Carbon Disclosure, Performance and the Green Reputation of Higher Educational Institutions in the UK

Abstract

Purpose – This study investigated the carbon emission disclosures (CED) and performance of UK Higher Educational Institutions (HEIs) and the associated impact on their environmental reputation. The paper argues that HEIs possess distinct characteristics that make comparisons with profit-oriented companies problematic and misleading.

Design/methodology/approach – The green score published by the People & Planet organisation provided the population for this analysis. All universities with a score were entered into the initial sample. The association between green reputation, CED and carbon performance was examined using a robust least squared regression model.

Findings – CED, carbon emissions and carbon audit were found to have highly significant determinant relationships with HEIs' green reputation status at a 1% significance level while the presence of standalone sustainability reporting was found to have a very weak significance in determining an HEI's environmental reputation.

Research limitations/implications – The study investigated the impact of CED and other indicators of carbon performance by HEIs on their green reputation. The impact of CED and other carbon performance measures needs to have a clear relationship with reputation in order to motivate HEIs to act and disclose.

Originality/value - The study is distinct in investigating the impact of CED and carbon performance by UK HEIs on their environmental reputation. The study shows whether, and how, the HEI CED and carbon performances contribute towards the environmental reputation of these institutions. HEIs have distinct characteristics from profit-seeking organisations and thus tailored research is required.

Keywords: Carbon emissions disclosure; higher education institutions; environmental reputation; green ranking; signalling theory

Paper type: Research paper

1 INTRODUCTION

Over the last couple of decades there has been growing acceptance in the extant academic literature that green reputation is an important component of competitive advantage; for-profit organisations that act in an environmentally responsible manner and have a history of fulfilling societal obligations are rewarded with enhanced green reputational advantage, which is a subset of overall corporate reputation (Fonseca et al., 2011). Enhanced reputation in turn leads to the creation of a better image which ultimately results in increased organisational value (Toms, 2002). To date, research has concluded that the presence of carbon emission disclosures (CED), supported by reductions in actual emission performance, has the capacity to create a positive environmental image and result in greater carbon responsiveness in adopting organisations, thereby enhancing corporate green reputation (Bebbington et al., 2008; Hasseldine et al., 2005; Toms, 2002).

However, the academic spotlight enjoyed by the for-profit sector with regard to the ultimate reputational impact of carbon emission disclosures (CED) has been largely absent in the non-profit world (Larrán et al., 2018). This study attempts to bridge that gap and make a novel contribution to the extant literature by focusing on a subset of non-profit organisations, namely UK higher education institutions (HEI). This study investigates how CED and associated carbon reduction might promote HEIs' green reputation and ultimately argues that HEIs can signal their carbon initiatives through CED to their myriad stakeholders. Given the absence of a regulatory imperative to discuss CED matters, the link to enhanced reputation is of paramount importance in order to motivate HEIs to act and disclose. Keeping in mind the specific characteristics that define the HEI sector (Alonso-Almeida et al., 2015; Ceulemans et al., 2015), this study demonstrates that such disclosures contribute towards the environmental reputation of the institution. Universities are social organisations that are not profit-seeking and

largely depend on government funding in several forms. The public accountability perspective suggests that managers are inherently trustworthy, with a greater commitment towards public accountability and transparency, and thus are more likely to engage in voluntary disclosure (Ntim et al., 2017). Drawing on the seminal work of Toms (2002) and Hasseldine et al. (2005) that explored the impact of corporate environmental disclosure on environmental reputation in profit-seeking organisations, this study is distinct in extending the prior literature by focusing on HEIs.

Consideration of reputation is often at the forefront of stakeholder decision-making. Within the corporate sphere, this is manifested in terms of investment decisions, career decisions and product choices. Enhanced reputation provides signals to stakeholders regarding relative organisational effectiveness compared with competing firms (Fomburn and Shanley, 1990; Riahi-Belkaoui, 1999). Therefore, a favourable reputation can result in a number of benefits, including: (i) the generation of excess returns by inhibiting the mobility of rivals in an industry (Caves and Porter, 1977); (ii) the possibility of charging premium prices to consumers (Klein and Leffler, 1981); and (iii) a positive effect on the market value of firms through the creation of a better image in the capital markets, resulting in investors who are more willing to trust their capital with firms that enjoy superior reputations due to lower perceived risks and enhanced financial performances (Miles and Covin, 2000).

The relationship between voluntary carbon disclosures and organisational green reputation is rapidly attracting interest among business leaders, academics and researchers (Sullivan and Gouldson, 2012). CED is voluntary, which means managers can choose the nature of their discussion. Therefore, it is up to them to decide what message they wish to impart and how best they can communicate this to the outside world (Sassen and Azizi, 2018). The ultimate

choice of message and dissemination mechanism sends signals to stakeholders and other readers about their carbon activities, which in turn is likely to influence their green reputation. The climate change and carbon disclosures typically reflect public awareness, respond to regulatory pressure, and accommodate social concern, and are therefore designed to protect institutional reputations (Bui and Fowler, 2017). While corporate social responsibility (CSR) gives an opportunity to contribute towards the well-being of the society (Schoormann et al., 2017), it also offers organisations a conscious mechanism by which they can enhance their reputation (Dahan and Senol, 2012; Ballou et al., 2006; Gray, 2006; Porter and Kramer, 2006; Smith, 2007; Woods, 2003). Indeed, Toms (2002) suggested that carbon implementation, auditing and subsequent disclosure in annual reports can form part of this by contributing to an organisation's environmental reputation. Further, Brown, Guidry and Patten (2010) added that enhanced corporate reputation can lead to substantial institutional benefit.

In the absence of an overt profit motive, documenting the tangible benefits of an environmental reputation in the non-profit sector can be more problematic. In response to recent calls for further research into HEIs' sustainability activities (Adams, 2013), this study focuses on the CED practices of UK HEIs. HEIs are well suited to becoming leaders in environmental protection, due to their influence on society based on their research, teaching, impact and policy development activities (Dahle and Neumayer, 2001). HEIs may expect to benefit from CED practices in several ways. First, the *greening* of campuses has a positive impact on the reputation and image of universities. As a result, compared with their counterparts, *greener* universities are more likely to attract a higher calibre of staff and students (De Villiers et al., 2014). Second, the integration of sustainability dimensions into university programmes further promulgates an image of an environmentally friendly university, which enhances their competitive advantage (Filho, 2011). Third, as with all environmental reporting, "information inductance…(whereby) enforced substantive disclosure is highly likely to change behaviour"

may exist (Gray, 2006, p. 78). Thus, it can be argued that HEIs can help to address their social and environmental obligations by engaging in CED (Larrán et al., 2018, 2016).

The primary objective of this study is to explore the impact of CED on HEI reputation. The focus on HEIs, although not unique, is still relatively novel in studies of this nature. The study examines the impact on reputation with reference to both volume and quality measures of CED. The key research question can be summarised as follows:

> What impact does CED and carbon performance have on HEIs' green reputation? How does this reputational impact differ with respect to the volume and quality of CED?

The remainder of the study is organised as follows. Section 2 presents an overview of the extant literature, followed by a description of the theoretical framework underpinning the analysis and hypothesis development described in section 3. The research methods used for the research are explained in section 4. Section 5 presents the results and relevant analyses. Finally, section 6 concludes with the importance of the research and scope for further research.

2 LITERATURE REVIEW

As noted earlier, the extant literature is replete with studies that have investigated the dynamics of voluntary social and/or environmental disclosure and its impact on corporate reputation. In particular, Hasseldine et al., (2005) and Toms (2002) explored the impact of corporate social and environmental disclosure on organisational reputation in profit-oriented companies. Toms (2002) used signalling theory to explore the impact of CED on the creation of environmental reputation. It made use of Management Today's survey of Britain's Most Admired Companies (MAC) as a proxy for environmental reputation while measures for disclosure quality distinguished between non-quantifiable, easily imitable, low quality disclosures and

quantifiable, verifiable high quality disclosures. Overall, the study reported a positive relationship between environmental disclosure and environmental reputation. Again using UK data, Hasseldine et al. (2005) built on this work by examining the impact of CED on firm value and found that the quality of disclosure had a greater impact on reputation than the volume of disclosures. Meanwhile, Brammer and Pavelin (2006) explored the relationship between corporate reputation and social performance for a sample of UK companies focusing on three social performance issues: employment, environment, and community issues. Overall, their results confirmed that social performance enhances corporate reputation. However, they noted variation across sectors and social performance categories, with greater potential for positive impact for firms engaged in environmental activities.

Explorations of the relationship between CSR, environmental reputation and corporate financial performance have a long pedigree in the extant accounting literature (Gray, 2006). For example, employing a three dimensional model for their exploration of US firms, Ullman (1985) documented a correlation between social performance, social disclosure and economic performance as determined by overall management strategy. In another US study, Herremans et al. (1993) found a significant positive relationship between CSR reputation and financial performance. Meanwhile, Van Staden and Hooks (2007) identified a positive relationship between environmental reporting by corporations and environmental responsiveness as measured by independent rankings in New Zealand.

Al-Tuwaijri et al. (2004) investigated the interrelationship between economic performance, social performance and social disclosure using a US sample[1]. A positive significant relationship was found between environmental performance and environmental disclosure using the three-

[1] This research used a sample of 198 firms and employed an OLS regression to test the three dimensional association. Environmental disclosure was identified using quantitative disclosure of pollution information. Environmental performance was measured using a non-financial ratio based on the relative quantity of hazardous waste. Finally, economic performance was measured using a market-based measure, namely annual stock return.

dimensional research design. The study also found a significant positive relation between economic performance and environmental performance. They demonstrated that good environmental performance was significantly associated with good economic performance and also with environmental disclosure. Thus, environmental reputation is more likely to be determined by independent and separable aspects of managerial strategy that should provide a potential theoretical solution to modelling problems. Using a sample of 3,141 Fortune firms over a 15 year period (1984-1998), Roberts and Dowling (2002) reported that firms with relatively good reputations were better able to sustain superior performance outcomes over time; the study argued that corporate reputation became an intangible factor which competitors found difficult to replicate, thereby sustaining competitive advantage and aiding value creation. Cho et al. (2012) investigated the extent to which firms' environmental performances were reflected in perceptions of their environmental reputation. They used a cross-sectional sample of 92 US firms from environmentally sensitive industries and found that environmental performance was negatively related to reputation scores and that environmental disclosure served to mediate the negative aspects of poorer environmental performance associated with those assessments. Bebbington et al. (2008) investigated the interplay between corporate social responsibility reporting and organisational reputation risk management processes and concluded that CSR could be viewed as both an outcome of, and part of, reputation risk management processes. According to their study, the concept of reputation risk management could assist in the understanding of corporate social responsibility reporting practice.

However, as noted in the introduction, the interplay between disclosure, performance and reputation is still in its infancy within the university sector (Fonseca et al., 2011; Ntim et al., 2017). A number of studies have (to varying degrees) attempted to address some of the key

issues in various global contexts[2]. For example, Canadian voluntary sustainability reporting practices were the subject of scrutiny by Sassen and Azizi (2017)[3], while US counterparts were examined in a related study by the same research team in 2018 (Sassen and Azizi, 2018). Meanwhile, Lozano and colleagues (Ceulemans et al., 2015; Lozano, 2006, 2011; Lozano et al., 2016) published a series of papers that explored the use of sustainability reporting in varying contexts, including Lozano (2011), who concluded that this reporting was lacking, both in terms of volume and the number of institutions providing it. Similar conclusions were reached by Alonso-Almeida et al., (2015). Using a case study approach, An, Davey and Harun (2017) examined sustainability reporting practices at a New Zealand public university, while Dagilienė and Mykolaitienė (2015) and Gamage and Sciulli (2017) investigated and reflected on practices in Lithuanian and Australian institutions respectively. Meanwhile, Larrán et al. (2018) noted that dependence on funding, size, institutionalisation, and region were all important determinants of sustainability reporting.

3 THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

In the extant literature, signalling theory is considered a useful tool in explaining voluntary disclosure (Toms, 2002, p. 258). Signalling theory was introduced by Spence (1973) based on Akerlof's seminal work in 1970. This theory recognises the information asymmetry existing between insiders and wider stakeholders and argues that signalling behaviours can reduce this information gap (Morris, 1987). This theory postulates that management can signal information

[2] A related strand of the literature examined performance exploring the level of integration of sustainable practices into university operations. For example, Larrán et al., (2016) surveyed Spanish universities to ascertain the level of commitment to sustainability matters in these institutions and called for greater integration of these considerations and activities into everyday activities. Other studies were more specialised, including, for example, De Villiers et al. (2014), which focused on an initiative around the preservation of trees in a single university campus. Although these studies are helpful in contextualising the recent debate, their focus differs from that explored here.

[3] In an earlier work, Fonseca et al., (2011) also explored practices at 12 Canadian universities.

in response to stakeholder pressure by means of voluntary disclosures aimed at reducing information asymmetry. Thus, voluntary disclosures can be used to distinguish one organisation from another.

The literature offers a number of perspectives on the nature of the signal transmitted via accounting disclosures (Toms, 2002; Watts and Zimmerman, 1978). For example, Ross (1977) posits that organisations with good news to share are more likely to signal this and employ techniques aimed at ensuring a maximum payoff for the signalling organisation. However, Grossman (1981) and Skinner (1994) debated the costs of non-disclosure, concluding that the disclosure of bad news can help mitigate against any reputational costs levied due to non-disclosure. Thus, there is a motivation for organisations to publish both good and bad news.

As a result, signalling theory has become very helpful in explaining voluntary disclosure and its impact on organisational reputation-building activities (Toms, 2002). It thus provides an excellent lens for exploring CED in HEIs. The remainder of this section will focus on detailing the hypotheses explored in this research, distinguishing in turn between carbon disclosures and performance and their hypothesised relationship with environmental reputation.

3.1 Carbon Disclosures and Green Reputation

The hypothesis Ha draws on the research of Hasseldine et al. (2005) and Toms (2002) who argued that voluntary disclosures are often used to provide positive signals. They suggested that organisational reputation could be managed through the disclosure process, as well as through other means. The disclosure process could be facilitated via various media, however, the annual report, being the most formal media directed towards stakeholders, is likely to be the most common form used to transmit this disclosure (McWilliams and Siegel, 2001). In addition, Ntim et al. (2017) and Tang (2018) suggested that carbon disclosures build positive HEI transparency and reputation. As annual reports are the primary mechanisms for CED

(Gray, Kouhy and Lavers, 1995), a higher volume of CED in annual reports is expected to result in a higher green reputation in society.

Ha: Carbon emission disclosure by HEIs is positively related to HEIs' green reputation

Disclosures made into standalone reports are likely to further enhance organisational transparency and therefore acceptance by wider society (Yekini and Jallow, 2012). Drawing on this argument, the production of standalone sustainability reports further enhance the status of the message communicated by organisations (Thorne et al., 2014); HEIs can effectively use expanded standalone reporting to further signal their carbon sensitivity to society and to enhance their environmentally friendly image (Ntim et al., 2017). This in turn should influence their green reputation positively.

Hb: Standalone sustainability reporting has a positive relationship with HEIs' green reputation

3.2 Carbon Performance and Green Reputation

The literature suggests that carbon performances further influence organisational reputation (Brammer and Pavelin, 2006). Reporting on carbon emission reductions is an established means of showcasing organisations' carbon credentials (Ingram and Frazier, 1980). A reduction in carbon emissions indicates a better carbon performance, which in turn is likely to result in an enhanced green reputation (Datt et al., 2019). Low carbon emitters are likely to enjoy a higher environmental reputation in society (Richardson and Kachler, 2016). This is supported by the empirical studies noted previously that document that enhancement of environmental performance contributes to greater environmental reputation (Toms, 2002).

Hc: Volume of reported carbon emissions has a negative relationship with HEIs' green reputation

The literature argues that the presence of carbon audit and assurance is likely to enhance organisational transparency and accountability (Datt et al., 2019). Further, Toms (2002) pointed to the role played by environmental auditing in contributing to the environmental reputation of organisations. He also argued that the credibility of CED could be ensured by organisations undertaking a voluntary audit of environmental activities; this could provide a positive signal to readers about the credibility of claims made in the CED. The value and credibility of carbon reporting is expected to increase with the presence of carbon audits, if they are properly conducted (Larrán et al., 2018). Environmental audits are largely voluntary (Bui and Fowler, 2017). Thus, the presence of a high quality audit should induce better carbon performance (Richardson and Kachler, 2016), leading to an enhanced green reputation.

Hd: Carbon audit quality has a positive relationship with HEIs' green reputation

Successive government strategies are postulated on the premise that investment in carbon reduction strategies manifests in better carbon performance (Adams et al., 2020; Bui and Fowler, 2017). In addition, the literature argues that investment in carbon reduction is likely to influence the carbon sensitivity in the company (Prado-Lorenzo et al., 2009). Although investments for carbon reduction are difficult to quantify, nonetheless, any investment in carbon reduction by universities is expected to be related to actual carbon reduction (Hassan et al., 2019; Saha et al., 2019). Thus, higher investment aimed at reducing and controlling carbon facilitates enhanced signalling of carbon sensitivity (Richardson and Kachler, 2016), which in turn builds reputation. Thus, greater carbon investment is likely to result in an enhanced green reputation.

He: Investment in carbon management has a positive relationship with HEIs' green reputation

Figure 1 summarises the hypothesised relationship between CED, carbon performance and HEIs' green reputation.

[Insert Figure 1 about here]

4 RESEARCH METHODOLOGY

This section presents an overview of the methodology adopted in the study. It contains details pertaining to sample selection, the measurement of variables, data analysis, and model specification.

4.1 Sample Selection

The initial sample chosen for this study included all 152 HEIs ranked and scored by the organisation People & Planet on their website[4] for the Green League 2013. This organisation produces the sole comprehensive and independent league table of UK HEIs based on their environmental performance. The most recent (2012) annual reports available at the time of the study were obtained; this enabled the researchers to assess the impact of CED on the following year's green reputation. The year lag was incorporated on the assumption that the impact of the CED was unlikely to affect the Green League score until the following year. The annual reports of 144 HEIs were

[4]https://peopleandplanet.org/green-league-2013/tables

downloaded from their websites or obtained directly from the HEIs[5]. Where available, data relating to the other variables such as carbon targets, carbon emissions, carbon audit, carbon investment, size and age were collated from Higher Education Funding Council of England (HEFCE) publications, HEI websites, the People & Planet organisation website and the Higher Education Statistics Agency (HESA). This process led to a final sample of 135.

4.2 Dependent Variable Definition and Measurement

4.2.1 Green Reputation

The variable of interest, i.e. dependent variable, for this study is the environmental or green reputation of HEIs, as ranked in the University Green League. UK universities receiving public authority funding and legally registered as a 'Higher Education Institution' are eligible for inclusion. The league table and scores are assessed with a maximum possible score of 100. The score is made up in part (37.5%) by analysing the Estates Management Statistics from HESA. The remaining 62.5% of questions are asked via the survey, which is issued as a freedom of information or environmental information request. People & Planet asks universities to support their survey with evidence allowing the answers to be checked and audited. The full methodology has been published on People & Planet's website. Universities are asked questions covering 13 sustainability topics, including carbon reduction, student and staff engagement, sustainable food, workers' rights, ethical investment and education for sustainability. Thus, universities receive a score out of 100 and are ranked in the Green League on the basis of their total scores (People & Planet, 2013).

[5] Annual reports are publicly available and produced regularly, management implement editorial control over them, formats are comparable with peer HEI annual reports (Al-Shaer et al., 2017; Saha, 2019; Saha and Akter, 2013; Schleicher and Walker, 2010) and thus provide a good source of disclosure and financial data.

4.3 Independent variables

4.3.1 Carbon Emission Disclosures

This research identifies the carbon disclosures (CED) with reference to the content as stated in the annual reports (Larrán et al., 2018). Taking account of the content of the disclosures made allows for the derivation of a quantitative scale for statistical analysis (Gray et al., 1995; Guthrie and Abeysekera, 2006; Hassan et al., 2019; Weber, 1988). In line with the arguments put forward by the disclosure literature, the annual report is considered the most reliable source for corporate environmental information; these reports are viewed as the most important channel used for the communication of organisational information to the public (Gray et al., 1995; Adams et al., 1998). As was largely the case here, downloading annual reports from an organisation's website also situates them in their original context and relevant information can be verified from the same website as necessary (Crowther, 2000; Guthrie and Abeysekera, 2006).

The quantity of disclosures was measured using sentence counts (Hackston and Milne, 1996; Ingram and Frazier, 1980; Saha et al., 2019). Sentences have some advantages over words, phrases and pages (Milne and Adler, 1999) – they are easily identifiable and involve less subjectivity in identification – and they have been supported by previous research (Ingram and Frazier, 1980). This ensures reliability in the coding process (Hackston and Milne, 1996; Walden and Schwartz, 1997). The research instrument in Appendix A was used to tabulate the volume of CED (Saha et al., 2019, pp. 421-422).

This study acknowledges the complex and "multi-faceted" (Beattie et al., 2004, p. 227) nature of quality measurement. Beattie points to key attributes of disclosure quality that aid in reducing any subjectivity associated with the technique; of particular relevance to this study are the distinctions between historical/forward-looking, financial/non-financial and

quantitative/non-quantitative disclosures. Therefore, the quality of CED is defined in this study in terms of specific mentions of CED activities and the evidence provided. The instrument in Appendix B, based on prior literature (Saha et al., 2019), was used to record the data on carbon reduction activities as well as the nature and type of disclosure supported by evidence. Most standard content analysis tools used in the extant literature only measure the quality (Freedman and Stagliano, 2008; Rankin et al., 2011; Yekini and Jallow, 2012) or the volume (Gray et al., 1995; Hackston and Milne, 1996) of disclosure. The research instrument used here strives to assess both the quality and volume of carbon disclosures.

4.3.2 Other Explanatory Variables

Where standalone environmental reports are available on the university website these are included in the analysis; these reports can bear different names but should focus on carbon sustainability in order to be included in this research. Moreover, universities produce an additional document named 'Carbon Management Plan' in response to the HEFCE's carbon reduction requirements; these plans are also considered in the research as standalone reports (where available) from individual HEI websites. For the purpose of scoring the disclosures in independent reports the same instrument developed for scoring the quality of CED in annual reports in Appendix B was used (Saha et al., 2019). Carbon emissions (kgCO2) volume data were also included.

HEIs are expected to have a carbon audit in place to facilitate control over carbon emission reductions (Larrán et al., 2018). Universities were scored on whether (i) an audit of their environmental performance was undertaken in the last five years across a range of factors (including biodiversity, construction and refurbishment, emissions and discharges, energy, sustainable procurement, transport, waste and water); and whether (ii) an externally audited

environmental management system was in place (e.g. ISO14001, EMAS, Ecocampus, Green Dragon, IEMA Acorn Scheme [BS8885]).

The monetary value reported to the Higher Education Statistics Agency (HESA) for the facility spending investment made by each of the HEIs was used as the proxy for carbon investment (Saha et al., 2019). These data show how much the universities spent on supporting all expenditure incurred (whether centrally or departmentally) on the management of premises (including academic buildings, central academic services, art centres, HE providers' health service premises, pavilions, sports buildings, etc.) and on roads and grounds, excluding residences and catering. This also includes repairs and maintenance expenditure, the maintenance of premises including the pay of staff involved, as well as maintenance provision charges.

4.3.3 Control Variables

Size has long been viewed as a key variable in explaining organisations' voluntary disclosures (Hassan et al., 2019; Larrán et al., 2018). HEI size was measured by the natural logarithm of total number of staff and students. This information was collected from HEFCE. The age of each HEI (in terms of completed years since its establishment) was collected from consulting individual HEI websites.

4.4 Model Specification

The following econometric models were used to investigate the impact of CED volume and quality in annual reports on the HEI environmental reputation.

$$\text{Reputation}_i = \beta_0 + \beta_1 \text{CED}_i + \beta_2 \text{Standalone}_i + \beta_3 \text{Emission}_i + \beta_4 \text{Audit}_i + \beta_5 \text{Investment}_i + \beta_6 \text{Controls}_i + \varepsilon_i \quad \ldots \quad \text{(i)}$$

where

β_0 is Intercept

β_1 to β_6 is	Coefficient of slope parameters
E is	Error term

Variables	Definition	Source
Dependent variable:		
Reputation	Green score achieved by individual HEIs in the People & Planet ranking	People & Planet website
Explanatory variables:		
CED	Carbon emission disclosure; CED volume (CEDV) is measured by content analysis of 2012 annual reports of sample HEIs. CED quality (CEDQ) - score ranges from 0 = no disclosure to 5 = high disclosure.	Content analysis of annual reports
Standalone	Standalone environmental reporting available on the website ranges from 0, if no disclosure, to 5, if high disclosure.	HEI websites
Emission	Carbon emissions (kgCO2) in the year 2012, which is the latest year for which data were available at the time of data collection.	HEFCE publication
Audit	Points received by the university for any carbon audit system in place, scored out of 8	People & Planet website
Investment	Facility spending of HEIs in 2011/12.	HESA website
Control variables:		
Size	HEI size measured by the natural logarithm of total number of Staff and Students.	HEFCE publication
Age	Age of the HEI in terms of completed years since its establishment.	HEI websites

5 EMPIRICAL RESULTS AND DISCUSSION

This section reports the results of the econometric analyses conducted as part of the study. It commences with a presentation of the descriptive statistics, followed by the inferential statistics designed to support or reject the hypotheses. Finally, a sensitivity analysis is provided to test the robustness of the investigation.

5.1 Descriptive Statistics

Table 1 reports the descriptive information (mean, median, standard deviation, maximum and minimum, skewness and kurtosis) for the dependent variable (green reputation score) and independent variables used in this study. Since CED volume, carbon target, carbon performance and age fall outside the expected range (Haniffa and Cooke, 2005), an additional test was done using the Shapiro-Wilk test statistic for checking normality of the distributions[6].

[Insert Table 1 here]

Respectively, the mean (median) green reputation score of HEIs reported here was 35.94 (35)[7], green reputation rank was 70.97 (70) and green reputation class was 2.48 (2). In terms of the CED, the mean (median) volume of disclosure was 2.78 (1.88) and that of CED quality was 3.07 (3). Standalone sustainability report, carbon target, emission, audit, and investment have means (medians) of 4.22 (5), 35.86 (38.5), 15.4 million (9.6 million), 4.32 (4), and 360.74 (343.5) respectively; the use of these variables represents a contribution to the extant literature as does the use of the People & Planet green ranking dataset as a dependent variable.

[Insert Table 2 here]

The distribution chart provided in Table 2 summarises the findings of the content analysis for the categorical variables representing CED quality and independent sustainability reporting of UK HEIs. Panel A presents the extent of CED quality in annual reports by UK HEIs. For the purpose of measuring the disclosure quality, this study used a CED index (see Appendix B) (Saha et al., 2019), which distinguished five levels of CED patterns. Panel A shows that 28

[6] The results of this additional testing are available from the authors on request.

[7] This is much higher than that reported by Hasseldine et al. (2005) and Toms (2002) in their studies of corporate entities which were all around 5. This variation can be explained by the fact that these studies focused on profit-oriented companies in the UK and, more importantly, that the index and bases they employed varied enormously from those used here.

HEIs in the sample did not engage in any CED in their annual reports, i.e. about 20% of sampled UK HEIs did not mention carbon emissions in their 2012 annual reports. Further, 34 HEIs disclosed a minimal amount of carbon emissions related information. This disclosure was narrative in nature and lacked specificity in terms of details on carbon reduction endeavours and targets. These HEIs limited their disclosures to largely imitable narratives, e.g. carbon policies, aims, goals. Fourteen HEIs in the sample disclosed a moderate volume of information, making use of targets, implementation and monitoring or results data to support their narrative disclosures on carbon reduction initiatives in their annual reports. Thirty-five universities disclosed more than average (but less than highest group); typical disclosures in this subset focused on the implementation and monitoring of carbon reduction activities as well as highlighting any favourable outcomes in terms of controlling carbon emissions. These universities also point to the achievement of kite marks or other external accreditation of their carbon initiatives. Thirty-three (23%) HEIs produced the highest level of CED; these institutions typically provided comparative data that could be helpful to those interested in relative performance, in addition to that provided by the other groups.

Panel B of Table 2 presents a summary of the extent of carbon disclosures made in standalone sustainability reports by the UK HEIs. Again, the CED index presented in Appendix B has been used to measure the extent of CED in these documents. Perhaps unsurprisingly, most HEIs' reports devote a great deal of space to discussion of CED matters in their sustainability reports. Indeed, 119 (71%) of those sampled disclosed the implementation, monitoring or results of their carbon activities; they supplemented this information with year-on-year comparisons and quantitative data and evidence. At the other end of the spectrum, 18 (approx. 11%) HEIs did not say anything about carbon emissions in their sustainability reports. Thirteen institutions disclosed a reasonable amount, but less than the highest level on carbon emissions; these organisations typically disclosed details of their carbon reduction activities and any

external validation or accreditation they have. As with the Annual Report disclosures, institutions in the remaining categories provided largely imitable, narrative information, lacking in specificity and evidential value.

5.1.1 Differences between HEIs with High and Low Environmental Reputation

In line with prior similar studies published in the extant disclosure literature, this paper explores the differences in the explanatory variables (Table 3) between institutions with a high green reputation and low green reputation (Reverte, 2009). The sample was split into three groups based on the People & Planet green score to proxy high, medium and low green reputation institutions respectively. Thus, the first group contained 45 HEIs with the highest green scores, the second group had 45 HEIs with moderate green scores and the third group included 45 HEIs with low green scores. Table 3 reports the mean values of the explanatory variables under analysis across various reputation levels. To test the statistical significance of the mean differences in the explanatory variables between top and bottom green scoring HEIs, a paired t-test (where the variable is normally distributed) and a Wilcoxon signed-rank test (where the variable is non-normally distributed) have been performed.

[Insert Table 3 here]

The results of the univariate analysis in Table 3, Panel A show that HEIs with higher green reputation scores make significantly more CED disclosures, devote proportionately more space to CED matters in annual reports, have higher CED quality, have a more efficient environmental audit in place, make a greater level of disclosure in standalone sustainability reports, are larger in size, and are newer when compared with those HEIs with lower green reputation scores. Although the findings also show that the HEIs with higher green reputation

scores emit less carbon and invest less in facilities, these differences are not significant at a 5% level between both groups of HEIs.

Interestingly, though to an insignificant level, HEIs with a greater green reputation were found to invest comparatively less on average on carbon reduction facility spending than other institutions. It is possible the HEIs with a lower green reputation are actually just expending resources in order to maintain their estates, as these organisations also tend to be significantly older than their higher environmentally reputed HEI counterparts. These older buildings and estates are often carbon inefficient and unable to make use of green technological developments, resulting in higher maintenance costs. The newer universities, which in this analysis were found to be more environmentally reputable, have newer and efficient estates in place and thus have relatively lower maintenance costs. These newer estates are also very much more environmentally sensitive and carbon friendly.

The univariate test of mean difference has been repeated with two groups. The two groups were high environmentally reputed and low environmentally reputed HEIs. The first group of high environmentally reputed HEIs hold People & Planet green scores above the median value, whilst the second group of low environmentally reputed HEIs include universities having lower than median green scores in the People & Planet green ranking. Panel B in Table 3 reports the mean values of the explanatory variables under analysis for both HEIs with a score higher than the median and those with a score lower than the median. To test the statistical significance of the mean differences in the explanatory variables between both groups of HEIs, this research performed another paired t-test. Also considering the non-normal distribution of the majority of explanatory variables, a Wilcoxon signed-rank test was done and presented in the same table. It should be noted that the results are generally consistent with earlier measures of univariate

analysis in Panel A, having the one-third top and bottom environmentally reputed HEIs of the total sample.

Table 4 reports both Pearson and Spearman correlation coefficients among the explanatory variables used in this study. Pearson correlation coefficients are presented in the bottom left diagonal segment, while the Spearman Rank correlation coefficients are presented in the upper right diagonal segment. The correlation coefficient values (between -1 and +1) show the degree and direction of correlation.

[Insert Table 4 here]

The correlation coefficients reported in Table 4 do not show any evidence of an unacceptable level of multicollinearity amongst the explanatory variables[8]. However, Table 4 does indicate the presence of some high correlation values between CED quality and volume, which calls for acknowledgment of the issue and further consideration in constructing models to capture individual and joint causal effect. Collinearity statistics for the explanatory variables confirm that both the variance inflation factor (VIF) and tolerance are at an acceptable limit (VIF < 10 and Tolerance > 0.10) indicating that multicollinearity is not an issue in this model (Haniffa and Cooke, 2005).

5.2 Regression Results

5.2.1 Reputation Impact with Disclosure Volume

[8] Although there is no straightforward universal benchmark for correlation coefficients (Alsaeed, 2006), an acceptable rule of thumb from prior literature shows that for checking problems of multicollinearity a correlation > 0.8 (Gujarati, 1995) is unacceptable.

The regression results presented in Table 5 show the impact of carbon emission disclosures and carbon performance on HEI green reputation. Considering the inherent structure of the data which is continuous in nature for the dependent variable – green reputation (score awarded by People & Planet) – the ordinary least square regression[9] method has been used.

All three versions of the models were tested in the study to find evidence of any deterministic relationship amongst CED, carbon performance and HEI green reputation[10]. First, in model 1, only CED in annual reports was entered as an explanatory variable along with the control variables, dropping standalone sustainability reporting and carbon performance. Second, in model 2, CED and standalone sustainability reports were entered as explanatory variables after controlling for other variables, excluding carbon performance from the equation. Finally, in model 3, CED, standalone sustainability reporting and additional carbon performance measures were entered in the model. In all three models, CED was revealed to have a highly significant determinant relationship with HEI green reputation at $p<0.01$. Carbon emission and carbon audit were also found to be highly significant in explaining changes in HEI green reputation in model 3. The presence of standalone sustainability reporting was found to have a very weak significance in determining HEI reputation in both models 2 and 3. R^2 values confirmed that the models were able to explain 28, 31 and 57 per cent of the variance in HEI green reputation

[9] Continuous independent variables are log-transformed and count variables are transformed with the square root. The histogram and interquartile range confirm the absence of any severe outliers and, thus, the normality assumption holds for hypothesis testing. The Shapiro Wilk test also confirms that residuals are normally distributed, as the normality hypothesis could not be rejected based on the p value. Further, the augmented component-plus-residual plots do not show an extreme departure from the linearity assumption and confirm the justification of the linear model. The White test could not reject the homogeneity assumption at the selected alpha level of 5%, suggesting that the data are good for regression analysis. White's heteroskedastic consistent standard errors are used, which are widely used in the literature to compensate for heteroskedasticity. Tests for model misspecification and omitted variables were also done without any issue.

[10] The Durbin-Wu-Hausman test was performed to confirm any suspected endogeneity effect on the predictor current carbon emission (Reverte, 2009). The amount of carbon investment is likely to have an effect on the volume of current carbon emission. The Durbin-Wu-Hausman test confirms the absence of any endogeneity effect.

respectively; these levels are considered satisfactory according to prior literature (Haniffa and Cooke, 2005; Toms, 2002).

[Insert Table 5 here]

5.2.2 Reputation Impact with Disclosure Quality

Table 5 employed a volumetric definition of CED; however, CED volume and quality were found to have a very high positive correlation, indicating that these notions can be used interchangeably to attest to the robustness of CED's impact on green reputation (Hasseldine et al., 2005; Toms, 2002). In a signalling theory context, Beattie et al. (2004) argued that organisations with enhanced disclosure levels typically have more news to divulge, which is in turn an indication of CED quality. The robustness of the model was tested and the results reported in Table 6; this confirms the results found in Table 5 and attests to the highly significant positive impact of CED on green reputation in HEIs as measured by employing the score obtained in the Green League by People & Planet.

[Insert Table 6 here]

Thus, the regression results reported in Tables 5 and 6 present evidence to support the view that CED (Ha), carbon emissions (Hb) and carbon audits (Hd) are highly significant determinant factors for explaining the variation in HEI green reputation. Disclosures are effectively used by organisations to provide signals about their commitment, activities, or results. Therefore, CED can be an effective tool for organisations to signal their commitment regarding carbon sensitivity to readers of their annual reports, which aids in building a positive image for the reporting entities. HEIs, thus, by disclosing CED in annual reports, signal their carbon initiatives in a quest for a positive reputation, which is reflected in the score they receive

for green reputation. Carbon initiatives herein might include details regarding firms' efforts to reduce carbon emissions, involvement of direct and active stakeholders in such activities, and carbon policies, among many others (Ramos et al., 2015). This communication through various media (e.g. the annual report, which is arguably the most formal form of media to communicate with stakeholders) can signal their carbon responsiveness to stakeholders and wider society in an effort to build their environmental reputation (Lozano et al., 2016). Carbon sensitivity is argued to be an important component of social expectation (Huang and Kung, 2010) and disclosing such sensitivity is a response to that expectation (Schaltegger et al., 2013), one which is increasingly demanded by society. HEIs have societal and environmental obligations (Glennie and Lodhia, 2013), which can be discharged by carbon reduction sensitivity and proper disclosure through various public media including annual reports and standalone sustainability reports (Alsaifi et al., 2019; Sassen and Azizi, 2018). With proper disclosure of their sensitivity to stakeholders, HEI leaders are seen as being more responsible stewards and social citizens. Thus, in line with prior literature (Larrán et al., 2016), the hypothesis that green reputation increases with higher CED is confirmed.

Emissions were found to be a significant predictor of reputation, which supports the third hypothesis, suggesting that carbon performance and emissions have a negative impact on environmental reputation. HEIs should consider efforts to reduce carbon emissions as this has become a key social concern at present (Cortese, 2003; Saha et al., 2019). This study presents evidence that there is a highly significant negative relationship between HEI carbon emissions and HEIs' green reputation as poor carbon management transmits a negative signal to society (Datt et al., 2019). This implies that HEIs emitting more carbon are likely to have a lower green or environmental reputation.

In addition, the presence of a carbon audit was shown to have a highly significant positive deterministic relationship with HEI reputation, which confirms the fourth hypothesis. Thus, the existence of an efficient carbon audit system would signal that a reporting organisation had a greater carbon sensitivity, resulting in a higher green reputation (Richardson and Kachler, 2016). HEIs with more effective environmental auditing procedures and environmental management systems can signal more carbon transparency and sensitivity to stakeholders and society, thereby enhancing their reputation (Larrán et al., 2018).

The regression results presented in both Tables 5 and 6 also provide evidence of the existence of a positive deterministic relationship between standalone sustainability reporting and HEI reputation with a low significance at 10%. This partial support of Hb suggests that HEIs influence their environmental reputation only marginally more through their signals in standalone sustainability reports or carbon management plans, potentially because standalone sustainability reports are considered as a supplementary medium of communication after the annual report and are limited in any additional information content.

Perhaps surprisingly, the findings did not support He, regarding any positive influence of carbon management investment on reputation. A possible explanation could be that universities that invest more in their facilities development do not necessarily disclose their commitment in annual reports, at least specifically in terms of carbon reduction commitment. This is interesting because it could serve as a useful tool for them to maintain their legitimacy with fund providers and powerful stakeholders (Bui and Fowler, 2017). However, this could be due to the possible inability of spending on facilities to lead to carbon reduction in practice. Facilities spending can be related to many factors, and carbon reduction is only one of them. In sum, investment in carbon management could not be proved to have any significant deterministic relationship with HEI reputation.

Among the control variables, the results show that environmental reputation varies with respect to the size of the HEIs. This finding is supported by prior related literature (Hassan et al., 2019; Larrán et al., 2018; Saha et al., 2019), suggesting that larger universities might have a stronger commitment to environmental sensitivity and can signal that through appropriate channels to enhance their environmental reputation. University age does not appear to have any significant impact on the environmental reputation of HEIs. As newer universities are often in a better position to have newer and greener technologies and, thus, should be better able to control their carbon emissions, and signal such activities, it was expected that age would be positively linked to green reputation. However, the results do not support this.

5.3 Additional Tests with Different Measures of Reputation

In order to provide additional evidence about the impact of CED on HEI environmental reputation, alternative measures of HEI reputation were employed to check the robustness of the analysis. These measures include 'green class' and 'green ranking'. Both serve the same purpose as the green score and are produced by the same organisation, People & Planet.

Table 7 presents the sensitivity analysis where green class is used as the dependent variable[11]. This allows categorisation of the sample universities using a qualitative scale of 0-4 as a dependent variable instead of the scores given for their green reputation. This qualitative scaling also facilitates coding of the reputational classes. Linear regression would not be able to treat this coding of 0, 1, 2, 3, and 4 properly as linear regression treats the difference between a 3 and a 4 the same as that of a 2 and a 3, whereas they are based on ranking (Smith and

[11] People & Planet award different classes to different universities based on their carbon emission policies and performances. This green classes include – First Class Awards, Upper Second Class Awards, Lower Second Class Awards, Third Class Awards, Failed or no award; those with no award include universities that did not supply any information for ranking.

Taffler, 2000). In this situation, ordered PROBIT is a better alternative to use (Al-Shaer et al., 2017). The ordered PROBIT provides a helpful framework for analysing such scaled responses. The results presented in Table 7 support the main regression results reported in Table 5. CED volume was found to be significant in all three separate models at a 1% significance level. Carbon emissions and carbon audit also emerged as highly significant at a 1% level of significance.

[Insert Table 7 here]

Table 8 presents a robustness check with green class as the dependent variable and CED quality (as opposed to CED volume) as the independent variable. This also requires an ordered PROBIT model. The robustness check offered in Table 8 supports the study's findings reported in Table 6. CED quality emerged as significant in all three separate models at a 1% level of significance. Carbon emissions and carbon audit also emerged as highly significant at a 1% significance level.

[Insert Table 8 here]

Universities have been ranked by People & Planet based on their achieved score and this green ranking of universities has been used as the dependent variable in the next sensitivity test, presented in Table 9 with an independent variable representing CED volume, and Table 10 with an independent variable representing CED quality. Table 9 presents the robustness check with the help of green ranking as the dependent variable. In this table, the robustness check supports the earlier results reported in Table 5 with CED volume as an independent variable and green ranking as the dependent variable. CED volume was found to be significant in all three separate models at a 1% level of significance. As before, carbon emissions and carbon audit also emerged as highly significant explanatory variables.

[Insert Tables 9 & 10 here]

Table 10 presents a sensitivity analysis with CED quality as an independent variable. Again, an ordered PROBIT model was employed as a robustness check, with green ranking as the dependent variable. This again supported the results presented earlier.

5.4 Summary of Results

Table 11 summarises the regression results and demonstrates that CED, carbon emissions and carbon audit have a highly significant impact on CED quality. Standalone carbon reporting is significant only at a 10% level and the impact is positive, whilst no evidence was found to suggest that investment to reduce carbon was a significant determinant of HEI green reputation.

[Insert Table 11 here]

6 CONCLUSION

The research is distinct in investigating the impact of CED and carbon performance by UK HEIs on their environmental reputation. It explores whether and how HEI CED and carbon performance contribute towards the environmental reputation of the institution. It argues that HEIs can *signal* their carbon initiatives through CED to their various stakeholders to create a positive image of environmental and carbon responsiveness. The study also argues that HEIs are different from profit-seeking companies and thus possess unique characteristics that differentiate them from extant results reported on that basis (Alonso-Almeida et al., 2015; Ceulemans et al., 2015). Universities are non-profit organisations, which primarily depend on government funding in several forms (Saha et al., 2019). A public accountability perspective

suggests that managers are inherently trustworthy with a greater commitment towards public accountability and transparency, and thus are more likely to engage in voluntary disclosure (Ntim et al., 2017). This calls for specific academic and research attention for HEIs. Generalising the research study for profit-oriented companies towards the largely publicly funded UK HEIs could be misleading. Thus, this study investigates the factors affecting HEI green reputation, including carbon disclosures in both annual reports and standalone reports and other carbon performance indicators, primarily relating to emissions, audit and investment. This research contributes to the existing knowledge of carbon disclosures by providing evidence of factors influencing organisational green reputation in a non-profit setting.

The findings suggest an association between the environmental reputation of HEIs and carbon emission disclosures by these organisations. It may be that HEIs are motivated to disclose a greater volume of more accurate and useful information on their carbon sensitivity. Carbon disclosures in annual reports signal organisational carbon sensitivity that enriches their image as environmentally responsible organisations and results in an enhanced green reputation. However, disclosures in standalone sustainability reports had only a limited impact on this reputation.

This study extends prior knowledge of sustainability practices in HEIs and contributes to the social disclosure literature by adding specialised reflection on HEIs regarding the relationship between carbon performance and green reputation. It aids in providing a more holistic understanding of how carbon performance is reflected in green reputation rankings. The findings of this study are expected to be of interest to university stakeholders and policymakers such as the Higher Education Funding Council for England (Sassen and Azizi, 2018). Policy-makers and regulatory bodies like HEFCE charged with fostering greater carbon sensitivity in

society in response to climate change threats may find the findings beneficial in their quest to motivate member organisations to actively engage in carbon reduction. HEFCE has a carbon reduction target in place to incentivise universities to reduce their carbon emission; the findings reported here are likely to support and bolster that campaign. Moreover, carbon reporting studies are relatively scarce in the context of universities (Fonseca et al., 2011; Larrán et al., 2018). The outcomes from this study indicating a relationship between carbon disclosure and environmental reputation should incentivise practitioners in the use of reporting strategies and practice. Organisations can disclose voluntary information in order to better manage stakeholders' expectations, discharge institutional responsibilities, legitimise their existence and, finally, build their reputation. This study could assist in providing a reference point for best practice and influence overseas universities in attempts to improve their rankings (Godemann et al., 2011). Although they may wish to adapt them according to their socio-cultural context, it is always helpful to have examples of best practice as sources of motivation and direction. The wider readership would benefit from applying the knowledge reported here to similar settings in the UK. The empirical findings could also prove useful to corporations operating in various industrial sectors in their attempts to facilitate emission reduction practices and policies and could encourage them to disclose their carbon management activities.

This study has some limitations, which unveil possibilities for future research. The present sample is restricted to HEIs in the UK. This research, in spite of the preliminary assumption of no year-to-year change in carbon disclosure, could be extended with a panel study covering a longer time span to reveal any longer-term trends. Qualitative analyses using case studies or interviews could provide clearer insight into the nature of disclosures to capture true intent. Mixed-method and comparative studies might also prove useful. In addition, future studies could incorporate external media (for example, internet reporting, and reporting in news outlets

such as television, newspaper or radio) which might facilitate a greater understanding of the relationship. Motivated from the results of this study, future research might specifically explore why investment in carbon management appears to make no difference to green reputation. Further research could also investigate whether the green rating/ranking makes a difference to student intake. Another thing that could be looked at is the impact of any courses/programmes/initiatives delivered by the universities that are related to climate change/sustainability, and how universities are responding to the UN Sustainable Development Goals. This study, therefore, paves the way for further research on HEI carbon disclosure.

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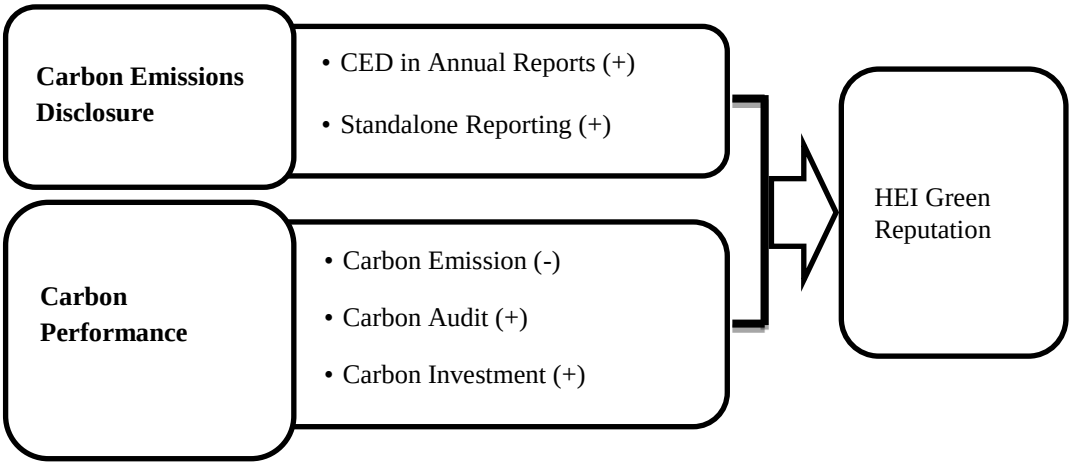
Figure 1
CED, Carbon Performance and HEI Reputation



Note: This figure summarises the hypothesised relationships explored in this paper.

Table 1
Descriptive Statistics for Variables

Variables	Mean (Median)	Standard deviation	Maximum (Minimum)	Skewness	Kurtosis
Panel A: Dependent variables					
Green Score	35.94 (35)	10.23	59.5 (8.5)	.139	2.79
Green Rank	70.97 (70)	41.26	143 (1)	.022	1.80
Green Class	2.48 (2)	1.31	5 (1)	.3965	1.99
Panel B: Independent variables					
CEDV	2.78 (1.88)	2.97	15.09 (0)	1.83	6.95
CEDQ	3.07 (3)	1.47	5 (1)	-.066	1.54
Emission	15400000 (9672079)	17500000	82800000 (613760)	2160000	7620000
Audit	4.32 (4)	2.11	8 (.5)	0.072	1.86
Investment	360.74 (343.5)	140.43	840 (126)	.863	3.96
Standalone	4.22 (5)	1.38	5 (1)	-1.50	3.65
Size	14601.07 (15120)	10065.07	42340 (320)	0.323	2.24
Age	90.20 (46.5)	124.65	845 (0)	3.62	18.97

Notes: Green Score = Score achieved by individual HEIs in the People and Planet ranking; Green Class = Class given by the People and Planet ranking to individual HEIs; Green Rank = Ranking of HEIs based on their green score achieved.

Table 2
Frequency Distribution of Categorical Independent Variables

Panel A. Carbon Emission Disclosure Quality

CED Quality	Frequency	Percent
No disclosure	28	19.44
Less than moderate disclosure	34	23.61
Moderate disclosure	14	9.72
More than moderate disclosure	35	24.31
High disclosure	33	22.92
Total	144	100.00

Panel B. Standalone Sustainability Report

Sustainability	Frequency	Percent
No disclosure	18	10.71
Less than moderate disclosure	10	5.95
Moderate disclosure	8	4.76
More than moderate disclosure	13	7.74
High disclosure	119	70.83
Total	168	100.00

Table 3
Differences in Explanatory Variables between High and Low Reputation Groups

Variables	Highest Reputation Group	Least Reputation Group	Mean Difference	T-value	Wilcoxon Rank test
Panel A: Top and Bottom One Third Group					
CED volume as sentence count	16.89	6.72	10.17	-3.801***	-4.001***
CED – ratio of total sentences	0.042	0.017	0.025	-3.643***	-3.918***
CED Quality	3.690	2.550	1.14	-4.101***	-3.751***
Emission	13,000,000	17,700,000	-4,700,000	1.317	-0.922
Audit	5.86	2.92	2.94	-7.935***	-6.007***
Investment	357.38	385.93	-28.55	0.773	0.602
Standalone	4.91	4.12	0.79	-3.287***	-3.448***
Size	18,809.66	11,824.79	6984.87	-3.751***	-3.884***
Age	40.07	122.41	-82.34	3.219***	3.824***
Panel B: Top and Bottom Two Groups Separated by Median					
CED volume as sentence count	15.65	8.58	7.07	-3.423***	-3.591***
CED – ratio of total sentences	0.036	0.022	0.014	-2.703***	-3.087***
CED Quality	3.63	2.76	0.87	-3.608***	-3.422***
Emission	14,700,000	18,600,000	-3,900,000	1.282	0.309
Audit	5.24	3.39	1.85	-5.675***	-5.076***
Investment	347.82	383.52	-35.70	1.341	1.155
Standalone	4.78	4.29	0.49	-2.647***	-2.151**
Size	18302.50	14182.22	4120.28	-2.59**	-2.85***
Age	56.49	123.86	-67.37	3.131***	3.377***

Notes: This table presents means, differences in means, t-values and Wilcoxon rank sum test values for the explanatory variables. *** p<0.01, ** p<0.05, * p<0.1.

Table 4
Pearson and Spearman Correlation Matrix for Explanatory Variables

	CEDV	CEDQ	Emit	Check	Invest	Standalone	Size	Age
CEDV	1	0.750	-0.065	0.297	0.037	0.046	-0.068	-0.014
CEDQ	0.765	1	-0.010	0.277	0.166	0.082	0.006	0.009
Emission	-0.073	-0.006	1	0.004	0.539	0.201	0.673	0.527
Audit	0.277	0.282	0.012	1	0.052	0.149	0.180	-0.087
Investment	0.068	0.172	0.508	0.087	1	0.126	0.304	0.302
Standalone	0.030	0.106	0.168	0.098	0.178	1	0.163	0.130
Size	-0.055	0.045	0.74	0.208	0.301	0.157	1	0.074
Age	0.008	-0.037	0.541	-0.085	0.312	0.142	0.110	1

Note: Lower diagonal shows Pearson correlations and upper diagonal shows Spearman correlations.

Table 5
Regression Results – Robust LS with CED Volume

Models	**(1)**	**(2)**	**(3)**
Variables	**Dependent variable = Green Reputation**		
CED Volume	**38.70*** **	**39.10*** **	**28.89*** **
	(7.82)	**(7.74)**	**(7.15)**
Standalone		**1.595***	**1.302***
		(0.75)	**(0.65)**
Carbon Emission			**-7.114*** **
			(1.46)
Carbon Audit			**2.030*** **
			(0.36)
Carbon Investment			1.521
			(1.97)
Size	**3.181****	**2.466***	**10.49*** **
	(1.00)	**(1.07)**	**(2.57)**
Age	**-1.915****	**-2.015****	0.0448
	(0.67)	**(0.65)**	(0.72)
Intercept	8.243	8.025	23.65
	(10.58)	(10.18)	(16.37)
R Squared	0.284	0.31	0.579
Adj. R-squared	0.266	0.288	0.549
RMSE	8.548	8.424	6.58
N	135	135	135
Robust standard errors in parentheses			*** p<0.01, ** p<0.05, * p<0.1

Table 6
Regression Results – Robust LS with CED Quality

Models	**(1)**	**(2)**	**(3)**
Variables	**Dependent variable = Green Reputation**		
CED Quality	**2.492*** **	**2.415*** **	**1.722*** **
	(0.49)	**(0.50)**	**(0.48)**
Standalone		1.223	1.072
		(0.74)	(0.62)
Carbon Emission			**-7.082*** **
			(1.48)
Carbon Audit			**2.112*** **
			(0.34)
Carbon Investment			0.847
			(2.02)
Size	**3.143** **	**2.621***	**9.933*** **
	(0.95)	**(1.05)**	**(2.56)**
Age	**-1.839** **	**-1.920** **	0.268
	(0.65)	**(0.63)**	(0.73)
Intercept	5.994	5.892	**31.19***
	(10.18)	(10.01)	**(15.64)**
R Squared	0.29	0.305	0.574
Adj. R-sq.	0.283	0.543	0.273
RMSE	8.45	6.619	8.508
N	135	135	135
Robust standard errors in parentheses			*** p<0.01, ** p<0.05, * p<0.1

Table 7
Regression Results – Green Class with CED Volume (Oprobit)

Models	**(1)**	**(2)**	**(3)**
Variables	**Dependent variable = Green Reputation**		
CED Volume	**4.917*** **	**5.062*** **	**5.241*** **
	(1.12)	**(1.12)**	**(1.37)**
Standalone		0.163	0.118
		(0.10)	(0.13)
Emission			**-1.334*** **
			(0.31)
Audit			**0.333*** **
			(0.07)
Investment			0.391
			(0.35)
Size	**0.306** **	0.233	**1.806*** **
	(0.11)	(0.12)	**(0.54)**
Age	**-0.215***	**-0.229***	0.061
	(0.10)	**(0.10)**	(0.15)
Intercept	**3.307** **	**3.336** **	1.595
	(1.25)	**(1.22)**	(2.86)
pseudo R-sq.	0.095	0.103	0.272
AIC	366	364.8	243.7
Log likelihood	-176	-174.4	-110.8
N	135	135	135
Robust standard errors in parentheses		*** p<0.01, ** p<0.05, * p<0.1	

Table 8
Regression Results – Green Class CED Quality (Oprobit)

Models	(1)	(2)	(3)
Variables	**Dependent variable = Green Reputation**		
CED Quality	**0.296*** **	**0.290*** **	**0.268** **
	(0.07)	**(0.07)**	**(0.08)**
Standalone		0.112	0.0694
		(0.10)	(0.13)
Emission			**-1.275*** **
			(0.32)
Audit			**0.348*** **
			(0.07)
Investment			0.257
			(0.36)
Size	**0.311** **	**0.264***	**1.651** **
	(0.11)	**(0.12)**	**(0.53)**
Age	**-0.207***	**-0.217***	0.093
	(0.09)	**(0.09)**	(0.15)
Intercept	**3.623** **	**3.630** **	0.317
	(1.22)	**(1.21)**	(2.84)
pseudo R-sq.	0.093	0.097	0.262
AIC	366.7	367.2	246.7
Log likelihood	-176.3	-175.6	-112.3
N	135	135	135
Robust standard errors in parentheses		***** p<0.01, ** p<0.05, * p<0.1**	

Table 9
Regression Results – Green Rank with CED Volume (Oprobit)

Models	(1)	(2)	(3)
Variables	**Dependent variable = Green Reputation**		
CED Volume	**4.774*** **	**4.905*** **	**5.059*** **
	(0.95)	**(0.93)**	**(1.07)**
Standalone		**0.185***	0.19
		(0.09)	(0.11)
Emission			**-1.193*** **
			(0.25)
Audit			**0.305*** **
			(0.06)
Investment			0.259
			(0.30)
Size	**0.403*** **	**0.325** **	**1.794*** **
	(0.12)	**(0.13)**	**(0.43)**
Age	**-0.213***	**-0.230** **	0.050
	(0.08)	**(0.08)**	(0.12)
Intercept	**6.608*** **	**6.718*** **	**6.281***
	(1.26)	**(1.20)**	**(2.55)**
pseudo R-sq.	0.044	0.048	0.112
AIC	1114.5	1112.1	849.7
Log likelihood	-492.2	-490	-362.9
N	135	135	135
Robust standard errors in parentheses		***** p<0.01, ** p<0.05, * p<0.1**	

Table 10
Regression Results – Green Rank CED Quality (Oprobit)

Models	**(1)**	**(2)**	**(3)**
Variables	**Dependent variable = Green Reputation**		
CED Quality	**0.312*** **	**0.306*** **	**0.311*** **
	(0.06)	**(0.06)**	**(0.08)**
Standalone		0.137	0.145
		(0.09)	(0.11)
Emission			**-1.196*** **
			(0.25)
Audit			**0.315*** **
			(0.06)
Investment			0.134
			(0.30)
Size	**0.401*** **	**0.345** **	**1.724*** **
	(0.11)	**(0.12)**	**(0.42)**
Age	**-0.204***	**-0.216** **	0.0967
	(0.08)	**(0.08)**	(0.12)
Intercept	**6.936*** **	**6.992*** **	**5.043***
	(1.22)	**(1.19)**	**(2.46)**
pseudo R-squared	0.045	0.048	0.112
AIC	1112.8	1112.4	850.5
Log likelihood	-491.4	-490.2	-363.2
N	135	135	135
Robust standard errors in parentheses		***** p<0.01, ** p<0.05, * p<0.1**	

Table 11
Summary Results

Predictors		CED Quality	
		Results	**Significance**
H1	CED	+	Highly Significant
H2	Standalone	+	Significant only at 10%
H3	Carbon Emission	-	Highly Significant
H4	Carbon Audit	+	Highly Significant
H5	Carbon Investment	+	Not Significant

Appendix A

Carbon emission disclosures index/instruments Name _____

Categories/ Themes Characteristics	Carbon policies, vision and strategies claim	Carbon governance and management systems	Regulatory compliance (e.g. mention of HEFCE)	Credibility, auditing and external assurance	Carbon profile	Carbon initiatives, processing, reduction and abatement	Carbon spending and financial data	Carbon focus on curriculum and education for carbon sustainability	Community engagement in carbon initiatives (staff-student engagement)	Other carbon disclosures	Total	
											Count	%
Monetary/good news												
Monetary/bad news												
Monetary/neutral												
Non-monetary/good news												
Non-monetary/bad news												
Non-monetary/ neutral												
Declarative/good news												
Declarative/bad news												
Declarative/neutral												
Diagrams												
Total												
Category-wise percentage												

Notes: Total amount of each type of carbon emission disclosures for each company = (Total carbon related themes in a specific category/ Total theme in the corporate annual report) x 100

Total amount of measured sentence disclosure (to nearest 100th)

Appendix B

Scoring of Disclosure Quality

CED Characteristics	Score	Typical Example
No disclosure	0	-
General rhetoric, pure narrative description of category	1	Sustainability continues to be a high priority for Anglia Ruskin University. (Anglia Ruskin University) We will make a significant contribution to global efforts to achieve environmental sustainability. (De Montfort University) Environmental awareness and sustainability have become core values of the University influencing policy development, and estates and infrastructure investment. (Manchester Metropolitan University)
Specific endeavour, statement of targets, narrative without evidence	2	The University has prepared a Carbon Reduction Management Plan that sets out its approach to reducing carbon emissions, in line with the sector targets published by HEFCE in January 2010. (Bath Spa University) In undertaking its activities, the University aims for the highest environmental standards, and promotes environmental awareness and good practice among staff, its students, and major suppliers. (Birmingham City University) The University has an Environmental Policy, which aims to limit any detriment or harm by managing its activities, buildings and estates in a way, which promotes environmental sustainability; conserves and enhances natural resources; prevents environmental pollution and brings about a continual improvement in its environmental performances. (Brunel University)
Use of target, implementation, monitoring or results; narrative with evidence	3	This year's projects include … the It's Better Off energy consumption and carbon reduction campaign, and centralised timetabling, to streamline and improve student's experience. (Loughborough University) We are introducing an energy and carbon dashboard to help building users develop energy plans to reduce consumption. (Newcastle University) A newly formed Sustainability Strategy Group has been established to oversee the University's Carbon Management Plan, approved by Council on 18 July 2011. (University of Essex)
Implementation, monitoring or results; Kite marks or external accreditation of carbon initiatives; quantitative with evidence	4	The University is a mandated participant in the Carbon Reduction Commitment (CRC) Energy Efficiency Scheme, which introduced carbon reporting from July 2011 and annual carbon tax starting at £12 per tonne of carbon (based on energy consumption) from July 2012. The cost of purchasing carbon allowances will be approximately £97,000 in 2012. (Bournemouth University) We were awarded a 'First' in the People & Planet Green League, a league table of environmentally friendly universities, for the 6th consecutive year. (Leeds Metropolitan University)

<table>
<tr><td></td><td></td><td>The School was recommended for ISO 14001 (the International Environmental Standard) and Eco Campus Platinum in July 2012. (London School of Economics and Political Science)</td></tr>
<tr><td>Implementation, monitoring or results with year comparisons; quantitative and comparable with evidence</td><td>5</td><td>From 2005 Carbon emissions were growing; however since the implementation of the plan in 2009 emissions have reduced and are now 14% lower than the 2005 level. Last year there was an 8% reduction (year on year) to 15,400 tonnes of CO2.

<table><tr><td>Year</td><td>2005/ 06</td><td>2006/ 07</td><td>2007/ 08</td><td>2008/ 09</td><td>2009/ 10</td><td>2010/ 11</td><td>2011/ 12</td></tr><tr><td>Tonnes CO2</td><td>17,971</td><td>18,093</td><td>20,166</td><td>19,161</td><td>17,393</td><td>16,664</td><td>15,400</td></tr></table>(Cranfield University)

Carbon statistics for the third quarter of 2011/12 indicated a total reduction in CO2 emissions compared to the 2008/09 baseline year of 4.2%, a significant increase on prior year comparator of 1.7%. (Durham University)

Carbon emissions decreased by 11% against the previous year, bringing the School’s overall carbon emissions to 12% below the 2005 baseline, in line with the target set by HEFCE for the sector. (London Business School)</td></tr>
</table>