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Investigating biodiversity and circular economy disclosure practices: Insights from global firms

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Abstract

Business activity has contributed to biodiversity loss. The Circular Economy (CE) system is recommended as a way of recovery and to improve global resilience. Combining accounting and ecology, we examine the intersectionality between biodiversity and CE. Therefore, the research aims to investigate the companies' reporting practices on both CE system implemented, and the corrective actions taken to repair biodiversity. To achieve the research aim, we developed a new disclosure index that includes both biodiversity and CE measures. Data is collected from 28 companies operating in three different industries sectors (aerospace and defense, motor vehicle and parts, and transportation) for 4 years (2012, 2014, 2016 and 2018). Our results show, in general, the overall scoring of disclosures is low, with companies providing minimal and vague information and many companies scored ZERO in all of our disclosure items showing that companies have a lack of knowledge on the biodiversity and CE concept. However, there is an increase in the level of disclosures on both biodiversity and CE between 2012, 2014, and 2016 and there is a small decrease for the 2018. Furthermore, the Motor industry is providing more disclosure on both biodiversity and CE, followed by Aerospace & Defense and Transportation industry was the lowest in providing disclosure on both biodiversity and CE. Our study contributes to both biodiversity and CE literature as well as providing some insights on the interconnection of both concepts which is crucial for the future sustainable development.

KEYWORDS
biodiversity, circular economy, SDGs, sustainable development, sustainable production

1 | INTRODUCTION

The implementation of the circular economy model (hereafter CE) is considered as a solution to prevent further biodiversity loss[1] and species extinctions (Hassan et al., 2021). Biodiversity is responsible for all life on earth and keeps the healthy balance in life of all species. Nature is declining at the fastest rate in human history and the integrity of ecosystems which support all health, well-being and business sustainability is at serious risk (WWF, 2020). Biodiversity in the last decades has drawn the interest and attention of many academics and researchers, who are trying to create awareness to people about the

[1]The loss of biodiversity is due to land conversion (majority forest loss and for agriculture basis), plastics in oceans, uncontrolled pollution (air, land, water and soil pollution are responsible for habitant loss of different animals as well as plants), unsustainable use of resources, and over-exploitation of species (Adler et al., 2018; Hassan et al., 2020), this has also caused the climate changes (Mantyka-Pringle et al., 2015) that accelerate natural reasons (forest fire, insects that destroy plans).

implications of further biodiversity loss on sustainable development (Hassan et al., 2020; Roberts et al., 2022). Biodiversity loss and species extinction are a part of wider global environmental challenges facing humanity (Roberts et al., 2021; Sobkowiak et al., 2020) and people and businesses are beginning to take action to protect it (Adler et al., 2018; Hassan et al., 2020; Mantyka-Pringle et al., 2015).

CE is a proposed concept and principles are bringing new ideas, design, and goals not only for the businesses and economy but also for the environment (Ferasso et al., 2020; Gusc, 2019; Urbinati et al., 2017). The most recent call to action is the United Nations Sustainability Goals which aim to transform the planet by 2030. Particularly, SDG 12 and SDG 15 aims to ensure sustainable consumption and production and protect life on land, respectively (United Nations, 2021). Thus, this article seeks to contribute to the extant literature by examining the link of biodiversity and CE reporting practices by global firms and the corrective actions taken to repair nature. The main motivation is to answer the call of scholars who recommend that the CE model can minimize the risk of further biodiversity loss (Hassan et al., 2021) and assist in developing solutions for achieving the SDGs (Roberts et al., 2022). CE is a developing research area and there are limited studies that enable us to specifically understand how companies are implementing the CE concept. Furthermore, there is a limitation in the existing literature that examines and aligns both CE and biodiversity.

Consequently, this study aims to contribute to the literature in the following ways. First, we contribute to the dearth of scholarly work that examines both the biodiversity crisis and CE concept which can assist in firms achieving the SDGs. Second, we contribute to the existing literature by developing an exclusive disclosure index based on the previous studies and combine both biodiversity and CE. Third, we provide company quotes on their efforts to protect nature which can assist companies in the future in their efforts to achieving sustainable production and consumption. We examine 28 companies of the Fortune Global 500 list over 4 years from the transportation, aviation and motor vehicle industries.

We followed prior studies (Adler et al., 2018; Hassan et al., 2020) and classify industry membership due to exposure of biodiversity risk recommended by F&C Asset Report (2004). Considering that integrating both CE and biodiversity are new area of research, we selected one industry from each classification of high, medium, and low risk that provided some sort of disclosure on biodiversity. This is because we expect that companies that provide some disclosure on biodiversity are likely to provide disclosure on CE too. In this article, we argue that corporate disclosure on biodiversity and CE is crucial to achieve the SDGs. Therefore, we follow prior biodiversity studies (e.g., Hassan et al., 2020; Roberts et al., 2021) and select one industry from a low-risk sector (motor vehicle & parts), one from medium-risk (aerospace & defense), and one from high-risk (transportation) for biodiversity and CE disclosure and we believe this article is the is the first to examine these specific industries in this context.

Therefore, the motivation for this article is to respond to this gap and highlight the practice of the world leading organizations for others to follow and provide a benchmark. It is important to understand that by providing disclosure, companies are starting to care more about the environment because they have realized that the connection between businesses and biodiversity (Adler et al., 2018; Hassan et al., 2020, 2021). To improve their negative impact on the environment, many companies have taken part in different types of programmes for a sustainable future and/or their become partners with sustainable organizations (Addison et al., 2019). Businesses are playing an important role for the support of biodiversity awareness by influencing people with events and/or advertisements to protect the biodiversity and take actions such as cleaning the oceans or the forests from rubbish and do not harm the environment or endangered species. The second motivation is to encourage firms to contributing to achieving SDG 12 and 15 which can positively impact the remaining of the SDGs. Hassan et al. (2020) suggested that a multidisciplinary research approach from a range of experts such as accounting, environmental, ecology and engineering is required to develop solutions for sustainable development,

Therefore, we examine 28 companies of the Fortune Global 500 list over 4 years from the transportation, aviation and motor vehicle industries representing high, medium and low risk as explained above. We examine the biodiversity and CE disclosure over 4 years and provide examples of disclosures to highlight current efforts in disclosure practices of firms.

The remainder of the article is structured as follows: In the next section we present the literature review and theoretical framework. Research method is presented in the third section, and then the results are presented in the fourth section. Finally, the articles conclusion is presented along with discussion and limitations in the sixth section.

2 | LITERATURE REVIEW

2.1 | Biodiversity awareness

Biological diversity also known as biodiversity is a compound word: the first part is the Bio which means life (including genetic resources, organism, and humanity) and the second part is Diversity which means variety (species and ecosystem) (United Nations, 2021). Biodiversity is defined as "the variety of living species on the Earth, including plants, animals, bacteria, and fungi" (WWF, 2020). Biodiversity is essential for a healthy ecosystem which is related to support human health, society, and sustainable planet for all (WWF, 2020). According to Sizemore (2015), there are four important ways that biodiversity provides value to people, which are: "The intrinsic value of biodiversity is composed of cultural, social, or ethical beliefs that ascribe inherent value to life in its many forms and may revolve around an anthropocentric viewpoint (e.g., intergenerational altruism) or a non-anthropocentric perspective (e.g., a value independent of the valuers). The utilitarian value of biodiversity represents the subsistence or commercial benefits (e.g., agriculture, medicine) humans derive. Biodiversity also possesses a serendipic value, which ascribes a future but currently unknown benefit. Lastly, biodiversity has a functional value for

humans" (p. 146). Biodiversity on earth is very rich and according to scientist there are about 8.7 million species, animals, and plants and only 1.2 million have been identified so far (WWF, 2020). Moreover, it is necessary because it is balancing the ecosystem. It also supports the economy and the society by keeping the Earth healthy and by producing a series of services and processes that will benefit humans (Silva et al., 2019). Also, biodiversity is important for human existence and for good standards of life because is providing and maintaining (WWF, 2020), a healthy ecosystem that provides oxygen that humans breathe, different animals and plants – can create a variety of foods (meat, milk, vegetables, etc.) and medical use – different types of flowers and plants can be used as medicines, etc that humans are dependent on (WWF, 2020). It has also been conveyed that "Without biodiversity, there is no future for humanity" (WWF, 2020) and that "For most of History, man had to fight nature to survive. In this century he is beginning to realize that, in order to survive, he must protect it" (GR, 2021).

However, nowadays biodiversity is facing gravely danger. In 2020, biodiversity loss has been ranked as one of the top five global risks (Addison et al., 2019). The loss of biodiversity is due to land conversion (majority forest loss and for agriculture basis), plastics in oceans, uncontrolled pollution (air, land, water and soil pollution are responsible for habitant loss of different animals as well as plants), unsustainable use of resources, and over-exploitation of species (Adler et al., 2018; Hassan et al., 2022), this has also caused the climate changes (Mantyka-Pringle et al., 2015) that accelerate natural reasons (forest fire, insects that destroy plans). Moreover, human activities (hunting, habitat conversion, etc.) lead to the loss of species and it has been measured that the current extinction of species is higher than 1000 times of the nature rate (Adler et al., 2018; Mantyka-Pringle et al., 2015).

It is worth mentioning that the majority of business has realized how important the biodiversity is and how dependable their functions are on critical services that ecosystem can provide (Adler et al., 2018). For example, Hassan et al. (2020, p. 1419) argued that "Biodiversity is critical to business survival as companies have a two-way relationship with biodiversity, including both the impact of companies on biodiversity, and the impact of biodiversity on companies." Smith et al. (2019) state that businesses are understanding their responsibilities of their operations towards the environment, and they are starting to take actions. For example, there are sustainable business models like Natural Capital Protocol (helping companies to be responsible environmental managers) and UN system of Environmental and Economic Accounting (a public accounting sector of global standards for the environment) to help and guide businesses to follow a logical process that explores environmental goals and objectives, measures performance, the need to take into account stakeholders and the role of organizations in promoting changes at both companies and system level (Addison et al., 2019). Also, there is a management structure, like Plan Do Check Act (PDCA) procedure, which will help in process control and to the continuous business improvement and to reduce the business impact on the environment (Addison et al., 2019). Companies are playing an important role in supporting the global effort to prevent the biodiversity loss because the biggest part of the international impact on biodiversity and the global ability. This will be achieved with the help of the sustainable organizations like United Nation (UN) and Global Reporting Initiative (GRI), which are helping businesses to reduce their environmental impact with strategies like UN SDG and Agenda 2030, and GRI Standards by managing their waste, managing their material issues, improving the materials production design to lengthen the usage, reduce disposal, etc (GRI, 2021; United Nations, 2021). Biodiversity literature is an emerging stream of literature with notable contributions examining both quantitative (e.g., Adler et al., 2018; Hassan et al., 2020; Rimmel & Jonäll, 2013; Roberts et al., 2021; Wagner, 2022) and qualitative methods (e.g., Atkins et al., 2018; Maroun & Atkins, 2018; Schaltegger et al., 2022; Sobkowiak, 2022; Weir, 2018) offering insights into how firms are responding to the biodiversity crisis. However, as yet, researchers are silent on examining both biodiversity and CE disclosures which is imperative to meet the SDGs.

2.2 | Linear and circular economy

Since the 17th century of the industrial revolution (Taleb & Al Farooque, 2020) until today, businesses are using the linear economy (LE) system. LE is following the 'take, make, and waste' system where businesses extract raw materials, transform them into products, sell the products to the clients and at the end, when the product is no longer needed or it is no longer working, dispose them away (Urbinati et al., 2017; Gusc, 2019; Scarpellini et al., 2020; Taleb & Al Farooque, 2020; Geissdoerfer et al., 2017). Having waste as the final status of utilization (Gusc, 2019) has contributed to the production of toxic waste, which is harmful for the environment and the society (EMF, 2020a). Moreover, some critical raw materials are starting to run out and this is showing us that the LE is not sustainable (EMF, 2020a; Taleb & Al Farooque, 2020).

Businesses also have understood that the current business' LE 'take, make, and waste' system does not work either for the environment or the businesses (Pinto e, 2020). The 'take, make, and waste' system extreme use of raw materials for production and the disposal at the end of it (Geissdoerfer et al., 2017; Gusc, 2019; Scarpellini et al., 2020; Taleb & Al Farooque, 2020; Urbinati et al., 2017) had caused the disappearing of many natural resources, which has had as a result the negative impact on biodiversity, like pollution in air, land and oceans, endangered species, etc (Baars & Haigh, 2020; Weetman, 2019). LE has a negative impact on the environment and the United Nations implemented the Sustainable Development Goals (SDGs) which are 17 goals to achieve a more sustainable future (United Nations, 2021). The LE concept does not benefit either the economy or biodiversity (Sillanpaa & Ncibi, 2019), and also, it does not align with the SDGs or sustainable development.

It is clear that LE cannot achieve those goals, for example, according to the Ellen Macarthur Foundation Report (EMF, 2020a), by 2050 there will be more plastics in oceans rather than fish and 22 million tonnes of plastic microfibres from clothes waste will be end up in the

ocean, this contests the objective of SDG 14 – to conserve and sustainably use the oceans, seas and marine resources for sustainable development (United Nations, 2021, non-paginated). Another example is 90 billion tonnes of resources are extracted annually (Weetman, 2019) and the majority end up in the landfilled this have the opposite effects of SDG 12 (United Nations, 2021, non-paginated). The LE logic does not benefit the environment or the economy, with the loss of uncountable resources with high economic possibilities are lost and cause irrecoverable damage to the land, oceans, air and living organism (plants, animals, humans etc) (Pinto e Costa, 2020). It has been also verified by economists, ecologists, professionals and academics that LE has multiple negative impact on the environment (Sillanpaa and Ncibi, 2019), and this approach is becoming more and more unsustainable (Gusc, 2019) because it continues to produce problems like resources scarcity and a high level of pollution and waste, and this has as a result the global challenges, which are biodiversity loss, pollution, and climate changes (EMF, 2021).

Academics and researchers have introduced a new businesses system, with the hope that this system can prevent further decline of natural resources. One of the main aims of CE is to achieve the long-life in products and to reduce the use of the raw materials (Scarpellini et al., 2020). Also, nowadays, businesses are quite well informed about the CE benefits and are trying to implement it as soon as possible. However, there are different types of CE businesses models that companies can use and find more suitable for them (Urbinati et al., 2017). Moreover, GRI in 2020 has published new standards based on CE that companies can follow in order to report their consequences on the environmental and society. At the moment, the majority of the researchers agree that CE is in the correct path as a business's system because it is promise for both success and a healthier environment (Völker et al., 2020). However, some other authors did not agree with that (Geissdoerfer et al., 2017).

The implementation of CE will help business and society to improve their impact on the environment and to prevent and reduce the biodiversity loss by implementing the CE concept. Also, few educational perspectives like product design practice, environmental, ecology industrial, social science, and political have already implemented CE (Ferasso et al., 2020; Urbinati et al., 2017). CE is a closed loop system (Ferasso et al., 2020) which is focused on the values of materials, resources, and products, to keep them in the market as long as possible (Taleb & Al Farooque, 2020). CE also plans to make technical loops waste-free (Corvellec et al., 2020), by supporting the revolution of physical, biological and digital technology that will create new ways for the operation and implementation of circular strategies by producer and users, for example when design products are no longer needed and returned to their makers, the technical materials of the products will be reused and the biological parts will increase agricultural value (EMF, 2020b). According to Atif et al. (2021), the principles of CE entailing the 10R-strategy to explain ways for value creation. These 10Rs are refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle and recover. However, the main three main principles (reuse, reduce and recycle) that commonly used in prior studies, to help achieve the product life extension, also known as the 3Rs (Scarpellini et al., 2020; Taleb & Al farooque, 2020). We are focusing on the 3Rs as CE is a new area and we would expect companies to provide disclosure of 3Rs rather than 10Rs. *Reduce or reduction*—which "is defined as series of manufacturing steps acting on an end-of-life part or product in order to return it to like-new or better performance, with warranty to match" (Urbinati et al., 2017), *reuse*—which is "The most sustainable product is often one we already own. Reusing a product preserve all of the added-value within that product" (Urbinati et al., 2017), and *recycling*—which is "the most common Circular Economy process through which used materials are treated so as to make them suitable for reuse" (Urbinati et al., 2017, pp. 488–489). Those principles have also been called by Ellen Macarthur Foundation (EMF, 2020a) as "design out waste and pollution", "keep products and materials in use" and "regenerate natural systems."

It is important to reinforce that the concept of CE is to decrease the dependence on energy and raw materials and alleviate the environmental impact of consumption and production (Scarpellini et al., 2020). It is a close production system, that aims to close the loop and eliminate the waste production, reduce all resources exploitation and reduce the emission leakages (Gusc, 2019; Ferasso et al., 2020; Geissdoerfer et al., 2017; Urbinati et al., 2017; Taleb & Al Farooque, 2020), by turning goods that are no longer in use or are at the end of their life into incomes for new ones (Ferasso et al., 2020; Taleb & Al Farooque, 2020). To put it another way, CE is planning to change the LE into a circle of CE (EMF, 2020b). This will enable the achievement of the SDGs (Zwiers et al., 2020) and restore the relation between society—business—nature (Corvellec et al., 2020).

It is worth mentioning that since the Covid-19 pandemic business moved towards to CE even faster (Hassan et al., 2021), hoping for a better future with less waste, less impact and more benefits for business, society, and the environment. Hassan et al. (2021) supported this notion and suggested the CE model should be implemented for sustainable development which has been amplified by the Covid pandemic. For example, the abolition of fuel subsidies and introducing long-term carbon (EMF, 2020a, 2020b) lifting or delaying bans on specific plastic disposable packaging (EMF, 2020a) and an increase in regulations and policies (EU Industrial Strategy, EU circular economy Action Plan, landfill taxes), etc. (EMF, 2020a, 2020b). CE brings new ideas and ways to all businesses (big, medium or small) with the approach to move away from the dependence on raw materials and emphasize on business performance based on waste recovering, a renewable energy system, and on the products reused (Gusc, 2019; Urbinati et al., 2017). Moreover, it is promising that the circular relation between customers, markets and natural resources have unique ability to combine societal and economic development with sustainability (Corvellec et al., 2020; Völker et al., 2020). The performance of CE principles usually requires new strategies, visions and basic redesign concepts of products to achieve the solution of the life extension (Ferasso et al., 2020).

CE is playing an important part in academic literature over the last decade, and the number of journals and articles are increasing (Geissdoerfer et al., 2017). Nowadays, businesses are aware of the opportunities that CE promised and the value possibilities for their

stakeholders and themselves (Geissdoerfer et al., 2017), but also they are aware of the environmental problems, along the lines of, air—land—water pollution, climate changes, biodiversity loss, materials recycling, waste, resources consumptions and gas emission (Scarpellini et al., 2020), and stakeholders are paying attention on the indicators performance and they are expecting from organizations to be clear and reveal non-financial information (Gusc, 2019). So, CE is making the companies to rethink about: models (create more stable revenues), tech (disruptive technologies), resources (reduce costs and waste), different design ways to create innovative solutions, and lastly collaborate (accessibility in new markets).

There are different ways on how companies want to establish the Circular Economy's Business Model (CEBM) and it is represented by different types (Urbinati et al., 2017), for example, product as a service, long life on products, digital platforming sharing, recycling and recovery, and creation of circular supply chain (EMF, 2021), which is based on the willingness of the company (Urbinati et al., 2017). Also, companies should include the CE principles into their business models by reformulating the policies, procedures and working practice that suit the implementation of the CE (EMF, 2021).

As this is the first study to link biodiversity to CE, we are focusing on positive impact of CE to create value for companies. For example, the BMW Group has installed recovery systems for end-of-life vehicles in 30 countries so far, offering vehicle owners environmentally friendly recycling and disposal at dedicated recovery centres. They also engaged in recycling management throughout material life cycles (BMW, Corporate Social Responsibility Report, 2012, p. 59).

2.3 | Theoretical framework

The main aim is to present a more evidence-based study and we therefore provide a brief overview of theory that has been employed in previous literature. Most existing biodiversity studies employ legitimacy, greenwashing, impression management, and institutional theory to explain their findings (e.g., Boiral, 2016; Hassan et al., 2020; Roberts et al., 2021). The most suitable theories, stakeholder and institutional, have been used in a number of biodiversity studies to explain findings (e.g., Gaia & Jones, 2017; Gaia & Jones, 2019; Roberts et al., 2021; Weir, 2019) and are also suitable to explain findings in the CE context are briefly explained.

Stakeholder theory assumes that "values are necessarily of doing business" (Freeman et al., 2004, p.364). Stakeholders are individuals or groups who can be influenced by the operations of a business (Sarkis et al., 2010). The theory suggest that business does not create values only for the shareholders but should emphasize on creating value for all the stakeholders including, employee, shareholders, customers, and suppliers (Gusc, 2019; Sarkis et al., 2010). In other words, other stakeholders' satisfaction contributes to the shareholders' wealth and satisfaction (Jamali, 2008). In this vein, Gusc, (2019) argued that the relationship with stakeholders is critical to the performance of the company. On the other hand, stakeholders also add more pressure on business to increase the positive impact and reduce the negative one. Also, the prior studies of Scarpellini et al. (2020) suggested that stakeholders, non-governmental organization (NGOs), media and government tend to apply pressure on the business for sustainable initiatives including the CE. Gusc (2019), argued that, for CE to effectively meet its accountability, the business must inform its stakeholders about how entrepreneurial practice can fit into the CE. To meet the SDGs, stakeholders will place more pressure on firms to be accountable for their impacts on nature and report their efforts in aligning to the goals. Thus, stakeholder theory argues that firms may seek to satisfy stakeholder expectations and engage in providing disclosure.

Institutional theory has recently been used extensively in describing sustainable activities in both individual and corporate levels (Ranta et al., 2018). The theory declares that organizational procedures are institutionalized through a number of adaptive procedures that are less affected by the individuals' members (Dubey et al., 2018). A number of studies based on sustainability and recycle production (Ranta et al., 2018), refers to institutional theory as proper theory for the evaluation of emerging social event around the application of the CE (Schulz et al., 2019). According to Jain et al. (2020), institutional theorists agreed that companies comply with the institutional pressures to transfer from the LE system to the CE system in order to obtain sociable legitimacy. According to Liu et al. (2018), institutional theory has been utilized in construction of theoretical models that investigate extraneous institutional guides for the applications of CE amid manufactures. Also, Ranta et al. (2018) and Schulz et al. (2019), have mentioned that institutional theory allows ways in which both guide and the effects of changing implementations and procedures related in the adoption of CE. Furthermore, firms may feel the need to conform to institutional pressures as explained by institutional theory as mimetic, normative and coercive to meet the expectations of stakeholders.

3 | RESEARCH METHOD

The sample for this study has drawn from the top 200 companies from the Fortune Global 500 list. The choice is purposeful as they are the world's leading organizations by revenue (Adler et al., 2018), vary in sector (Addison et al., 2019), and are geographically diverse (Hassan et al., 2020). We believe that there is a high possibility for the top companies to reveal more information about CE and biodiversity (Roberts et al., 2021). The sample includes 28 companies from three industries sectors the aerospace and defense, motor vehicle and parts, and transportation. We follow the previous studies (e.g., Adler et al., 2018; Hassan et al., 2020, 2022; Roberts et al., 2021) and select one industry from each biodiversity risk category recommended by F&C Asset Report (2004), low risk, medium risk, and high risk.[2] As

[2]High-risk sectors (red zone) are Construction and building materials, electricity, food and drug retailers, food producers and processors, forestry and paper, leisure and hotels, mining, oil and gas, transportation, and utilities. Medium-risk sectors (amber zone) are aerospace and defense; beverages, chemicals, financial services, general retailers, household goods and textiles, personal care and household products, pharmaceuticals and biotech, support services, tobacco. Low-risk sectors (green zone) are automobiles and parts, diversified industrials, electronic and electrical equipment, engineering & machinery, health, information technology hardware, media and entertainment, software and computer services, steel and other metals, telecom services.

TABLE 1 Biodiversity and CE disclosure

Biodiversity and CE disclosure index	
B1	Company reports on corporate expressions of moral, ethical, and/or emotional motivations for preserving species and preventing extinction with a consideration of ecosystem level effects, including normative reflective self-accounts of the company's impact on threatened and endangered species.
B2	Company report on its involvement in afforestation activities (such as seedling transplantation, forest plantation, sustainable forestry practices, or other reforestation activities).
B3	Company report on "biodiversity assessment" of its activities in and around the manufacturing plants, mines, transport infrastructure, and/or other locations.
B4	Company report on biodiversity partners (both local and international organizations) helping company in biodiversity conservation
B5	Company report on biodiversity projects undertaken to enhance the biodiversity in and around the manufacturing plants, mines, transport infrastructure and/or other locations
B6	Company report on its involvement in land management/land rehabilitation activities
B7	Company reports steps taken for creating biodiversity awareness among its employees or in the community
B8	Company reports on environment policy strategy (or statement) values (or concerns) biodiversity.
B9	Company reports biodiversity action plans or biodiversity goals/targets for coming years.
B10	Record a list of plant and animal species, identified as endangered by the IUCN Red List, whose habitats are affected by the company's activities
B11	Report where, geographically, the company's activities pose a threat to endangered plant and animal species, as identified by the IUCN Red List
B12	Report and assess habitat status area protected, restored, affected, and conserved.
B13	Report on potential risks/impacts on these specific species arising from the company's operations.
B14	Company reports ecosystems affected/conserved/protected/restored.
CE1	Waste generation and significant waste-related impacts
CE2	Management of significant waste-related impacts (RECYCLING)
CE3	Waste generated
CE4	Waste diverted from disposal
CE5	Waste directed to disposal
CE6	Use of Sustainable Raw Materials

mentioned in the introduction, we followed Hassan et al., 2020 and further classify the industry membership by the traffic light (red, amber and green). For the purpose of the analysis, we grouped the amber and red together and we called them "high-risk zone" and there are 20 companies are classified under this category. The other group is "low-risk zone" and there are 92 companies are classified under this category covers the sectors that classified as green. There are 112 firm year observations in total. Considering that integrating both CE and biodiversity are new area of research, we selected one industry from each classification that provided some sort of disclosure on biodiversity. This is because we expect that companies that provide some disclosure on biodiversity are likely to provide disclosure on CE too. Therefore, we selected the following sectors low-risk sector (motor vehicle & parts), one from medium-risk (aerospace and defense) and one from high-risk (transportation). Our sample is from 7 different countries, 8 companies from USA, 8 companies from China, 5 companies from Germany, 3 companies from Japan, 2 companies from France, 1 from South Korean and 1 from the Netherlands. We investigated 4 years, namely, 2012, 2014, 2016 and 2018. The researchers downloaded all annual and sustainability reports for the 4 years and data collected between November 2020 and January 2021.

We devise a disclosure index which combines both biodiversity and CE items which is presented in Table 1. For the biodiversity index items we follow Hassan et al. (2020) as a starting point that developed a comprehensive biodiversity index that includes a wide range of biodiversity indicators. We justify this choice of framework as it offers the most comprehensive disclosure framework to capture all relevant biodiversity disclosure. We thoroughly investigated the content of the biodiversity disclosure index offered by Hassan et al. (2020) and we selected the most disclosed biodiversity items, and we also selected the relevant items to our selected industries and companies. For the CE index, we are following a huge stream of studies (Clarkson et al., 2008; Hassan, 2015; Hassan & Guo, 2017) that used GRI guidelines as their disclosure index. Therefore, we measured the CE by 5 items. Waste generation and significant waste-related impacts (CE1), management of significant waste-related impacts (CE2), Waste generated (CE3), waste diverted from disposals (CE4), waste directed to disposal (CE5) and use of sustainable raw materials (CE6). The index is split into three parts. The first part has 14 items, and it is based on the biodiversity about what companies are doing in order to prevent biodiversity loss. The second part has 6 items, and it is based on the CE GRI standards.

To ensure that all information based on biodiversity and CE were collected, keywords were used for the research. Those words are "Biodiversity," "Habitant," "Species," "Ethical," "Moral," "Forest," "Reforestation," "Assessment," "Plants," "Transport," "Partners," "Projects," "Manufacturing," "Management," "Land," "Rehabilitation," "Awareness," "Employees," "Policy", "Strategy," "Values," "Statements," "Targets," "Goals," "IUCN," "Geographically," "Protect," "Restore," "Affected," "Risk," "Impact," "Ecosystem," "Circular Economy," "Recycling," "Recovery," "End of life," "Hazardous," "Waste generated," "Waste," "Disposal," "Landfill," "Packaging," "Circular measures," "Reuse," "Metal," "Plastic," "Value chain," "Incineration," "Upstream," "Downstream," "Waste-related," "Diverted," "Directed," "Sustainable," "Raw Material," "Waste generation," "Management of significant waste-related impacts," "Waste diverted from disposals," "Waste directed to disposal," "Use of Sustainable Raw Materials," "United Nation," "Sustainability Development Goals (SDG)," "Business for Nature (BFN)," "Circulytics" and "Upcycling." All these keywords helped to gather all the appropriate and relevant information for the biodiversity and the CE.

The disclosure index scored was according to the previous studies (Adler et al., 2018; Hassan et al., 2020; Hassan et al., 2022). Both the biodiversity & CE disclosure index were scored from 0 to 3. The biodiversity disclosure was scored as follows: 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).

We interpret the remainder of our analysis by thematic analysis. This is a method of analyzing qualitative data that involves identifying, analyzing and reporting patters or themes within data (Braun & Clarke, 2006). It is a method for describing data, but it also entails interpretation in the selection of codes and the creation of themes. Thematic analysis is a very powerful and flexible tool of analysis that can be used within range of paradigmatic or epistemological orientations (Kiger & Varpio, 2020) and can be used when attempting to comprehend a set of experiences, thoughts, or behaviors across a data set (Braun & Clarke, 2006). In our article, we interpreted and classified companies' disclosure quotes on both biodiversity and CE into different themes to allow us to provide a full picture of what good disclosure practice looks like. We followed Hassan et al., 2021 and Braun and Clarke (2006) six steps of conducting thematic analysis:

1. Familiarizing yourself with your data: "Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas". We have investigated what companies are reporting on both biodiversity and CE. We had to read and reread what they mentioned in their reports and select the most relevant sections and put them in a separate file as quotes from these companies.
2. Generating initial codes: "Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code". We did not do any coding for our data.
3. Searching for themes: "Collating codes into potential themes, gathering all data relevant to each potential theme". After including all quotes into separate file, we tried to assign these quotes under our both biodiversity and CE themes.
4. Reviewing themes: "Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic 'map' of the analysis". We have spent a considerable amount of time in this stage as there were some quotes can be relevant to more than one theme and the authors had to discuss each quote to make sure it is assigned to the most relevant theme.
5. Defining and naming themes: "Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme". This is not relevant as we have identified the themes previously.
6. Producing the report: "The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis". This is where we have written our results and discussion.

TABLE 2 Total disclosure over the years

	2012	2014	2016	2018	Changes %
Total biodiversity					
min	0	0	0	0	
max	29	29	30	23	−21%
average	5.93	7.25	7.43	5.36	−10%
ST DEV	9.22	9.69	10.65	7.24	
Total CE					
min	0	0	0	0	
max	6	11	9	9	50%
average	0.96	1.54	1.89	2.14	122%
ST DEV	1.69	2.41	2.13	2.37	

The researchers conduct a content analysis of the index items. Similar to Atkins et al. (2018), we use an interpretivist text analysis. We review and consider statements which disclose efforts to protect and conserve biodiversity with emotive and genuine concern. A score is assigned for the qualitative information relevant to each disclosure.

4 | RESULTS

4.1 | Result of the Total sample

The sample was examined for the years 2012, 2014, 2016 and 2018 for the biodiversity and CE disclosures (see Table 2). The overall results of the biodiversity disclosure showed an increase for the years 2012, 2014, and 2016, however, there was a decrease in the year 2018. The average for the biodiversity increased in a scoring 5.93, 7.25, 7.43, for the years 2012, 2014, 2016 respectively but was decreased to 5.36 in 2018, showing a total decrease of 10%. The maximum from the total sample of biodiversity disclosure decreased by 21% throughout the years, there was a small increase between the years 2014 and 2016 from 29 to 30, however, between the 2016 and 2018 there was a decrease from 30 to 23. Now, for the CE disclosure there is a slight increase between the years and that it is shows that companies are taking the CE content more seriously. The average for the CE disclosures increased in a scoring 0.96, 1.54, 1.89, and 2.14 in 2012, 2014, 2016, and 2018, respectively. The maximum disclosure of CE had an overall increase of 50% in 2012 and in 2014 there is a noticeable increase from 6 to 11, but there is a small decrease between the years 2014 and 2016 from 11 to 9 and was remained at 9 for the year 2018.

Although, the overall scoring of the study is extraordinarily low for both biodiversity and CE disclosures, when you keep in mind that

TABLE 3 Biodiversity disclosure

	0					1					2					3					
	2012	2014	2016	2018	T	2012	2014	2016	2018	T	2012	2014	2016	2018	T	2012	2014	2016	2018	T	Total score
B1	21	21	22	22	**86**	1	0	0	3	**4**	7	2	2	2	**13**	2	2	2	2	**8**	**111**
B2	19	14	14	17	**64**	2	4	2	4	**12**	2	6	7	5	**20**	2	6	7	5	**20**	**116**
B3	19	19	22	21	**81**	2	1	0	1	**4**	5	6	4	5	**20**	3	6	2	2	**13**	**118**
B4	21	21	19	21	**82**	21	21	19	21	**82**	3	6	2	2	**13**	2	6	7	5	**20**	**197**
B5	19	19	19	17	**74**	1	0	1	3	**5**	5	5	3	6	**19**	5	5	3	6	**19**	**117**
B6	22	18	18	21	**79**	2	3	4	1	**10**	3	2	3	5	**13**	3	2	3	5	**13**	**115**
B7	23	19	19	21	**82**	1	2	2	2	**7**	1	3	3	3	**10**	1	3	3	3	**10**	**109**
B8	22	21	22	20	**85**	1	1	1	1	**4**	5	5	4	7	**21**	5	5	4	7	**21**	**131**
B9	25	24	21	24	**94**	1	1	1	1	**4**	2	3	5	3	**13**	2	3	5	3	**13**	**124**
B10	25	23	24	26	**98**	2	3	1	1	**7**	1	2	2	0	**5**	0	0	1	1	**2**	**112**
B11	25	25	26	26	**102**	2	2	0	2	**6**	1	1	2	0	**4**	0	0	0	0	**0**	**112**
B12	20	21	21	22	**84**	3	2	1	1	**7**	4	3	3	5	**15**	1	2	3	0	**6**	**112**
B13	25	28	27	28	**108**	1	0	0	0	**1**	2	0	1	0	**3**	0	0	0	0	**0**	**112**
B14	22	21	23	24	**90**	2	1	3	2	**8**	4	5	2	1	**12**	0	1	0	1	**2**	**112**

the highest score that a company could score is 60 (20 items for both biodiversity and CE @ 3). The GRI standards for the CE were published in 2020, so maybe that can explain the low level of the CE disclosures. However, the biodiversity disclosures had been decreased quite a lot in 2018. The average scores of the biodiversity disclosures are consistent with findings from Adler et al. (2018) and Hassan et al. (2020) and confirm that there is a huge call for awareness and accountability in biodiversity and CE disclosures. In the next section we present the results for biodiversity and CE disclosures.

4.2 | Biodiversity disclosures

Most companies scored zero across all disclosures (see Table 3). This is consistent with the findings of numerous biodiversity studies (e.g., Adler et al., 2018; Hassan et al., 2020, 2022; Roberts et al., 2021). Index item B1 "Company reports on corporate expressions of moral, ethical, and/or emotional motivations for preserving species and preventing extinction with a consideration of ecosystem level effects, including normative reflective self-accounts of the company's impact on threatened and endangered species" and B9 "Company reports biodiversity action plans or biodiversity goals/targets for coming years" have the highest overall of zeros with 86 and 94 respectively. Also, companies like FedEx, Beijing Automotive Group, Deutsche Post, China Post Group, FedEx, China South Industries Group, China North Industries, China FAW Group, and SAIC Motor had the score "0" to all the disclosures for all years.

This demonstrates the need for reasonable frameworks and stricter rules, which will give the opportunity for companies to better understand biodiversity and to manage their impact.

B2 "Company report on its involvement in afforestation activities (such as seedling transplantation, forest plantation, sustainable forestry practices, or other reforestation activities)" examine the activities of a company. B2 is one of the disclosures with the highest scoring for "1", "2", and "3" by having an overall of 12, 20 and 20, respectively, but also, with the lowest scoring in zero. Alder et al. (2018) and Hassan et al. (2020), has mentioned that this item was one of the highest disclosures in their studies as well. In 2012, Ford was one of the companies with the highest score for B2 and it points out the following:

> Ford has created wildlife habitats at many of our facilities. We are committed to maintaining our existing wildlife habitat sites and to creating as many new sites as possible in the future. Wildlife habitats on Ford facilities range in size from five acres to more than 100 acres and include ecosystems as diverse as wetlands, woodlands, prairies, meadows, and forests (Ford Sustainability Report, 2012/2013, non- paginated).

Also, UPS had scored "3" in the disclosure B2 by mentioning the following:

> UPS launched the Global Forestry Initiative in 2011 to plant, protect, and preserve trees that help absorb carbon, prevent erosion, and provide habitats for wildlife in urban and rural areas around the world. In 2018, we planted 2.7 million trees through employee volunteer projects and grants to our environmental non-profit partners. We are more than 80 percent toward our goal to plant 15 million trees by 2020 (UPS CRS Report, 2018, p. 10).

Two of the companies that scored "2" for the B2 are Peugeot and Honda, which stated the following respectively:

> 2 million trees, including more than 50 native species, were reintroduced in a plantation of nearly 2,000 hectares. At the heart of the project, an area of 1,800 hectares of virgin forest with high biodiversity value has been devoted to scientific research since 2009 (Peugeot CSR Report, 2018, p.232).
>
> Production sites protect and manage the forest watershed that they benefit from and strive to keep them optimized for each region (Honda Sustainability Report, 2018, p. 47).

Boeing and Airbus scored "1" for the B2 disclosure and they had mentioned the following on their report respectively:

> After expanding into South Carolina, Boeing worked with several state, federal and local agencies, including the Lowcountry Land Trust, to preserve about 4,000 additional acres (1,619 hectares) of habitat, containing 2,000 acres (809 hectares) of wetlands and native plants at risk (Boeing Environmental Report, 2018, p.13).
>
> BIOMASS will provide global scale maps of biomass, changes due to forest loss (from logging/burning) and forest regrowth, improving the understanding of the contribution of forests to the global carbon budget (Airbus Annual Report, 2018, p. 57).

This shows that both Boeing and Airbus are starting to understand their responsibilities towards to the environment and biodiversity by start to protect it and restoring it, this is consistent with Smith et al. (2019).

B4 "Company report on biodiversity partners (both local and international organisations) helping company in biodiversity conservation" examine the biodiversity partners of a company, also had one of the highest scorings especially for "1" and "3", with an overall of 82 and 20 respectively. This is in 2018, Toyota had score "3" in B4 and reported the following:

> In July 2016, Toyota entered into a five-year partnership with WWF (World Wide Fund for Nature) aiming at accelerating the globe's transition to sustainability. Toyota is the first car company and the first Japanese

> company to sign a Global Corporate Partnership agreement with WWF (Toyota Environmental Report, 2018, p.47).

> Toyota began a five-year partnership with International Union for Conservation of Nature (IUCN) 1 in May 2016 to raise awareness of the biodiversity crisis (Toyota Environmental Report, 2018, p.48).

General Motors also scored "3" in the B4 disclosure by mentioning the following:

> Our engagement with Ceres demonstrates the effectiveness of our strategy to work with the most impactful organizations and pursue more meaningful partnerships around sustainability issues that are critical to our business. In addition to Ceres, we work closely with organizations such as the World Wildlife Fund (WWF) and the World Resources Institute (WRI) that provide guidance on a range of issues, such as renewable energy, climate change, water risk management, environmental education and sustainable transportation (GM Sustainability Report, 2018, p.33).

Boeing was one of the companies that scored "2" for the disclosure B4, by stating:

> Boeing has been an invaluable partner in the Lowcountry. Not only do they share our passion for the protection of special places and overall quality of life, they are committed to developing innovative solutions and growing partnerships that promote economic development and the protection of special places. We truly want the same things—and community collaborations help us find solutions to our most pressing issues (Boeing Environmental Report, 2018, p.13).

Lockheed Martin had scored "1" for B4 and reported the following:

> We also partner with the U.S. Department of Energy's Better Plants Program and the Environmental Protection Agency's ENERGY STAR Program and Green Power Partnership to support our practice of industrial energy management. We benefit from resources, expertise, and valuable peernetworking opportunities offered through these partnerships, which help us achieve our energy and carbon reduction goals (Lockheed Martin Sustainability Report, 2018, p. 37).

The B10 "Report where, geographically, the company's activities pose a threat to endangered plant and animal species, as identified by the IUCN Red List" and B13 "Report on potential risks/impacts on these specific species arising from the company's operations" have the highest scoring of zeros with 102 and 108, respectively.

Although B12 "Report and assess habitat status area protected, restored, affected, and conserved" has the highest scoring in "1", "2" and "3", and the lowest scoring in zero. Boeing has a score of "3" in 2016 and reported the following:

> Young trees, shrubs and other vegetation are part of Boeing's project to restore habitat near its former Plant 2 site along a stretch of the Lower Duwamish Waterway near Seattle (Boeing, Environmental Report, 2016, p.46).

This shows that Boeing is concerned about the biodiversity loss, and it is offering assurance that measures are taken to ensure the protection of natural and restoration in the area. This is consistent with Addison et al. (2019).

Peugeot had a score of "2" for the B12, stating the following:

> These studies assess the sensitivity of natural environments located in the immediate vicinity of the sites, and particularly the proximity of special protection areas of fauna and flora (Peugeot CSR Report, 2018, p.232).

This demonstrates that Peugeot cares about the biodiversity and is trying to protect it by finding ways to not harming the environment.

General Motors had scored "1" in 2016 for the disclosure B12 and had reported the following:

> We work to restore, protect and promote biodiversity, focusing on areas providing tangible business value, such as green infrastructure and landscaping (reduced maintenance, native plantings, stormwater management, tree canopies); wetlands (stormwater management); supply chain (education, responsible sourcing); pollinators and safe migration (food security, employee engagement); and forestation (heat island effect, carbon reduction), to name a few. Currently, 63 of 87 sites are Wildlife Habitat Council (WHC) certified, 49 of which are manufacturing sites and 14 nonmanufacturing sites (GM Sustainability Report, 2018, p.150).

This illustrates that General Motors had been focusing a lot on the protection and the restoration of the biodiversity. This is related to Smith et al. (2019) study.

4.3 | CE disclosures

CE is a new system, and our examination of disclosure is low. However, to prevent future loss of biodiversity, it is important for companies to implement the CE in their strategy. Nowadays, biodiversity loss is one of

TABLE 4 Circular economy disclosure

	0					1					2					3					
	2012	2014	2016	2018	T	2012	2014	2016	2018	T	2012	2014	2016	2018	T	2012	2014	2016	2018	T	Total score
C1	26	27	26	21	**100**	2	1	2	7	**12**	0	0	0	0	**0**	0	0	0	0	**0**	**112**
C2	22	16	13	11	**62**	4	10	10	13	**37**	2	2	5	4	**13**	0	0	0	0	**0**	**112**
C3	23	24	22	23	**92**	5	3	5	5	**18**	0	1	1	0	**2**	0	0	0	0	**0**	**112**
C4	22	18	16	16	**72**	5	7	9	10	**31**	1	3	3	2	**9**	0	0	0	0	**0**	**112**
C5	25	24	24	24	**97**	3	3	4	3	**13**	0	1	0	1	**2**	0	0	0	0	**0**	**112**
C6	26	24	23	20	**93**	2	3	5	8	**18**	0	1	0	0	**1**	0	0	0	0	**0**	**112**

the top five global risks (Addison et al, 2019) due to the species extinction, climate changes, human activities and destruction of forests etc (Adler et al., 2018; Hassan et al., 2020; Mantyka-Pringle et al., 2015).

CE Disclosures have been published by GRI in 2020, that is, why the scoring is very poor, which is noticeable in Table 4, there is not a scoring for "3". Also, there is not any literature available for the CE scoring of GRI standards yet.

The disclosure C2 "Management of significant waste-related impacts" and C4 "Waste diverted from disposal" have the highest scoring in "1" and "2". For example, Peugeot was one of the companies that scored "2" to both C2 and C4, reporting the following:

For C4:

> Based on the extended producer responsibility principle, the Group's brands in France have implemented procedures for collecting and processing tyres held by authorised dismantlers. In 2018, at least 50% of the 5,340 tonnes of tyres from ELVs were treated as "materials recovery" (for reuse, drainage solutions, granulation, etc.) (Peugeot, CSR Report, 2018, p.108).

And for C4:

> In 2018, 1,336 tonnes of waste produced in one country were transferred to another one for treatment. These operations only occur in Europe and concerned the following waste (Peugeot, CSR Report, 2018, p.227).

Also, BMW had scored "2" for the disclosure C2 and reported the following:

> We do not consider end-of-life vehicles as waste to be disposed of, but rather as a secondary source of raw materials. Established recovery systems for end-of-life vehicles, components and materials ensure that they are reintegrated into the raw materials cycle (BMW, Sustainable Value Report, 2012, p.60).

BMW did not dispose any product when they were not usable anymore and they reuse raw materials, which is consistent with the Scarpellini et al.'s (2020) findings, that CE can decrease the dependence on raw materials.

The disclosure with the lowest scoring are C1 "Waste generation and significant waste-related impacts" had scored only for "1", and the C5 ""Waste directed to disposal" had scored "1″ and a very small scoring of "2″. One of the companies that had scored "2″ for C5 is Renault, reporting the following:

> Disposal consists of burning the waste (without energy recovery) or burying it in landfill. Renault is seeking to minimize the use of this waste management method. Based on a like-for-like scope of operations, Renault

> has reduced the quantities of manufacturing waste sent to landfill (except demolition waste and foundries) by 66% since 2007. At the end of 2016, Curitiba eliminated its last use of landfill channels and became the first mixed plant (producing vehicles and powertrains) in Groupe Renault to reach zero landfill (Renault, Financial Report 2018, p. 169).

For the disclosure C1 Aviation Industry Corp. of China had scored "1" and reported the following:

> The packaging materials such as plastics, metals, papers, woods and composite materials are mainly recycled to save the use of packaging materials (AviChina, Annual Report, 2018, p.84).

Moreover, Ford had a score of "1" for C1, and reported the following:

> Raw material extraction may result in environmental impacts, such as water scarcity, air and water pollution, and waste generation that must be minimized and mitigated (Ford, Sustainability Report, 2012, non-paginated).

The disclosure C3 "Waste generated" had a small amount of scoring in "1" and "2". UPS had scored "1" by reporting the following:

> In 2012, UPS operating facilities in the United States generated 1,475 tons of hazardous waste. To ensure hazardous wastes are properly disposed of, we manage these wastes through approved national vendors that have a documented track record of compliance with recognized industry disposal practices (UPS, CSR Report, 2012, p.94).

Also, FedEx had scored "1" as well for C3 by mentioning the following:

> In FY12, the total waste generated that we were able to track at FedEx facilities amounted to 74,624 U.S. tons. The majority of that waste is considered non-hazardous and municipal solid waste, while the remaining waste streams include: regulated non-hazardous waste, such as oil filters, in certain U.S. states; hazardous waste, which is dangerous or potentially harmful to human health or the environment; "universal waste," which includes batteries, mercury containing equipment and fluorescent light bulbs; and e-waste, such as obsolete handheld scanners, computers and peripheral devices (FedEx Global Citizenship Goals & Progress Update, 2012, p. 12).

Furthermore, for C5 which is the use of sustainable raw materials, there are 93 companies that had the score zero, 18 companies had scored "1", and only one company scored "2". However, with a closer look at the Table 4, it is noticeable that there is an increase in the sustainable raw materials per year. Also, this is related to the other CE disclosures, this is showing that companies started to adopt CE more throughout the years. Renault had scored "1" and reported the following for the use of raw material:

> Certain raw materials used in the automotive industry are considered strategic since any restriction in the supply chain could impact production and other conditions (Renault, Financial Report 2018, p.110).

4.4 | Detailed comparison between biodiversity and CE per company

Table 5 illustrates the total number of biodiversity disclosures that each company have for the years. Airbus Group has scored zero for 2012, 2014 and 2016. However, there is an increase of "6" in 2018. BMW had an increase from 2012 to 2014 going from 8 to 11 respectively, nevertheless, there was a dramatic decrease and scored zero for the years 2016 and 2018. Boeing was having a steady increase during the years, especially for 2012, 2014 and 2016, receiving scores of 4, 23 and 25 respectively. However, a small decrease of 17 was reported in 2018. A Similar decrease happens in Daimler, there was an increase in 2012, 2014 and 2016 with scores of 7, 15 and 22, whereas there was a decrease in 2018 with a score of 16. Dongfeng Motor Group had a decrease from 20 to 19 from 2012 to 2014 but had an increase in 2016, bring it back to 20. However, the year 2018 received a score of zero. Ford Motors during the years of 2012 and 2014 showed a decrease from 25 to 15, respectively, and had decrease to zero in 2016. Conversely, in 2018 there was an increase, receiving a score of 14. General Motors was decreased in 2012 to 2014 from 13 to 0 respectively but there was an increase between the years 2014 to 2016 from 0 to 15, although the disclosures were decreased again from 15 to 11 in 2016 to 2018. Honda Motors had a general decrease during the years. Hyundai Motors had a stable score of 2 for the years 2012, 2014 and 2016. However, in 2018 had a decrease to zero. Lockheed Martin for the two first years (2012 and 2014), had a score of zero, they then had an increase up to 2 in 2016 but did not keep increasing for long and declined to 1 in 2018. Nissan Motors for 2012 scored 3, which increased to 6 in 2014/ Nonetheless, in 2016 there was a decrease to 2, which decreased further to 1 in 2018. Peugeot had scored zero in 2012 but in 2014 there was an increase to 23, the increase continues in 2016 with a score of 27. Nevertheless, in 2018 there was a decrease, bringing the score back down to 23. Renault scored zero for the years 2012, 2014 and 2016, until an increase to 9 in 2018. Robert Bosch had a stable score of 1 for the years 2012, 2014 and 2016. However, it was decreased to zero in 2018. Toyota remained stable and equal, increasing for the years 2012, 2014 and 2016 with scores of 24, 27, and 30 respectively, although there was a decrease in 2018, bringing their score to 18. United Technologies had a score of zero in 2012 and there was an

TABLE 5 Total disclosure for biodiversity and CE per company

	Total biodiversity disclosure					Total circular economy disclosure				
Year	2012	2014	2016	2018	Total	2012	2014	2016	2018	Total
Companies										
Airbus Group	0	0	0	6	**6**	0	1	0	2	**3**
Aviation Industry Corp. of China	0	0	0	0	**0**	0	0	0	4	**4**
Beijing Automotive Group	0	0	0	0	**0**	0	0	2	5	**7**
BMW	8	11	0	0	**19**	1	3	3	3	**10**
Boeing	4	23	25	17	**69**	2	3	3	3	**11**
China FAW Group	0	0	0	0	**0**	0	0	0	0	**0**
China North Industries	0	0	0	0	**0**	0	0	0	0	**0**
China Post Group	0	0	0	0	**0**	0	0	0	0	**0**
China South Industries Group	0	0	0	2	**2**	0	0	0	0	**0**
Daimler	7	15	22	16	**60**	1	1	3	3	**8**
Deutsche Post	0	0	0	0	**0**	0	1	1	1	**3**
Dongfeng Motor Group	20	19	20	0	**59**	0	0	1	0	**1**
FedEx	0	0	0	0	**0**	3	2	2	1	**8**
Ford Motors	25	15	0	14	**54**	6	5	4	4	**19**
General Motors	13	0	15	11	**39**	1	1	2	1	**5**
Honda Motor	22	18	20	13	**73**	0	0	2	2	**4**
Hyundai Motor	2	2	2	0	**6**	0	2	0	1	**3**
Lockheed Martin	0	0	2	1	**3**	3	4	4	1	**12**
Nissan Motor	3	6	2	1	**12**	1	1	3	2	**7**
Peugeot	0	23	27	23	**73**	0	11	9	8	**28**
Renault	0	0	0	9	**9**	6	5	5	9	**25**
Robert Bosch	1	1	1	0	**3**	0	0	0	0	**0**
SAIC Motor	0	0	0	0	**0**	0	0	0	0	**0**
Toyota	24	27	30	18	**99**	0	0	5	5	**10**
United Technologies	0	8	9	0	**17**	1	1	1	1	**4**
UPS	6	4	4	4	**18**	2	0	0	0	**2**
US Postal Service	2	2	2	1	**7**	0	2	2	2	**6**
Volkswagen	29	29	27	14	**99**	0	0	1	2	**3**
Total	166	203	208	150	**727**	27	43	53	60	**183**

increase in 2014 and 2016, with scores of 8 and 9 respectively but a decrease in 2018 brought their score back to zero. UPS scored 6 in 2012. However, there was a decrease to 4 in 2014, which remained stable over the next few years. U.S. Postal Service were stable for the first 3 years scoring 2 but there was a decrease in 2018 with a score of 1. Volkswagen was scored 29 for the years 2012 and 2014. However, a decrease reduces it to 27 and the decrease continues in the year 2018, receiving a score of 14.

The companies Aviation Industry Corp. of China, Beijing Automotive Group, China FAW Group, China North Industries, China Post Group, Deutsche Post, FedEx, and SAIC Motor, had scored zero in all the disclosures for all the years.

The majority of the companies for the biodiversity disclosure had a stable or a small decrease in 2018. The reason for that could be due to the unavailability to access environmental reports for some companies, or because most of the companies are mentioning the biodiversity actions on the actual website rather than the reports.

Table 5 also shows the total scores of CE disclosures for each company throughout the years. Airbus Group had scored zero in 2012 and increased in 2014 with a score of 1. However, a decrease in 2016 brought it back to zero but there is an increase again in 2018 receiving a score of 2. Aviation Industry Corp. of China had scored zero for the first 3 years, although there is an increase in 2018 with a score of 4. Beijing Automotive Group had scored zero for the first 2 years, however, there is an increase of 2 and 5 for 2016 and 2018 respectively. BMW had increased from 2012 with a score of 1 and increased to 3 in 2014, which remains stable for the other years as well. Boeing had similar increase as BMW by scoring 2 in 2012, which increased to 3 for 2014 and remains stable for 2016 and 2018. Daimler had scored 1 in 2012 and 2014 and increased to 3 in 2016 and 2018. Deutsche

TABLE 6 Total disclosure per sector

		Biodiversity					CE				
	Classifications	2012	2014	2016	2018	Biodiversity total	2012	2014	2016	2018	CE Total
Aerospace & DeF	**Medium-risk**	4	31	36	26	97	6	9	8	11	34
Motor Vec & Parts	**Low-risk**	154	166	166	119	605	16	29	40	45	130
Transportation	**High-risk**	8	6	6	5	25	5	5	5	4	19
Total		166	203	208	150	727	27	43	53	60	183

Post had scored zero in 2012, which increases in 2014 with a score of 1 and this stays stable for the rest of the years. Dongfeng Motor Group had scored zero for the first 2 years and there was an increase in 2016 with a score 1. Nevertheless, in 2018 it had decreased again to zero. FedEx had scored 3 for 2012 but decreased to 2 in 2014 and 2016, which decreased again in 2018 resulting in a score of 1. Ford Motors had scored 6 in 2012 but decreased in 2014 to 5, and also, in 2016 and 2018 the score decreased to 4. General Motors had scored 1 for 2012 and 2014 and it had increased to 2 in 2016 but declined back to 1 again in 2018. Honda Motor had scored zero for the first 2 years and had increased to 2 for the last 2 years. Hyundai Motor had scored zero for 2012 but it increased to 2 in 2014. Nonetheless, in 2016 there was a decrease to zero again which increased again to 1 in 2018. Lockheed Martin had score 3 in 2012 and increased to 4 in 2014 and 2016. However, in 2018 it decreased to 1. Nissan Motor had scored 1 for 2012 and 2014 and in 2016 it had increased to 3, whereas in 2018 it had decreased to 2. Peugeot scored 0 in 2012 and in 2014 there was a big increase to 11. Conversely, in 2016 the score decreased to 9 which decreased even further to 8 in 2018. Renault had scored 6 in 2012 but it decreased to 5 in 2014 and 2016 but increased in 2018 to 9. Toyota had scored zero for 2012 and 2014, although it increased to 5 in 2016 and 2018. United Technologies had scored 1 for all the years. UPS had scored 2 for 2012 but was decreased to zero for the years 2014, 2016, and 2018. U.S. Postal Service had scored zero for 2012. However, it was increased to 2 in 2014 and remained stable for the following years. Volkswagen had scored zero for 2012 and 2014. Moreover, there was an increase to 1 in 2016, which increased again in 2018 to 2.

Although, the companies China FAW Group, China North Industries, China Post Group, China South Industries Group, Robert Bosch, and SAIC Motor had scored zero in all the disclosures for all the years.

The majority of the companies had remained stable in the CE disclosure. However, there were some companies who had a decrease in CE, and this potentially could be due to CE being a new concept in businesses. Furthermore, Table 5 illustrates that companies were showing an interest for the CE and were trying to adopt it slowly throughout the years.

4.5 | Industry sector analysis for biodiversity and CE disclosure

Following previous studies (Adler et al., 2018; Hassan et al., 2020, 2022) all companies were grouped into sectors such as Motor Vehicle and Parts, Aerospace and Defense, and Transportation which are separated into three categories, to low-risk, medium-risk and high-risk respectively and shows the level of the biodiversity risk. As it is noticeable from Table 6, Motor Vehicle and Parts had the higher score in both biodiversity and CE disclosures and is classified as low risk. However, Transportation had the lowest number of disclosures for both biodiversity and CE and is classified as high-risk.

For the Sector Aerospace and Defense biodiversity had scored an overall 97 and CE had scored 34. Biodiversity had scored 4 for 2012 whereas CE had scored 6. In 2014 both biodiversity and CE had an increase to 31 and 9 respectively. Biodiversity increased again to 36 in 2016 whereas CE had a very small decrease with score of 8. However, in 2018 CE had increased to 11 whereas biodiversity had decreased to 26.

Biodiversity for the Motor Vehicle and Parts had scored an overall total of 605 and CE overall score was 130. Biodiversity for the year 2012 had a score of 154 whereas CE had score of 16, which increased in 2014 to 166 and 29 for biodiversity and CE respectively. In 2016 biodiversity remained stable at 166. However, CE had increased to 40. Also, for 2018 CE continues to increase with a score of 45 whereas biodiversity had decreased to 119.

Biodiversity for the Transportation Sector had scored an overall of 25 and CE had an overall score 19. In 2012, biodiversity had a score of 8 whereas CE had a score of 5. In 2014, biodiversity had a decrease to 6 whereas CE remained stable to 5. Both biodiversity and CE remain stable to 6 and 5 respectively for 2016. However, in 2018 there is a decreased for both biodiversity and CE with scores of 5 and 4 respectively. In general, the overall scoring of the disclosure is very low, and this is related to Adler et al. (2018) and Hassan et al. (2020).

Both biodiversity and CE had an increase for the first 3 years in the overall total. However, in 2018 biodiversity decreased, whereas CE had increased in that year. This is shows that CE received more attention in 2018. The decrease in 2018 for biodiversity and the low number of disclosures in general of CE may have been caused by the lack of knowledge and understanding on the biodiversity and CE concept, and also, the limited access to methods and tools that can help companies to reveal and to model the impact of risk. Stakeholder Theory can be related because if stakeholders put more pressure on businesses for a positive impact and CE effectively to meet its accountability, then this can improve both the environment and the profitability of the business. Also, Agency Theory can be related as well because it can help businesses to examine sustainable production and consumption, which can be achieved by CE and can help on the reduction of the negative impact and protect biodiversity.

Also, there is a belief that in the future there will be a huge change in reporting for biodiversity (GRI, 2021) and CE because businesses nowadays are corporate with sustainable organizations, which can help businesses to reduce their negative impact on the environment and can give them a better understanding on how important the biodiversity is for their business and how CE system can benefit both the environment and their business.

5 | CONCLUSION

Linking both biodiversity and circular economy together did not attract much academic research and hence the main aim of this article is to investigate the level of disclosure on both Biodiversity and CE of 28 companies with a high gross in the Fortune Global 500 list in global firms. Based on prior studies (Hassan et al., 2020, 2021 and Roberts et al., 2022) and global reporting initiatives guidelines, we developed our unique disclosure index that covers both biodiversity and CE together. It is worth mentioning that biodiversity is one of the top five global risks in the world. Companies nowadays, are taking actions to reduce their negative impact on the environment by co-operating with sustainable organizations like UN, GRI, and WWF. However, the current businesses system LE does not benefit the environment or the companies, which is why CE had been created. Evidence shows that CE can prevent biodiversity loss and restore nature.

This article contributes to our understanding on what companies are reporting on their efforts to protect and restore biodiversity, implement CE practices, and presents some supportive quotes as evidence for the discussion of the results by year, themes, companies, and industry sector. Some of the quotes reveal that companies are really trying to improve their impact towards to the environment for a better future. Also, the findings are showing that companies are taking the biodiversity and CE concept more seriously nowadays. This study shed some lights on the importance of both biodiversity and circular economy for businesses. In addition, we propose that the adoption and implementation of the circular economy can enhance stakeholders' credibility and trust and that can create value in the short, medium and long term for the company. The transformation for the business to implement CE can become a game-changer by significantly reducing pressure on the planet, biodiversity loss, and extinction and support a sustainable future for all.

Our results showed an increase in disclosures for the years 2012, 2014, and 2016. However, there was a very small decrease in 2018. Also, the results reveal that there is a connection between the biodiversity and CE and the best industry sector for providing disclosure on both biodiversity and CE is the Motor Vehicle and parts and the lowest is the transportation. This is consistent with prior studies that low intense sectors are providing high level of disclosure comparing with high intense sectors (Hassan et al., 2020, 2021 and Roberts et al., 2021). However, the overall scoring of disclosures was low, with companies providing minimal and vague information. The findings disclosed found that many companies had scored zero in all disclosures, showing that companies have a lack of knowledge on the biodiversity and CE concept. Overall, our results imply that businesses must make transformational changes to achieving SDG 12 and 15.

Our study has some implications for policy makers and businesses particularly in aligning with the SDGs. We find that the policymakers while focusing on financial requirements and the transparency of reporting by the business should consider non-financial aspects like elements of CE, to assist companies to sustain for the long term in the economy. Our study provides some quotes from those companies that provide disclosures on both biodiversity and circular economy to allow other companies to adopt similar approach to reporting. Such quotes will help companies to provide reliable, accurate and honest disclosures to cover these issues that in the interests of stakeholders. Our research provides practical implications to policy makers to develop guidelines to regulators about the importance of creating awareness of biodiversity and extinction accounting among business community. Our results are important to accounting regulators also to enforce mandatory rules and regulations and to issue some guidelines on how to implement a circular economy.

Our study has several limitations. It covers only specific sectors. More studies are needed to investigate both biodiversity and CE in more sectors. Also, more studies are needed to focus on one sector/one company. Our study investigated 4 years only. More research is needed to cover more years to be able to conduct a robust statistical analysis. As this is the first study to link both biodiversity and circular economy together, more attention is required to increase the awareness among researchers and business about biodiversity & circular economy together to illustrate how they can add value to the companies. In the short, medium, and long run. Future research should explore how accounting can affect the CE-transition and how accounting barriers for the CE can be mitigated.

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REFERENCES

Addison, P., Stephenson, P., Bull, J., Carbone, G., Burgman, M., Burgass, M., Gerber, L., Howard, P., McCormick, N., McRae, L., Reuter, K., Starkey, M., & Milner-Gulland, E. (2019). Bringing sustainability to life: A framework to guide biodiversity indicator development for business performance management. *Business Strategy and the Environment*, *29*(8), 3303–3313. https://doi.org/10.1002/bse.2573

Adler, R., Mansi, M., & Pandey, R. (2018). Biodiversity and threatened species reporting by the top fortune global companies. *Accounting, Auditing & Accountability Journal*, *31*(3), 787–825.

Airbus (2018). Annual Report. https://www.airbus.com/en/investors/financial-results-annual-reports

Atif, S., Ahmed, S., Wasim, M., Zeb, B., Pervez, Z., & Quinn, L. (2021). Towards a conceptual development of industry 4.0, Servitisation, and circular economy: A systematic literature review. *Sustainability*, *13*, 6501. https://doi.org/10.3390/su13116501

Atkins, J., Maroun, W., Atkins, B., & Barone, E. (2018). From the big five to the big four? Exploring extinction accounting for the rhinoceros. *Accounting, Auditing & Accountability Journal*, *31*(2), 674–702.

Baars, N. and Haigh, L. (2020). *A circular world is biodiverse. But does biodiversity need the circular economy?*. Circle-economy.com. https://www.

circle-economy.com/blogs/a-circular-world-is-biodiverse-but-does-biodiversity-need-the-circular-economy

BMW (2012) Sustainable Value Report. https://www.bmw.com/en/innovation/sustainability-at-bmw.html

Boiral, O. (2016). Accounting for the unaccountable: Biodiversity reporting and impression management. *Journal of Business Ethics*, *135*(4), 751–768. https://doi.org/10.1007/s10551-014-2497-9

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101.

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

Corvellec, H., Böhm, S., Stowell, A., & Valenzuela, F. (2020). Introduction to the special issue on the contested realities of the circular economy. *Culture and Organization*, *26*(2), 97–102. https://doi.org/10.1080/14759551.2020.1717733

Dubey, R., Gunasekaran, A., Childe, S., Papadopoulos, T., & Helo, P. (2018). Supplier relationship management for circular economy. *Management Decision*, *57*(4), 767–790. https://kar.kent.ac.uk/67375/1/Supplier%20Relationship%20Management%20for%20Circular%20Economy.pdf

Ellenmacarthurfoundation (EMF).org. (2020a). Build back better with the circular economy. https://www.ellenmacarthurfoundation.org/our-work/activities/covid-19/plastic-packaging

Ellenmacarthurfoundation (EMF).org. (2020b). *Policymakers*. https://www.ellenmacarthurfoundation.org/our-work/activities/covid-19/policymakers

Ellenmacarthurfoundation (EMF).org. (2021). *Build back better with the circular economy*. https://www.ellenmacarthurfoundation.org/our-work/activities/covid-19/plastic-packaging

F&C Asset Report (2004). http://www.businessandbiodiversity.org/pdf/FC%20Biodiversity%20Report%20FINAL.pdf

FedEx (2012). Global CitizenshipGoals & Progress Update 2012. https://www.fedex.com/content/dam/fedex/us-united-states/sustainability/gcrs/FedEx_GCR121.pdf

Ferasso, M., Beliaeva, T., Kraus, S., Clauss, T., & Ribeiro-Soriano, D. (2020). Circular economy business models: The state of research and avenues ahead. *Business Strategy and the Environment*, *29*(8), 3006–3024. https://doi.org/10.1002/bse.2554

Ford. (2012). Sustainability Report. https://corporate.ford.com/social-impact/sustainability.html

Freeman, R., Wicks, A., & Parmar, B. (2004). Stakeholder theory and "the corporate objective revisited". *Organization Science*, *15*(3), 364–369. https://doi.org/10.1287/orsc.1040.0066

Gaia, S., & Jones, M. J. (2017). UK local councils reporting of biodiversity values: A stakeholder perspective. *Accounting, Auditing & Accountability Journal.*, *30*, 1614–1638.

Gaia, S., & Jones, M. J. (2019). Biodiversity reporting for governmental organisations: Evidence from English local councils. *Accounting, Auditing & Accountability Journal.*, *33*, 1–31.

Geissdoerfer, M., Savaget, P., Bocken, N., & Hultink, E. (2017). The circular economy – a new sustainability paradigm? *Journal of Cleaner Production*, *143*, 757–768.

Globalreporting.org. (2021). *GRI 306: WASTE 2020*. https://www.globalreporting.org/media/ikhf0ggk/gri-306-waste-2020.pdf

GM (2018). GM Sustainability Report. https://www.gmsustainability.com/

Gusc, J. (2019). *Circular Economy and Accountancy profession*. ResearchGate. https://www.researchgate.net/publication/336312572_Circular_Economy_and_Accountancy_profession

Hassan, A. (2015). Environmental performance and voluntary disclosure on specific environmental activities: An empirical study of carbon vs. non-carbon intensive industries-legitimacy proactive approach. *International Journal of Sustainable Economy*, *7*(4), 243–260.

Hassan, A., Elamer, A. A., Lodh, S., Roberts, L., & Nandy, M. (2021). The future of non-financial businesses reporting: Learning from the Covid-19 pandemic. *Corporate Social Responsibility and Environmental Management*, *28*(4), 1231–1240.

Hassan, A., & Guo, X. (2017). The relationships between reporting format, environmental disclosure and environmental performance: An empirical study. *Journal of Applied Accounting Research*, *18*(4), 425–444.

Hassan, A., Roberts, L., & Atkins, J. (2020). Exploring factors relating to extinction disclosures: What motivates companies to report on biodiversity and species protection? *Business Strategy and the Environment*, *29*(3), 1419–1436.

Hassan, A., Roberts, L., & Rodger, K. (2022). Corporate accountability for biodiversity and species extinction: Evidence from organisations reporting on their impacts on nature. *Business Strategy and the Environment*, *31*(1), 326–352.

Honda. (2018). Sustainability Report 2018. https://global.honda/sustainability/report/pdf-download/2018.html

Jain, N., Panda, A., & Choudhary, P. (2020). Institutional pressures and circular economy performance: The role of environmental management system and organizational flexibility in oil and gas sector. *Business Strategy and the Environment*, *29*(8), 3509–3525.

Jamali, D. (2008). A stakeholder approach to corporate social responsibility: A fresh perspective into theory and practice. *Journal of Business Ethics*, *82*(1), 213–231. https://doi.org/10.1007/s10551-007-9572-4.pdf

Kiger, M. E., & Varpio, L. (2020). Thematic analysis of qualitative data: AMEE guide no. 131. *Medical Teacher*, *42*(8), 846–854. https://doi.org/10.1080/0142159X.2020.1755030

Liu, J., Feng, Y., Zhu, Q., & Sarkis, J. (2018). Green supply chain management and the circular economy. *International Journal of Physical Distribution & Logistics Management*, *48*(8), 794–817. https://www.researchgate.net/profile/Liu-Junjun/publication/326968281_Green_supply_chain_management_and_the_circular_economy_Reviewing_theory_for_advancement_of_both_fields/links/5cc12eb992851c8d2202fb92/Green-supply-chain-management-and-the-circular-economy-Reviewing-theory-for-advancement-of-both-fields.pdf

Mantyka-Pringle, C., Visconti, P., Di Marco, M., Martin, T., Rondinini, C., & Rhodes, J. (2015). Climate change modifies risk of global biodiversity loss due to land-cover change. *Biological Conservation*, *187*, 103–111.

Maroun, W., & Atkins, J. (2018). The emancipatory potential of extinction accounting: Exploring current practice in integrated reports. *Accounting Forum*, *42*(1), 102–118.

Peugeot (2018). CSR Report 2018. https://www.peugeot.co.uk/about-us/environment.html

Pinto e Costa, M. (2020). *Linear economy – an unsustainable posture for the planet*. En.beecircular.org. https://en.beecircular.org/post/linear-economy

Ranta, V., Aarikka-Stenroos, L., Ritala, P., & Mäkinen, S. (2018). Exploring institutional drivers and barriers of the circular economy: A cross-regional comparison of China, the US, and Europe. *Resources, Conservation and Recycling*, *135*, 70–82. https://lutpub.lut.fi/bitstream/handle/10024/158840/ranta_et_al_exploring_institutional_final_draft.pdf?sequence=1&isAllowed=y

Renault (2018). Financial Rreport 2018. https://www.renaultgroup.com/en/finance-2/

Rimmel, G., & Jonäll, K. (2013). Biodiversity reporting in Sweden: Corporate disclosure and preparers' views. *Accounting, Auditing & Accountability Journal*, *26*, 746–778.

Roberts, L., Hassan, A., Elamer, A., & Nandy, M. (2021). Biodiversity and extinction accounting for sustainable development: A systematic literature review and future research directions. *Business Strategy and the Environment*, *30*(1), 705–720.

Roberts, L., Nandy, M., Hassan, A., Lodh, S., & Elamer, A. A. (2022). Corporate accountability towards species extinction protection: Insights from ecologically forward-thinking companies. *Journal of Business Ethics*, *178*(3), 571–595.

Sarkis, J., Zhu, Q., & Lai, K. (2010). An organizational theoretic review of green supply chain management literature. *International Journal of Production Economics*, *130*(1), 1–15. https://edisciplinas.usp.br/pluginfile.php/4097785/mod_resource/content/1/sarkis2011.pdf

Scarpellini, S., Marín-Vinuesa, L., Aranda-Usón, A., & Portillo-Tarragona, P. (2020). Dynamic capabilities and environmental accounting for the circular economy in businesses. *Sustainability Accounting, Management and Policy Journal*, *11*(7), 1129–1158. https://doi.org/10.1108/SAMPJ-04-2019-0150/full/html

Schaltegger, S., Gibassier, D., & Maas, K. (2022). Managing and accounting for corporate biodiversity contributions. Mapping the field. *Business Strategy and the Environment*. https://doi.org/10.1002/bse.3166

Schulz, C., Hjaltadóttir, R., & Hild, P. (2019). Practising circles: Studying institutional change and circular economy practices. *Journal of Cleaner Production*, *237*, 117749.

Sillanpaa, M., & Ncibi, C. (2019). *The circular economy* (pp. 1–319). Candice Janco.

Silva, G., Regan, E., Pollard, E., & Addison, P. (2019). The evolution of corporate no net loss and net positive impact biodiversity commitments: Understanding appetite and addressing challenges. *Business Strategy and the Environment*, *28*(7), 1481–1495. Available at:. https://doi.org/10.1002/bse.2379

Sizemore, G. (2015). Accounting for biodiversity in the dairy industry. *Journal of Environmental Management*, *155*, 145–153.

Smith, T., Beagley, L., Bull, J., Milner-Gulland, E., Smith, M., Vorhies, F., & Addison, P. (2019). Biodiversity means business: Reframing global biodiversity goals for the private sector. *Conservation Letters*, *13*(1). https://doi.org/10.1111/conl.12690

Sobkowiak, M. (2022). The making of imperfect indicators for biodiversity: A case study of UK biodiversity performance measurement. *Business Strategy and the Environment*. https://doi.org/10.1002/bse.3133

Sobkowiak, M., Cuckston, T., & Thomson, I. (2020). Framing sustainable development challenges: Accounting for SDG-15 in the UK. *Accounting, Auditing & Accountability Journal.*, *33*, 1671–1703.

Taleb, M., & Al Farooque, O. (2020). Towards a circular economy for sustainable development: An application of full cost accounting to municipal waste recyclables. *Journal of Cleaner Production*, *280*, 124047.

United Nations. (2021). Sustainabledevelopment.un.org. https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf

UPS. (2018). CSR Report, 2018. https://about.ups.com/us/en/social-impact/reporting.html

Urbinati, A., Chiaroni, D., & Chiesa, V. (2017). Towards a new taxonomy of circular economy business models. *Journal of Cleaner Production*, *168*, 487–498.

Völker, T., Kovacic, Z., & Strand, R. (2020). Indicator development as a site of collective imagination? The case of European Commission policies on the circular economy. *Culture and Organization*, *26*(2), 103–120. https://doi.org/10.1080/14759551.2019.1699092

Wagner, M. (2022). Business, biodiversity and ecosystem services: Evidence from large-scale survey data. *Business Strategy and the Environment*. https://doi.org/10.1002/bse.3141

Weetman, C. (2019). *Linear economy issues | circular economy podcast*. Rethink Global. https://www.rethinkglobal.info/episode-2-linear-economy-and-risks/

Weir, K. (2018). The purposes, promises and compromises of extinction accounting in the UK public sector. *Accounting, Auditing & Accountability Journal*, *31*, 875–899.

Weir, K. (2019). The logics of biodiversity accounting in the UK public sector. *Accounting Forum*, *43*(3), 348–379.

WWF (2020). https://wwf.panda.org/knowledge_hub/all_publications/living_planet_report_timeline/lpr_2012/health_of_our_planet/

Zwiers, J., Jaeger-Erben, M., & Hofmann, F. (2020). Circular literacy. A knowledge-based approach to the circular economy. *Culture and Organization*, *26*(2), 121–141.

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