51.

Chithambo, L., & Tauringana, V. 2014. Company specific determinants of greenhouse gases disclosures. *Journal of Applied Accounting Research*, 15 (3): 323-338.

Choi, B.B., Lee, D., & Psaros, J. 2013. An analysis of Australian company carbon emission disclosures. *Pacific Accounting Review*, 25 (1): 58-79.

Cho, C.H., & Patten, D.M. 2007. The role of environmental disclosures as tools of legitimacy: a research note. *Accounting, Organizations and Society*, 32 (7-8): 639-647.

Cho, C.H., Guidry, R.P., Hageman, A.M., & Patten, D.M. 2012. Do actions speak louder than words? An empirical investigation of corporate environmental reputation. *Accounting, Organizations and Society*, 37 (1): 14-25.

Cho, C. H., Michelon, G., Patten, D. M., & Roberts, R. W. 2014. CSR report assurance in the USA: an empirical investigation of determinants and effects. *Sustainability Accounting, Management and Policy Journal*, 5 (2): 130-148.

Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. 2008. Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis. *Accounting, Organizations and Society,* 33(4-5): 303-327.

Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. 2011. Does it really pay to be green? Determinants and consequences of proactive environmental strategies. *Journal of Accounting and Public Policy*, 30 (2): 122–144.

Clarkson, P., Li, Y., Richardson, G., & Tsang, A. 2019. Causes and consequences of voluntary assurance of CSR reports: international evidence involving Dow Jones Sustainability Index inclusion and firm valuation. *Accounting, Auditing & Accountability Journal*, 32 (8): 2451-2474.

Cohen, J., & Simnett, R. 2015. CSR and assurance services: A research agenda. *Auditing: A Journal of Practice & Theory*, 34 (1): 59–74.

Comyns, B., & Figge, F. 2015. Greenhouse gas reporting quality in the oil and gas industry: A longitudinal study using the typology of "search", "experience" and "credence" information. *Accounting, Auditing & Accountability Journal*, 28 (3): 403-433.

Coram, P. J., Monroe, G. S., & Woodliff, D. R. 2009. The value of assurance on voluntary nonfinancial disclosure: an experimental evaluation. *Auditing: A Journal of Practice and Theory*, 28 (1): 137-151.

Cormier, D., & Magnan, M. 1999. Corporate environmental disclosure strategies: Determinants, costs and benefits. *Journal of Accounting, Auditing & Finance,* 14(4): 429-451.

Cormier, D., Magnan, M., & Van Velthoven, B. 2005. Environmental disclosure quality in large German companies: Economic incentives, public pressures or institutional conditions? *European Accounting Review,* 14(1): 3-39.

Cotter, J., & Najah, M. M. 2011. Institutional investor influence on global climate change disclosure practices. *Australian Journal of Management*, 37 (2): 169-187.

Cowen, S. S., Ferreri, L. B., & Parker, L. D. 1987. The impact of corporate characteristics on social responsibility disclosure: A typology and frequency based analysis. *Accounting, Organizations and Society,* 12(2): 111-122.

Datt, R. R., Luo, L., & Tang, Q. 2019. The impact of legitimacy threat on the choice of external carbon assurance: evidence from the US. *Accounting Research Journal*, 32 (2): 181-202.

De Villiers, C., & Van Staden, C. 2006. Can less environmental disclosure have a legitimizing effect? Evidence from Africa. *Accounting, Organizations and Society*, 31 (8): 763-781.

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.

De Villiers, C., & Van Staden, C. J. 2011. Where firms choose to disclose voluntary environmental information. *Journal of Accounting and Public Policy,* 30(6): 504-525.

Deegan, C., Rankin, M., & Voght, P. 2000. Firms' disclosure reactions to major social incidents: Australian evidence. *Accounting Forum,* 24(1): 101-130.

Déjean, F., & Martinez, I. 2009. Environmental disclosure and the cost of equity: the French case. *Accounting in Europe*, 6 (1): 57-80.

Delfgaauw, T. 2000. Reporting on sustainable development: a preparer's view. *Auditing*, 19 (1): 67-74.

Dixon, R., Mousa, G. A., & Woodhead, A. D. 2004. The necessary characteristics of environmental auditors: a review of the contribution of the financial auditing profession. *Accounting Forum*, 28 (2): 119–138.

Eleftheriadis, I. M., & Anagnostopoulou, E. G. 2015. Relationship between Corporate Climate Change Disclosures and Firm Factors. *Business Strategy and the Environment*, 24 (8): 780-789.

Elsayed, K., & Paton, D. 2005. The impact of environmental performance on firm performance: static and dynamic panel data evidence. *Structural Change and Economic Dynamics*, 16 (3): 395–412.

Eugénio, T.P., Lourenço, I.C., & Morais, A.I. 2013. Sustainability strategies of company TimorL: extending the applicability of legitimacy theory. *Management of Environmental Quality: An International Journal*, 24 (5): 570-582.

Fazzini, M., & Maso, L. D. 2016. The value relevance of "assured" environmental disclosure: the Italian experience. *Sustainability Accounting, Management and Policy Journal*, 7 (2): 225-245.

Fernandez-Feijoo, B., Romero, S., & Ruiz, S. 2018. Financial auditor and sustainability reporting: does it matter? *Corporate Social Responsibility and Environmental Management*, 25 (3): 209-224.

Forsius, M., Anttila, S., Arvola, L., Bergstrom, I., Hakola, H., Heikkinen, H.I., Jelenius, J., Hyvarinen, M., Jylha, K., Karjalainen, J., Kaskinen, T., Laine, K., Nikinmaa, E., Letonen-Sainio, P., Rankinen, K., Reinikainen, M., Setala, H., Vuorenmaa, J. 2013. Impacts and adaptation options of climate change on ecosystem services in Finland: a model based study. *Current Opinion in Environmental Sustainability*, 5 (1): 26–40.

Freedman, M., & 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.

Giannarakis, G., Zafeiriou, E., & Sariannidis, N. 2017. The impact of carbon performance on climate change disclosure. *Business Strategy and the Environment*, 26 (8): 1078-1094.

Giannarakis, G., Zafeiriou, E., Arabatzis, G., & Partalidou, X. 2018. Determinants of corporate climate change disclosure for European firms. *Corporate Social Responsibility and Environment Management*, 25 (3): 281-294.

Gibson, R., & Guthrie, J. 1995. Recent Environmental Disclosures in Annual Reports of Australian Public and Private Sector Organisations. *Accounting Forum*, 19 (2/3): 111–27.

Gillet-Monjarret, C. 2012. A study of sustainability verification practices: the French case. *Journal of Accounting & Organizational Change*, 8 (1): 62-84.

Gillet-Monjarret, C. 2015. Assurance of sustainability information: a study of media pressure. *Accounting in Europe*, 12 (1): 87-105.

Gillet-Monjarret, C. 2018. Assurance reports included in the CSR reports of French firms: a longitudinal study. *Sustainability Accounting, Management and Policy Journal*, 9 (5): 570-594.

Gonzalez-Gonzalez, J.M., & Ramírez, C.Z. 2016. Voluntary carbon disclosure by Spanish companies: an empirical analysis. *International Journal of Climate Change Strategies and Management*, 8 (1): 57-79.

Gray, R.H., Kouhy, R., & Lavers, S. 1995. Corporate social and environmental reporting: a review of the literature and a longitudinal study of UK disclosure. *Accounting, Auditing & Accountability Journal*, 8 (2): 47-77.

Green, W., & Li, Q. 2012. Evidence of an expectation gap for greenhouse gas emissions assurance. *Accounting, Auditing & Accountability Journal*, 25 (1): 146–173.

Green, W., & Taylor, S. 2013. Factors that influence perceptions of greenhouse gas assurance provider quality. *International Journal of Auditing*, 17 (3): 288-307.

Green, W., Taylor, S., & Wu, J. 2017. Determinants of greenhouse gas assurance provider choice. *Meditari Accountancy Research*, 25 (1): 114-135.

Groening, C. J., & Kanuri, V. K. 2013. Investor reaction to positive and negative corporate social events. *Journal of Business Research*, 66 (10): 1852-1860.

Guenther, E., Guenther, T., Schiemann, F., & Weber, G. 2016. Stakeholder relevance for reporting: explanatory factors of carbon disclosure. *Business & Society*, 55(3): 361–397.

Guthrie, J., Cuganesan, S., & Ward, L. 2008. Industry Specific Social and Environmental Reporting: The Australian Food and Beverage Industry. *Accounting Forum*, 32 (1): 1–15.

Guthrie, J., & Farneti, F. 2008. GRI Sustainability Reporting by Australian Public Sector Organizations. *Public Money and Management*, 28 (6): 361–366.

Guthrie, J., & Parker, L. D. 1989. Corporate Social Reporting: A Rebuttal of Legitimacy Theory. *Accounting and Business Research*, 19 (76): 343-352.

Haque, S., & Deegan, C. 2010. Corporate Climate Change-Related Governance Practices and Related Dislosures: Evidence from Australia. *Australian Accounting Review*, 55 (20): 317-333.

Hasan, M., Roebuck, P., & Simnett, R.2003. An investigation of alternative report formats for communicating moderate levels of assurance. *Auditing A Journal of Practice and Theory*, 22(2):171-187.

Hassan, A., Elamer, A. A., Fletcher, M., & Sobhan, N. 2019. Voluntary assurance of sustainability reporting: evidence from an emerging economy. *Accounting Research Journal*, in press.

Henriques, I., & Sadorsky, P. 1999. The relationship between environmental commitment and managerial perceptions of stakeholder importance. *Academy of Management Journal, 42*(1): 87-99.

Hill, C. W. L., & Jones, T. M. 1992. Stakeholder-agency theory. *Journal of Management Studies*, 29 (2): 131-154.

Hodge, K., Subramaniam, N., & Stewart, J. D. 2009. Assurance of sustainability reports: impact on report users' confidence and perceptions of information credibility. *Australian Accounting Review*, 19(3):178 - 194.

Hossain, M., Farooque, O. A., Momin, M. A., & Almotairy, O. 2017. Women in the boardroom and their impact on climate change related disclosure. *Social Responsibility Journal*, 13 (4): 828-855.

Huggins, A., Green, W., & Simnett, R. 2011. The competitive market for assurance engagements on greenhouse gas statements: Is there a role for assurers from the accounting profession? *Current Issues in Auditing*, 5 (2): A1–A12.

Intergovernmental Panel on Climate Change. 2001. Summary for Policymakers Climate Change 2001: The Scientific Basis. *Third Assessment Report*. Geneva.

Intergovernmental Panel on Climate Change. 2007. The Physical Science Basis. *Fourth Assessment Report*. Valencia, Spain.

International Federation of Accountants. 2012. International Standard on Assurance Engagements (ISAE) 3410, Assurance Engagements on Greenhouse Gas Statements. *Fiftieth Meeting of the International Auditing and Assurance Standards Board*. Toronto, Canada.

Jaggi, B., Allini, A., Macchioni, R., & Zagaria, C. 2018. The Factors Motivating Voluntary Disclosure of Carbon Information: Evidence Based on Italian Listed Companies. *Organization & Environment*, 31(2): 178–202.

Jones, M. J. 2010. Accounting for the environment: Towards a theoretical perspective for environmental accounting and reporting. *Accounting Forum*, 34: 123-138.

Jones, M., & Solomon, J. 2010. Social and environmental report assurance: some interview evidence. *Accounting Forum*, 34 (1): 20-31.

Jones, P., Comfort, D., & Hillier, D. 2015. Materiality and external assurance in corporate sustainability reporting: an exploratory study of UK house builders. *Property Management*, 33 (5): 430-450.

Junior R. M., Best P.J., & Cotter J. 2014. Sustainability reporting and assurance: a historical analysis on a world-wide phenomenon. *Journal of Business Ethics*, 120 (1): 1–11.

Kalu, J.U., Buang, A., & Aliagha, G.U. 2016. Determinants of voluntary carbon disclosure in the corporate real estate sector of Malaysia. *Journal of Environmental Management*, 182: 519-524.

Karamanou, I., & Vafeas, N. 2005. The association between corporate boards, audit committees, and management earnings forecasts: an empirical analysis. *Journal of Accounting Research*, 43 (3): 453-486.

Kılıç, M., & Kuzey, C. 2019. The effect of corporate governance on carbon emission disclosures: Evidence from Turkey. *International Journal of Climate Change Strategies and Management*, 11 (1): 35-53.

Knox, S., Maklan, S., & French, P. 2006. Corporate social responsibility: exploring stakeholder relationships and programme reporting across leading FTSE companies. *Journal of Business Ethics*, 61 (1): 7-28.

Kolk, A., Levy, D., & Pinkse, J. 2008. Corporate responses in an emerging climate regime: The institutionalization and commensuration of carbon disclosure. *European Accounting Review*, 17 (4): 719-745.

KPMG. 2013. The KPMG survey of corporate responsibility reporting 2013. *KPMG Global Sustainability Services*, Amsterdam.

Lash, J., & Wellington, F. 2007. Competitive advantage on a warming planet. *Harvard Business Review*, 85 (3): 94-102.

Lee, S.Y., Park, Y.S., & Klassen, R.D. 2015. Market responses to firms' voluntary climate change information disclosure and carbon communication. *Corporate Social Responsibility and Environmental Management*, 22 (1): 1-12.

Liao, L., Luo, L., & Tang, Q. 2015. Gender diversity, board independence, environmental committee and greenhouse gas disclosure. *The British Accounting Review*, 47: 409-424.

Liu, X., & Anbumozhi, V. 2009. Determinant factors of corporate environmental information disclosure: an empirical study of Chinese listed companies. *Journal of Cleaner Production*, 17: 593-600.

Lozano, R., & Huisingh, D. 2011. Inter-linking issues and dimensions in sustainability reporting. *Journal of Cleaner Production*, 19 (2-3): 99–107.

Lozano, R. 2015. A holistic perspective on corporate sustainability drivers. *Corporate Social Responsibility and Environmental Management*, 22 (1): 32–44.

Luo, L., Lan, Y. –C., & Tang, Q. 2012. Corporate incentives to disclose carbon information: evidence from the CDP Global 500 report, *Journal of International Financial Management & Accounting*, 23 (2): 93-120.

Luo, I., & Tang, Q. 2014. Does voluntary carbon disclosure reflect underlying carbon performance? *Journal of Contemporary Accounting & Economics*, 10 (3): 191–205.

Luo, L. 2019. The influence of institutional contexts on the relationship between voluntary carbon disclosure and carbon emission performance. *Accounting and Finance*, 59 (2): 1235-1264.

Manetti, G., & Toccafondi, S. 2012. The role of stakeholders in sustainability reporting assurance. Journal of Business Ethics, 107 (3): 363-377.

Marín, L., Rubio, A., & de Maya, S.R. 2012. Competitiveness as a strategic outcome of corporate social responsibility. *Corporate Social Responsibility and Environmental Management*, 19 (6): 364–376.

Martinov-Bennie, N. 2012. Greenhouse gas emissions reporting and assurance: reflections on the current state. *Sustainability Accounting, Management and Policy Journal*, 3 (2): 244-251.

Matisoff, D.C., Noonan, D.S., & O'Brien, J.J. 2012. Convergence in environmental reporting: assessing the carbon disclosure project. *Business Strategy and The Environment*, 22 (5): 285-305.

McWilliams, A., & Siegel, D. 2001. Corporate social responsibility: a theory of the firm perspective. *Academy of Management Review*, 26 (1): 117–127.

Mock, T., Strohm, C., & Swartz, K. 2007. An examination of worldwide assured sustainability reporting. *Australian Accounting Review*, 17 (41): 67-77.

Monteiro, S. M. S., & Guzmán, B. A. 2010. The influence of the Portuguese environmental accounting standard on the environmental disclosures in the annual reports of large companies operating in Portugal: a first view (2002-2004). *Management of Environmental Quality: An International Journal*, 21 (4): 414-435.

Moroney, R., Windsor, C., & Aw, Y.T. 2012. Evidence of assurance enhancing the quality of voluntary environmental disclosures: an empirical analysis. *Accounting and Finance*, 52 (3): 903-939.

Neu, D., Warsame, H., & Pedwell, K. 1998. Managing public impressions: Environmental disclosures in annual reports. *Accounting, Organizations and Society,* 23(3), 265-282.

Nikolaeva, R., & Bicho, M. 2011. The role of institutional and reputational factors in the voluntary adoption of corporate social responsibility reporting standards. *Journal of Academy of Marketing*, 39 (1): 136-157.

Niskala, M., & Pretes, M. 1995. Environmental reporting in Finland: a note on the use of financial reports. *Accounting, Organizations and Society*, 20 (6): 457-466.

O'Donovan, G. 2000. Legitimacy theory as an explanation for corporate environmental disclosures. *PhD thesis in Business*, Victoria University of Technology, Melbourne.

O'Donovan, G. 2002. Environmental disclosure in the annual report: extending the applicability and predictive power of legitimacy theory. *Accounting, Auditing & Accountability Journal*, 15 (3): 344-371.

O'Dwyer, B., Owen, D., & Unerman, J. 2011. Seeking legitimacy for new assurance forms: the case of assurance on sustainability reorting. *Accounting, Organizations & Society*, 36 (1): 31-52.

Othman, R., Nath, N., & Laswad, F. 2017. Sustainability Reporting by New Zealand's Local Governments. *Australian Accounting Review*, 27 (3): 315-328.

Patten, D. M. 1991. Exposure, legitimacy and social disclosure. *Journal of Accounting and Public Policy,* 10 (4): 297-308.

Patten, D. M. 2002a. The relation between environmental performance and environmental disclosure: A research note. *Accounting, Organizations and Society*, 27 (8): 763-773.

Patten, D.M. 2002b. Media exposure, public policy pressure, and environmental disclosure: an examination of the impact of TRI data availability. *Accounting Forum*, 26 (2): 152-171.

Peters, G. F., & Romi, A. M. 2015. The association between sustainability governance characteristics and the assurance of corporate sustainability reports. *Auditing: A Journal of Practice & Theory*, 34 (1): 163-198.

Pflugrath, G., Roebuck, P., & Simnett, R. 2011. Impact of assurance and assurer's professional affiliation on financial analysts' assessment of credibility of corporate social responsibility information. *Auditing: A Journal of Practice & Theory*, 30 (3): 239-254.

Porter, M.E., & van der Linde, C. 1995. Green and competitive: ending the stalemate. *Harvard Business Review*, 73 (5):120-134.

Prado-Lorenzo, J.-M., Rodríguez-Domínguez, L., Gallego-Álvarez, I., & García-Sánchez, I.-M. 2009. Factors influencing the disclosure of greenhouse gas emissions in companies world-wide. *Management Decision*, 47 (7): 1133-1157.

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

Radhouane, I., Nekhili, M., Nagati, H., & Paché, G. 2020. Is voluntary external assurance relevant for the valuation of environmental reporting by firms in environmentally sensitive industries? *Sustainability Accounting, Management and Policy Journal*, 11 (1): 65-98.

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

Reid, E. M., & Toffel, M. W. 2009. Responding to public and private politics: Corporate disclosure of climate change strategies. *Strategic Management Journal*, 30 (11): 1157-1178.

Reimsbach, D., Hahn, R., & Gürtürk, A. 2018. Integrated Reporting and Assurance of Sustainability Information: An Experimental Study on Professional Investors' Information Processing, *European Accounting Review*, 27 (3): 559-581.

Roberts, C. 1991. Environmental disclosures: a note on reporting practices in Mainland Europe. *Accounting, Auditing and Accountability Journal*, 4 (3): 62-71.

Roberts, R. W. 1992. Determinants of corporate social responsibility disclosure: An application of stakeholder theory. *Accounting, Organizations and Society*, 17 (6): 595-612.

Rossi, A., & Tarquinio, L. 2017. An analysis of sustainability report assurance statements: evidence from Italian listed companies. *Managerial Auditing Journal*, 32 (6): 578-602.

Sellami, Y. M., Hlima, N. D. B., & Jarboui, A. 2019. An empirical investigation of determinants of sustainability report assurance in France. *Journal of Financial Reporting and Accounting*, 17 (2): 320-342.

Sharma, S., & Nguan, O. 1999. The Biotechnology Industry and Strategies of Biodiversity Conservation: The Influence of Managerial Interpretations and Risk Propensity. *Business Strategy and the Environment*, 8 (1): 46–61.

Simnett, R., Nugent, M., & Huggins, A. 2009. Developing an international assurance standard on greenhouse gas statements. *Accounting Horizons*, 23 (4): 347–363.

Simnett, R., Vanstraelen, A., & Chua, W. F. 2009. Assurance on sustainability reports: an international comparison. *The Accounting Review,* 84 (3): 937–967.

Skinner, D. J., & Sloan, R. G. 2002. Earnings surprises, growth expectations, and stock returns or don't let an earnings torpedo sink your portfolio. *Review of Accounting Studies*, 7 (2-3): 289-312.

Smith, L. C., Smith, L. M., & Ashcroft, P. A. 2011. Analysis of environmental and economic damages from British Petroleum's Deepwater Horizon oil spill. *Albany Law Review*, 74 (1): 563-585.

Stanny, E., & Ely, K. 2008. Corporate Environmental Disclosures about the Effects of Climate Change. *Corporate Social Responsibility and Environmental Management*, 15 (6): 338-348.

Stanny, E. 2013. Voluntary disclosures of emissions by US firms. *Business Strategy and the Environment*, 22 (3): 145-158.

Suchman, M. C. 1995. Managing Legitimacy: strategic and institutional approaches. *Academy of Management Review*, 20 (3): 571-610.

Suddaby, R., Cooper, D. J., & Greenwood, R. 2007. Transnational regulation of professional services: governance dynamics of field level organizational change. *Accounting, Organizations and Society*, 32 (4-5): 333-362.

Tagesson, T., Blank, V., Broberg, P., & Collin, S. O. 2009. What explains the extent and content of social and environmental disclosures on corporate websites: a study of social and environmental reporting in Swedish listed corporations. *Corporate Social Responsibility and Environmental Management*, 16 (6): 352-364.

Thompson, P., & Cowton, C. J. 2004. Bringing the environment into bank lending: Implications for environmental reporting. *The British Accounting Review,* 36 (2), 197-218.

Thornton, R. V., & Hsu, S. 2001. Environmental management systems and climate change. *Environmental Quality Management*, 11 (1): 93-100.

Tyson, T., & Adams, C. A. 2020. Increasing the scope of assurance research: new lines of inquiry and novel theoretical perspectives. *Sustainability Accounting, Management and Policy Journal*, 11 (2): 291-316.

Udayasankar, K. 2008. Corporate Social Responsibility and Firm Size. *Journal of Business Ethics*, 83 (2):167–175.

Van der Laan, G., Ees, H. V., & Witteloostuijn, A. V. 2008. Corporate social and financial performance: an extended stakeholder theory, and empirical test with accounting measures. *Journal of Business Ethics*, 79 (3): 299–310.

Wallace, W. A. 1987. The economic role of the audit in free and regulated markets: a review. *Research in Accounting Regulation*, 1: 7–34.

Watts, R. L., & Zimmerman, J. L. 1986. Positive Accounting Theory (Prentice Hall, New Jersey).

Weber, J. L. 2018. Corporate social responsibility disclosure level, external assurance and cost of equity capital. *Journal of Financial Reporting and Accounting*, 16 (4): 694-724.

Wong, J., Wong, N., Li, W. Y., & Chen, L. 2016. Sustainability assurance: an emerging market for the accounting profession. *Pacific Accounting Review*, 28 (3): 238-259.

Yunus, S., Evangeline, E.T., & Abhayawansa, S. 2016. Determinants of carbon management strategy adoption: evidence from Australia's top 200 publicly listed firms. *Managerial Auditing Journal*, 31 (2): 156-179.

Zhou, S., Simnett, R., & Green, W. J. 2016. Assuring a new market: the interplay between country-level and company-level factors on the demand for greenhouse gas (GHG) information assurance and the choice of assurance provider. *Auditing: A Journal of Practice & Theory*, 35 (3): 141–168.

Zorio, A., García-Benau, M. A., & Sierra, L. 2013. Sustainability development and the quality of assurance reports: empirical evidence. *Business Strategy and the Environment*, 22 (7): 484-500.

Table 1: Prior studies		
Panel A: Studies examining company specific determinants of corporate climate change disclosures		
Study	**Sample & Data**	**Findings**
Chithambo & Tauringana, 2014.	210 companies listed on the London Stock Exchange. Data relate to the year 2011.	While larger firms having more financial slack and belonging to environmentally sensitive industries have a higher level of climate change disclosure, firms with high leverage tend to disclose less information.
Eleftheriadis & Anagnostopoulou, 2015.	47 firms listed on the Athens Stock Exchange. Data relate to the period 2008-2011.	Firm size and profitability have significant positive impact on the level of corporate climate change disclosure but industry type has insignificant impact on the same.
Freedman & Jaggi, 2005.	120 firms from 20 countries. Data relate to the year 2000.	Larger firms belonging to environmentally sensitive industries disseminate more climate change information. In addition, firms domiciled in the countries that have ratified the Kyoto Protocol have higher level of global warming related disclosure compared to firms in other countries.
Giannarakis *et al*., 2017.	119 large firms listed on the London Stock Exchange. Data relate to the year 2014.	Firms with better environmental performance have higher level of climate change disclosure.
Giannarakis *et al*., 2018.	215 companies of Bloomberg European 500 Index large firms listed on the London Stock Exchange. Data relate to the year 2014.	External assurance of environmental information increases the level of climate change disclosure. Moreover, firms with better environmental performance and a higher proportion of government ownership tend to provide more information relating to climate change.

Table 1: Prior studies (Continued)		
Panel A: Studies examining company specific determinants of corporate climate change disclosures		
Study	**Sample & Data**	**Findings**
Gonzales-Gonzales & Ramírez, 2016.	82 Spanish companies that responded to the CDP (2012) questionnaire. Data relate to the year 2012.	Larger firms with high financial risk are under high stakeholder pressures and tend to disclose more climate change-related information.
Luo *et al*., 2012.	291 firms from the CDP Global 500 Report, 2009. Date relate to the year 2009.	Larger companies are under more economic and institutional pressures and tend to disclose more information on carbon emissions.
Prado-Lorenzo *et al*., 2009.	101 largest firms from the USA, Canada, Australia and the EU. Data relate to the year 2007.	Firm size and market capitalization have been found to have significantly positive effect on the level of climate change disclosure.
Stanny & Ely, 2008.	494 listed US companies (chosen from S&P 500).	Firm size, previous year's disclosures and foreign sales significantly and positively affect firms' decision to disclose climate change-related information.
Panel B: Studies examining the effect of corporate governance characteristics on corporate climate change disclosures		
Ben-Amar & McIlkenny, 2015.	559 firm-year observations from the 200 firms covered in the CDP-Canada annual survey. Data relate to the period from 2008 to 2011.	There is a positive association between board effectiveness and the firm's carbon disclosure quality.
Ben-Amar *et al*., 2017.	541 firm-year observations from the 200 firms covered in the CDP Canada annual Survey. Data relate to the period 2008-2014.	The probability of voluntary climate change disclosure is higher for companies with a higher number of women on boards.
Choi *et al*., 2013.	The largest 100 companies listed on the Australian Securities Exchange. Data relate to the period from 2006 to 2008.	The quality of corporate governance is a key driver for corporate climate change disclosures.
Hossain *et al*., 2017.	1,175 firm-year observations from 331 companies in 33 countries. Data relate to the period from 2011 to 2013.	Firms with a higher number of women directors and a larger board tend to provide more carbon emissions information.

Table 1: Prior studies (Continued)		
Panel B: Studies examining the effect of corporate governance characteristics on corporate climate change disclosures		
Study	**Sample & Data**	**Findings**
Jaggi *et al*., 2018.	671 firm-year observations from the firms listed on the Italian Stock Exchange. Data relate to the period from 2010 to 2013.	Existence of environmental committees, board independence and institutional shareholdings has a strong positive effect on firms' voluntary carbon disclosure decisions. The effect is even stronger for firms operating in highly polluting industries.
Kılıç & Kuzey, 2018.	770 firm-year observations from 154 companies listed on the Borsa Istanbul. Data relate to the period from 2011 to 2015.	Firms with a higher percentage of independent directors, a sustainability committee and a higher number of foreign directors are more likely to disclose carbon emissions information.
Liao *et al*., 2015.	329 largest UK companies included in the 2011 CDP FTSE350 reports.	The propensity and extent of disclosure of GHG information is higher for the firms that have a higher percentage of female directors on the board, greater board independence and an environmental committee.
Rankin *et al*., 2011.	187 firms listed on the Australian Stock Exchange. Date relate to the year 2007.	Larger companies having environmental management systems and higher corporate governance quality are likely to voluntarily disseminate information relating to climate change.
Yunus *et al*., 2016.	893 firm-year observations from 200 companies listed on the Australian Securities Exchange. Data relate to the period from 2008 to 2012.	Firms having an environmental committee, larger board size, greater board independence and implementing an environmental management system are more likely to adopt carbon management strategy.

Table 2: Sample selection

Observations	Year								Total observations
	2008	2009	2010	2011	2012	2013	2014	2015	
Initial sample per year	37	37	37	37	37	37	37	37	296
No. of yearly observations with missing data	(18)	(14)	(13)	(9)	(4)	(3)	(1)	(6)	(68)
Final observations per year	19	23	24	28	33	34	36	31	228

Table 3: Definitions of the variables used

Variable	Definition
CCDS	CDP carbon disclosure score.
EX_ASSUR	A dummy variable which is equal to 1 if the sustainability or environmental report is externally assured and 0 otherwise.
FSIZE	Firm size is the logarithm of the firm's year-end total assets.
PROF	Profitability is the return on assets.
LEV	Leverage is the ratio of year-end total debt to year-end total equity.
GRWTH	Growth is the percentage of increase in yearly sales.
ASST_AGE	Asset age is the ratio of net property, plant and equipment to gross property, plant and equipment.
RNDINT	Research and development intensity is the ratio of research and development expenditure to net sales revenue.
IND	A dummy variable, which is equal to 1 if the firm is in one of the highly polluting industries and 0 otherwise.

Table 4: Descriptive statistics

Variable	Mean	Maxi.	Min.	Std. Dev.
CCDS	71.12	100.00	0.00	23.92
EX_ASSUR	0.42			0.49
FSIZE	6.42	7.58	5.19	0.57
PROF	0.06	0.61	-0.09	0.07
LEV	2.39	74.37	0.00	10.34
ASST_AGE	0.40	0.72	0.17	0.12
RNDINT	0.02	0.19	0.00	0.03
GRWTH	0.01	0.69	-0.63	0.17
IND	0.71			0.45

Table 5: Pearson correlations

	CCDS	EX_ASSUR	FSIZE	PROF	LEV	ASST_AGE	RNDINT	GRWTH	IND
CCDS	1.000000								
EX_ASSUR	0.549869 (0.0000)	1.000000							
FSIZE	0.318284 (0.0000)	0.381180 (0.0000)	1.000000						
PROF	-0.102594 (0.1884)	-0.192446 (0.0130)	-0.209960 (0.0066)	1.000000					
LEV	0.040049 (0.6084)	-0.011753 (0.8805)	0.226670 (0.0033)	-0.149904 (0.0539)	1.000000				
ASST_AGE	-0.222850 (0.0039)	-0.104993 (0.1782)	0.113830 (0.1442)	0.000810 (0.9917)	-0.050098 (0.5215)	1.000000			
RNDINT	0.199381 (0.0100)	0.209479 (0.0068)	0.069156 (0.3760)	0.030026 (0.7010)	-0.100403 (0.1981)	-0.211933 (0.0061)	1.000000		
GRWTH	-0.065195 (0.4040)	-0.036966 (0.6363)	-0.108028 (0.1659)	0.057027 (0.4655)	-0.001880 (0.9808)	0.114207 (0.1429)	-0.133757 (0.0858)	1.000000	
IND	0.061175 (0.4337)	0.025662 (0.7428)	0.226897 (0.0033)	-0.254534 (0.0009)	0.118028 (0.1299)	0.212988 (0.0059)	-0.472469 (0.000)	0.026627 (0.7335)	1.000000

Table 6: Regression results

Dependent variable CCDS				
Variable	**Coefficient**	**Standard Error**	**t-Statistic**	***p*-value**
Intercept	7.91	30.73	0.26	0.79
EX_ASSUR	24.32***	3.39	7.17	0.00
FSIZE	9.80*	5.01	1.96	0.06
PROF	-9.67	20.65	-0.46	0.64
LEV	-0.11	0.245	-0.45	0.64
ASST_AGE	-27.44	16.65	-1.64	0.11
RNDINT	61.32	83.36	0.73	0.46
GRWTH	3.94	7.15	0.55	0.58
IND	1.88	6.70	0.28	0.77
Year effect	Yes			
R^2		0.32		
F-statistic		8.81***		

***p<0.01; **p<0.05; *p<0.10.

Table 7: Results of endogeneity test

Dependent variable CCDS				
Variable	**Coefficient**	**Standard Error**	**t-Statistic**	***p*-value**
Intercept	-46.20	31.03	-1.49	0.13
RESID_EX_ASSUR	24.86***	3.36	7.39	0.00
FSIZE	19.07***	4.93	3.87	0.00
PROF	-12.57	20.41	-0.62	0.53
LEV	-0.15	0.25	-0.63	0.53
ASST_AGE	-26.64	16.69	-1.60	0.11
RNDINT	95.16	82.39	1.16	0.25
GRWTH	4.68	7.08	0.66	0.51
IND	4.76	6.40	0.74	0.45
R^2		0.32		
F-statistic		9.24***		

***p<0.01; **p<0.05; *p<0.10.

Table 8: Results of Tobit model

Dependent variable CCDS

Variable	Coefficient	Standard Error	z-Statistic	*p*-value
Intercept	32.59*	18.71	1.74	0.08
EX_ASSUR	22.27***	3.41	6.53	0.00
FSIZE	5.82*	3.06	1.90	0.06
PROF	14.62	21.88	0.67	0.50
LEV	0.02	0.15	0.12	0.90
ASST_AGE	-38.39***	13.08	-2.94	0.00
RNDINT	76.13	52.48	1.45	0.14
GRWTH	-0.23	8.80	-0.03	0.97
IND	6.30	4.01	1.57	0.11
R^2		0.56		

***p<0.01; **p<0.05; *p<0.10.

Table 9: Results of ordered logit regression analysis for the period 2016-2018

Dependent variable CCDS				
Variable	**Coefficient**	**Standard Error**	**z-Statistic**	***p*-value**
Threshold of the dependent variable				
2 – Band C or C-	2.47	2.42	1.02	0.31
3 – Band B or B-	3.83	2.42	1.58	0.11
4 – Band A or A-	4.86**	2.43	2.00	0.05
Independent and control variables				
EX_ASSUR	1.11***	0.36	3.09	0.00
FSIZE	0.63*	0.37	1.73	0.08
PROF	0.001	5.03	0.00	0.99
LEV	-0.24	0.47	-0.51	0.61
ASST_AGE	0.24	1.01	0.24	0.81
RNDINT	1.81	5.14	0.35	0.72
GRWTH	-1.53	0.96	-1.59	0.11
IND	-0.39	0.41	-0.96	0.33
Pseudo-R^2		0.16		
LR-statistic		26.19***		

***p<0.01; **p<0.05; *p<0.10.

Table 10: Impact of Type of Assurance Provider and Type of Financial Auditor (OLS regression)

Dependent variable CCDS

Variable	**Coefficient**	**Standard Error**	**t-Statistic**	***p*-value**
Intercept	58.38	39.71	1.47	0.15
ASSUR_PRVDR	-6.87	11.58	-0.59	0.55
BIG4	14.31	11.07	1.29	0.20
FSIZE	6.09	6.43	0.94	0.35
PROF	34.87	39.60	0.88	0.38
LEV	-0.05	0.28	-0.19	0.84
ASST_AGE	-44.26	26.82	-1.64	0.11
RNDINT	-11.07	92.81	-0.11	0.91
GRWTH	6.07	9.86	0.61	0.54
IND	-1.36	10.34	-0.13	0.89
Year effect	Yes			
R^2		0.12		
F-statistic		0.86		

***p<0.01; **p<0.05; *p<0.10.

Table 11: Impact of Type of Assurance Provider and Type of Financial Auditor (Logit regression)

Dependent variable CCDS				
Variable	**Coefficient**	**Standard Error**	**z-Statistic**	***p*-value**
Threshold of the dependent variable				
2 – Band C or C-	7.15*	3.82	1.87	0.06
3 – Band B or B-	5.30	5.78	0.91	0.36
4 – Band A or A-	7.33	5.85	1.25	0.21
Independent and control variables				
ASSUR_PRVDR	0.97	1.47	0.66	0.50
BIG4	1.08	1.26	0.85	0.39
FSIZE	0.81	0.79	1.03	0.30
PROF	-5.73	12.24	-0.46	0.64
LEV	-0.66	1.02	-0.64	0.51
ASST_AGE	2.07	2.86	0.72	0.46
RNDINT	1.89	10.26	0.18	0.85
GRWTH	0.19	3.43	0.06	0.95
IND	0.31	1.09	0.28	0.77
Pseudo-R^2		0.14		
LR-statistic		24.88***		

***p<0.01; **p<0.05; *p<0.10.

Table 12: Effects of industry dummies

Dependent variable CCDS				
Variable	**Coefficient**	**Standard Error**	**t-Statistic**	***p*-value**
Intercept	-11787.19***	888.44	-13.27	0.00
EX_ASSUR	7.16***	2.69	2.65	0.00
FSIZE	10.75**	4.68	2.30	0.02
PROF	-23.32	14.35	-1.62	0.11
LEV	-0.04	0.21	-0.20	0.83
ASST_AGE	-18.12	12.67	-1.42	0.15
RNDINT	-122.62	84.30	-1.45	0.14
GRWTH	0.57	4.82	0.11	0.90
Industry dummies				
CONDIS	-19.54*	10.08	-1.93	0.06
MAT	-4.75	9.20	-0.51	0.60
IT	14.76	13.21	1.12	0.26
INDUST	-7.85	9.01	-0.87	0.38
Year effect	Yes			
R^2		0.65		
F-statistic		24.34***		

***p<0.01; **p<0.05; *p<0.10.

Appendix A

The final letter grade that a particular company receives is awarded based on the score obtained in the highest achieved level. For example, if company XYZ achieves 88% in Disclosure level, 76% in Awareness level and 65% in Management level, it will finally receive a letter grade of B. If a company obtains less than 40% in its highest achieved level, its letter score will have a minus sign. For example, if company ABC achieves 76% in Disclosure level and 38% in Awareness level, it will finally receive a letter grade of C-. Note that a company must achieve over 75% in Leadership to be eligible for an A and thus be part of the A List, which represents the highest scoring companies. This is how the companies get ranked. Table A1 displays this ranking system.

Table A1: The ranking system

Leadership	75-100%	A
	0-74%	A-
Management	40-74%	B
	0-39%	B-
Awareness	40-74%	C
	0-39%	C-
Disclosure	40-74%	D
	0-39%	D-

Table A2: Regression results with Lagged EX_ASSUR

Dependent variable CCDS				
Variable	**Coefficient**	**Standard Error**	**t-Statistic**	***p*-value**
Intercept	5.88	31.95	0.18	0.85
Lagged EX_ASSUR	20.57***	3.41	6.02	0.00
FSIZE	11.23**	5.16	2.17	0.03
PROF	-16.05	20.53	-0.78	0.43
LEV	-0.13	0.24	-0.52	0.59
ASST_AGE	-30.44*	17.03	-1.78	0.07
RNDINT	53.30	83.77	0.63	0.53
GRWTH	5.97	7.59	0.78	0.43
IND	-0.54	6.81	-0.08	0.96
Year effect	Yes			
R^2		0.26		
F-statistic		6.14***		

Notes: This table present the estimates obtained from the following model $CCDS_{i,t} = \beta_0 + \beta_1 EX\_ASSUR_{i,t-1} + \beta_2 FSIZE_{i,t} + \beta_3 PROF_{i,t} + \beta_4 LEV_{i,t} + \beta_5 ASST\_AGE_{i,t} + \beta_6 RNDINT_{i,t} + \beta_7 GRWTH_{i,t} + \beta_8 IND_{i,t} + \beta_9 YEAR_{i,t} + \varepsilon_{it}$

***p<0.01; **p<0.05; *p<0.10.

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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.

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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 Côte (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.

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

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-a-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 Ramırez, 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.

References

Adler, R., Mansi, M. and Pandey, R. (2018), "Biodiversity and threatened species reporting by the top Fortune Global companies", *Accounting, Auditing and Accountability Journal*, Vol. 31 No. 3, pp. 787-825.

Al-Shaer, H. and Zaman, M. (2018), "Credibility of sustainability reports: the contribution of audit committees", *Business Strategy and the Environment*, Vol. 27 No. 7, pp. 973-986.

Al-Tuwaijri, S.A., Christensen, T.E. and Hughes, K.E. II (2004), "The relations among environmental disclosure, environmental performance, and economic performance: a simultaneous equations approach", *Accounting, Organizations and Society*, Vol. 29 Nos 5/6, pp. 447-471.

Andrikopoulos, A. and Kriklani, N. (2013), "Environmental disclosure and financial characteristics of the firm: the case of Denmark", *Corporate Social Responsibility and Environmental Management*, Vol. 20 No. 1, pp. 55-64.

Barut, M., Raar, J. and Azim, M.I. (2016), "Biodiversity and local government: a reporting and accountability perspective", *Managerial Auditing Journal*, Vol. 31 No. 2, pp. 197-227.

Bhattacharyya, A. and Yang, H. (2019), "Biodiversity disclosure in Australia: effect of GRI and institutional factors", *Australasian Journal of Environmental Management*, Vol. 26 No. 4, pp. 347-369.

Boiral, O. (2013), "Sustainability reports as simulacra? A counter-account of A and A+ GRI reports", *Accounting, Auditing and Accountability Journal*, Vol. 26 No. 7, pp. 1036-1071.

Boiral, O. (2016), "Accounting for the unaccountable: biodiversity reporting and impression management", *Journal of Business Ethics*, Vol. 35 No. 4, pp. 751-768.

Braam, G.J.M., Weerd, L.U., de Hauck, M. and Huijbregts, M.A.J. (2016), "Determinants of corporate environmental reporting: the importance of environmental performance and assurance", *Journal of Cleaner Production*, Vol. 129, pp. 724-734.

Chithambo, L. and Tauringana, V. (2014), "Company specific determinants of greenhouse gases disclosures", *Journal of Applied Accounting Research*, Vol. 15 No. 3, pp. 323-338.

Cho, C.H. and Patten, D.M. (2007), "The role of environmental disclosures as tools of legitimacy: a research note", *Accounting, Organizations and Society*, Vol. 32 Nos 7/8, pp. 639-647.

Cho, C.H., Michelon, G., Patten, D.M. and Roberts, R.W. (2014), "CSR report assurance in the USA: an empirical investigation of determinants and effects", *Sustainability Accounting, Management and Policy Journal*, Vol. 5 No. 2, pp. 130-148.

Choi, B.B., Lee, D. and Psaros, J. (2013), "An analysis of Australian company carbon emission disclosures", *Pacific Accounting Review*, Vol. 25 No. 1, pp. 58-79.

Clarkson, P.M., Li, Y., Richardson, G.D. and Vasvari, F.P. (2008), "Revisiting the relation between environmental performance and environmental disclosure: an empirical analysis", *Accounting, Organizations and Society*, Vol. 33 Nos 4/5, pp. 303-327.

Clarkson, P.M., Li, Y., Richardson, G.D. and Vasvari, F.P. (2011), "Does it really pay to be green? Determinants and consequences of proactive environmental strategies", *Journal of Accounting and Public Policy*, Vol. 30 No. 2, pp. 122-144.

Cotter, J. and Najah, M.M. (2011), "Institutional investor influence on global climate change disclosure practices", *Australian Journal of Management*, Vol. 37 No. 2, pp. 169-187.

De Villiers, C. and Van Staden, C. (2006), "Can less environmental disclosure have a legitimizing effect? Evidence from Africa", *Accounting, Organizations and Society*, Vol. 31 No. 8, pp. 763-781.

Deegan, C. (2002), "Introduction: the legitimizing effect of social and environmental disclosures - a theoretical foundation", *Accounting, Auditing and Accountability Journal*, Vol. 15 No. 3, pp. 282-311.

Dhaliwal, D., Li, Z., Tsang, A. and Yang, G. (2011), "Voluntary non-financial disclosure and the cost of equity capital: the case of corporate social responsibility reporting", *The Accounting Review*, Vol. 86 No. 1, pp. 59-100.

Dutta, P. (2020), "Determinants of voluntary sustainability assurance: the importance of corporate environmental performance", *Social Responsibility Journal*, Vol. 16 No. 8, pp. 1403-1414.

Dutta, P. and Dutta, A. (2021), "Impact of external assurance on corporate climate change disclosures: new evidence from Finland", *Journal of Applied Accounting Research*, Vol. 22 No. 2, pp. 252-285.

Freedman, M. and Patten, D.M. (2004), "Evidence on the pernicious effect of financial report environmental disclosure", *Accounting Forum*, Vol. 28 No. 1, pp. 27-41.

Gaia, S. and Jones, M.J. (2017), "UK local councils reporting of biodiversity values: a stakeholder perspective", *Accounting, Auditing and Accountability Journal*, Vol. 30 No. 7, pp. 1614-1638.

Gaia, S. and Jones, M. (2020), "Biodiversity reporting for governmental organisations: evidence from English local councils", *Accounting, Auditing and Accountability Journal*, Vol. 33 No. 1, pp. 1-31.

Giannarakis, G., Zafeiriou, E. and Sariannidis, N. (2017), "The impact of carbon performance on climate change disclosure", *Business Strategy and the Environment*, Vol. 26 No. 8, pp. 1078-1094.

Giannarakis, G., Zafeiriou, E., Arabatzis, G. and Partalidou, X. (2018), "Determinants of corporate climate change disclosure for European firms", *Corporate Social Responsibility and Environmental Management*, Vol. 25 No. 3, pp. 281-294.

Gillet-Monjarret, C. (2015), "Assurance of sustainability information: a study of media pressure", *Accounting in Europe*, Vol. 12 No. 1, pp. 87-105.

Gonzalez-Gonzalez, J.M. and Ramırez, C.Z. (2016), "Voluntary carbon disclosure by Spanish companies: an empirical analysis", *International Journal of Climate Change Strategies and Management*, Vol. 8 No. 1, pp. 57-79.

Gray, R., Kouhy, R. and Lavers, S. (1995), "Corporate social and environmental reporting: a review of the literature and a longitudinal study of UK disclosure", *Accounting, Auditing and Accountability Journal*, Vol. 8 No. 2, pp. 47-77.

GRI (2007), *Biodiversity – A GRI Reporting Resource*, GRI, Amsterdam.

Gujarati, D.N. (1995), *Basic Econometrics*, McGraw-Hill, New York, NY.

Haque, F. and Jones, M.J. (2020), "European firms' corporate biodiversity disclosures and board gender diversity from 2002 to 2016", *The British Accounting Review*, Vol. 52 No. 2, 100893.

Hassan, A.M., Roberts, L. and Atkins, J. (2020), "Exploring factors relating to extinction disclosures: what motivates companies to report on biodiversity and species protection?", *Business Strategy and the Environment*, Vol. 29 No. 3, pp. 1419-1436.

Hoffmann, V.H. and Busch, T. (2008), "Corporate carbon performance indicators: carbon intensity, dependency, exposure, and risk", *Journal of Industrial Ecology*, Vol. 12 No. 4, pp. 505-520.

Jaggi, B., Allini, A., Macchioni, R. and Zagaria, C. (2018), "The factors motivating voluntary disclosure of carbon information: evidence based on Italian listed companies", *Organization and Environment*, Vol. 31 No. 2, pp. 178-202.

Jones, M.J. (1996), "Accounting for biodiversity: a pilot study", *The British Accounting Review*, Vol. 28 No. 4, pp. 281-303.

Jones, M.J. (2003), "Accounting for biodiversity: operationalising environmental accounting", *Accounting, Auditing and Accountability Journal*, Vol. 16 No. 5, pp. 762-789.

Jones, M.J. and Solomon, J.F. (2013), "Problematising accounting for biodiversity", *Accounting, Auditing and Accountability Journal*, Vol. 26 No. 5, pp. 668-687.

Kılıç, M. and Kuzey, C. (2019), "The effect of corporate governance on carbon emission disclosures: evidence from Turkey", *International Journal of Climate Change Strategies and Management*, Vol. 11 No. 1, pp. 35-53.

Konar, S. and Cohen, M.A. (2001), "Does the market value environmental performance?", *The Review of Economics and Statistics*, Vol. 83 No. 2, pp. 2814-2890.

Luo, L. (2019), "The influence of institutional contexts on the relationship between voluntary carbon disclosure and carbon emission performance", *Accounting and Finance*, Vol. 59 No. 2, pp. 1235-1264.

Luo, L. and Tang, Q. (2014), "Does voluntary carbon disclosure reflect underlying carbon performance?", *Journal of Contemporary Accounting and Economics*, Vol. 10 No. 3, pp. 191-205.

Mohammed, J. (2019), "The role of genetic diversity to enhance ecosystem service", *American Journal of Biological and Environmental Statistics*, Vol. 5 No. 3, pp. 46-51.

Moroney, R., Windsor, C. and Aw, Y.T. (2012), "Evidence of assurance enhancing the quality of voluntary environmental disclosures: an empirical analysis", *Accounting and Finance*, Vol. 52 No. 3, pp. 903-939.

Niskala, M. and Pretes, M. (1995), "Environmental reporting in Finland: a note on the use of financial reports", *Accounting, Organizations and Society*, Vol. 20 No. 6, pp. 457-466.

Patten, D.M. (2002), "The relation between environmental performance and environmental disclosure: a research note", *Accounting, Organizations and Society*, Vol. 27 No. 8, pp. 763-773.

Potdar, A., Gautam, R., Singh, A., Unnikrishnan, S. and Naik, N. (2016), "Business reporting on biodiversity and enhancement of conservation initiatives", *International Journal of Biodiversity Science*, Ecosystem Services and Management, Vol. 12 No. 3, pp. 227-236.

Rimmel, G. and Jonäll, K. (2013), "Biodiversity reporting in Sweden: corporate disclosure and preparers' views", *Accounting, Auditing and Accountability Journal*, Vol. 26 No. 5, pp. 746-778.

Schneider, A., Samkin, G. and Davey, H. (2014), "Biodiversity reporting by New Zealand local authorities: the current state of play", *Sustainability Accounting, Management and Policy Journal*, Vol. 5 No. 4, pp. 425-456.

Van Liempd, D. and Busch, J. (2013), "Biodiversity reporting in Denmark", *Accounting, Auditing and Accountability Journal*, Vol. 26 No. 5, pp. 833-872.

Willison, J.H.M. and Côte, R.P. (2009), "Counting biodiversity waste in industrial eco-efficiency: fisheries case study", *Journal of Cleaner Production*, Vol. 17 No. 3, pp. 348-353.

Yunus, S., Elijido-Ten, E. and Abhayawansa, S. (2016), "Determinants of carbon management strategy adoption: evidence from Australia's top 200 publicly listed firms", *Managerial Auditing Journal*, Vol. 31 No. 2, pp. 156-179.

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