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An Investigation into Biodiversity Accounting: Evidence from the European Manufacturing Sector

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Abstract:

Purpose:
This paper aims to contribute to the biodiversity literature by examining the biodiversity reporting practices of the top 100 manufacturing companies in the European Union.

Methodology:
This study uses content analysis to explore and investigate disclosure themes in sustainability reports (and equivalents) for 2019–2021.

Findings:
Descriptive statistics, frequency charts, and graphical representations of the data support the results. Biodiversity reporting is still limited but nascent. There was an increase in Biodiversity reporting from 2019 to 2021 during the COVID-19 pandemic, with more disclosure acceptance from the sampled companies. Contrary to expectations, larger companies showed little under-reporting compared to smaller manufacturing companies.

Implication:
These findings contribute to the discussion on biodiversity reporting practices, especially in the era of the COVID-19 pandemic. The results are helpful for policymakers, academic researchers, and stakeholders seeking to promote Biodiversity reporting in organizations.

INTRODUCTION

The world's Biodiversity is declining at an alarming rate, and its loss is now a primary global concern. Impending mass extinction of species is a future concern, and preventing this from happening requires the engagement of all business sectors (Simberloff, 1996; United Nations (UN), 2010). Biodiversity loss is accelerating and trending at a rate with no foreseeable chances of slowing down (Barnosky et al., 2011; Everard et al., 2020). All stakeholders on the planet are responsible for protecting Biodiversity, and commitment is needed more than ever to mitigate activities that affect non-humans. The World Economic Forum (2021) recognized biodiversity loss as one of the top five global risks in 2021 and compelled business leaders to participate in species conservation. In 2010, the UN called for the world to live in harmony with nature and designated strategic plans to focus on Biodiversity (UN, 2010).

Guidelines play an integral role in holding companies responsible, and the most prominent of these is the Global Reporting Initiative (GRI), the most commonly used reporting standard with a third-party assurance of sustainability data (KPMG, 2020). The framework includes sections dedicated to proposed guidance for biodiversity reporting and holds organizations responsible for disclosing and managing their biodiversity-related impacts (GRI, 2016). To push companies to prevent biodiversity, the European Union (EU) developed biodiversity targets to safeguard biodiversity, published in its 2020 biodiversity strategy. Though this policy did not halt Biodiversity by 2020, some progress was made, bringing Biodiversity to the forefront of the EU

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(Generation Climate Europe, 2021). Therefore, on May 20, 2020, the EU extended and published its 2030 strategy for Biodiversity, focusing on repairing the relationship with nature.

While much effort has advanced in studies focused on sustainability, there needs to be more reporting on Biodiversity (Grabsch et al., 2011). Since the UN declared Biodiversity in 2010, there has been more uptake in research attempting to promote biodiversity awareness and extinction; however, very few companies are providing any substantial biodiversity reporting (Adler et al., 2017; Hassan et al., 2020; UN, 2010). An emergence of studies has evaluated biodiversity reporting by top global performing companies (Adler et al., 2018; Hassan et al., 2020; Hassan et al., 2021), reporting practices of countries (Grabsch, 2011; Hossain, 2017; Mansi et al.,2014; Rimmel & Jonäll, 2013; Syarifuddin & Damayanti, 2019; Van Liempd & Busch, 2013; Zhao & Atkins, 2021), and a limited amount of studies on specific sectors (Adler et al., 2017; Gaia & Jones, 2020; Maroun et al., 2018; Schneider et al., 2014; Usher & Maroun, 2018; Weir, 2018; 2019). However, cross-sector research is still lacking in biodiversity studies. Largely absent is the evaluation of biodiversity practices of the manufacturing sector, which relies directly and indirectly on biodiversity ecosystems (Convention on Biological Diversity (CBD), 2018). Given the lack of reporting, its implications, and the EU strategies for protecting biodiversity, this research addresses the gap by evaluating the manufacturing sector from the EU perspective.

This paper aims to examine the Biodiversity reporting practices of the manufacturing sector within the European Union. The current research is the first, to our knowledge, to explore the reporting practices of the manufacturing industries from the EU and adopt the coding themes for Biodiversity from prior researchers (Grabsch et al., 2011; Jonäll & Rimmel, 2016; Mansoor & Maroun, 2016; Van Liempd & Busch, 2013; Usher & Maroun, 2018). Regarding the coding themes, this paper developed a scorecard similar to Grabsch et al. (2011) for tracking the content analysis of the biodiversity themes. The influential potential of this paper is vast and will contribute to the current strand of academic research, but most importantly, it will encourage other companies to report on biodiversity.

The remainder of this research paper is structured as follows. The following section presents the literature review of the nature of Biodiversity and current biodiversity reporting practices, along with the impacts of business sectors on Biodiversity with the European Union. The following section discusses the data collection process and methodological approach carried out in the study. The next section reports the results, followed by detailed discussions on the results attained. Finally, the last section presents the conclusions, limitations of the paper, and future avenues for research.

Literature Review. The origins of Biodiversity stemmed from the 1980s and were coined by the American botanist Walter G. Rosen in 1986 at a forum on Biodiversity (Sarkar, 2001). Biodiversity is a vital element of the Earth's well-being and the continuum of human beings (Jones & Solomon, 2013). There are myriads of contributing definitions to Biodiversity, but the essence of its definition is captured within the definition established by the GRI. "Biodiversity is the variability among living organisms from all sources and the ecological complexes of which they are part, ranging from birds in the air, fish in the sea, and microorganisms in the soil to genetic variety within crops and diversity of ecosystems. This variability is essential for ecosystems to function efficiently..." (GRI, 2007, p.7). Biodiversity plays an integral role in the environment, and it plays a crucial role in the survival of humans, an essential ingredient to the economy (Gaia & Jones, 2020).

Over the last 20 years, environmental data has increased in accounting and integrated reports, but biodiversity reporting needs to be more robust (PwC 2014, 2015). As the world's biodiversity continues to deplete at soaring rates, businesses require corporate accountability in the bleak future (Grabsch et al., 2011; Jones & Solomon, 2013). Various initiatives have been established to promote corporate commitments and facilitate discussions on biodiversity and its inhabitants. In 2010, the UN introduced several programs to address climate change, habitat destruction, and species loss (UN, 2019). Contributing to these efforts, the

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United Nations Global Compact (UNGC) and International Union for Conservation of Nature (IUCN) presented a framework in four sections to contribute to the integration of biodiversity and ecosystem services: (a) review risks and opportunities, (b) integrate strategies into firms' operations, (c) collaborate with stakeholders and business partners, and (d) monitor, evaluate and disclose firms' performance (UNGC, 2012, p.5). While there has been an uptake of companies with various frameworks, the most prominent and globally recognized is the GRI. Since the introduction of GRI, it has remained the most commonly used reporting standard, allowing for third-party assurance of sustainability data (KPMG, 2020). The GRI developed biodiversity specifics and dedicated proposed guidelines for reporting and managing biodiversity-related impacts (GRI, 2016). Table 1 depicts the reporting standards set out by the GRI.

Table 1. Global Reporting Initiative (GRI), Standard disclosures GRI 304: Biodiversity 2016.

Standard disclosures	Explanation
Disclosure 304-1	Operational sites owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas.
Disclosure 304-2	Significant impacts of activities, products, and services on Biodiversity.
Disclosure 304-3	Habitats protected or restored.
Disclosure 304-4	IUCN Red List species and national conservation list species with habitats in areas affected by operations.

Source: GRI (2021), Consolidated set of GRI sustainability reporting standards (2021), p. 147, https://www.globalreporting.org/standards/download-the-standards/

In 2020, more than 80% of the top companies across 52 countries surveyed by KPMG had sustainability reporting, including high-performing regions like North America, Europe, Asia Pacific, Africa, and Latin America (KPMG, 2020). Though there is evident uptake in sustainability reporting, very few companies report on biodiversity loss; one-quarter of companies from high-risk sectors disclose Biodiversity (KPMG, 2020). Other studies have highlighted and supported the lack of Biodiversity reporting across many organizations. Boiral (2016) argued that Biodiversity largely remains underreported across many organizations. While investigating board diversity relative to the GRI and EU biodiversity standards, Haque and Jones (2020) discovered poor biodiversity disclosure within the selected and sampled firms from the European Union. Similarly, Jones and Solomon (2013) and Tregidga (2013) highlighted that accounting academia could be criticized for its low priority on Biodiversity and the lack of attention to accounting for Biodiversity.

A string of research has stressed the need for companies to partake in more reporting on biodiversity loss and improving their practices. Although disclosure reporting research has increased recently (Atkins et al., 2014), biodiversity reporting remains nascent, and accounting literature faces criticisms for its lack of exploration in this research area (Rimmel & Jonall, 2013; Zhao & Atkins, 2021). To date, only a limited number of studies (Cuckston, 2013; Freeman & Groom, 2013; Van Liempd & Busch, 2013; Rimmel & Jonall, 2013; Siddiqui, 2013; Tregidga, 2013) have reported on companies' reporting practices on biodiversity loss. As the need for biodiversity reporting grows, information is scarce (Van Liempd & Busch, 2013), and detailed reporting needs to be improved (Jones & Solomon, 2013).

Van Liempd and Busch (2013) examined the level of Biodiversity reporting by analyzing the annual reports from 24 of the largest companies in Denmark. They found that the reporting could have been better, and more biodiversity reporting was present. In their 2013 study, Rimmel and Jonall examined biodiversity reporting from 29 companies listed on the Stockholm Stock Exchange in Sweden. They found that minimal reporting was provided and emphasized the need for more focused and limited information. In an extensive

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study on biodiversity reporting in developed economies in Europe, Haque and Jones (2020) discovered an overall poor biodiversity disclosure among the selected and sampled firms from the European Union. These studies all agree on common ground, which is that biodiversity reporting from Western developed countries needs to be improved. The low level of biodiversity reporting demonstrates the need for more extensive reporting (Jones & Solomon, 2013) across all borders and industries. A closer look at high-performing companies on a global scale also revealed shortcomings in biodiversity reporting. Adler et al. (2018) observed reporting on Biodiversity to be very limited within their review of the reporting by the top 150 Fortune Global companies; 10% met the reporting standards but still needed to be more consistent in reporting. Recently, Hassan et al. (2020) conducted a similar study by testing the top 200 Fortune Global companies, and the results were consistent with those of Adler et al. (2018). Reporting on Biodiversity is inadequate, and very few companies provide substantial reporting (Hassan et al., 2020). Moreover, these studies show the need for more commitment to biodiversity loss and continued assessments among top-performing companies.

The post-era of the Industrial Revolution witnessed the emergence and boom of the manufacturing sector within Europe (Euraxess, 2022). According to the World Bank (2022), the manufacturing sector contributes 15% of the EU's Gross Domestic Product (GDP) and employs over 33 million. Recognized as a global manufacturing center, the EU's manufacturing sector is a primary driver in contributing to biodiversity loss (CBD, 2018). The reporting for biodiversity loss varies across countries and sectors. Since consumers are more environmentally conscious with purchases, more pressure is being applied to producers to manufacture more sustainably (Lindahl, 2006; Windsor, 2011). As previously explored, countries have a long way to go in reporting biodiversity loss. Some authors have extended the study of Biodiversity reporting from different sectors to help illuminate areas for future development. The manufacturing sector affects the environment in multiple ways; from extracting raw materials to product life cycles, energy consumption, and product design, the sector is riddled with environmental impacts (Ghobakhloo, 2018). Some studies on the extent of biodiversity disclosures in Sweden, Denmark, England, and Germany discovered that high environmental impact industries are more likely to include disclosures on biodiversity issues (Grabsch et al., 2011). Upon examining the top 150 Fortune Global companies, Adler et al. (2018) also found that industries in high-impact biodiversity areas were likelier to report on Biodiversity. Hence, this study examines the high-impact manufacturing sector within the European Union to contrast, compare, and provide more knowledge on biodiversity reporting.

In support of this study, it is essential to note that previous studies have found low levels of biodiversity reporting in the seafood, food, retail, and mining industries in South Africa despite the country's high level of biodiversity (Mansoor & Maroun, 2016; Maroun et al., 2018; Usher & Maroon, 2018). Boiral (2016) argued in the analysis of the GRI sustainability reports from the mining sector that the reports needed to be more reliable for biodiversity accountability and reporting within this sector. There were clear limitations and opacities in the reporting of biodiversity disclosures (Boiral, 2016); this beckons the call for more industry-specific studies in examining biodiversity reporting in accounting. Since the UN called for biodiversity commitments among businesses in 2010, the This. Coupled with the importance of the manufacturing industries' impacts on biodiversity loss and the EU's commitments to conserving Biodiversity, this research is poised to contribute to the academic gap by pursuing this research. While the disclosure of Biodiversity is emerging in research, it is clear that very little literature currently exists on investigating Biodiversity reporting in the manufacturing sectors.

The Covid-19 crisis was a wake-up call to pay attention to human environmental impacts. Since the evolution of the COVID-19 pandemic, businesses have been urged to pay close attention to mitigating and alleviating their environmental impacts (Hassan et al., 2021). Several multidisciplinary studies have concluded that pandemics such as COVID-19 result from biodiversity loss and a consequence of negative human contributions to the environment (UN, 2020; World Health Organisation, 2020). The health of humankind and

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economic growth are inextricably linked to environmental health (Conservational International, 2022). The behavior of humans and how companies treat the environment is now more critical than ever. According to Ceballos et al. (2020), biodiversity destruction by humans, such as the abuse of and illegal trafficking of wildlife, is a direct cause of the origination of pandemics like COVID-19. Other experts have indicated that the depletion of the ecosystem strips nature's ability to aid in regulating diseases and is essential in curtailing its widespread (Everard et al., 2020). While biodiversity loss and ecosystem reduction continue, the opportunities for transmission of pathogens from animals to people (such as COVID-19) increase (UNEP, 2020). It is speculated that consciousness of the protection of nature will likely increase due to the COVID-19 pandemic and the emergence of studies directly linking degradation in Biodiversity and the spread of diseases (Hassan et al., 2021; Everard et al., 2020; World Health Organisation, 2020). Turning the page to a new chapter and raising awareness about social responsibility is crucial. However, more than mere commitment is required to prevent future pandemics; it is essential to emphasize accountability and manage activities to address biodiversity loss (Hassan et al., 2021). Given the nascent state of research on biodiversity disclosures and its significance in COVID-19, this research paper seeks to contribute and stream awareness into the level of reporting within the context of the manufacturing sector. Furthermore, to the best of our knowledge, this paper will be one of the first to assess the specific industry from the view of the European Union.

METHODS

The study focused on examining how often biodiversity reporting occurs. It selected the top 100 companies in the manufacturing sector of the European Union based on total revenue. These companies were chosen because it was anticipated that they would significantly impact biodiversity. Furthermore, these companies are all located in advanced developed economies and are charged with carrying out the EU's biodiversity commitments within the EU biodiversity strategy. The reporting years selected for this research are 2019, 2020, and 2021, which will compare the reporting levels on biodiversity before and in the wake of COVID-19. For the final sample of companies included in this research, the sustainability and integrated reports (or equivalents) were examined using content analysis to identify, examine, and classify the themes of Biodiversity.

Data Collection. The data for this study was collected from the annual sustainability reports and integrated reports of the top 100 manufacturing companies within the European Union from 2019 to 2021. We used the Orbis database to identify the top 100 active companies in the manufacturing sector by operating revenue total as of April 22, 2022 (www.bvdinfo.com). We chose to use this database because it is a robust global database representing over 400 million companies with detailed financial information that is both holistic and reliable (Orbis, 2022, Overview section). These reports were collected from the publicly available websites of the companies during the period April through May 2022.

We downloaded 264 sustainability reports and combined reports (or their equivalents) for the top 100 companies. From the Orbis database that reported the top 100 companies, it was impossible to access sustainability reports for 12 companies as they were not readily available for publication. All the reports were taken directly from the companies' websites covering the fiscal years 2019, 2020, and 2021. The final sample consisted of 88 companies and their relevant reports for the sampled period (see Appendix A). For the final sample of companies, we used content analysis, which is commonly used in previous works to examine biodiversity disclosures (e.g., Adler et al., 2018; Boiral, 2016; Cuckston, 2013; Hassan et al., 2020; Maroun & Atkins, 2018; Usher and Maroun (2018); van Liempd & Busch, 2013). Similar to previous studies (e.g., Adler et al., 2017; Hassan et al., 2020), we should have included website content in the research as we cannot justify when the website's information is updated. Therefore, we only examined these specific annual reports as the source of data collection for this research.

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Data Analysis. The data analysis began with searching the reports for the following keywords concerning Biodiversity: 'biodiversity,' 'habitat,' 'ecosystem,' 'conservation,' 'species,' 'flora,' 'fauna,' 'wildlife,' 'marine life' adapted by van Liempd and Busch (2013) and extended by the researchers with the introduction of key terms: 'forest,' 'trees,' 'land,' 'wind,' 'deforestation,' 'organism,' 'waste,' 'wetland,' 'threat,' and 'ecology.' These key terms were all selected as they are derived from a broad sense of the definition within the biodiversity context. Following the approach of Grabsch et al. (2011) and van Liempd and Busch (2013), the identified sections of the reports dealing with Biodiversity were examined and classified according to the coding themes of Biodiversity. Grabsch et al. (2011) developed these biodiversity disclosure themes from existing literature and the GRI for biodiversity indicators. These biodiversity themes are outlined in Table 2. The elements of these codes are divided into the seven broad categories of (1) scene setting, (2) species-related, (3) social engagement, (4) performance evaluation, (5) internal management, (6) risk, and (7) external reports.

Table 2. Disclosure Matrix

Codes/Themes	Explanation
Scene setting:	
Mission Statement Motivation Definition	The company defines Biodiversity directly or considers it when setting its mission statement, vision, and motivation.
Species related:	
Site Specific	Mention of Biodiversity at specific sites
Specific Species	Mention of specific species
Surveys	Reporting of biodiversity surveys conducted
IUCN red list	Mention of the IUCN red list
Social engagement:	
Partnerships Awards Stakeholder engagement	Engagement with communities to promote awareness around biodiversity issues, partnership with organizations, and awards for biodiversity initiatives
Performance evaluations:	
Targets performance	Reporting of any biodiversity targets and achievement of targets
Costs	Reporting of costs relating specifically to Biodiversity as a result of rehabilitation, closure, or specific initiatives
Internal management:	
Biodiversity actions plan	Information relating to biodiversity action plans
Biodiversity officer	Biodiversity officer to address biodiversity concerns
Risk:	
Risk	Reporting and assessment of biodiversity risk
Risk management	Systems/processes developed to manage or mitigate biodiversity risk
Incidents	Reporting of specific incidents/accidents which impacted (or did not impact) Biodiversity
Materiality	Disclosing Biodiversity as a material risk for the company

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External reporting:	
Global Reporting Initiative	Reference to GRI Biodiversity reporting indicators

The researchers adapted and deemed the content analysis approach as the proper methodology to analyze the collected reports. Content analysis is the recommended technique for qualitatively and quantitatively coding annual reports' data into pre-defined categories (Guthrie et al., 2004). Additionally, we incorporated the interpretive approach parallel to Atkins et al. (2018) when reviewing the biodiversity content to ensure it fits within the stipulated defined scope and meaning of the particular codes. We followed an analogous process to Grabsch et al. (2011) and Usher and Maroun (2018), where each disclosure was quantified and scored for tracking purposes. The sustainability and integrated (or equivalents) reports were searched and flagged whenever a specific disclosure was identified. Each disclosure index was awarded a score of '1' if the particular index was present and a score of '0' if the disclosure was absent. A scorecard was utilized to tally the points of each disclosure theme at the end. The maximum points a company could tally is 57, which comprises the 19 items across all seven categories for each year under review. It means that a maximum of 19 is awarded for each year, and since there are three years under review, 57 (3 years * 19 biodiversity items) would be the maximum points on the scorecard. Each researcher re-examined the reported results for accuracy and consistency with the data coded. For effectiveness in content analysis, the classification categories should be clear and objectively maintained (Guthrie et al., 2004). Hence, we ensured that any discrepancy was discussed in length and accurately classified with the agreement of all researchers.

RESULTS AND DISCUSSION

The final results of the biodiversity themes were aggregated and summarized in Table 3 for all the selected companies in the sample. The analysis results were interpreted and presented in descriptive results supported by charts, graphs, and tables.

This section presents the results of Biodiversity reporting for the three years analyzed, considering the companies in the sample. First, an overview of the general state of biodiversity reporting is presented through an assessment of the biodiversity index items. Second, the trend in reporting habits of large firms versus smaller firms is evaluated and presented. Third, a descriptive statistical analysis of the results obtained is examined through the lens of the seven themes to view Biodiversity reporting since COVID-19. Furthermore, the presentation of the results is supported by including tables and figures.

To analyze biodiversity reporting, we examined the state of biodiversity reporting from 2019 to 2021 in reports within the EU, focusing on the manufacturing sector. Table 3 provides the data for all 19 biodiversity index items, including the totals for each item, year, and percentage change year over year. Let us recall that the total for each biodiversity index item was tallied using a score of '1' for the presence of the index within the reports or a score of '0' if the index was absent. Therefore, the overall total in each specific index is cumulative of all companies within the final sample selected, an aggregate of 88.

As indicated by the tabulated results, there are low levels of Biodiversity reporting on the vast majority of the 19 index items for the EU's manufacturing sector. On an individual index analysis, at least 50% of the companies reported progressively over the three years on items, namely, mission, motivation, partnerships, stakeholder engagement, biodiversity action plans, risk, and risk management. At the same Time, some indexes experienced the lowest level and were limited in reporting, namely, biodiversity officer, definition, and awards. A year-over-year comparison shows an uptake in reporting on each biodiversity index. The data showed an increase in total reporting of 653 to 743 from 2019 to 2020 and 743 to 835 from 2020 to 2021. The uptake in reporting could be attributed to the EU's framework and targets pushing companies to increase reporting on

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biodiversity, especially since the COVID-19 pandemic, as well as companies' involvement with partnerships to express concern for nature to their stakeholders. While there is evidence of increased reporting, it is still being determined whether companies engage in biodiversity disclosures to improve their corporate image to the stakeholders or display a genuine concern for nature (Boiral, 2016).

Table 3. Biodiversity Index Items Mapping for the years 2019 to 2021

Biodiversity Index Items	Years		
	2019	2020	2021
Mission Statement	47	48	54
Motivation	47	48	56
Definition	4	6	10
Site Specific	38	47	52
Specific Species	43	46	53
Surveys	17	21	23
IUCN red list	13	12	14
Partnerships	65	74	78
Awards	7	10	12
Stakeholder engagement	58	66	70
Targets performance	35	42	54
Costs	20	25	29
Biodiversity actions plan	59	70	76
Biodiversity officer	5	3	4
Risk	53	68	75
Risk management	70	78	82
Incidents	20	21	29
Materiality	30	33	37
External reporting (GRI)	22	25	27
Total	653	743	835

Figure 1 depicts a graphical representation of the biodiversity index items for the fiscal years 2019, 2020, and 2021 to gain further insights into the disclosure items. The data showed an increase in most of the index. However, companies still need to have a higher level of reporting in some categories. Companies should have reported more adequately on the presence of biodiversity officers, less than 2%, which seemingly decreased from 2019 to 2021, while definition and awards showed an upward trend closer to 2% in reporting over the fiscal years. The index items of materiality and external reporting did not have any significant percentage increases and maintained minimal changes within the range of 3%. However, target performance showed a significant average of -1.1% change from 2019 to 2021. The more oversized reported items such as mission, motivation, specific species, partnerships, stakeholder engagement, risk, and risk management are reported twice the amount of the lower reported items with uptake of 6% and more lavish over the fiscal years.

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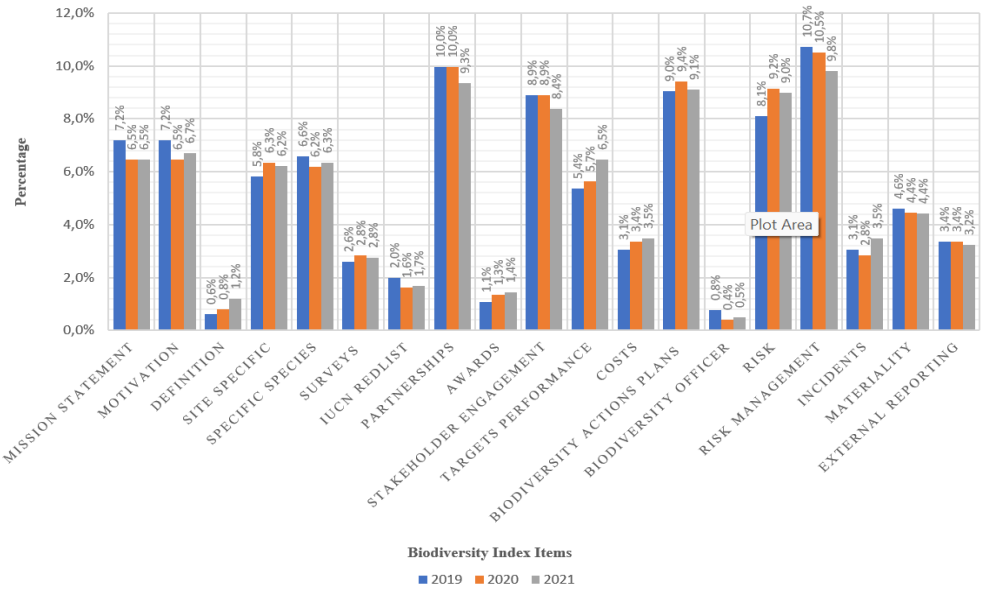

Figure 1. Biodiversity Index Items Chart for the years 2019 to 2021

It was necessary to tabulate companies' scores of the biodiversity index items to view the overall picture of reporting. The data frequency for the 88 companies ranked from the highest operating revenue to the lowest showed relatively low levels of reporting across the three years studied (see Appendix B, Table B1). However, there will be more visible efforts to disclose certain items from most companies from 2019 through 2021. Nineteen companies should have consistently reported on all 2019, 2020, and 2021 biodiversity index items. Moreover, the two companies should have disclosed the biodiversity index items from 2019 through 2021.

On the contrary, one company reported on all the biodiversity index items from 2019 through 2021. Microanalysis of the results revealed an increase in reporting from 2019 to 2021. It is gleaned from the fact that 14 companies did not report on any of the items in 2019, while this amount dropped to seven in 2020 and finally to six companies in 2021. Furthermore, 47 companies reported on ten or more biodiversity index items in 2021 compared to only 33 in 2019. Overall, this showed a relative increase in participation among the companies in the sample, with evidence of reporting from more companies across fiscal years.

The manufacturing companies within the sample were ranked based on operating revenue and their overall reporting percentages on Biodiversity (see Appendix B, Figure B1). In general, through careful analysis of the percentages and trends in biodiversity reporting, there is no conclusive evidence of more excellent reporting among the large operating companies compared to the smaller companies in the sample. To analyze the trend in reporting, we examined this data based on the following operating revenue ranges: companies less than 25 million, companies between 25 million and 50 million, companies between 50 million and 100 million, and companies with at least 100 million. Among the manufacturing firms with at least 100 million in revenue, notably three, only one company depicted overall reporting above 1%. On the contrary, there were observations of more companies with 1% or more outstanding within the lower operating ranges, but notably with more companies falling into these thresholds.

Across the fiscal years represented in the sample, 13 companies scored 2% and, more significantly, represented the highest in Biodiversity reporting based on scoring at least 45 biodiversity index items out of 57

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possible points. More reporting is likely present at the more prominent companies than smaller ones. These findings are discussed in detail later in the discussion section of this research paper.

We examined seven themes and categories using descriptive statistics to analyze the trends in biodiversity reporting since the COVID-19 pandemic. Theme 1, "scene-setting," included three index items: mission statement, motivation, and definition. Theme 2, "species related," comprised four index items: site-specific, specific species, surveys, and IUCN red list. Theme 3, "social engagement," included three index items: partnerships, awards, and stakeholder engagement. Theme 4, "performance evaluations," contained two index items: target performance and cost. Theme 5, "internal management," comprised two index items: biodiversity action plans and biodiversity officer. Theme 6, "risk," included four index items: risk, risk management, incidents, and materiality. Theme 7 is "external reporting." Table 4 presents the descriptive statistics for each theme, including the sum, mean, standard deviation, and percentage change from 2019 to 2021. Along with this information, Figure 2 was constructed to support the graphical representation of the sum of each theme for the years 2019 through 2021. The results support an increase in most reporting categories from 2019 to 2021.

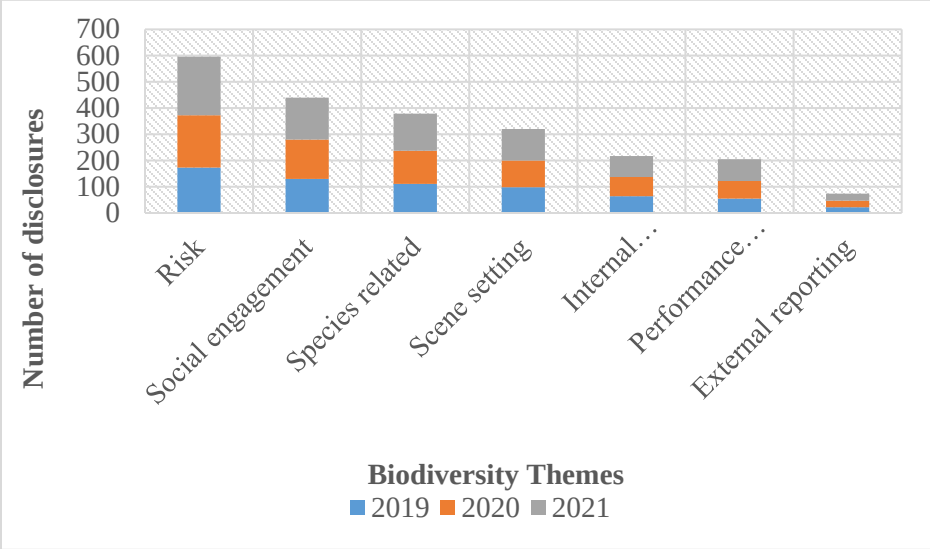

Figure 2. Biodiversity Index Themes for 2019 to 2021

At the end of 2019, there was evidence of reporting across all themes, with most companies reporting on risk, social engagement, and species. In the year 2020, reporting across all themes increased in scene setting, species, social engagement, performance evaluations, internal management, risk, and external reporting; those figures were 4%, 14%, 15%, 22%, 14%, 16%, and 14%, respectively. Figure 2 supported these upward trends and increases across all themes in 2020. As illustrated, there was a significant increase in all themes disclosed within the manufacturing companies for the fiscal year 2021. It is also supported by the aggregated 743 in 2020 to 835 in 2021 and the percentage change of 28% in 2021 across all themes compared to 14% in 2020 (see Table 4). Across the fiscal years, the average disclosure increased when focusing on the mean scores. The scores were 7.42, 8.44, and 9.49 (rounded to the nearest 10th), indicating increased reporting on more biodiversity themes over the fiscal years. The most significant increase was observed in performance evaluations, 51%, and risk, 29%, indicating that companies are assessing their performance based on the targets set forth and mitigating risks that threaten the ecosystem.

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Table 4. Descriptive Statistical Analysis on Biodiversity Themes for 2019 to 2021

Summary of Themes			
	2019	**2020**	**2021**
Sum	653	743	835
StdDev	5.377	5.159	5.029
Mean	7.420	8.443	9.489
		14%	28%
Scene setting			
	2019	**2020**	**2021**
Sum	98	102	120
StdDev	1.066	1.092	1.095
Mean	1.114	1.159	1.364
Percentage (%) Change		4%	22%
Species related			
	2019	**2020**	**2021**
Sum	111	126	142
StdDev	1.434	1.396	1.393
Mean	1.261	1.432	1.614
Percentage (%) Change		14%	28%
Social engagement			
	2019	**2020**	**2021**
Sum	130	150	160
StdDev	0.959	0.860	0.810
Mean	1.477	1.705	1.818
Percentage (%) Change		15%	23%
Performance evaluations			
	2019	**2020**	**2021**
Sum	55	67	83
StdDev	0.835	0.871	0.855
Mean	0.625	0.761	0.943
Percentage (%) Change		22%	51%
Internal management			
	2019	**2020**	**2021**
Sum	64	73	80
StdDev	0.562	0.460	0.419
Mean	0.727	0.830	0.909

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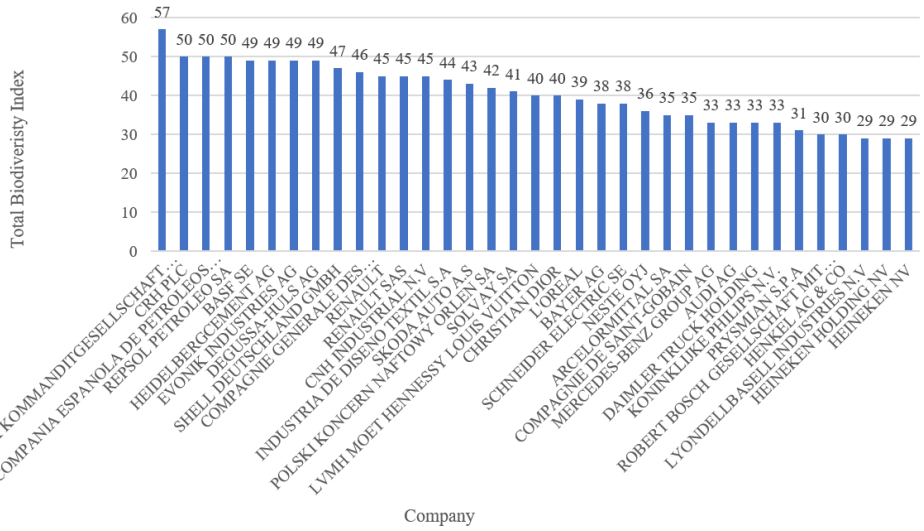
Percentage (%) Change		14%	25%
Risk			
	2019	**2020**	**2021**
Sum	173	200	223
StdDev	1.334	1.239	1.174
Mean	1.966	2.273	2.534
Percentage (%) Change		16%	29%
External reporting			
	2019	**2020**	**2021**
Sum	22	25	27
StdDev	0.435	0.454	0.464
Mean	0.250	0.284	0.307
Percentage (%) Change		14%	23%

The primary purpose of this study was to assess the scope of biodiversity reporting in the EU manufacturing sector. The research results will discuss in detail the themes sought to explore and indicate the industry's reporting through the lens of three research questions: the overall degree of biodiversity reporting, small versus large companies reporting, and reporting in the wake of COVID-19.



Notes: The highest cumulative points a company can receive is 57, based on 19 biodiversity items within the seven categories (19*3 [years: 2019,2020,2021] = 57).

Figure 3. Companies Reporting on 50% or more of Biodiversity Index Items

It is evident from the findings of this study that disclosures on biodiversity still need to be improved in the companies' sustainability reports and their equivalents. In total, only one among the selected top 100 companies with the highest level of reporting disclosed all elements in the sample from 2019 to 2021. From

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these results, it can be inferred that only 1.13% of the total companies in the sample fully met all the biodiversity requirements tested, which indicates a shallow level of reporting from the manufacturing sector. The minimal and low level of reporting is consistent with previous findings by Grabsch et al. (2011), Mansoor and Maroun (2016), Usher and Maroun (2018), and Van Liempd and Busch (2013). Furthermore, of the 88 in the sample, only 35 companies reported on 50% or more of the biodiversity items from 2019 to 2021, indicating low levels of biodiversity reporting (see Figure 3). Given the large-scale industrial impacts of manufacturing processes on Biodiversity, one would expect to see a higher level of reporting among these top manufacturing companies (Mader & Scheyvens, 2019; F&C, 2004). Hassan et al. (2021) challenged the need for biodiversity disclosures to its embryonic nature and companies' undeveloped knowledge of their impacts on the ecosystem. Other researchers argued that more guidance is necessary for defining and interpreting biodiversity risks within individual companies (Usher & Maroun, 2018). An expert, such as an accountant, could help companies with the proper guidance and knowledge needed to drive the momentum on biodiversity reporting and preventing its extinction (Hassan et al., 2021).

Of the sample examined, a handful of companies provided disclosures across most of the biodiversity elements, as seen in Figure 1. It is consistent with recent studies (e.g., Adler et al., 2018; Gaia & Jones, 2020; Hassan et al., 2020; Rimmel & Jonäll, 2013) where low reporting levels on biodiversity indices were deduced. Significantly, few companies addressed the disclosure elements of biodiversity definition, awards, IUCN red list, surveys, and biodiversity officers. Nevertheless, companies that addressed these disclosure items undoubtedly provided actual information about the element. For example, defining Biodiversity. Scene setting requires a company to define "biodiversity clearly" (Buchling & Maroun, 2021). Of the few definitions provided, one company captured the essence of Biodiversity, defined as:

"The diversity of ecosystems, habitats and landscapes on earth, species diversity, and genetic diversity within a biological species or population." [Merck Kommanditgesellschaft AUF Aktien, Corporate Responsibility Report 2021, Pg. 217].

Similarly, another company incorporated a sound definition in their biodiversity section, defined as:

"…. concept that encompasses not only ecosystems and their living components but also the ecological processes that sustain them and the valuable services that they provide and on which we all depend." [Repsol Petroleo SA, Integrated Management Report 2021, pg. 80].

Companies that reported on awards received due to their biodiversity initiatives were few. It is noteworthy to make mention of some of the organizations that handed these awards, such as act4nature international, awarded to Schneider Electric SE for its publication on biodiversity footprint, and Compania Espanola DE Petroleos SAU for its biodiversity action plans, which received multiple awards and high recognition by the European Commission. An integral requirement of the GRI is the IUCN red list, which needed to be added to all the reports examined and pointed out by only 14 companies in 2021. Atkins and Maroun (2018) argued that companies should report on the species at greatest risk of extinction. However, these results still depict deficiency in specific IUCN red list species and site specifics with a listing of red list species. Another apparent remark within the results is the need for more presence of biodiversity officers to deal with biodiversity concerns. However, companies with designated officers reported that they provided more elements of biodiversity on the scorecard. It could imply that having a specific officer dedicated to Biodiversity can help the company uptake the initiatives and improve reporting on Biodiversity. On the positive side of the spectrum, there has been a progressive uptake from 2019 to 2021 in biodiversity action plans, the risk associated with risk management, stakeholder engagements and partnerships, and a clear mission backed by motivational efforts. The most prevalent themes reported were risk and risk management, which could imply that companies are self-aware of their associated exposure to biodiversity and have proposed efforts to manage those risks.

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In addition to the findings of low disclosures, the results did not find a skewed indication of more reporting in favor of larger companies. These findings are inconsistent with the Australian mining industry observations that Adler et al. (2017) provided, claiming that larger companies are more likely to report than smaller ones. Instead, there was an average balance in the reporting percentage among the smaller operating revenue companies versus larger-scale manufacturing companies. From the extrapolated results, a more significant number of companies falling below the 100 million range reported more than the companies below, but this is simply because there was more representation in companies falling below the 100 million threshold (see Appendix B, Figure B1). Therefore, more than looking at this research question, the lens of the top manufacturing companies is needed to draw any clear conclusions on the level of reporting among the larger versus smaller companies. The data was homogeneous across different ranges and not conclusively skewed to any one spectrum in the operating threshold. However, there was a clear indication that more manufacturing firms reported on at least 1% (24 or higher from the possible 57 points) of the biodiversity index items compared to those with lower percentages. These results suggest that companies are now taking more accountability for their impacts on the environment where Biodiversity is concerned. However, based on the findings, a more plausible explanation is the pressure from shareholders and the European Union's biodiversity action initiatives over the years.

The data suggest that reporting has increased in line with the hypothesized association between the COVID-19 pandemic and biodiversity reporting. Building on existing evidence that COVID-19 is a direct cause of human destruction of Biodiversity, the results fit within the theory that companies' reporting would change since COVID-19 (Hassan, 2021; UN, 2020; World et al., 2020). From the observed data, the overall biodiversity index items reported increases from pre-pandemic to the era of pandemic-Covid-19, 2019 through 2021. There were clear indications of increased commitments from companies in 2021 compared to prior years within the sampled period. For example, Microsoft Ireland Operations Limited did not disclose biodiversity as a material item in 2019 nor incorporated biodiversity within its mission. However, these elements were present in 2020 and 2021 as their commitments accelerated during the pandemic.

Further statistical analysis (see Table 4) also showed uptake in the majority of the biodiversity themes and the GRI as more manufacturing companies adopted these sustainability reporting standards as their guidelines for reporting on Biodiversity. Nevertheless, companies that only reported partially using the GRI integrated aspects of the standards and Sustainable Development Goals defined by the United Nations. The research verifies the growth in interest in biodiversity initiatives and shows promising trends in commitments by companies to report on Biodiversity since the COVID-19 pandemic.

CONCLUSION

This paper examines the extent of biodiversity reporting practices in the top manufacturing sector within the EU from 2019 to 2021. We used the biodiversity index developed by prior literature (Grabsch et al., 2011; Jonäll & Rimmel, 2016; Mansoor & Maroun, 2016; Van Liempd & Busch, 2013; Usher & Maroun, 2018) to investigate key areas of companies' sustainability reports and its equivalents. We analyzed and presented the data using various tables and figures, followed by detailed findings and outcomes.

The paper addresses the gap in research by conducting the first study on biodiversity reporting in the manufacturing sector within the EU. Through the biodiversity efforts in commitments and targets set forth by the European Union, there are noticeable observations of an encouraging trend in Biodiversity reporting within the manufacturing sector. Among the primary outcomes, only a few companies scored high on the biodiversity index items, which depicts the need for further developments in biodiversity reporting by companies. We must combat biodiversity extinction, and companies are called upon to pay keen attention to their environmental impacts and report on these.

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We investigated and analyzed the dimensions of the critical elements of the biodiversity index present within the reports. The findings show that disclosures on Biodiversity by manufacturing companies in the EU are limited but nascent. The results are in line with prior studies that found low levels of Biodiversity reporting in Europe (Grabsch et al., 2011; Jones, 1996; Rimmel & Jonall, 2013; Van Liempd & Busch, 2013), the mining sector (Adler et al., 2017), and the seafood industry (Usher & Maroun, 2018). Many expert scholars have indicated that the destruction of Biodiversity has led to the COVID-19 pandemic, and companies are now incorporating Biodiversity into their business models (Ceballos et al., 2020; Hassan et al., 2021). Based on our sample's results, there has been an increase from 2019 to 2021 in the disclosure of biodiversity-related index items from the manufacturing sector. COVID-19 appeared to have been a catalyst for biodiversity reporting, but we recommend that researchers extend this study in the future once ample data becomes available to investigate this point further. It is a promising outlook for the future as all companies across various sectors require more commitment to protect biodiversity and its inhabitants for the sake of a healthy planet for all.

This research paper has limitations. Notably, the sample examined in this paper is limited to the manufacturing sector, and its results cannot be generalized across other industries. It raises opportunities for future studies across different sectors within different countries to assess the state and development of biodiversity reporting. Carrying out similar research on another sector could lend to academic knowledge and development within the field but also allow comparisons with the findings of this paper. This study demonstrates that this is a fruitful time to examine the state of biodiversity reporting, especially since the start of the COVID-19 pandemic. Future academic research could explore this variable across various industries and countries within the context of Biodiversity. Furthermore, the sample size utilized within this research is a smaller portion of the larger population in companies within the manufacturing sector. Future research could replicate the methodology used within this paper to extend the sample size and examine similar variables to determine the level of disclosure reporting.

REFERENCE

Adler, R., Mansi, M., Pandey, R., & Stringer, C. (2017). United Nations Decade on Biodiversity. *Accounting, Auditing & Accountability Journal, 30*(8), 1711–1745. https://doi.org/10.1108/AAAJ-04-2015-2028

Adler, R., Mansi, M., & Pandey, R. (2018). The top Fortune global companies report biodiversity and threatened species. *Accounting, Auditing and Accountability Journal, 31*(3), 787–825. doi:10.1108/AAAJ-03-2016-2490

Atkins, J., Grabsch, C., & Jones, M. (2014). Corporate Biodiversity reporting: Exploring its anthropocentric nature. In M. Jones (Ed.), Accounting for Biodiversity (pp. 215–244). Routledge.

Atkins, J., & Maroun, W. (2018). Integrated extinction accounting and accountability: Building an ark. *Accounting, Auditing and Accountability Journal, 31*(3), 750–786. doi:10.1108/AAAJ-06-2017-2957

Barnosky, A.D., Matzke, N., Tomiya, S., Wogan, G.O.U., Swartz, B., Quental, T.B., Marshall, C., McGuire, J.L., Lindsey, E.L., Maguire, K.C., Mersey, B., & Ferrer, E. (2011). Has the Earth's sixth mass extinction already arrived? Nature 471 (7336), 51–57.

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

Büchling, M., & Maroun, W. (2021). Accounting for Biodiversity and extinction: The case of South African national parks. *Social and Environmental Accountability Journal, 41*(1-2), 66-97. doi:10.1080/0969160X.2021.1889385

CBD. (2018). Biodiversity Mainstreaming in the Manufacturing and Processing Sector. DOI:10.1596/978-1-4648-1174-6

VIKRAMA RESEARCH INSTITUTE
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E-ISSN - 2986-3023 (ONLINE)
LOKA: JOURNAL OF ENVIRONMENTAL SCIENCES
Indexed By : GARUDA Google ROAD ISJD EBSCO

Ceballos, G., Ehrlich, P. R., & Raven, P. H. (2020). Vertebrates on the brink as indicators of biological annihilation and the sixth mass extinction. Proceedings of the National Academy of Sciences of the United States of America, 1–7. https://doi.org/10.1073/pnas.1922686117

Conservational International. (2022). Impact of COVID-19 on Nature. Conservation.org. Retrieved May 27, 2022 from https://www.conservation.org/stories/impact-of-covid-19-on-nature

Cuckston, T. (2013). Bringing tropical forest biodiversity conservation into financial accounting calculation. *Accounting, Auditing and Accountability Journal, 26*(5), 688–714. doi:10.1108/AAAJ-02-2013-1231

Euraxess (2022). Cdn4.euraxess.org. Retrieved on May 27, 2022 from https://cdn4.euraxess.org/sites/default/files/labor_market_information_manufacturing_sector.pdf

Everard, M., Johnston, P., Santillo, D., & Staddon, C. (2020). The role of ecosystems in mitigation and management of COVID-19 and other zoonoses. Environmental Science & Policy, pp.111, 7–17. https://doi.org/10. 1016/j.envsci.2020.05.017

F&C Asset Management plc. (2004). Is Biodiversity a material risk for companies? An assessment of the exposure of FTSE sectors to biodiversity risk, September, F&C Asset Management plc, London, UK

Freeman, M. C., & Groom, B. (2013). Biodiversity valuation and the discount rate problem. *Accounting, Auditing and Accountability Journal, 26*(5), 715–745. doi:10.1108/AAAJ-02-2013-1226

Gaia, S. & Jones, M. (2020). "Biodiversity reporting for governmental organizations: Evidence from English local councils," *Accounting, Auditing & Accountability Journal, Vol. 33* No. 1, pp. 1-31. https://doi.org/10.1108/AAAJ-05-2018-3472

Generation Climate Europe. (2021). Protecting Biodiversity in the EU: The failures of the Biodiversity Strategy 2020 and what we can learn for the future. Retrieved on May 26, 2022, from https://gceurope.org/protecting-biodiversity-in-the-eu-the-failures-of-the-biodiversity-strategy-2020-and-what-we-can-learn-for-the-future/

Ghobakhloo, M. (2018). "The future of manufacturing industry: a strategic roadmap toward Industry 4.0", *Journal of Manufacturing Technology Management, Vol. 29* No. 6, pp. 910-936. https://doi.org/10.1108/JMTM-02-2018-0057

Grabsch, C., Jones, M.J. and Solomon, J.F. (2011). "Accounting for biodiversity in crisis: a European perspective," paper presented at 34th EAA Annual Congress, Rome, Italy, 20-22 April.

GRI. (2007). Biodiversity. A GRI Reporting Resource, Global Reporting Initiative, Amsterdam.

GRI. (2016). A consolidated set of GRI sustainability reporting standards. Retrieve May 26, 2022 from https://www.globalreporting.org/standards/gri-standards-download-center/consolidated-set-of-gri-standards/

Guthrie, J., Petty, R., Yongvanich, K. & Ricceri, F. (2004). "Using content analysis as a research method to inquire into intellectual capital reporting", *Journal of Intellectual Capital, Vol. 5* No. 2, pp. 282–293.

Haque, F., & Jones, M. J. (2020). European firms' corporate biodiversity disclosures and board gender diversity from 2002 to 2016. British Accounting Review, 52(2) doi: 10.1016/j.bar.2020.100893

Hossain, M.M. (2017). 'Accounting for biodiversity in Australia: The case of the Murray Darling Basin Authority,' Pacific Accounting Review 29(1), 2–33. https://doi.org/10.1108/PAR-03-2016-0033

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. doi:10.1002/csr.2145

Hassan, A. M., 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. doi:10.1002/bse.2442

VIKRAMA RESEARCH INSTITUTE
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LOKA: JOURNAL OF ENVIRONMENTAL SCIENCES
Indexed By : GARUDA Google ROAD ISJD EBSCO

Jonäll, K., & Rimmel, G. (2016). 'Corporate bee accountability among Swedish companies', in K. Atkins & B. Atkins (eds.), The business of bees: An integrated approach to be decline and corporate responsibility, pp. 301–319, Greenleaf Publishers, Sheffield.

Jones, M. J. (1996). Accounting for Biodiversity: A pilot study. British Accounting Review, 28(4), 281–303. doi:10.1006/bare.1996.0019

Jones, M., & Solomon, J. (2013). Problematizing accounting for Biodiversity. *Accounting, Auditing & Accountability Journal, 26*(5), 668–687. doi:10.1108/AAAJ-03-2013-1255

KPMG. (2020). The Time has Come: The KPMG Survey of Sustainability Reporting 2020. Retrieved May 22, 2022 from https://home.kpmg/xx/en/home/insights/2020/11/the-time-has-come-survey-of-sustainability-reporting.html

Lindahl, M. (2006). Engineering designers' experience of design for environment methods and tools - Requirement definitions from an interview study. *Journal of Cleaner Production,14*(5), 487–496.

Mader, A., & Scheyvens, H. (2019). Biodiversity and Industry. Retrieved May 27, 2022, from https://www.iges.or.jp/en/publication_documents/pub/reportchapter/en/10312/2019.+GEO6+for+Industry+in+Asia+Pacific+-+Biodiversity.pdf

Mansi, M., Pandey, R., & Stringer, C. (2014). Biodiversity reporting in India: A view from the top. Corporate Ownership and Control, 12(1 Continued 4), pp. 418–427. doi:10.22495/cocv12i1c4p5

Mansoor, H. & Maroun, W. (2016). 'An initial review of biodiversity reporting by South African corporates – The case of the food and mining sectors', South African *Journal of Economic and Management Sciences 19*(4), 592–614. https://doi.org/10.4102/sajems.v19i4.1477

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

Maroun, W., Usher, K. & Mansoor, H. (2018). "Biodiversity reporting and organized hypocrisy: the case of the South African food and retail industry," Qualitative Research in Accounting & Management, Vol. 15 No. 4, pp. 437-464

Orbis. (2022). Orbis is the resource for entity data. Retrieved on May 29, 2022 from https://www.bvdinfo.com/en-gb/ourproducts/data/international/orbis

PwC. (2014). The Value Creation Journey: A survey of JSE Top-40 companies' Integrated Reports. Retrieved May 27, 2022 from http://www.pwc.co.za/en/assets/pdf/integrated-reporting-survey-2014.pdf

PwC. (2015). Integrated reporting: Where to next? Retrieved May 27, 2022 from http://www.pwc.co.za/en/assets/pdf/integrated-reporting-survey-2015.pdf

Rimmel, G., & Jonäll, K. (2013). Biodiversity reporting in Sweden: Corporate disclosure and preparers' views. *Accounting, Auditing & Accountability Journal, 26*(5), 746–778. https://doi.org/10.1108/AAAJ-02-2013-1228

Sarkar, S. (2001). Defining "Biodiversity"; Assessing Biodiversity, The Monist, Volume 85, Issue 1, January 1, 2002, Pages 131–155. https://doi.org/10.5840/monist20028515

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

Siddiqui, J. (2013). Mainstreaming biodiversity accounting: Potential implications for a developing economy. *Accounting, Auditing and Accountability Journal, 26*(5), 779–805. doi:10.1108/AAAJ-03-2013-1242

Simberloff D (1996). Lawton, J. H. and May, R. M. (Eds.). Extinction Rates. 1995. OxfordUniversity Press, Oxford. Xii + 233 pp. *Journal of Evolutionary Biology 9* (1): 124-126. DOI: 10.1046/j.1420-9101.1996.t01-1-9010124.x

VIKRAMA RESEARCH INSTITUTE
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LOKA: JOURNAL OF ENVIRONMENTAL SCIENCES
Indexed By : GARUDA Google ROAD ISJD EBSCO

Syarifuddin, S. & Damayanti, R.A. (2019). "Biodiversity accounting: Uncover environmental destruction in Indonesia," *Social Responsibility Journal, Vol. 16* No. 6, pp. 809-825. https://doi.org/10.1108/SRJ-11-2018-0291

Talbot, D., & Boiral, O. (2021). Public organizations and biodiversity disclosure: Saving face to meet a legal obligation? Business Strategy and the Environment, 30(5), 2571–2586.

Tregidga, H. (2013). Biodiversity offsetting: Problematisation of an emerging governance regime. *Accounting, Auditing and Accountability Journal, 26*(5), 806–832. doi:10.1108/AAAJ-02-2013-1234

United Nations. (2010). Retrieved on May 27, 2022 from https://www.cbd.int/2011-2020/

United Nations. (2019). SEEA experimental ecosystem accounting revision. United Nations Statistical Commission. Retrieved May 27, 2022 from https://seea.un.org/content/seea-experimental-ecosystemaccounting-revision

United Nations. (2020). Retrieved May 27, 2022 from https://www.unep.org/news-and-stories/story/2020-crunch-year-biodiversity-and-climate-emergencies

UNEP. (2020). Coronaviruses: Are they here to stay? UN Environment Programme (UNEP). Retrieved on May 27, 2022 from https://www.unenvironment.org/news-and-stories/story/coronaviruses-are-they-here-stay

UN Global Compact & IUCN. (2012). A Framework for Corporate Action on Biodiversity and Ecosystem Services. Retrieved on May 27, 2022 from https://www.unglobalcompact.org/library/139

Usher, K. & Maroun, W. (2018). "A review of biodiversity reporting by the South African Seafood industry", *South African Journal of Economic and Management Sciences, Vol. 21* No. 1, pp. 1–12.

Van Liempd, D., & Busch, J. (2013). Biodiversity reporting in Denmark. Accounting, Auditing and Accountability Journal, 26(5), 833–872. https://doi.org/10.1108/AAAJ:02-2013-1232

Weir, K. (2018). The purposes, promises and compromises of extinction accounting in the UK public sector. *Accounting, Auditing & Accountability Journal, 31*(3), 875–899. https://doi.org/10.1108/AAAJ-03-2016-2494

Weir, K. (2019). The logic of Biodiversity accounting in the UK public sector. *Accounting Forum. Taylor & Francis, 43*(3), 348–379. https://doi.org/10.1080/01559982.2019.1605873

Windsor, S.E. (2011). An Introduction to Green Process Management. ASQ Quality Press, Milwaukee, WI.

The World Bank. (2022). Manufacturing, value added (% of GDP) - European Union | Data. Data.worldbank.org. Retrieved May 27, 2022, from https://data.worldbank.org/indicator/NV.IND.MANF.ZS?locations=EU

World Economic Forum. (2021). The Global Risks Report 2021. Retrieved May 22, 2022 from https://www.weforum.org/reports/the-global-risks-report-2021

World Health Organisation. (2020). Coronavirus. Retrieved May 27, 2022 from https://www.who.int/health-topics/coronavirus#tab=tab_1

Zhao, L. & Atkins, J. (2021). Assessing the Emancipatory Nature of Chinese Extinction *Accounting, Social and Environmental Accountability Journal*, 41:1-2, 8–36, DOI:10.1080/0969160X.2021.1889386