Measuring the relationship between reporting on biodiversity actions and its determinants to achieve SDGs: Insights from UK Higher Education Institutions (HEIs)

Abstract

Purpose – This study aims to investigate the prevalence of reporting on biodiversity actions within the annual reports, corporate social responsibility reports, and sustainability reports of UK higher education institutes (HEIs). Additionally, the research seeks to examine potential associations between biodiversity and its determinant factors including governance mechanisms-frequency of board meeting, board diversity, and Vice Chancellor tenure-assurance provided by big 4 and environmental awards received by HEIs to support progress toward achieving specific Sustainable Development Goals (SDGs).

Design/methodology/approach – The authors devised a biodiversity index to measure the extent of reporting on biodiversity actions across four years (2019 – 2022) encompassing 130 UK HEIs, totalling 520 university-year observations. Employing a triangulation approach grounded in three distinct theoretical frameworks - deep ecology, stakeholder and signalling, this study posits that governance mechanisms, assurance practices, and environmental awards within UK HEIs influence the extent of reporting on biodiversity actions.

Findings – This research reveals a notably low level of biodiversity disclosure among UK HEIs. Variability exists across HEIs, with those established before 1992 exhibiting significantly higher biodiversity reporting score compared to their newer counterparts. The study also establishes that governing board mechanisms, specifically Vice Chancellor (VC) tenure and environmental awards received by HEIs exert a significant impact on biodiversity. Conversely, the authors found frequency of board meetings, board diversity positively (insignificant) linked to biodiversity reporting. Assurance and audited by big4 found to have negative (insignificant) relationship with biodiversity.

Originality/value –This is the first empirical study to investigate reporting on biodiversity actions in 130 UK HEIs over four years. It links also biodiversity reporting to its determinant factors including governance mechanisms (frequency of board meeting, board diversity, and Vice Chancellor tenure), assurance provided by big 4 and environmental awards received by HEIs to support progress toward achieving specific Sustainable Development Goals (SDGs). The study develops a unique (26-item) biodiversity index encompassing reporting on biodiversity actions. This approach presents novel insights into the governance and accountability practices concerning biodiversity disclosures in the higher education sector. Its originality lies in its focus on biodiversity, which significantly contributes to academic discourse and practical application in sustainability governance within higher education institutions.

Limitations: This study is limited to UK higher education institutions (HEIs), highlighting the need for future research to explore a broader, international sample to enable cross-country comparisons and enhance the generalisability of the findings. More determinants variables can be measured in future research.

Keywords: Governance, accountability, biodiversity reporting, higher education institutions, panel data

1. Introduction

The degradation of ecosystems and biodiversity loss are pressing global challenges, with biodiversity ranked among the top three global risks (Sobkowiak et al., 2020; WEF, 2022). Recognising the role of natural capital in sustainable development, organisations and global bodies such as the UN and EU advocate for biodiversity (Arora et al., 2020; Castilla-Polo and Sánchez-Hernández, 2022). The UN Sustainable Development Goals (SDGs) urge both public and private sectors to contribute to Sustainable Development by 2030 (UN, 2023). These goals aim to address the most pressing global challenges - including poverty, inequality, climate change, nature degradation, peace, and justice. Also, they illustrated that biodiversity loss directly affects human well-being and organisational functioning (van Liempd and Busch, 2013; Hassan et al., 2020).

While existing research has examined biodiversity within organisations (Cuckston, 2013; Samkin et al., 2014; Anthony and Morrison Sunders, 2023), there is limited attention to public sector contexts, particularly Higher Education Institutions (HEIs) (Gaia and John Jones, 2017; Weir, 2019). Universities hold a unique position in society, serving not only as hubs of creative thinking and innovation but also as institutions that fulfil multiple roles, including the preparation of future leaders (Adams, 2018; Hassan et al., 2019). They play a crucial role in societal development, with graduates and professionals expected to generate positive impacts on people, communities, the environment, and the planet (Adams, 2013; Moscardini et al., 2022). Given this responsibility, universities that educate students on the importance of protecting biodiversity should also actively commit to safeguarding biodiversity within their own institutional practices. However, their contributions to biodiversity conservation often remain underreported in institutional strategies and activities (BUFDG, 2016; Adhikariparajuli et al., 2023). Therefore, we are arguing that improved transparency by reporting on biodiversity actions allows universities, to show its vast social and economic impact by integrating biodiversity into education, operations, and governance (DUFDG, 2016; Hassan, et al., 2019).

Addressing this gap and to understand the intersection between biodiversity reporting and HEI governance and strategic activities. This study aims to explore how UK HEIs disclose their biodiversity-related efforts, with particular attention to the factors that influence such disclosures to contribute to SDGs achievements. We intentionally selected specific determinant

variables, namely corporate governance, assurance by big 4, and environmental awards, as we are focusing on reporting practices related to biodiversity actions. Corporate governance indicators were included to assess the extent to which universities are committed to addressing biodiversity issues at the board level, and to examine whether board diversity influences the reporting of biodiversity-related activities. We also hypothesise that the Vice-Chancellor (VC) tenure plays a significant role in enhancing biodiversity disclosures. In addition, and because we argue that obtaining external assurance strengthens stakeholders' trust and enhances the credibility of reported Information, assurance was selected as a key determinant (Hassan, et al., 2020; Roberts et al., 2022). Lastly, environmental awards were included as an external validation of universities' efforts to protect nature and biodiversity. We believe that this extends biodiversity protection beyond traditional CSR (Roberts et al., 2022) and aligns with calls to investigate biodiversity practices across varied sectors and national settings (Roberts et al., 2021). Prior work on biodiversity accounting in the UK public sector (Weir, 2019) and sustainability reporting frameworks (Ball and Bebbington, 2008; Cohen, 2022) supports the need to explore value creation in HEIs (Adams et al., 2014), where knowledge on biodiversity-governance intersections remains scarce.

Our research questions are:

- How do UK HEIs report on biodiversity actions to support progress towards achieving the Sustainable Development Goals (SDGs)?
- What are the determinants factors influencing the reporting on biodiversity actions in UK HEIs?

The study is original and contributes to biodiversity reporting literature. It is the first empirical study of reporting on biodiversity practices and actions in UK HEIs, examining governance factors such as frequency of board meetings, diversity, VC tenure, assurance by big 4 and environmental awards. It expands existing work that focused on local governments in the UK (Gaia and Jones, 2020), Australia (Barut et al., 2016), Canada (Talbot and Boiral, 2021), and New Zealand (Schneider et al., 2014). Also, another important contribution is, based on prior studies (Hassan et al., 2020; Roberts et al., 2022), we have developed our own biodiversity disclosure 26-item index, encompassing biodiversity disclosures related to nature in a broader sense. We opted for this framework due to its comprehensive nature, covering a wide range of relevant disclosures, including current actions, preventative actions, and adopted guidelines

related to biodiversity. Our index reflecting on organizations' practices through an investigation of reporting on biodiversity actions within the neglected sector of higher education.

Our study also contributes to literature on SDGs, drawing on the recent UWS–THE white paper (2025) which assesses UK universities' SDG performance across regions and institution types, highlighting best practices and aligns university efforts with SDG goals such as climate action and biodiversity restoration (UN, 2020). Our study demonstrates how research variables, such as corporate governance (including board meeting frequency, board diversity, and Vice Chancellor tenure), assurance practices, and the pursuit of environmental awards, influence biodiversity reporting and contribute to the achievement of selected Sustainable Development Goals (SDGs).". Also, amid financial pressures, global competition, and post-pandemic recovery, there is an urgent need for transparency and accountability in UK HEIs (Ntim, 2018; Elmaghri et al., 2022a). However, addressing broad sustainability goals remains difficult (Lozano, 2011; Moscardini et al., 2022). To better understand what drives universities to report on biodiversity actions, this study uses a multi rigour theoretical framework that integrates deep ecology, stakeholder, and signalling theories (Cuckston, 2013; Gaia and Jones, 2017; Weir, 2019; Saha et al., 2021). We believe that biodiversity reporting is seen as proactive public-sector tools (Gaia and John Jones, 2017; Talbot and Boiral, 2021), yet current biodiversity disclosures are fragmented and inadequate for stakeholder needs (Barut et al., 2016; Gaia and Jones, 2019).

By going beyond earlier studies on HEI governance and sustainability disclosures (Ntim et al., 2017; Elmaghri et al., 2021; Adhikariparajuli et al., 2023), this study offers a holistic and interdisciplinary perspective that advances the academic discourse on biodiversity governance. It responds to the evolving sustainability landscape in higher education and provides actionable insights for HEI leaders and policymakers to align their institutions with the SDGs as global goals.

The reminder of this paper is structured as follows: Section presents a theoretical literature along with a systematic analysis of studies within the UK HEI sector. Section three outlines the development of hypotheses. Section four details the research design. Section five presents the empirical analysis. Section six concludes the study with recommendations for future research.

2. Theoretical Literature Review

Prior biodiversity theories have argued that the ability of organisations to improve degradation is disadvantaged by some organisational theories including greenwashing (Hassan

et al., 2020), legitimacy (Bhattacharyya and Yang, 2019) and impression management (Boiral, 2016). These theories often treat humans and biodiversity as separate entities, suggesting that this separation aids in understanding complex situations (Castree, 2002; Newton, 2002). However, humans, society and biodiversity are interconnected and mutually influential. Researchers argue that human-induced biodiversity destruction, including habitat reduction and behavioural changes, fosters conditions conducive to new viruses and diseases such as COVID-19 (Hassan et al., 2020).

The lack of a comprehensive theoretical model integrating biodiversity and society often demotivates organizations from developing strategies for biodiversity preservation. To address this, we are following the recommendation of Roberts et al. (2022) to adopt a triangulation of theories. We propose combining deep ecology, stakeholder, and signalling theories to establish connections between biodiversity, organizations, society, and humans. The theoretical triangulation is shown in Figure 1.

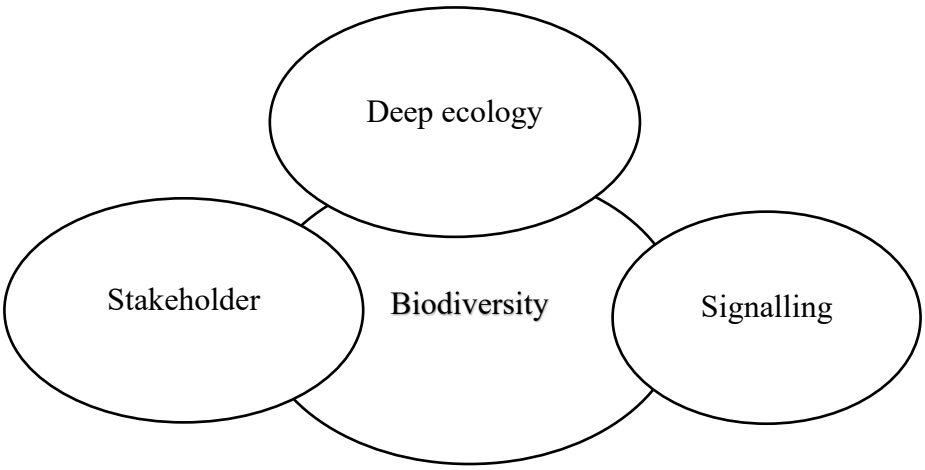

Figure 1. Triangulation of theories model

Source: Figure by Authors

Deep ecology theory. Deep ecologists of the view that biodiversity has intrinsic value, and all nonhuman life should be preserved (Naess, 2008). The theory posits that followers not only protect the planet for the sake of humans, but also, for the sake of the planet itself. The theory based in the belief that humans, society, and organisations must radically change their relationship to biodiversity from one that values biodiversity solely for its usefulness to human beings to one that recognizes that biodiversity has an inherent value (Naess, 2008). Therefore, the theory does not view humans as most important species, instead deep ecology theories supporters believe that all things in the ecosystem have value whether they are human or

animal, living or non-living and biodiversity has value because of what it contributes to human satisfaction (Thompson and Barton, 1994).

In the last decade, scholars have begun to examine the relationship between biodiversity and business and argue that human overexploitation is responsible for the majority of ecosystem destruction and biodiversity loss (Adler et al., 2018). Jones and Solomon (2013) believe that reporting on biodiversity can inform society and enhance their understanding of human's role in biodiversity loss. Van Liempd and Busch (2013) states that, in addition to the business rationale for organisations to report and manage their biodiversity impact, there also exists a moral obligation to report and manage the impact on biodiversity including biodiversity. Atkins et al. (2014) believe that biodiversity reporting will influence organisations to take additional more effective actions to manage their biodiversity impact. This paper will enhance prior studies (e.g., Adler et al., 2021; Hassan et al., 2020; 2021) that emphasise the importance of biodiversity and believe that biodiversity is critical to business survival as organisations have a two-way relationship with biodiversity, including both the impact of companies on nature and the impact of biodiversity on companies (Hassan et al., 2020).

Recognising the significance of biodiversity to both humanity and businesses, recent accounting studies (Hassan et al., 2020, 2021; 2022; Roberts et al., 2022) have examined the reporting on biodiversity-related issues by companies globally (Mansoor and Maroun, 2016; Adler et al., 2021; Maroun et al., 2018). However, this extensive research has predominantly concentrated on biodiversity reporting with public listed companies, with limited focus on investigations in the public sector, which will be the focus in this paper.

Stakeholder theory. It is very common theory in sustainability/ biodiversity literature to explain the needs and expectations of human groups and individuals affected by the company (Gaia and Jones, 2020). The theory posits that organisations, as consumers of scarce and valuable resources such as air, water, and other natural resources bear ethical and moral responsibility to contribute back to society and the environment (Galbreath, 2018; Rahman et al., 2021). The theory also holds organisations responsible for stakeholders' welfare, recognising that their manufacturing and business activities contribute to environmental pollution, emitting greenhouse gases and producing toxic wastes that negatively affect the ecosystem and all living creatures (Rahman et al., 2021). However, previous studies adopting stakeholder theory have predominantly focused on human stakeholders such as employees,

NGO's, government agencies, environmental groups, and customers (e.g., Jones, 1995; Schaltegger et al., 2017). Acknowledging a limitation within stakeholder literature, recent studies such as Roberts et al., 2022 advocate for the inclusion of species as stakeholders for preventing further pandemics or species loss. Following Robets, et al., (2022), we include species as an additional stakeholder category in the HEI sector, alongside traditional stakeholders such as students, government, society, funding bodies. It is essential to recognize biodiversity and non-human species as key stakeholders in organizational decision-making, given the interdependent relationship between ecological systems and business operations. Therefore, organizations must recognise that nature and biodiversity are of fundamental value either directly or indirectly linked to corporate activity (Adler et al., 2018; Atkins and Atkins, 2018; Bebbington and Unerman, 2018).

Signalling Theory. Research highlights that stakeholder and signalling theories overlap in social and environmental studies (Deegan, 2002; Gaia and Jones, 2017, 2019). Stakeholder theory has been used to explain the needs and expectations of human groups and individuals affected by the company (Boiral and Heras-Saizarbitoria, 2017; Gaia and Jones, 2019). Mahoney et al. (2013) argue that there are several theories focusing on the relationship between voluntary disclosures and performance, which are generally consistent with either theories grounded in a socio-political perspective to which *greenwashing*[1] belongs, or a voluntary disclosure perspective to which *signalling theory*[2] belongs, (Hassan and Guo, 2017).

Signalling theory posits that disclosure is a strategic decision, with organisations choosing to disclose when the benefits outweigh the costs, thereby signalling a strong commitment to stakeholders (Clarkson et al., 2008; Cho et al., 2012). The theory acknowledges the variation in information between stakeholders and the organisations, emphasising the role of communication in bridging this gap between the organization and its stakeholders (Adhikariparajuli, et al., 2021). Advocates of signalling theory (Cho et al., 2012; Clarkson et al., 2008; Cho et al., 2015a) argue that organisations with proactive strategies and superior performance are motivated to provide extensive disclosures. This serves to articulate their mission, values, environmental principles, and the long-term sustainability underpinning their

[1] Greenwashing "involves selective disclosure of positive sustainability actions resulting in misleading and biased reporting" (*Mahoney et al*., 2013, p. 352). Greenwashing is a practice that is deceptively used to promote the perception that a company's policies or products are environmentally friendly, when arguably they are not.

[2] Signalling theory is "*...useful for describing behaviour when two parties (individuals or organizations) have access to different information. Typically, one party, the sender, must choose whether and how to communicate (or signal) that Information, and the other party, the receiver, must choose how to interpret the signal (Connelly, et al., 2011, p.39)".*

business strategy (Clarkson et al., 2008; Cho et al., 2012; Hassan et al., 2019). According to Zijl et al. (2017), if biodiversity is integral to the business model, signalling theory predicts that reporting aims to demonstrate effective management of non-financial factors, thus preserving or enhancing firm value and minimising the risk of adverse selection.

In the HEI context, signalling theory suggests an information asymmetry that predominantly favours universities (Connelly et al., 2011; Taj, 2016; Zutshi et al., 2018). While this disparity ideally motivates universities to communicate information to stakeholders, this rebalancing does not consistently materialise as anticipated (Veltri and Silvestri, 2015; Zutshi et al., 2018; Adhikariparajuli, et al., 2021). Therefore, we expect that if universities aim to report on biodiversity actions, this should signal how they create value for society (Secundo et al., 2016), and by getting such information externally assured by big 4, this enhancing stakeholders' trust and credibility (Hassan et al., 2020; Roberts et al., 2022; Altenburger and Schaffhauser-Linzatti, 2014) and enhances HEIs accountability (Rinaldi et al., 2018).

Aligned with both deep ecology and stakeholder theories, there are substantial expectations for HEIs to disclose information about their relationship with biodiversity, especially when adopting a broader stakeholders' concept that includes non-human species alongside human stakeholders, as explained above. In today's highly competitive environment, universities face heightened scrutiny from stakeholder's who are keen on understanding how these institutions contribute value to society (Secundo et al., 2016). The growing stakeholder demand for increased transparency (Ramírez, 2015; Veltri et al., 2015) has various interest groups to develop guidelines aimed at enhancing reporting standards (Gamage and Sciulli, 2017).

This study explores how key research variables, including aspects of corporate governance (such as frequency of board meeting, board diversity, and Vice Chancellor tenure), assurance provided by big 4, and the pursuit of environmental awards, shape biodiversity reporting and support progress toward achieving specific SDGs.

Based on the above discussion, the transactional element of signalling theory involves communication, and HEIs play a vital role on conveying essential information to interested parties to ensure social acceptance (Connelly et al., 2011; Taj, 2016; Zutshi et al., 2018). Thus, we propose that HEIs will employ signalling when reporting on biodiversity to bolster credibility and gain stakeholders' trust (Altenburger and Schaffhauser-Linzatti ,2014).

3. Empirical Studies and development of hypotheses

Building on existing literature, we perceive biodiversity as an extension of CSR (e.g., Bhattacharyya and Yang, 2019; Hassan et al., 2020). Our review of prior studies on biodiversity reveals several thematic areas: some biodiversity practices and characteristics (Bebbington et al., 2020; Tashakor, et al., 2019), while others focus on determinants of biodiversity and the necessity for biodiversity accounting (Atkins and McBride, 2022; Descalzo-Ruiz, 2022). Additional studies delve into organisational compliance with biodiversity regulations (Adler et al., 2021), while another stream concentrates on biodiversity management, operationalizing environmental management and accounting (Jones, 2003; Schaltegger, 2018; Schaltegger et al., 2022). Such management practices lay the groundwork for biodiversity reporting and aid organisations in managing their environmental impact while safeguarding and enhancing nature. Furthermore, some studies focus on proposing indices, reporting methods, and measurement tools to biodiversity disclosure (Maroun and Atkins, 2021; Hassan, et al., 2020; 2022; Roberts et al., 2022).

Our study contributes to the existing literature by developing a biodiversity disclosure index, reflecting on organisations' management practices through an investigation of reporting practices and actions within the neglected sector of higher education. In developing the index, we consulted prior studies and regulations such as the Global Reporting Initiative (GRI). While previous biodiversity studies have overlooked governance, this study aims to investigate how UKHEIs report on biodiversity actions and disclose their efforts related to biodiversity to support progress towards achieving specific SDGs, with a specific focus on the determinants that influence such disclosures. We have deliberately selected a set of key variables, corporate governance, external assurance, and environmental awards, given our emphasis on understanding the drivers behind biodiversity-related reporting. Corporate governance factors were included to evaluate the extent of institutional commitment to biodiversity issues at the board level, to explore whether board diversity affects the quality and frequency of biodiversity disclosures, and to assess whether the Vice-Chancellor's (VC) tenure contributes to more comprehensive reporting. Furthermore, external assurance provided by big 4 was selected based on the premise that third-party verification enhances the credibility of sustainability disclosures and reinforces stakeholders' trust (Hassan et al., 2020; Roberts et al., 2022). Finally, environmental awards were considered as a form of independent recognition of universities'

performance in protecting biodiversity and the natural environment. We expect that linking reporting on biodiversity actions and its determinants factors to be influences by the suggested theoretical model, namely deep ecology, signalling and stakeholders theories.

3.1 Biodiversity and frequency of governing board meetings

In the context of public accountability within HEIs, the frequency of governing board meetings serves as a critical indicator of governance effectiveness. It reflects the board's capacity to monitor institutional performance, shape strategic direction, and respond to emerging challenges (Coy et al., 2011; Jensen, 1993). Regular meetings are considered vital for enabling governors to deliberate meaningfully, oversee executive leadership, and make timely decisions (Lipton and Lorsch, 1992; Ntim et al., 2017). As such, meeting frequency is commonly used as a proxy for board effectiveness and organisational responsiveness (Ntim and Osei, 2011; Ntim, 2018).

From a signalling theory perspective, the frequency of board meetings can send powerful cues to stakeholders about the institution's commitment to transparency, strategic clarity, and sustainability engagement (Moratis, 2023). Simultaneously, frequent meetings also enhance stakeholder representation and engagement, facilitating more responsive and informed governance (Freeman and Phillips, 2002). Building on stakeholder theory, HEIs are expected to extend their accountability not only to traditional human stakeholders, such as students, regulators, and funding agencies, but also to non-human stakeholders, including ecosystems and biodiversity (Roberts et al., 2022). Recognising non-human species as legitimate stakeholders acknowledges their intrinsic value and reflects the growing emphasis on the interdependence between ecological systems and institutional operations (Adler et al., 2018; Atkins and Atkins, 2018; Bebbington and Unerman, 2018). Frequent and well-structured board meetings can support this broader view of stakeholder engagement by enabling timely responses to ecological concerns and supporting decisions aligned with sustainability goals. These actions demonstrate a commitment to environmental stewardship consistent with deep ecology theory, which promotes nature preservation as an ethical imperative (Bhattacharyya and Yang, 2019). In this sense, biodiversity-related disclosures serve not only as informational outputs but also as signals of institutional values, enhancing stakeholder trust and social legitimacy (Jones and Solomon, 2013; Cho et al., 2015a; Odriozola and Baraibar-Diez, 2017).

Within the UK HEI context, more frequent governance meetings are expected to facilitate consistent dialogue on nature conservation and bolster the credibility of biodiversity

disclosures within CSR frameworks. By proactively sharing such Information, institutions not only meet growing public expectations for transparency but also contribute to broader societal efforts in environmental sustainability. In line with signalling theory, these disclosures can be viewed as reputational tools that signal institutional accountability and environmental engagement (Adhikariparajuli et al., 2021; Zutshi et al., 2018).

Despite these theoretical expectations, empirical findings on the relationship between frequency of board meeting and voluntary disclosure remain mixed, particularly in the non-profit and HEI sectors. For example, Van Puyvelde et al. (2018) found a positive link between frequency of board meeting and voluntary disclosure in U.S. not-for-profit organisations, whereas Xue and Niu (2019) observed a negative association in a Chinese sample. Similarly, while Ntim et al. (2017) found no significant relationship in a study of 130 UK HEIs, Adhikariparajuli et al. (2021) identified a positive correlation between frequency of board meeting and the extent of institutional disclosure. In contrast, more recent evidence from Adhikariparajuli et al. (2023) showed a significant negative relationship between frequency of board meeting and non-financial disclosure across the top 100 global universities. These contradictory findings suggest that the impact of frequency of board meeting may depend on contextual factors such as communication effectiveness, timeliness of decision-making, and the nature of board discussions (Ntim et al., 2018; Elmaghri et al., 2018; Ozkan, 2007). Infrequent meetings, for example, may hinder responsiveness to environmental risks and lead to missed opportunities for proactive biodiversity management.

We also believe that testing the frequency of board meetings can support progress towards achieving specific SDGs. For instance, consistent reporting on biodiversity actions, ensures that ecological considerations are embedded in institutional planning and development, such as campus landscaping, research priorities, and land use, contributing directly to SDG 15: Life on Land. Moreover, aligning biodiversity with governance structures enhances experiential learning opportunities, promotes interdisciplinary sustainability education, and embeds environmental values within the university culture, supporting SDG 4: Quality Education. Regular updates in board meetings also drive the adoption of sustainable practices in areas like procurement and land management while fostering transparency, thereby contributing to SDG 12: Responsible Consumption and Production. Finally, regular meetings allow for presenting biodiversity actions that facilitates alignment with national biodiversity strategies and strengthens partnerships with conservation organizations and local communities, advancing SDG 17: Partnerships for the Goals.

Given the absence of empirical studies that directly examine the link between frequency of board meeting and reporting on biodiversity actions in the HEI sector, this study seeks to address this research gap. It is particularly relevant as institutions increasingly seek to align governance practices with environmental sustainability and stakeholder expectations.

Therefore, we propose the following hypothesis:

Hypothesis 1: The frequency of governing board meetings has a positive relationship with reporting on biodiversity actions in UK HEIs.

3.2 Biodiversity and governing board diversity

Blau (1977) conceptualized diversity as the degree to which individuals in a population are spread across a wide range of statuses. In governance contexts, diversity is often represented through demographic attributes such as gender, ethnicity, nationality, age, professional experience, religion, and education. These dimensions are increasingly recognised as valuable contributors to board-level decision-making and organisational strategy. As Hillman et al. (2002) suggest, demographically diverse boards bring distinctive skills, knowledge, and perspectives that can strengthen organisational governance. This understanding is particularly relevant for UK HEIs, where board diversity is crucial not only for enhancing governance quality but also for meeting regulatory expectations. HEIs operate within a complex web of stakeholder relationships, including student funding bodies, research councils, regulatory agencies, and government entities, which necessitates the effective management of stakeholder perceptions (Hassan et al., 2019; Ntim, 2018). The Committee of University Chairs (CUC, 2020) further reinforces this by urging HEI governing bodies to embed values of equality, inclusion, diversity, and ethical conduct in both board composition and institutional culture.

While the theoretical importance of board diversity is well-established, empirical findings remain mixed, especially concerning its influence on organisational performance, voluntary disclosure, and sustainability practices in the public and non-profit sectors. For instance, Buse et al. (2016) reported a significant positive relationship between gender and ethnic diversity and voluntary disclosure in a study of 1,456 U.S. not-for-profit organisations. In contrast, Elmagrhi et al. (2018), studying the 100 largest UK charities, found a negative relationship between board diversity, capital structure, and performance. Within the HEI context, Ntim et al. (2017) demonstrated that board diversity positively influences voluntary disclosure, while

Elmaghri et al. (2022) linked board diversity with improved accountability and risk reporting. However, contrasting findings by Adhikariparajuli et al. (2023), who examined the top 100 global HEIs, indicated a negative association between board diversity and non-financial information disclosure. Additionally, Ntim (2018) highlighted the continued underrepresentation of women—particularly those from Black, Asian, and Minority Ethnic (BAME) backgrounds—on UK HEI boards. Despite growing scholarly attention, the specific relationship between board diversity and biodiversity reporting within HEIs remains underexplored. Biodiversity disclosure is emerging as a vital component of sustainability reporting, yet there is a notable gap in research examining how diverse governance structures may influence such practices. Nonetheless, existing literature and theoretical foundations offer valuable insights. Board diversity, especially in gender, ethnicity, and nationality, can facilitate a wider range of viewpoints, thereby enhancing environmental awareness and potentially fostering more robust biodiversity-related initiatives. Empirical support for these links can be drawn from studies such as Post et al. (2011), who found that gender-diverse boards are associated with stronger environmental CSR performance, and Bear et al. (2010), who argued that diverse boards are more inclined to pursue social and environmental responsibility. Board diversity is also linked to improved transparency and voluntary reporting, as evidenced by Buse et al. (2016) and Elmaghri et al. (2022), whose findings underscore the positive effect of board diversity on disclosure quality in not-for-profit and HEI settings. While Naidoo and Gasparatos (2018) did not focus directly on-board composition, they documented an increasing trend in biodiversity disclosures, suggesting that such practices may be shaped by board-level values and priorities.

To interpret these relationships, this study draws upon stakeholder, signalling, and deep ecology theories. Stakeholder theory posits that diverse boards are better equipped to represent a broader spectrum of stakeholder interests, including those of environmental groups and future generations (Hillman et al., 2002; Ntim et al., 2017). Signalling theory, as articulated by Miller and Triana (2009), suggests that board diversity serves as a visible signal of an organisation's alignment with social expectations and environmental values, thereby enhancing its legitimacy (Hassan et al., 2019; Gaia and John Jones, 2019; Elmaghri and Ntim, 2022a). Deep ecology theory adds a normative dimension, proposing that organisations governed by individuals with intrinsic ecological values may be more committed to biodiversity preservation.

This study contributes particularly to the deep ecology perspective by arguing that increased board size and greater representation of women and ethnic minorities can introduce ecological

worldviews into strategic discussions. Such diversity may facilitate an inclusive ethical orientation toward nature, making biodiversity a legitimate subject in governance discourse. Roberts et al. (2022) advocate for the equal consideration of human and non-human stakeholders, recognising other species, ecosystems, and biodiversity as legitimate stakeholders. This perspective highlights the intrinsic value of non-human life and underscores the increasing recognition of the interconnectedness between ecological systems and institutional functions (Adler et al., 2018; Atkins and Atkins, 2018; Bebbington and Unerman, 2018). Bhattacharyya and Yang (2019) further support this view, asserting that nature restoration initiatives undertaken by HEIs reflect a deep commitment to environmental ethics.

We also believe that testing the diversity of university boards, across dimensions such as gender, ethnicity, discipline, age, geographic background, and professional expertise, as one of the determinants factors in reporting on biodiversity actions, can support progress and contribute to the achievement of multiple (SDGs). A more diverse board brings a broader spectrum of perspectives, values, and priorities, enriching biodiversity-related decision-making and enhancing impact across sustainability efforts. For example, diverse boards are more likely to incorporate a wide range of ecological and cultural values into biodiversity discussions, resulting in more inclusive and context-sensitive decisions, advancing SDG 15: Life on Land. They can also help shape biodiversity education programs that reflect varied cultural and disciplinary perspectives, thereby enriching the curriculum and increasing its relevance, supporting SDG 4: Quality Education. Furthermore, promoting gender diversity in governance ensures that women's voices, often deeply connected to community-based and environmental stewardship, are included in strategic biodiversity decisions, contributing to SDG 5: Gender Equality. Inclusive governance also supports SDG 10: Reduced Inequalities by enabling more equitable biodiversity policies that recognize the needs and contributions of underrepresented communities. A diverse board also enhances institutional governance, fostering inclusive and participatory processes in biodiversity policymaking, aligning with SDG 16: Peace, Justice, and Strong Institutions. Lastly, such diversity helps expand the university's networks, facilitating collaborations with a wider array of biodiversity stakeholders, including NGOs, indigenous communities, and international partners, thereby advancing SDG 17: Partnerships for the Goals.

Therefore, building on these theoretical and empirical foundations, we propose that board diversity in HEIs may be positively associated with biodiversity reporting. By integrating underrepresented voices, a diverse board is more likely to recognise the importance of

ecological sustainability and act accordingly—thereby enhancing voluntary disclosure and contributing meaningfully to global biodiversity goals.

Hypothesis 2: Governing board diversity has a positive relationship with reporting on biodiversity actions in UK HEIs.

3.3 Biodiversity and Vice Chancellors (VC) tenure

As universities continue their transformation from public service institutions to entities that increasingly mirror private-sector organisations in structure and function, the role of the Vice Chancellor (VC) has evolved accordingly. VCs are now more akin to Chief Executive Officers (CEOs), embodying strategic leadership rather than traditional academic stewardship (O'Meara and Petzall, 2007). This shift has brought greater emphasis on performance, accountability, and voluntary disclosure, particularly in relation to social and environmental challenges. Breakwell and Tytherleigh (2010) note that shorter VC tenures may reflect the growing volatility of the role, shaped by increasing institutional pressures and shifting priorities. Conversely, longer-serving VCs offer continuity, organisational memory, and stability—factors that are essential for implementing sustainable development initiatives. Elmaghri et al. (2022) further argue that the performance of VCs is influenced by characteristics such as age, gender, specialisation, and remuneration, which also play a role in disclosure outcomes. Hillman (2022) highlighted that the average VC tenure in UK HEIs is five years, although most retire from their role after approximately eight years. However, as senior university executives, VCs can exert significant influence over institutional decision-making, including voluntary sustainability disclosure (Elmagrhi et al., 2021). Drawing on these insights, this study uses VC tenure, measured by the number of years served, as a key variable to examine its impact on biodiversity reporting, consistent with previous research (Ntim et al., 2017; Breakwell and Tytherleigh, 2010). However, existing evidence on this relationship remains inconclusive. Adhikariparajuli et al. (2023), in a global study of 100 HEIs, found no significant association between VC tenure and non-financial disclosures. Similarly, Cheah et al. (2023), analysing 126 UK HEIs, reported that longer tenures may lead to declining motivation and reduced engagement in sustainability reporting. Although the average VC tenure in UK HEIs is around five years, most step down within eight (Hillman, 2022). Moreover, Roberts et al. (2024) observed that extended career horizons among VCs can correlate with diminished sustainability performance, particularly when disclosures become vague, repetitive, or lacking in substance.

Despite these mixed findings, there is reason to believe that longer serving VCs, particularly those nearing retirement, may be inclined toward legacy-building initiatives such as institutional sustainability and biodiversity commitments (de Villiers et al., 2024). The increasing regulatory and reputational pressures facing UK HEIs, including mandates to operationalise the Sustainable Development Goals (SDGs) and achieve Net-Zero targets, further necessitate strategic leadership at the executive level.

While there is limited empirical research directly connecting VC tenure to biodiversity reporting, insights from the corporate sustainability literature offer valuable parallels. Leadership stability is often linked to long-term planning and coherent vision-setting. Waldman and Siegel (2008) emphasise that executive leadership style significantly affects corporate social responsibility (CSR) practices. Similarly, Petrenko et al. (2016) demonstrate that CEOs with strong personal commitment to sustainability are more likely to drive meaningful environmental disclosures. By extension, VCs with longer tenures may be more capable of integrating biodiversity considerations into institutional reporting due to their strategic influence and deeper understanding of institutional dynamics. Moreover, longer-serving VCs are well positioned to foster stakeholder engagement and institutional trust, enhancing responsiveness to environmental concerns. Boiral et al. (2017) highlight the importance of senior management in shaping environmental disclosure through legitimacy and reputational strategies. Likewise, Hassan et al. (2019) show that leadership involvement in stakeholder management strengthens transparency and accountability in HEIs. Although Adhikariparajuli et al. (2021) do not specifically examine VC tenure, their research supports the broader relevance of governance characteristics in shaping non-financial disclosure practices. Thus, the present study builds on stakeholder theory, signalling theory, and deep ecology theory to explore this underexamined link. According to stakeholder theory, VCs with longer tenures may be better equipped to interpret and meet the expectations of various stakeholders, including those concerned with biodiversity (Roberts et al., 2022). This engagement reflects a stewardship approach aligned with deep ecology, where VCs act as guardians of natural capital. From a signalling theory perspective, biodiversity reporting may function as a visible indicator of ethical leadership and institutional responsibility, particularly among older, reputable, or long-serving VCs aiming to enhance their legacy and institutional standing (Breakwell and Tytherleigh, 2010).

We also believe that testing the Vice Chancellor (VC) tenure as one of the determinant factors in reporting on biodiversity actions, can help embed sustainability leadership within university

governance and align long-term institutional strategies with environmental stewardship. This approach not only strengthens accountability and continuity but also enhances the overall impact of biodiversity initiatives throughout the VC's term, directly contributing to several (SDGs). For instance, incorporating biodiversity metrics into the VC's performance indicators ensures that ecological considerations inform key strategic decisions, such as campus land use, infrastructure development, research focus areas, and partnerships, contributing to SDG 15: Life on Land. VCs held accountable for biodiversity outcomes are also more likely to advocate for the integration of sustainability into academic programs and support student-led conservation efforts, advancing SDG 4: Quality Education. Also, linking biodiversity responsibilities to the VC's role reinforces sustainability reporting as a core leadership function, promoting transparency and responsible institutional practices in line with SDG 12: Responsible Consumption and Production. Embedding biodiversity into performance evaluation also enhances governance by encouraging inclusive, transparent, and mission-aligned decision-making, supporting SDG 16: Peace, Justice and Strong Institutions. Finally, a VC guided by biodiversity-focused performance goals is better positioned to align the university with national biodiversity agendas, regional conservation programs, and global partnerships, thereby contributing to SDG 17: Partnerships for the Goals

Furthermore, we anticipate that VCs with greater experience and more diverse backgrounds, including gender diversity, may be more inclined to initiate consistent discussions on ecological restoration and embed sustainability values within institutional culture.

Based on the above discussion, we propose the following hypothesis:

Hypothesis 3: VCs tenure has a positive relationship with reporting on biodiversity actions in UK HEIs.

3.4 Biodiversity and assurance provided by Big 4

The central aim of Corporate Social Responsibility (CSR) and sustainability reporting is to meet societal expectations (Junior et al., 2014). To enhance both the credibility and quality of such reporting, organisations frequently engage third-party assurance providers, often accounting firms, to increase stakeholders' confidence and trust in disclosed information (Simnett et al., 2009; Maroun, 2018). A growing body of research has explored the assurance of CSR reports (Simnett et al., 2009; Perego and Kolk, 2012; Peters and Romi, 2015), revealing

its importance for stakeholder trust. Hodge et al. (2009) found that stakeholders place greater confidence in CSR disclosures that are supported by a reasonable level of independent assurance. Extending this understanding to biodiversity, which can be viewed as a dimension of CSR, we anticipate a potential link between biodiversity reporting and the use of assurance services. For example, Xue and O'Sullivan (2013) analysed 113 UK Higher Education Institutions (HEIs) and found that 78% engaged Big Four audit firms, with KPMG auditing 38% of the institutions. These findings suggest that prestigious auditors are commonly selected by UK HEIs, particularly those established before 1992 (Ntim et al., 2017). However, perspectives on the implications of auditor size vary. Gordon et al. (2002) proposed that larger audit firms might serve as substitutes for weak internal controls, potentially diminishing the incentive for voluntary disclosure. In contrast, Ntim et al. (2017) reported no significant relationship between audit firm size and voluntary disclosure within the UK HEI context. Notably, no prior research has examined the specific association between audit firm size and biodiversity disclosure, highlighting a gap this study aims to address.

According to stakeholder theory, externally assured reports are perceived by stakeholders as more legitimate and trustworthy representations of organisational performance (Cho et al., 2015a). Within the context of UK HEIs, third-party assurance can signal adherence to ecological stewardship principles and commitment to protecting natural capital, consistent with deep ecology theory (Bhattacharyya and Yang, 2019). By engaging independent assurance providers, HEIs may mitigate legitimacy risks, shift attention from negative environmental outcomes, and build stakeholder trust (Perego and Kolk, 2012; Gürtürk and Hahn, 2016). Jones and Solomon (2013) argue that meaningful nature reporting can raise public awareness and motivate organisations to take more effective biodiversity-related actions. Therefore, UK HEIs may seek third-party assurance to enhance the credibility of their biodiversity disclosures, ultimately bolstering reputation and stakeholder confidence (Cho et al., 2014; Odriozola and Baraibar-Diez, 2017). From the lens of signalling theory, organisations often procure assurance services to convey the legitimacy and appropriateness of their actions to stakeholders (Gray et al., 1996; Clarkson et al., 2011). As such, we expect UK HEIs that report on biodiversity to utilise assurance as a signal of responsible governance and commitment to social and environmental values (Bagnoli and Watts, 2017). Despite the associated costs, engaging assurance services can help institutions communicate positive performance and reinforce their dedication to biodiversity (Bagnoli and Watts, 2017).

Combining perspectives from both stakeholder and signalling theories, we examine whether UK HEIs that disclose biodiversity information are more likely to engage in external assurance. We also expect these institutions to favour high-quality assurance providers, particularly the Big Four firms, to convey superior performance (Cho et al., 2015a; Braam and Peeters, 2018). In the post-pandemic context, we anticipate that HEIs committed to biodiversity will increasingly adopt a deep ecological approach that recognises non-human species as stakeholders (Roberts et al., 2022). Thus, our hypothesis aims to contribute to the growing body of literature that suggests a positive relationship between biodiversity disclosure and external assurance (Hassan et al., 2020). According to deep ecology and stakeholder theories, organisations are expected to safeguard biodiversity and recognise species as legitimate stakeholders (Samkin et al., 2014). Given the mixed evidence on the role of external assurance in enhancing accountability, our study investigates its potential influence on the biodiversity practices of UK HEIs. Previous research also suggests that while Big Four audit services are more costly, they serve as signals of higher quality assurance (Simnett et al., 2009; Hodge et al., 2009; Braam and Peeters, 2018). Audit fees, in this context, can act as proxies for audit effort, with accounting professionals typically perceived to deliver more rigorous assurance than non-accounting providers. These perceptions directly impact stakeholders' trust in the integrity of CSR disclosures. Aligned with signalling theory, we anticipate that HEIs demonstrating superior biodiversity practices will engage Big Four firms to distinguish themselves from lower-performing peers, thereby enhancing credibility and public trust (Hodge et al., 2009). Selectively appointing reputable firms signals that the reported biodiversity data are both accurate and meaningful. Consequently, assurance from Big Four auditors likely serves to reinforce stakeholder confidence, elevate institutional reputation, and contribute to perceived legitimacy (Perego and Kolk, 2012; Luo et al., 2012; Cho et al., 2012; Odriozola and Baraibar-Diez, 2017).

We also believe that testing the independent assurance by Big Four accounting firms, as one of the determinants of reporting on biodiversity actions, brings greater professionalism, credibility, and accountability to sustainability disclosures. This third-party validation reinforces environmental governance and transparency within higher education institutions, directly advancing several SDGs. For instance, external assurance enhances the accuracy and reliability of biodiversity data, promoting more responsible campus resource management, contributing to SDG 12: Responsible Consumption and Production. It also ensures that biodiversity commitments are meaningfully embedded in institutional planning and operations,

rather than remaining aspirational, supporting SDG 15: Life on Land. Moreover, assured biodiversity reporting builds trust among stakeholders by demonstrating that the university is managing its environmental impacts transparently, aligning with SDG 16: Peace, Justice, and Strong Institutions. Finally, assurance by Big Four firms helps universities align with internationally recognized reporting frameworks, enabling stronger, data-driven collaborations with governments, NGOs, and other stakeholders, furthering SDG 17: Partnerships for the Goals.

Therefore, we propose the following hypothesis**:**

Hypothesis 4: Assurance conducted by Big Four firms are positively associated with reporting on biodiversity actions in UK HEIs.

3.5 Biodiversity and gaining environmental awards

Environmental awards and certifications represent external, third-party evaluations of an organisation's environmental performance (Jacobs et al., 2010). Within quality management literature, such third-party assessments have been shown to positively influence organisational financial performance and market perception (Hendricks and Singhal, 1996; Corbett et al., 2005). Securing an environmental award serves as a powerful signal of responsible environmental behaviour in response to stakeholder expectations (Deegan, 2002; Cho et al., 2015b), and may encourage other organisations to disclose their CSR initiatives (Hassan and Ibrahim, 2012). Award-winning organisations often demonstrate greater transparency, which can positively influence investor perceptions and attract future financial support (Clarkson et al., 2011). Moreover, environmental awards provide an opportunity for institutions to communicate a genuine commitment to nature conservation (Atkins et al., 2014; Adler et al., 2018), serving both symbolic and practical roles in environmental stewardship. Empirical evidence supports this view; for instance, Hassan and Ibrahim (2012) found a positive association between the inclusion of environmental awards within a corporation's environmental management system (EMS) and its level of environmental sustainability disclosure. Similarly, Alshuwaikhat et al. (2016) reported that environmental awards enhance institutional engagement in campus sustainability, particularly in the context of Saudi Arabian HEIs.

Nonetheless, some limitations exist. Adams (2013) noted that sustainability practices within universities, particularly in areas such as reporting, assurance, and performance evaluation, remain underdeveloped, constraining the sector's ability to lead transformational change via knowledge transfer. Furthermore, Conke (2023) cautions that environmental award recognition alone should not be regarded as a definitive indicator of genuine environmental commitment, given the limited scope of such evaluations.

Drawing from these insights, this study seeks to contribute to the literature by examining whether UK HEIs disclose their receipt of environmental awards and how such recognition relates to biodiversity efforts. From the perspective of deep ecology, public disclosure of environmental awards may reflect a broader commitment to protecting both human and non-human stakeholders. If UK HEIs are actively engaging in and reporting on nature-positive initiatives, it suggests an underlying alignment with deep ecological values. In addition, signalling theory suggests that HEIs may pursue environmental awards to publicly demonstrate superior environmental performance and differentiate themselves from peers. Furthermore, consistent with stakeholder theory, increased transparency regarding biodiversity efforts, especially when validated by external awards, can enhance stakeholder trust and organisational legitimacy.

We also believe that testing environmental awards, as one of the determinants in reporting on biodiversity actions, can create strong incentives for universities to embed sustainability into their core functions. This alignment drives measurable biodiversity action while enhancing institutional reputation and supports several SDGs. For example, award criteria often require evidence of habitat protection, species conservation, and nature-based campus planning, achieving SDG 15-life on land. Awards promote transparency and structured biodiversity reporting as part of overall sustainability documentation, achieving SDG 12-Responsible Consumption and Production. Environmental awards often assess sustainability education and student engagement in biodiversity projects, achieving SDG 4- quality education. Award programs frequently value biodiversity-enhancing green spaces that benefit students and the wider community, achieving SDG 11-Sustainable Cities and Communities. Participating in award schemes fosters collaboration with environmental NGOs, local governments, and other institutions, achieving SDG17-Partnerships for the Goals

Based on this rationale, we propose the following hypothesis**:**

Hypothesis 5: Receiving an environmental award is positively associated with reporting on biodiversity actions in UK HEIs.

4. Research design

4.1 Data collection

Our sample comprises the full population of 130 UK higher education institutions (HEIs) listed in *The Complete University Guide* (2023) as of 31 January 2023. This comprehensive approach ensures broad regional and geographic representation across Scotland, England, Wales, and Northern Ireland. Since the launch of the *Times Higher Education Impact Rankings* in 2019, UK HEIs have faced growing pressure to transparently report their sustainability performance, further justifying the relevance and timeliness of this study.

This study analyses the period from 2019 to 2022 to evaluate potential improvements in biodiversity reporting, resulting in a total dataset of 520 observations drawn from 130 UK higher education institutions (HEIs) over the four-year period. The research relies on a range of secondary data sources relevant to sector-specific characteristics of HEIs.

Primary data for biodiversity reporting analysis were manually collected from institutional sustainability reports and financial statements, which were accessed and downloaded directly from each HEI's official website. To ensure a comprehensive dataset, additional contextual and institutional information was gathered from publicly available sources, including HEI websites and other relevant institutional reports. This manual collection approach allowed for detailed review and consistency in identifying and interpreting disclosure practices across institutions.

4.2 Definition of variables and model specification

Biodiversity (dependent variable)

We classify our variables used in testing H1-H5 into three main types, and Table 1 provides variable definitions along with details on the measurement for each. Content analysis,

a method commonly employed in prior research on voluntary disclosure in the UK HEI sector (e.g., Ayoubi and Massoud, 2007; Hassan et al., 2019; Jiang and Carpenter, 2013; Low et al., 2015) is employed for making replicable and valid inferences from texts to the context of their use (Adler et al., 2018).

To measure our primary dependent variable, biodiversity, we devised a 26-item framework adapted from (Hassan et al., 2020; Roberts et al., 2022), who primarily focused on biodiversity disclosures. This framework was modified to suit the HEI sector, encompassing all disclosures related to biodiversity in a broader sense. We opted for this framework due to its comprehensive nature, covering a wide range of relevant disclosures, including current actions, preventative actions, activities, and adopted guidelines related to biodiversity (refer to Appendix 1 for details). The framework incorporates components such as afforestation activities, restoration projects, environmental partnerships, and articulated goals and strategies pertaining to nature, all aligned to SDGs 14 and 15. Research indicates that organisations may issue general symbolic statements on nature to legitimize their operations. Hence, we develop the components of the index to facilitate a deeper understand of the specific activities HEIs may be reporting on. To ensure a thorough collection of all and pertinent biodiversity Information, we performed an eighteen[3] keyword search and supplemented it with manual data collection, resulting in a robust measurable approach.

To measure the dependent variable, this research adopts the weighted scoring method. Each item is assigned a weight, accounting for the variation in the importance of each type of Information, both quantitative and qualitative terms. Our index covers four subcategories. The first sub-category "HEIs report on current/ previous actions (CPA)" and covers ten items. The second sub-category is "prevent activities happening in the future (PAF) and includes six items. The third sub-category is "Report on activities contributing to nature loss (ELOSS)" and involve six items. Finally, "report on guidelines or adopt the following (FG)" and contains four items. We follow previous studies (Adler et al., 2018; Hassan et al., 2020) and score the index disclosure from 0 to 3 [4]. The total disclosure score of biodiversity disclosed in HEI sustainability reports is the dependent variable. The authors independently coded the data and

[3] The keywords are "nature", "wildlife", "forest", "biodiversity", "flora", "fauna", "species", "ecology", "forest", "plantation", "nature positive", "habitat", "marine", "ocean", "river", "SDG", "ecosystem", "conservation".

[4] A score of "0" was awarded for no disclosure at all. A score of *"*1*"* was awarded when the disclosure relating to a particular item was minimal, vague, and/or completely general. A score of "2" was awarded when disclosures contained objective, verifiable and current data. A score of "3" was awarded when disclosure included all the ingredients of code "2," as well as providing specific information identifying the site/operating facility, affected species, and/or number of affected flora/fauna; a description of specific measures taken and/or amount of money spent; a discussion of trend information; and/or a linking of the data presented to a company strategy, aim performance measure, target, incident, or accident (Adler et al., 2018; Hassan et al, 2020).

subsequently held a meeting to reconcile any discrepancies, following established practices (Hassan et al., 2019). Data collection was conducted between January and March 2023.

Independent variables

In this study, we investigate various independent variables as internal governance mechanisms. These variables include frequency of governing board meetings (GBM), governing board diversity (GBD), VC`s tenure (VCT), Assured and Audited by big4 (ABB) respectively, while environmental awards received by HEIs (EWA). Please refer to Table 1 for detailed variable definitions.

We selected these variables for several reasons. For instance, in terms of board meetings, Adhikariparajuli et al. (2023) suggest that more frequent governance meetings encourage boards to disclose more voluntary information related to the value-creating activities of HEIs. However, no significant association is highlighted between governing board meetings and voluntary disclosure within the UK HEI context by Ntim et al. (2017). In contrast, Vafeas (1999) concluded that regular board meetings might have a negative impact due to executives' time, travel arrangements, and potential conflicts of opinions. Similarly, regarding governing board diversity, Gordon et al. (2002) posit that diverse governance boards are associated with greater diversity in stakeholder representation and increased expertise, potentially leading HEIs to disclose more voluntary information. in and disclose biodiversity actions. However, Gordon et al. (2002) argued that audit firm size may act as a substitute for weak internal control structures; thus, a negative influence of audit firm size on voluntary disclosure practices could be expected. In terms of Vice-Chancellor (VC) tenure, Hillman (2022) highlighted that the average VC tenure in UK HEIs is five years, although most retire from their role after approximately eight years. However, as senior university executives, VCs can exert significant influence over institutional decision-making, including voluntary sustainability disclosure (Elmagrhi et al., 2021). Environmental awards can serve as a useful indicator of an institution's commitment to sustainability, offering a platform to visibly recognise and communicate environmental efforts. They also act as a signalling mechanism, demonstrating a genuine concern for nature and reinforcing accountability for conservation practices (Atkins et al., 2014; Adler et al., 2018).

Control variables

Finally, to account for potential omitted variables bias (Gujarati, 2021; Wooldridge, 2010), we include several control variables. These include the establishment of the HEI,

geographical location of HEI, size of the HEI, annual council funding, growth, and liquidity (Adhikaiparajuli et al., 2022; Ntim et al., 2017; Hassan et al., 2019).

4.3 Data analysis and model specification

The following equation is developed to test the hypotheses. The regression model is as follows:

$$TOTAL\ Biodiversity = \beta_0 + \beta_1 GBM + \beta_2 GBD + \beta_3 VCT + \beta_4 ABB + \beta_5 EWA + \beta_6 EST + \beta_7\, GLH + \beta_8 SIZE + \beta_9 FUND + \beta_{10} GWTH + \beta_{11} LIQ + \varepsilon \quad (1)$$

Where TOTAL biodiversity is the total biodiversity, reporting score, *GBM* refers to frequency of governing board meetings, *GBD* refers to governing board diversity, *VCT* refers to VC`s tenure, *ABB* refers to HEIs assured and audited by big four, *EWA* refers to gaining an environmental award. Control variables of *EST* is a dummy variable with a value of "1" if established before 1992 and "0" otherwise, *GLH* refers to the geographical location of the HEI with a value of "0" if HEI located in Scotland, "1" if HEI located in England, "2" if HEI located in Northern Ireland and "3" if the HEI located in Wales, of *SIZE* refers to the number of full-time students, *FUND* refers to annual council funding/total income, *GWTH* refers to current year's total income minus previous year's total income divided by previous year's total income, and *LIQ* refers to current assets divided by current liabilities, β_0 *the regression intercept, and* ε the error term.

Insert table 1 here

5. Analysis

5.1 Descriptive analysis

Table 2 presents the summary statistics for all, pre- and post-1992 HEIs biodiversity. Examinations of summary statistics reveals several interesting findings. First, in line with prior research (e.g. Ntim et al., 2017; Hassan et al., 2019, Maingot and Zeghal, 2008), there

is a large degree variability in our biodiversity measure. For instance, biodiversity score ranges from a minimum mean of 19.14% in 2019, to a maximum mean of 34.38% in 2022. However, the mean of 34.38% is lower than Ntim et al. (2017) who reported a score of 44.02% for voluntary disclosure in 130 UK HEIs in 2012, and Hassan et al., 2019 who found a score of 47.47% for integrated reporting (IR) content element disclosure in 135 UK HEIs between 2014 and 2017. At the same time, there is evidence of significant differences in some of the sub-indices. For instance, biodiversity related to activities contributing to nature positive loss (ELOSS) ranges from minimum of 0% to maximum of 18%.

Table 2 also depicts a consistent upward trend in biodiversity for both pre- and post-1992 HEIs. Interestingly, pre-1992 HEIs exhibit slightly higher disclosure across all four elements of biodiversity. This contrasts with findings from Ntim et al. (2017) and Banks et al. (1997) who found no differences of voluntary disclosure within pre or post 1992 HEIs. Which possibly indicating that pre-1992 HEIs are more proactive in reporting activities contributing to nature preservation and in aligning with the SDG commitments (Purcell et al., 2019).

Inset Table 2 here

Table 3 presents the variation in biodiversity Disclosure across Higher Education Institutions (HEIs) in four geographical regions of the UK. Notably, HEIs in Wales exhibit the highest level of disclosure across all four dimensions of biodiversity, in comparison to their counterparts in England, Northern Ireland, and Scotland. This finding contradicts the results of Adhikriparajuli et al. (2021), who reported no significant differences in voluntary Integrated Reporting disclosure among UK HEIs across these regions.

Insert Table 3 here

Table 4 provides the correlation matrix, examining Pearson coefficients to address potential multicollinearity issues. The consistent result from the test indicates no significant multicollinearity issues in this study, ensuring the robustness of our findings.

Insert Table 4 here

5.2 Regression analysis and discussion

Table 5 presents the main analysis of the study. Column 1-4 presents the biodiversity by theme and column 5 the total biodiversity disclosure. Furthermore, column 6 indicates the low VIF values, and reinforce that our variables are not impacted by multicollinearity issues, as none exceed the threshold of 10 (Gujarati, 2021). This ensures the reliability of our results.

Insert table 5 here

Furthermore, Table 5 reveals a significant positive association between several internal governance mechanisms and control variables with reporting on biodiversity actions. Specifically, Vice-Chancellor tenure (VCT), the receipt of environmental awards by HEIs (EWA), the establishment year of the institution (EST), geographical location (GLH), and institutional size (SIZE) all demonstrate a positive and significant influence across various biodiversity themes. These findings are consistent with those reported by Ntim et al. (2017) and Elmagrhi et al. (2021). However, they contrast with the results of Roberts et al. (2024), who identified a negative relationship between VC tenure and voluntary disclosure in UK HEIs. This discrepancy may be attributed to the relatively early stage of biodiversity adoption within UK HEIs, where not all institutions are yet fully aware of or engaged in such voluntary disclosure practices.

In addition, although, contrary to our predictions that, frequency of governance board meetings (GBM), governing board diversity (GBD), audits conducted by Big Four firms (ABB), and growth (GWT) have positive but statistically insignificant effects on biodiversity. The findings from Table 5, specifically in column 5, underscore the partial role of governance variables in determining biodiversity. Particularly, the frequency of corporate governance board meetings (GBM) has positive but not significant association with total biodiversity reporting score, which does not support H1. Our results for H1 (positive but not significant) align with several prior studies. The nonsignificant effect of GBM is supported by Gordon et al., (2002) who found no significant influence GBM on the general disclosure of 100 US HEIs. Ntim et al. (2017) found a positive but non-significant relationship between frequency of board meeting and disclosure in UK HEIs, suggesting that institutional policy, regulatory compliance, or sector norms may play a stronger role, especially within the UK's mature governance framework. Similarly, Van Puyvelde et al. (2018) reported a positive association in the U.S., where frequent board meetings are linked to increased engagement, oversight, and

transparency, driven by a strong regulatory and philanthropic emphasis on accountability. Our findings are also consistent with Adhikariparajuli et al. (2021), who observed a positive correlation in UK HEIs. In line with our expectations, testing the frequency of board meetings can support progress toward key SDGs, namely (SDG 4, 12, 15, and17). However, our findings contrast with Adhikariparajuli et al. (2023), who reported a significant negative relationship between frequency of board meeting and non-financial disclosure in global HEIs, likely due to differing governance and disclosure norms. Similarly, they diverge from Xue and Niu (2019), who observed a negative association in China, possibly reflecting cultural or institutional contexts where frequent meetings are symbolic or crisis-driven rather than reflective of effective governance.

Although our findings indicate a positive association between gender board diversity (GBD) and biodiversity reporting, the relationship is statistically insignificant, suggesting that Hypothesis 2 (H2) is not empirically supported. Nevertheless, the positive direction of the relationship aligns with a body of prior research. For example, Bear et al. (2010) posited that diverse boards are more likely to pursue social and environmental responsibility, while Post et al. (2011) found that gender-diverse boards are associated with enhanced environmental corporate social responsibility (CSR) performance. Buse et al. (2016), in their study of 1,456 U.S. not-for-profit organizations, identified a significant positive relationship between board gender and ethnic diversity and voluntary disclosure, proposing that diversity promotes transparency through broader deliberation and stakeholder engagement. Similarly, Ntim et al. (2017), in an analysis of 130 UK higher education institutions (HEIs), reported that greater board diversity positively influences voluntary disclosure, fostering transparency and responsiveness. Elmagrhi et al. (2022) also observed that board diversity in UK HEIs enhances accountability and risk reporting, indicating that diversity contributes to institutional resilience and oversight. Although Naidoo and Gasparatos (2018) did not directly examine board composition, they documented a rising trend in biodiversity disclosures, implying that such practices may reflect board-level values and strategic priorities. Consistent with our expectations, we contend that examining the diversity of university boards, including dimensions such as gender, ethnicity, disciplinary background, age, geographic representation, and expertise, can enhance biodiversity reporting and support the advancement of multiple SDGs, specifically SDGs 4, 5, 10, 15, 16, and 17. However, our findings diverge from those of Adhikariparajuli et al. (2023), who reported a negative association between board diversity and non-financial disclosure among the top 100 global HEIs. This outcome may reflect symbolic

diversity efforts, weak disclosure standards, or governance challenges inherent in diverse institutional contexts. Similarly, Elmagrhi et al. (2018) identified a negative relationship between board diversity, capital structure, and performance in major UK charities, suggesting that in the absence of institutional preparedness, inclusive practices, and appropriate board training, diversity may hinder rather than enhance decision-making.

Our findings regarding Vice-Chancellor tenure (VCT) reveal a significant positive association with total biodiversity disclosure, thereby providing empirical support for Hypothesis 3. This result aligns with previous research emphasizing the role of leadership in driving sustainability outcomes. For instance, Waldman and Siegel (2008) underscore that executive leadership style plays a critical role in shaping corporate social responsibility (CSR) practices. In a similar vein, Petrenko et al. (2016) demonstrate that CEOs with a strong personal commitment to sustainability are more inclined to promote meaningful environmental disclosures. By extension, Vice-Chancellors (VCs) with longer tenures may be better positioned to incorporate biodiversity considerations into institutional reporting due to their strategic influence, institutional knowledge, and deeper understanding of organizational dynamics. Furthermore, long-serving VCs are likely to enhance stakeholder engagement and build institutional trust, which in turn fosters responsiveness to environmental issues. Boiral et al. (2017) emphasize the significance of senior management in shaping environmental disclosure through legitimacy and reputational mechanisms. Hassan et al. (2019) similarly find that leadership involvement in stakeholder management enhances transparency and accountability within higher education institutions (HEIs). Supporting this perspective, Elmaghri et al. (2021) report a positive relationship between the length of a VC's tenure and voluntary disclosure practices among UK HEIs, suggesting that longer-serving VCs demonstrate a greater willingness to pursue biodiversity-oriented initiatives. In line with our expectations, examining VC tenure as a determinant of biodiversity reporting highlights the role of sustainability leadership within university governance. Longer tenures can help embed long-term strategic thinking aligned with environmental stewardship, thereby amplifying the impact of biodiversity initiatives over time and contributing directly to several SDGs, namely SDGs 4, 12, 15, 16, and 17. However, our results contrast with those of Adhikariparajuli et al. (2023), who found no significant association between VC tenure and non-financial disclosures in global HEIs, implying that institutional governance or organizational culture may exert a stronger influence than individual leadership. Similarly, Cheah et al. (2023) observed that longer VC tenure in UK HEIs may diminish motivation and engagement with sustainability reporting, potentially due

to complacency over time. Hillman (2022) noted that the average VC tenure in the UK is approximately five years, with many stepping down within eight, which may limit the continuity required for sustained strategic leadership. Furthermore, Roberts et al. (2024) found that longer VC career horizons are associated with weaker sustainability performance, as late-career leaders may prioritize legacy management and risk aversion over substantive environmental, social, and governance (ESG) commitments.

Our results in relations to ABB shows a negative but statistically insignificant relationship with biodiversity, suggesting that H4 is not supported. This finding does not align with the non-significant positive association reported by Ntim et al. (2017) in UK HEIs, nor with the significant negative association observed by Gordon et al. (2002) in US HEIs. The divergent results in the US context may reflect differences in the audit market structure at the time, particularly the presence of the Big Six audit firms, which contrasts with the current UK context, where only four major audit firms dominate the market.

Furthermore, the significant positive influence of EWA on biodiversity report empirical support consistent with previous studies on mainstream biodiversity reporting practices and disclosures (Roberts et al., 2022; Atkin et al., 2014). So, H5 is supported. This empirical support aligns with the outcomes of earlier HE studies (Ralph and Stubbs, 2014). Moreover, it corroborates findings in the realm of biodiversity disclosures of corporate firms (Adler et al., 2018; Hassan et al., 2020). This result is in line with expectations of signalling theory which posits that HEIs signal responsible behaviour by obtaining environmental awards and demonstrate excellence in environmental performance. The results for this hypothesis are consistent with the theoretical framework. In terms of deep ecology, the findings suggest that if UK HEIs are committed to positive interactions with nature and provide disclosures, they are implicitly committed to focusing on both human and non-human stakeholders (Deep Ecology). Furthermore, the results may imply that if UK HEIs provide positive disclosures about their relationship with nature, they are likely to actively seek awards to showcase their superior performance (signalling theory). Additionally, our results support our arguments that UK HEIs would pursue awards to enhance stakeholders' trust and credibility (stakeholder theory). Our findings align with Atkins et al. (2014) and Adler et al. (2018), who noted that environmental awards play both symbolic and practical roles by signalling commitment to environmental stewardship. Similarly, Hassan and Ibrahim (2012) found that integrating awards into Environmental Management Systems (EMS) enhances sustainability disclosure.

Alshuwaikhat et al. (2016) reported that awards boost sustainability engagement in Saudi HEIs, highlighting their motivational impact. Our results are in line with our expectations that that testing environmental awards, as one of the determinants in reporting on biodiversity actions, can create strong incentives for universities to embed sustainability into their core functions. This alignment drives measurable biodiversity action while enhancing institutional reputation, and supports several SDGs, namely SDG 4, 11, 12, 15 and 17. However, Adams (2013) emphasized that underdeveloped sustainability practices limit universities' transformative potential, while Conke (2023) cautioned that award criteria may not fully reflect genuine environmental performance. Together, these studies support our investigation into how UK HEIs disclose environmental awards and their link to biodiversity initiatives, using deep ecology, signalling theory, and stakeholder theory as interpretive lenses.

Additionally, in relation with control variables, negative but statistically insignificant associations were found between liquidity (LIQ), annual council funding (FUND), and biodiversity. In relation with control variables, the coefficients on the establishment of HEI (EST) SIZE, geographical location of HEI (GLH) are consistent with our prediction. However, growth (GWTH), liquidity (LIQ) and annual council funding (FUND) are negative but statistically insignificant, which are not expected.

Theoretically, we suggest that this evidence offers empirical support of multi-theoretical framework which incorporate insights from reporting on biodiversity actions & practices and disclosure through deep ecology, stakeholder and signalling theories. For example, our findings are consistent with stakeholder and signalling theories, suggesting the longer server VC may enhance transparency, public accountability, and legitimacy in addressing stakeholders' challenges, positioning HEIs as responsible entities (Elmaghri et al., 2021; Hassan et al., 2019; Ntim et al., 2017). These results also support (Roberts et al., 2022). Finding that recognizing species as stakeholder provides emphasis on the equal importance of both human and non-human stakeholders and display responsible corporate governance by embedding deep ecological culture. Furthermore, our findings endorse the notion that effective decision-making by longer server VCs, coupled with timely responses to challenges and increased disclosure about biodiversity restoration efforts, demonstrates HEIs' commitment to preserving biodiversity. This resonates with deep ecology theory, emphasising the stewardship of natural capital (Bhattacharyya and Yang, 2019; Roberts et al., 2022).

Our findings underscore the importance of biodiversity reporting in informing the public and raising awareness about humanity's contribution to biodiversity loss. This has achieved from developing a 26-item biodiversity index that designed to capture the breadth of activities reported by HEIs. The index encompasses elements such as afforestation efforts, ecological restoration projects, environmental collaborations, and clearly articulated goals and strategies aligned with SDGs 14 and 15. This index highlights the critical role of transparent disclosure in fostering societal engagement with nature conservation and restoration. Our findings also support the argument that longer server of a Vice-Chancellor, the more likely to be responsible and display corporate governance by embedding deep ecological culture into their institutions. This is also reflected in reporting on sustainability in general and biodiversity in particular, which are often strengthened by environmental awards received by HEIs, ultimately boosting stakeholder confidence and enhancing institutional reputation (Cho et al., 2014; Odriozola and Baraibar-Diez, 2017).This implicitly aligns with signalling theory, suggesting that if UK HEIs have initiatives to protect biodiversity, they are likely to report on biodiversity actions and share it with external stakeholders. This view of VC work efficiency aligns with signalling theory, which suggests that boards with longer-tenured directors may exhibit weak governance and prioritise financial sustainability over potentially neglecting environmental activities (Elmagrhi et al., 2021; Ntim et al., 2017).

In summary, our results related to Hypotheses 3 and 5 are supportive of the three proposed theories of deep ecology, stakeholders and signalling. The findings lend support to the "ecological self" concept of deep ecology theory, suggesting that biodiversity activities rely more on changing people's behaviour rather simply increasing the number of individuals engaged in certain activities or the frequency of meetings.

Insert Table 6 here

5.3 Further analysis and Robustness test

Presented in Table 6, in our robustness analysis, we employed fixed effect (FE) regression to examine various governance indices and their sub-indices (GBM, GBD, VCT, ABB, and EWA) as proxies for the domination mechanism, aiming to address concerns about endogeneity. We chose fixed-effects analysis to mitigate potential issues related to omitted

variables, dynamic and simultaneous endogeneity (Hassan et al., 2019; Alnabsha et al., 2018; Elamer et al., 2020). This decision was supported by two main reasons: firstly, the suitability of the fixed effects model when the number of observations exceeds the time series (Gujarati, 2021); and secondly, the results of the Hausman test, which indicated that the fixed effect model is more appropriate than the random effects model, considering the comprehensive features of HEIs within the sector (Hassan et al., 2019; Adhikariparajuli et al., 2022).

The results presented in Model 1 indicate significant positive associations between VC tenure (VCT), environmental awards received by HEIs (EWA), and biodiversity. To address potential endogeneity issues arising from simultaneous relationships among our study variables, we employed weighted least squares (WLS) and lagged-effect models (DL) in Models 2 and 3, respectively. Recognizing that unobserved heterogeneities may affect governance variables and that error terms may vary over time, we utilized lagged estimators, as suggested by Ntim et al. (2017) and Hassan et al. (2019). The results reported in Models 2 and 3 of Table 6 align closely with those in Model 1, suggesting that our findings are not significantly influenced by endogeneity issues.

Furthermore, we separated the sample into pre- and post-1992 HEIs. The results demonstrate critical associations and variations between biodiversity and governance variables. However, total biodiversity comprises four different elements, as shown in Table 6, indicating that some variables have a stronger association with governance variables than others. Similar results were observed in both pre- and post-1992 established HEIs.

6. Conclusions

In conclusion, our study aimed to investigate the prevalence of reporting on biodiversity actions within the annual reports, corporate social responsibility reports, and sustainability reports of UK higher education institutes (HEIs) over a four-year period. Additionally, the research seeks to examine potential associations between biodiversity and its determinant factors including governance mechanisms (such as board meeting frequency, board diversity, and Vice Chancellor tenure), assurance practices and environmental awards received by HEIs to support progress toward achieving specific SDGs. Our findings are important in understanding the role of UK HEIs achieving sustainable development, aligning to the SDGs whilst facing mounting environmental global challenges. Our results showed that there are

positive significant results between biodiversity and VC tenure. Which indicates that VCs with longer serving are more willing to work positively towards biodiversity-focused initiatives. In line with our expectation that testing the Vice Chancellor (VC) tenure as one of the determinant factors in reporting on biodiversity actions, can help embed sustainability leadership within university governance and align long-term institutional strategies with environmental stewardship. This approach enhances the overall impact of biodiversity initiatives throughout the VC's term, directly contributing to several SDGs, namely SDG 4, 12, 15, 16 and 17. Our results in relation to environmental awards showed positive significant results with biodiversity and in line with our expectations that that gaining environmental awards, can create strong incentives for universities to embed sustainability into their core functions. This alignment drives measurable biodiversity action while enhancing institutional reputation and supports several SDGs, namely SDG 4, 11, 12, 15, and 17.

Our findings also highlight the positive (insignificant) relationship between Reporting on biodiversity actions and its determinant factors (frequency of board meetings, board diversity). Such positive link suggesting the progress to achieve several SDGs. In line with our expectations, testing the frequency of board meetings can support progress toward key SDGs, namely, SDG 4, 12, 15, and 17. Also, testing the diversity of university boards, across gender, ethnicity, discipline, age, geography, and expertise, can enhance biodiversity reporting and advance multiple SDGs, namely SDG 4, 5, 10, 15, 16 and 17. Our results also showed a negative but statistically insignificant relationship with biodiversity and assurance provided by big4.

Despite an increasing trend in biodiversity among UK HEIS, the overall scores remain extremely low, emphasising the urgent need for heightened awareness and accountability in biodiversity disclosures. Strengthening annual reporting functions enables HEIs to enhance both transparency and accountability. Although HEIs disseminate various types of Non-Financial Disclosures, mainly biodiversity, through diverse channels, such as institutional websites, newsletters, and press releases, the annual report remains a critical mechanism for facilitating "open and ongoing public scrutiny" (Ntim et al., 2017).

The empirical analysis, grounded in stakeholder, deep ecology, and signalling theories, reveals first-time evidence of significant positive relationships between reporting on biodiversity actions and VC tenure and getting environmental award. This aligns with prior studies that examine the effect of board and executive meetings in wider disclosure context

(Ntim et al., 2017; Elmaghri et al., 2021). Furthermore, stakeholder theory supports our findings, as frequent board and executive meetings could facilitate the implementation of nature friendly strategies, recognising all species as stakeholders (Gaia and Jones, 2019; Roberts et al., 2020). Similarly, deep ecology theory enhances institutional awareness and promotes equality between species by valuing their intrinsic worth (Marun and Atkins, 2021; Atkins et al., 2014).

Moreover, we find a significant positive relationship between biodiversity and the attainment of environmental awards, indicating exemplary environmental performance among recognised HEIs. Stakeholder theory encourages accountability for species and nature protection, while the biodiversity reporting tool signals excellence, differentiating institutions with high-quality disclosure themselves from HEIs with low-quality disclosure (Mmako and Van Rensburg, 2017; Adhikariparajuli et a., 2022).

Our study starts a new stream of research on biodiversity disclosure and at the same time makes significant contributions to the existing literature in several key areas. Firstly, we provide novel evidence on the relationship between reporting on biodiversity actions and its determinant factors within UK HEIs and, introducing a comprehensive disclosure index that surpasses the scope of previous studies. Secondly, the research seeks to examine potential associations between biodiversity and its determinant factors including governance mechanisms (such as board meeting frequency, board diversity, and Vice Chancellor tenure), assurance practices and environmental awards received by HEIs to support progress toward achieving specific SDGs. Thirdly, our study advances theoretical frameworks by adopting a triangulation of theories, departing from a singular approach observed in prior studies (e.g., Ntim et al., 2017; Elmagrhi et al., 2021), leading to a more nuanced interpretation of results. Overall, our research significantly enhances understanding of the factors influencing biodiversity in the context of UK HEIs.

The implications of our research are diverse and significant. Firstly, the results of this paper are relevant to university stakeholders, including academics. It sheds light on the role of universities in addressing the UNSDGs, namely SDG 4, 5, 10, 12, 15, 16 and 17. The study demonstrates that sustainability is a core concern not only for the private sector but also for the public sector, including higher education institutions (HEIs). This is because sustainability is central to the public sector's mission to serve the public good, protect shared resources, and promote long-term societal well-being. For universities in particular, sustainability is core to

their role as educators, researchers, and community leaders. As institutions shaping future generations and public policy, universities have a responsibility to embed sustainability across teaching, research, operations, and engagement, aligning their actions with global goals such as the UN SDGs. Secondly, this paper initiates a new area of research by exploring how universities address the SDGs at a strategic level. It invites future studies to examine the relationship between biodiversity and the Times Higher Education Impact Rankings, particularly how sustainability disclosures influence institutional positioning. This connection helps clarify the strategic role of universities in global sustainability frameworks. Thirdly, our findings highlight the urgent need for UK HEIs to intensify their efforts in preserving and protecting biodiversity recognising its intrinsic value for sustainable development. This requires the adoption of conservation practices and policies, and our results offer practical evidence to support the development of institutional policies aligned with, and contributing to, the SDGs. Fourthly, the findings have implications for leadership and governance within universities, particularly in relation to the role of VCs. As influential leaders, VCs shape institutional strategies and are therefore critical in ensuring that initiatives for nature preservation, protection, and restoration are embedded within university agendas.

Overall, this study identifies actionable implications for practice, especially in guiding UK HEIs toward more effective governance and accountability in relation to biodiversity. These implications are directly linked to the study's findings and conclusions and offer concrete guidance for enhancing sustainability practices within the higher education sector.

While our study offers valuable recommendations, several caveats should be noted. Firstly, our sample is confined to the UK HEIs, suggesting the need for future research to examine a global sample of universities to facilitate cross-country comparisons. Secondly, while our research sheds light on the relationship between biodiversity reporting and its determinants, further exploration of other governance structure mechanisms such as participation of independent executive, social status of executives and VCs` remuneration is warranted. Additionally, conducting interviews or case studies with individual VCs and HEIs could provide deeper insights into the motivations and obstacles to biodiversity reporting. Lastly, exploring biodiversity reporting in emerging economics could contribute to sustainability literature.

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Table 1. Summary of variables and measurements

	Dependent variable
Biodiversity	Is the total biodiversity disclosure score. Containing 26 items based on four main themes (see Appendix 1) for more details). Including (a) HEI report on current/previous actions (CPA) including 10 items; (b) HEI prevent activities happening in the future (PAF) including 6 items; (c) HEI report on activities contribution to nature positive loss (ELOSS) including 6 items; (d) HEI report on guidelines or adopt the following (FG) including 4 items (FG). All 26 items have a score threshold of 0-3, resulting in a total potential score of (26 x 3) 78.
	Independent variables
GBM	Governing board meetings measured by number of governing board meetings. Data collected from HEIs annual report.
GBD	Governing board diversity measured by percentage of female and Black, Asian and Ethnic Minorities (BAME) member to the total number of governing boards of an HEI. Data collected from HEIs annual report.
VCT	VCs tenure denotes no years' work as VC in HEI. Data collected from HEIs annual report.
ABB	Has a value of "1" when HEI has sustainability repot assured by one of Big4, "0" otherwise. Data collected from HEI sustainability report.
EWA	Environmental award, value of "1" if award is given, "0" otherwise. Data collected from HEI sustainability report.
	Control variables
EST	HEI establishment has a value of "1" if established before 1992, and "0" otherwise. Data collected from HEIs annual report.
GLH	Geographical location of HEI has a value of "0" if HEI located in Scotland, value of "1" if HEI located in England, value of "2" if HEI located in Northern Ireland and value of "3" if HEI located in Wales. Data collected from HEIs annual report
SIZE	Measured by total number of full-time HEI students. Data collected from HEIs annual report.
FUND	Measured by annual council funding/total income [Ntim et al., 2017; Hassan et al., 2019].
GWTH	Measured by current year's total income minus previous year's total income divided by previous year's total income multiply by 100. [Hassan et al., 2019; Adhikaiparajuli et al., 2022].
LIQ	Measured by current assets divided by current liabilities [Ntim et al., 2017; Hassan et al., 2019]

Source: Author`s own creation

Table 2 Total Biodiversity Disclosure Score

	Total sample (520)				Pre 1992 (212)				Post 1992(308)			
Variables	**2019**	**2020**	**2021**	**2022**	**2019**	**2020**	**2021**	**2022**	**2019**	**2020**	**2021**	**2022**
Total biodiversity Score												
Mean	19.14	26.48	29.95	34.38	26.23	32.89	34.77	35.95	19.94	21.38	21.99	23.95
STD	22.21	24.97	25.36	25.36	24.78	27.72	26.85	27.15	23.15	23.12	19.98	22.49
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max	78.00	78.00	78.00	78.00	75.00	78.00	78.00	78.00	70.00	71.00	71.00	71.00
CPA												
Mean	9.36	12.41	13.88	14.35	12.55	15.04	16.60	13.64	7.17	10.60	12.00	9.78
STD	10.47	11.19	11.26	11.36	11.47	12.23	11.62	12.39	9.19	10.11	10.68	10.40
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	18.00	30.00	30.00	30.00
PAF												
Mean	5.85	7.41	8.35	9.07	7.75	9.09	10.40	8.47	4.55	6.25	6.75	6.95
STD	6.25	6.60	6.70	8.63	6.70	7.06	6.92	7.43	5.61	6.04	6.22	6.27
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
ELOSS												
Mean	2.10	3.72	4.31	5.42	3.26	4.92	5.91	4.32	1.30	2.88	3.21	3.81
STD	4.21	5.26	5.62	5.22	5.42	6.23	6.46	5.95	2.92	4.34	4.69	4.72
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	13.00	16.00	17.00	17.00
FG												
Mean	2.34	3.45	3.85	4.87	2.66	3.83	3.87	2.94	1.64	2.35	3.09	3.25
STD	2.45	3.57	3.98	4.00	3.72	4.36	4.01	3.85	3.10	3.52	3.92	3.96
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	9.00	9.00	9.00	9.00

Source: Author`s own creation

Table 3. Total Biodiversity Disclosure score in different geographical region

Variables	Mean	Median	SD	Max	Min
Total Biodiversity disclosure in		**English HEIs [107 HEIs]**			
CPA	12.15	12.00	11.32	30	0
PAF	7.18	8.00	6.65	18	0
ELOSS	3.64	0.00	5.30	18	0
FG	2.78	0.00	3.81	12	0
Total disclosure	25.71	24.00	25.02	78	0
Total Biodiversity disclosure in		**Scottish HEIs [14 HEIs]**			
CPA	8.79	8.00	9.49	30	0
PAF	6.79	8.50	6.42	18	0
ELOSS	1.82	0.00	3.26	11	0
FG	2.11	0.00	3.31	9	0
Total disclosure	19.29	16.50	21.26	67	0
Total Biodiversity disclosure in		**Northern Irish HEIs [2 HEIs]**			
CPA	15:00	16.50	13.49	30	0
PAF	8.25	9.00	7.81	18	0
ELOSS	2.50	1.50	3.29	9	0
FG	5.63	9.00	4.65	9	0
Total disclosure	31.38	36.00	28.18	66	0
Total Biodiversity disclosure in		**Wales HEIs [7 HEIs]**			
CPA	16.11	14.50	8.86	30	0
PAF	10.75	11.00	5.01	18	0
ELOSS	5.04	2.50	6.26	20	0
FG	3.93	3.00	3.64	14	0
Total disclosure	35.82	32.00	19.18	82	0

Source: Author`s own creation

Table 4. Bivariate correlation for all 130 HEIs

Variables	Total biodiversity	GBM	GBD	VCT	ABB	EWA	EST	GLH	SIZE	FUND	GWTH	LIQ
Total biodiversity												
GBM	0.121**	1.000										
GBD	0.095	0.333**	1.000									
VCT	0.082*	0.055	0.133**	1.000								
ABB	0.239**	0.305**	0.373**	0.133**	1.000							
EWA	0.159**	0.026	0.030	-0.001	0.203**	1.000						
EST	0.262**	0.225**	0.125**	-0.137**	0.038	-0.053	1.000					
GLH	0.002	0.060	-0.015	0.135*	-0.034	-0.219**	-0.015	1.000				
SIZE	0.335**	0.268**	0.158**	0.090*	0.298**	0.141**	0.372**	0.033	1.000			
FUND	0.170**	0.212**	0.165*	0.056	0.180*	0.135*	0.527**	-0.217**	0.334**	1.000		
GWTH	-0.002	-0.015	0.135**	0.059	-0.038	-0.053	-0.091*	0.040	-0.016	-0.008	1.000	
LIQ	-0.036	0.096*	0.151**	0.192**	0.025	-0.009	-0.224**	0.137**	-0.163*	0.151**	0.006	1.000

Notes: Please see Table 1 for full variable definitions. Pearson`s correlation coefficients are reported in the above table. *** means significance at the 1% level ($p<0.01$); ** means significance at the 5% level ($p<0.05$); * means significance at the 10% level ($p<0.10$).

Source: Author`s own creation

Table 5. Pooled OLS regression analysis of all study variables with each theme of Biodiversity

Dependent Variables	CPA	PAF	ELOSS	FG	Total Biodiversity disclosure	VIF
GBM	0.596	0.271	0.337	0.199	0.124	1.23
	(0.529)	(0.786)	(0.869)	(0.231)	(0.301)	
GBD	0.636	0.266	0.374	2.904***	0.733	1.45
	(0.472)	(0.786)	(0.999)	(0.003)	(0.463)	
VCT	0.093*	2.472**	1.908**	2.456*	2.307**	1.32
	(0.181)	(0.013)	(0.003)	(0.014)	(0.021)	
ABB	-0.536	-0.919	-0.600	-0.574	-0.773	1.56
	(0.168)	(0.358)	(0.548)	(0.565)	(0.463)	
EWA	4.641***	3.935***	1.608**	1.060**	2.689***	1.21
	(0.000)	(0.000)	(0.056)	(0.028)	(0.000)	
Control Variables						
EST	3.648***	3.770***	3.874***	3.950***	3.716***	1.67
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
GHL	2.661***	2.451**	1.825	1.538**	2.623***	1.15
	(0.008)	(0.014)	(0.068)	(0.039)	(0.009)	
SIZE	5.382***	3.103***	3.874***	3.160***	5.081***	1.36
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
FUND	-1.160	0.782	-0.216	0.025	-0.352	1.27
	(0.246)	(0.434)	(0.829)	(0.979)	(0.725)	
GWTH	0.418	-0.036	-0.642	0.198	-0.004	1.14
	(0.675)	(0.970)	(0.288)	(0.842)	(0.996)	
LIQ	1.204	-0.640	-0.532	-0.070**	-0.817	1.19
	(0.229)	(0.522)	(0.315)	(0.039)	(0.414)	
Constant	2.342***	2.569***	1.241**	2.678*	2.060**	-
F-Value	9.415***	7.648***	5.580***	5.547***	9.053***	-
Adj. R^2	0.48	0.51	0.42	0.41	0.57	-
No of Obs.	520	520	520	520	520	-

Notes: Please see Table 1 for full variable definitions. *** means significance at the 1% level (p<0.01); ** means significance at the 5% level (p<0.05); * means significance at the 10% level (p<0.10).

Source: Author`s own creation

Table 6. Robustness analysis

Independent variable	Fixed effect (FE)	WLS	Dependent Lag (DL)	Pre 1992			Post 1992		
				FE	WLS	DL	FE	WLS	DL
Model	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
GBM	0.037	0.902	0.091	2.105	0.455	0.943	0.291	0.428	0.921
	(0.970)	(0.367)	(0.927)	(0.337)	(0.649)	(0.347)	(0.197)	(0.668)	(0.734)
GBD	0.599	-0.507	0.858	0.668	1.951*	0.232	1.089	2.372**	1.923*
	(0.549)	(0.611)	(0.391)	(0.505)	(0.052)	(0.816)	(0.277)	(0.018)	(0.057)
VCT	1.138**	3.045***	1.049**	0.362	1.242	0.474	1.887**	5.455***	1.456**
	(0.056)	(0.000)	(0.001)	(0.717)	(0.215)	(0.636)	(0.061)	(0.000)	(0.005)
ABB	0.117	0.387	0.913	0.249	0.495	0.489	0.100	0.402	0.900
	(0.266)	(0.698)	(0.361)	(0.803)	(0.620)	(0.625)	(0.920)	(0.687)	(0.368)
EWA	3.238***	6.226***	2.078**	1.974*	7.004***	2.208**	2.258**	3.610***	2.677**
	(0.000)	(0.000)	(0.078)	(0.050)	(0.000)	(0.028)	(0.081)	(0.000)	(0.018)
Control Variables									
EST	2.669**	6.534***	5.822**	2.282**	2.658***	1.109**	1.542**	2.443**	1.356**
	(0.074)	(0.000)	(0.098)	(0.079)	(0.005)	(0.091)	(0.098)	(0.090)	(0.017)
GLH	1.154**	5.787***	1.651**	0.452*	2.829***	1.344	1.591*	3.595***	1.892*
	(0.034)	(0.000)	(0.099)	(0.097)	(0.000)	(0.181)	(0.031)	(0.000)	(0.013)
SIZE	1.896**	10.12***	1.861*	1.388*	2.829***	1.442**	1.440**	9.005***	1.101**
	(0.090)	(0.000)	(0.073)	(0.651)	(0.000)	(0.081)	(0.066)	(0.000)	(0.012)
FUND	-1.181	-0.758	-0.519	0.759	-0.455	0.242	-0.459	-0.543	-0.540
	(0.982)	(0.448)	(0.603)	(0.442)	(0.649)	(0.808)	(0.646)	(0.587)	(0.589)
GWTH	1.487	1.274	1.843	-0.134	-0.826	0.652	-1.805	-2.583	0.064
	(0.232)	(0.172)	(0.400)	(0.893)	(0.409)	(0.515)	(0.072)	(0.123)	(0.948)
LIQ	-0.420	-0.858	-0.277	-0.059	1.067	0.161	-0.072	-2.583	0.064
	(0.440)	(0.391)	(0.400)	(0.952)	(0.287)	(0.871)	(0.942)	(0.123)	(0.948)
Constant	2.354***	3.173***	3.646***	1.800***	3.268***	2.041***	2.578***	2.633***	2.455***
Adj. R2	0.66	0.69	0.73	0.60	0.64	0.76	0.66	0.88	0.61
No of observation	520	520	390	212	212	159	308	308	231

Notes: Please see Table 1 for full variable definitions. *** means significance at the 1% level ($p<0.01$); ** means significance at the 5% level ($p<0.05$); * means significance at the 10% level ($p<0.10$)

Source: Author`s own creation

Appendix 1. Disclosure Index

CPA	HEI REPORT ON CURRENT/PREVIOUS ACTIONS	Reference
1	HEI reports on partnership engagement between wildlife/nature/conservation organisations and the company, which aim to address impacts on endangered species	Atkins and Atkins, (2018); Atkins and Maroun, (2018); Hassan et al. 2020; Hassan et al., (2021); Roberts et al., (2022).
2	HEI reports on assessment and reflection on outcome/impact of engagement/partnerships and decisions taken about necessary changes to policy/initiatives going forward	Atkins and Atkins, (2018); Atkins and Maroun, 2018; Hassan et al. (2020); Hassan et al., (2021); Roberts et al., 2022
3	HEI reports on its involvement in afforestation activities (such as seedling transplantation, forest plantation, sustainable forestry practices, or other reforestation activities	Adler et al., (2018); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
4	HEI reports on its involvement in land management/land rehabilitation activities	Adler et al., (2018); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
5	HEI reports on floral/faunal wealth in or around its operational area (functional/transportation)	Adler et al., (2018); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
6	HEI reports on donations provided (or conducted philanthropic activities) which contributed to the conservation, protection, enhancement, promotion, and preservation of nature	Adler et al., (2018); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
7	HEI reports steps taken for creating nature positive awareness among its employees or in the community	Adler et al., (2018); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
8	HEI reports on amount spent (RandD, technologies, innovations) for nature conservation/restoration	Adler et al., (2018); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
9	HEI reports on environment policy strategy (or statement) values (or concerns) nature positive	Adler et al., (2018); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
10	HEI reports nature action plans on nature positive goals/targets for coming years	Adler et al., (2018); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
PAF	**PREVENT ACTIVITIES HAPPENING IN THE FUTURE**	
11	Report on potential risks/impacts on these specific species arising from the HEIs operations	Atkins and Maroun (2018), King and Atkins (2016); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
12	Report assessments of whether or not HEIs initiatives/actions are assisting in prevention of future nature loss	Atkins and Maroun (2018), King and Atkins (2016); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)

13	Report strategy for the future development and improvement of actions/initiatives	Atkins and Maroun (2018), King and Atkins (2016); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
14	In the future, collaborate with key advisors across professions to conceptualise accounts and progress with ecologists, scientists, humanities scholars, and other experts	Jones and Solomon (2013); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
15	Update stakeholders with progress and future actions	Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
16	Provide education on nature positive initiatives to schools in future	Atkins et al. (2018)
ELOSS	**REPORT ON ACTIVITIES CONTRIBUTING TO NATURE LOSS**	
17	HEI reports a record list of plant and animal species identified as endangered by the IUCN Red List, whose habitats are affected by the HEI's activities	(GRI); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
18	HEI reports where, geographically, the company's activities pose a threat to endangered plant and animal species, as identified by the IUCN Red List	(GRI); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
19	HEI reports and assess habitat status area protected, restored, affected, and conserved	(GRI); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
20	HEI reports on potential risks/impacts on these specific species arising from the HEI's operations	(GRI); Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
21	HEI reports on nature, rivers, creeks, waterways, or marine affected/protected/restored	Adler et al 2018; Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
22	HEI reports on HEI's nature loss due to its operations (Adler et al, 2018)	Adler et al., 2018 Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022)
FG	**REPORT ON GUIDELINES OR ADOPT THE FOLLOWING**	
23	HEI reports on compliance with United Nations Sustainability Development Goal SDG 12 Sustainable Consumption and Production (No12)	Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022). (UN, 2015)
24	HEI reports on compliance with United Nations Sustainability Development Goal (No14) Life under water	Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022). (UN, 2015)
25	HEI reports on compliance with United Nations Sustainability Development Goal SDG 15 (No15) Life on Land	Hassan et al. (2020), Hassan et al., (2021), Roberts et al., (2022). (UN, 2015)

26	HEI reports using the International Integrated Reporting Council (IIRC) framework	Hassan et al. (2020), Hassan et al., (2021), IIRC, 2013; Roberts et al., (2022)

Source: Author`s own creation