



# Trends in private sector engagement with biodiversity: EU listed companies' disclosure and indicators

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## ABSTRACT

The EU biodiversity strategy highlights the relevance of the private sector and its prominent role as potential degrader and as protector of biodiversity. However, the topic of biodiversity seems to be downplayed and disregarded by most companies, and the potential proxies leading them to report on the matter are not yet clear.

This exploratory paper aims at assessing the companies' actual engagement with the EU biodiversity strategy, and the factors influencing the relevance and quality of their disclosure indicators. To that purpose, 170 listed companies from the 5 biggest economies in the EU have been studied after their reporting indicators on biodiversity in 2018 and 2021, focusing on country, sector and impact intensity as potential drivers, as well as on the changes in reporting and indicators between those years.

Our findings highlight an increased but heterogeneous engagement with biodiversity among EU listed companies, with limited relevance given by the companies to standard and quantitative performance indicators, and a strong influence on reporting of factors such as the companies' country of origin, and the companies' sector/activity. All of which suggests different approaches to biodiversity within the private sector and insufficient corporate action to meet the EU biodiversity strategy goals.

## 1. Introduction

The huge damage of the world's biodiversity is recognized as one of the mayor concerns of the environmental crisis and considered one of the greatest threats to the planet and to human survival (Tregidga, 2013). Although the safe limit for biodiversity loss was established at 10% (Steffen et al., 2015), Rockström and his team calculated that many regions in the planet were already above 16% of biodiversity loss. Recently, in 2019, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) declared an emergency on biodiversity, pointing out to its degraded and, in most cases, worsened state worldwide (McQuatters-Gollop et al., 2022).

This destruction has two main reasons, first, the dramatic evolution of climate change, considered as a key factor to analyse the past and future of biodiversity distribution (Cheung, 2009; Peterson et al., 2002; Parmesan and Yohe, 2003; Thomas et al., 2004), and second, the environmental issues caused by social and economic activities (Liu et al., 2022). The two factors are actually relational (Liempd and Busch, 2013; Mansoor and Maroun, 2016), since biodiversity protection is closely related to the health of our society, and the recent emergence of the

COVID-19 pandemic only enhances the urgency of its defense and recovery (EU, 2020).

Despite the urgency of the issue and the numerous environmental initiatives developed in the framework of business sustainability or Corporate Social Responsibility (CSR), the companies' environmental departments did not consider biodiversity as a relevant matter to take into account when making strategic decisions until just a few years ago (Winn and Pogutz, 2013). Nevertheless, in the report named "Its Business Risk Report", PWC (2010) considered that biodiversity loss would have dramatic consequences for business in the future. Similarly, KPMG (2012) argued that biodiversity loss is one of the ten sustainability main concerns that will affect the majority of companies' activities during the next years and therefore a critical risk that should be managed for business survival. The loss of biodiversity creates high risks for business activity, by endangering the availability of natural resources, supply chains, and ecosystem services (Smith et al., 2020), among others. The World Business Council for Sustainable Development in its document "Guide to Corporate Ecosystem Valuation: A Framework for Improving Corporate Decision-Making" considered that the continuing destruction of the ecosystems is putting companies at a high risk (WBCSD World

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Business Council for Sustainable Development, 2011a, p. 2). The guide brings in a different way to perceive the corporations' relationship with the environment, acknowledging that companies not only use and have an impact on ecosystems, but they also crucially depend on them to generate long-term value. As a consequence, businesses have started recognizing their responsibility for mitigating their environmental impacts and their need to make positive contributions to biodiversity conservation (Tregidga, 2013).

The European Union is a leader in establishing specific legislation and policy aimed at protecting biodiversity and its commitment is visible in recent communications from the Commission itself (EU, 2020). Over the years, biodiversity protection has been included in existing policy instruments (European Common Agricultural Policy), new platforms have been developed (IPBES), and existing indicators have been reinforced (the convention on the Conservation of Migratory Species of Wild Animals (CMS)) (Geijzendorffer et al., 2016). In 2011, the EU Biodiversity Strategy developed the EU Business and Biodiversity Platform,<sup>1</sup> which 'provides a unique forum for dialogue and policy interface to discuss the links between business and biodiversity at EU level'. However, the real impact of the strategy among European companies appears to be unknown. In line with other initiatives such as the Circular Economy Action Plan,<sup>2</sup> large companies are targeted as priority actors in promoting Biodiversity through Natural Capital Accounting, Innovation and Finance. Large companies, which have the necessary resources and are more accountable for significant impacts on Biodiversity (Marco-Fondevila et al., 2021), are the ones expected to lead and support the institutional initiatives. However, as stated by Addison et al. (2018), the penetration of corporate biodiversity disclosure is pretty low, with only 49% of the sample studied mentioning the topic.

Therefore, the current paper aims to understand the reported commitments to biodiversity of European companies. A specific study for the EU companies' reporting and accountability practice is needed to assess how important biodiversity is for business, their engagement in protecting it, and the efficacy of the different policies developed by the EU over the years.

The companies selected for the current research are listed companies belonging to the EU five largest economies, and, therefore, to countries with different values, cultural approaches to biodiversity and slightly different norms about the matter, representing a good sample of the EU diversity. The country-wise perspective allows studying the potentially distinctive behaviour of companies from different countries, and its impact on biodiversity disclosure.

Looking to how companies' reporting on biodiversity has changed from 2018 to 2021, and adopting the country and sectoral view as two potential drivers for biodiversity reporting in companies, the study of the company's level of engagement in biodiversity is based in Addison et al. (2018), testing the presence/existence of the topic in the reports, together with the importance it receives, which is defined by the relevance given to the actions undergone by the company in relation to biodiversity.

Based on this approach, the first research question is:

- RQ1. How has EU companies' reporting of biodiversity changed from 2018 to 2021?

As concluded by previous literature, notably before 2011, companies report very little information on biodiversity indicators (Adler et al., 2018; Usher and Maroun, 2018), if any, mostly with a legitimacy aim and with minimal usefulness (Anthony and Morrison-Saunders, 2023). Indeed, from a critical perspective, reporting requires quantitative data

<sup>1</sup> [https://ec.europa.eu/environment/biodiversity/business/about-us/mission-statement/index\\_en.htm](https://ec.europa.eu/environment/biodiversity/business/about-us/mission-statement/index_en.htm)

<sup>2</sup> <https://www.interregeurope.eu/winpol/news/news-article/8053/new-circular-economy-action-plan/>

and indicators to be useful and relevant (Hassan et al., 2020). However, over the period considered, the institutional initiatives described, together with other drivers such as stakeholders' pressure, society awareness, etc., may have had an impact on companies' approach to biodiversity in terms of importance given, information reported and commitment adopted, as part of their sustainability strategy.

Public disclosure of commitments, actions and actual performance through corporate biodiversity accounting and reporting is a key component of organizational legitimacy and stewardship as it potentially reflects a strong identification signal of biodiversity as a material issue (Boiral, 2016; Addison et al., 2018). In 2018, Adler et al. examined disclosures related to threatened species and habitats published by the world's largest multinationals comprising the Fortune Global 150 and found that less than 10% were providing relatively substantial information which, nevertheless, lacked consistency in terms of indicators employed to outline performance.

From this standpoint, the second goal of this paper is mapping the companies' biodiversity actual engagement and performance by studying the relevance of their reporting and indicators. Analysing the reports in 2018 and 2021, we look at how companies assume the materiality of the topic, and to what degree are they reporting substantial information through specific indicators. Therefore, the second research question focuses on the relevance and usefulness of the companies reporting on biodiversity, again, adopting the country and the sector as potential drivers:

- RQ2. Do the EU largest companies disclose substantial information and indicators about biodiversity?

As a whole, the paper contributes to several lines of study and to several stakeholders with different interests in biodiversity. A limited number of empirical papers analyse the companies' behaviour regarding the disclosure of biodiversity, and most of them are focused on a single country (Jones et al., 2013; Siddiqui, 2013; Liempd and Busch, 2013; Schneider et al., 2014), or in sectors which activity presents particularly negative impacts on biodiversity (Boiral, 2016; Boiral and Heras-Saizarbitoria, 2017; Mansoor and Maroun, 2016). Looking to Biodiversity reporting in mega-diverse countries, Skouloudis et al. (2019) analyse whether companies report on the topic and with which performance metrics, to conclude that disclosure on biodiversity is still underreported and subject to important variations among countries and sectors.

In this sense, our work aims at contributing to this emergent line of research with a more holistic view of the relationship between business and biodiversity indicators, developing a multisectoral and multinational study. Highlighting the actual differences for disclosure of biodiversity indicators among countries and sectors in the main European economies brings in a more complete view of previous studies, allowing us to map the level of biodiversity engagement and reporting of European companies through the level and extent of disclosure, which may help policy makers adapt their new strategies.

## 2. Methods

### 2.1. The sample

Previous research about companies' disclosure on biodiversity found out that companies listed in exchange markets are likely to be the ones with more and better information about the topic (Adler et al., 2018), while many of the non-listed companies may lack reports and public information. Literature has clearly established that companies' size has a significant effect in social and environmental disclosure for two main reasons (Álvarez Etxeberria and Aldaz Odriozola, 2018): large firms are more capable to absorb costs arising from disclosure (Deegan and Gordon, 1996; Hackston and Milne, 1996; Gray et al., 2001) and large companies face higher potential political costs linked to stakeholders' reaction to social/ environmental performance issues (Aerts et al.,

2006).

The sample for the research, consequently, was focused on listed companies, under the assumption that they are the ones with more and more detailed information and disclosure about biodiversity. Looking to have a representative sample for EU listed companies, the five largest economies of the EU in year 2022, which accounted for 70% of the whole EU GDP, were chosen to form the sample, rendering a final number of 170 listed companies.

The companies' distribution per country, considering the countries where the headquarters are settled, is presented in Table 1. The possible bias derived of counting with a different number of companies for every country (after the number taken by the stock index), was avoided by weighting them as percentages when needed.

Together with the country perspective, the activity sector of the company was also considered potentially relevant and explanatory of companies' behaviour towards biodiversity, since it is linked to particularities related to the exposure to final customers, regulation, management standards, etc. Furthermore, the activity in every sector entails different levels of exposure to biodiversity impacts, which could also have an influence in the level of reporting. Therefore, following several references to define a basic intensity scale of potential impact after the companies' activity (WBCSD, 2011b), the 10 sectors were grouped according to their 'biodiversity impact intensity', whether low, medium or high, based on Adler et al. (2018) classification.

Table 2 presents the sample distribution according to the companies' sector and activity intensity.

The two indicators will therefore guide the research to analyse the 170 companies' behaviour about biodiversity: The country to which they belong and the sector in which they operate (considering also the intensity of the activity impact on biodiversity).

## 2.2. The research

The main source of information for the current research was the publicly accessible information and indicators reported by the companies in years 2018 and 2021. The reason to select those two years relies on the goal of assessing the evolution of biodiversity reporting over the last few years while limiting as much as possible the effects that COVID19 pandemics may have had on companies' performance and disclosure (years 2019 and 2020).

Given that the topic of biodiversity is subject to diverse, scattered and heterogeneous information (Adler et al., 2018), the approach used in this research to answer the first research question was based in Marco-Fondevila et al. (2018) research to assess the companies' engagement in Circular Economy, and in Addison et al. (2018) study about corporate biodiversity reporting among the top 100 companies of 2016 Fortune Global. **Engagement** is therefore tested by analysing whether biodiversity is reported or not, looking at its presence in reports (volume of explicit references and mentions), and by assessing the importance given to the topic, according to its relevance for the company. The latter is established by identifying where biodiversity information is disclosed by the companies, in top, strategic, specific or minor reporting sections (Table 3).

The second research question, linked to specific and quantitative information about sustainability within the companies' reports, is tested through two proxies, based on the Global Reporting Initiative (GRI, 2021) guidance for reporting, and on Addison et al. (2018) research. Firstly, the **Materiality** is analysed by checking whether biodiversity is tested from a materiality point of view or not, and if the company has

**Table 1**  
Sample. Companies per country.

EU Country	Germany	France	Italy	Spain	Netherlands
Stock Index	DAX30	CAC40	MIB40	IBEX35	AEX25
Companies	30	40	40	35	25

considered it to be a material topic or not. Materiality, as a concept, is understood by GRI (2021) definition: 'a topic may be considered material if it is important to stakeholders, whether internal or external, even if the relative significance of the impacts on the economy, environment or society is lower than for other topics'. Secondly, the **Performance indicators** describe the quality of reporting, by assessing how detailed, accurate and useful the information provided about biodiversity is, analysing the presence or not of quantitative data, and checking the use of specific indicators. Being the most extended reporting standard, the inclusion of the GRI indicators specifically targeting biodiversity information (304–1 to 304–4) was also taken into account (Table 4).

Once the variables defined, all sustainability public disclosure from the selected companies was collected for years 2018 and 2021, whether in sustainability reports, annual reports, Websites or Non-financial information reports. The content analysis of the companies' disclosed information was performed by the authors, by thoroughly reading and analysing the texts and data related to biodiversity. Detecting any narrative linked to biodiversity, in line with Anthony and Morrison-Saunders (2023) number of narratives mentioning the value, and assessing its relevance (subject to adequately understanding the report contents), entails a lot of complexity, thus advising for a personal reading from authors and not for specific computer software which could lead to errors. The selected variables and proxies were firstly examined for the whole sample of 170 companies, and secondly, from a country, sectoral and impact intensity perspective (in line with Addison et al. (2018), categories for risk).

## 3. Findings

### 3.1. Engagement

Looking at the first research question, the companies' engagement with the topic in 2018 and 2021 reporting serves as a preliminary indication about how biodiversity perception may be changing through time. After collecting all references to biodiversity in the companies' reports, a varied scenario was obtained, with companies mentioning the topic more than a hundred times (specially in 2021 reports), and companies with no references at all. As shown in Fig. 1, most companies barely referred to it in their 2018 reports, and a notable change is observable in the trend for 2021.

Table 5 presents the country distribution of companies mentioning biodiversity, as well as the average references for 2018 and 2021. It is noted how France and Spain lead the table in both, number of companies mentioning biodiversity and average number of references per company. On the other side, the evolution from 2018 to 2021 is positive in all countries, notably in the Netherlands, with a relevant increase in number of companies reporting about biodiversity, and average number of references per company. On the contrary, considering the low figure they had in 2018, the German companies show only a slight improvement from 2018 to 2021. In any case, there is a high dispersion in number of references among companies, as shown by the standard deviation ( $\sigma$ ), systematically higher than the corresponding means.

The analysis per sector and biodiversity impact intensity (Table 6) clarifies the previous results even though the dispersion among companies within sectors is still remarkable. Looking at 2018, the low presence of biodiversity references in *Heavy industry* or *Pharmaceutical* companies stands out, considering the impact in biodiversity such activities have. On the contrary, it can be noted how the *Energy* and *Infrastructures* sectors (medium and high impact), do mention the topic extensively. In 2021, a change in trend is perceived, with all sectors assuming biodiversity as a topic to address, with a notable increase in number of references throughout the reports.

Although this analysis does not provide the detail of what is actually reported, it gives an idea on the relevance gained through the period, as well as on the countries and sectors where the topic is more relevant.

As a more detailed indicator for engagement, we look at the

**Table 2**  
Sample companies' distribution per sector.

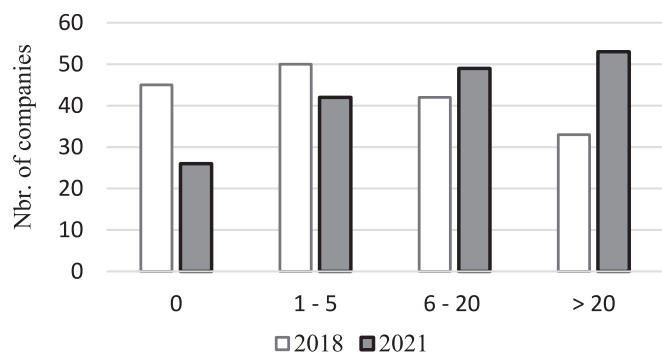
Sector	Energy	Financial Services	Heavy industry	Infrastructures	Manufacture	Media & Telecom	Pharma & Chemicals	Services	Technology	Transport & Logistics
Companies	21 12,3%	35 20,6%	7 4,1%	8 4,7%	29 17,1%	10 5,9%	17 10,0%	20 11,8%	15 8,8%	8 4,7%
Impact intensity	Medium	Low	High	High	Medium	Low	Medium	Low	Low	Medium

**Table 3**  
Variables used for engagement.

Concept	Variable	Answer	
Engagement	Presence of the topic	Explicit references and mentions	Nbr.
	Relevance given to the topic	CEO/president/top institutional message	y/n
		Strategic/main corporate lines	y/n
		Specific programs/ projects	y/n
		Minor actions/ initiatives	y/n

**Table 4**  
Variables used for specific and quantitative information.

Concept	Variable	Answer	
Specific and quantitative information	Materiality & Reporting	Materiality is tested/ analysed	y/n
		Biodiversity is considered to be material	y/n
	Performance Indicators	Indicators with quantitative data are reported	y/n
		GRI 304 series Indicators are reported	y/n



**Fig. 1.** Number of references of biodiversity in company reports.

importance of the context in which biodiversity is mentioned within the companies reports (from top institutional message to minor activities), as well as at the significance of the contents reported (strategic axis, part of a program, minor initiative, etc.). The results obtained for the 170

**Table 5**  
Biodiversity presence per country.

Presence	2018				2021				Variation	
	Companies mentioning	$\mu$	$\sigma$		Companies mentioning	$\mu$	$\sigma$		Companies mentioning	$\mu$
Spain	31	88,6%	19,9	27,4	34	97,1%	30,6	33,6	+8,6%	+53,8%
Netherlands	12	48,0%	4,3	9,0	20	80,0%	12,2	17,0	+32,0%	+181,5%
France	37	92,5%	18,9	20,8	39	97,5%	33,8	41,3	+5,0%	+79,4%
Italy	27	67,5%	6,5	12,0	31	77,5%	15,4	27,5	+10,0%	+136,5%
Germany	18	60,0%	6,5	10,7	20	66,7%	10,8	17,4	+6,7%	+66,7%
Total	125	73,5%	11,8	19,0	144	84,7%	21,6	31,4	+11,2%	+82,2%

companies are shown in Table 7.

Firstly, the positive trend is evident, with higher percentages for 2021 in all four categories, suggesting that companies increasingly view biodiversity as important. However, it is also notable that most companies keep biodiversity at a level of minor activities or operational involvement. From a country perspective, Spanish and French companies appear to give more importance to biodiversity (although Spanish went slightly back in top relevance), followed by Italy, although the impulse seen in Dutch companies in 2021 is also remarkable.

This same analysis at the sector and impact level (Table 8), confirms the leading role assumed by Energy, followed by Infrastructures and Manufacture. It is notable how in 2018, among the companies giving high relevance to biodiversity (Top & Strategic), there is none coming from Media & Telecom, Pharmaceutical & Chemicals, Technology and Transport & Logistics, and just about 5% coming from Heavy Industry. In fact, the relevance given by all companies in Media & Telecom and by most of Technology and Transport & Logistics is very low. In 2021, however, the Pharmaceutical & Chemicals sector and, with minor relevance, the Heavy Industry sector have changed their trend, and started giving more relevance to the topic.

Finally, it can be noted that, although companies with high impact activities show higher percentages in all four categories of relevance than low impact ones, the medium impact intensity group shows a higher increase through the years, which could suggest the topic is becoming relevant for companies which were not concerned by the topic in 2018.

In sum, more than 50% of companies did not consider biodiversity as a relevant topic in 2018, including it just in minor actions or isolated initiatives of the company, and frequently, as an additional feature of a broader initiative addressing other sustainability topics (for instance, an initiative to reduce carbon emissions by planting trees is said to have a beneficial impact on biodiversity). Although a clear change can be seen in 2021 reports, still, almost 85% of companies do not consider biodiversity as a strategic axis, and only 34% of companies do count on operative initiatives (permanent or part of a long-term program). From a geographical perspective, Spanish and French companies are the ones disclosing more on biodiversity, although the Netherlands and Italy show a relevant increase in 2021. From the impact perspective, the companies with medium impact appear to have given more relevance to the topic during the studied period.

### 3.2. Specific and quantitative information

The first proxy relates to the concept of materiality, as explained in



**Table 6**  
Biodiversity presence per country and impact.

	2018			2021			Variation	
	Companies Mentioning	$\mu$	$\sigma$	Companies Mentioning	$\mu$	$\sigma$	Companies Mentioning	$\mu$
Energy (21)	100,0%	32,4	30,2	100,0%	55,5	44,6	0,00	+71,2%
Financial S. (35)	62,9%	3,6	6,6	87,1%	9,4	12,3	+24,2%	+161,1%
Heavy Industry (7)	28,6%	11,4	29,8	85,7%	16,6	27,5	+57,1%	+45,0%
Infrastructures (8)	87,5%	26,8	22,8	87,5%	33,3	18,1	0,00	+24,3%
Manufacture (29)	89,7%	14,7	17,1	89,7%	24,8	35,5	0,00	+68,1%
Media & Telecom (10)	80,0%	6,5	5,9	90,0%	12,3	11,6	10%	+89,2%
Pharmaceutical (17)	58,8%	6,5	8,7	94,1%	18,6	29,5	+35,3%	+188,2%
Services (20)	65,0%	10,7	18,6	70,0%	22,1	37,5	+5%	+106,1%
Technology (15)	60,0%	3,0	3,8	73,3%	6,5	6,7	+13,3%	+117,8%
Transport & Logistics (8)	87,5%	6,5	6,3	87,5%	11,9	10,1	0,00	+82,7%
Low (80)	65,0%	5,6	10,9	76,3%	12,4	21,5	+11,3%	+121,4%
Medium (75)	85,3%	16,9	26,4	90,0%	30,6	42,4	+4,7%	+81,0%
High (15)	60,0%	19,6	26,5	86,7%	25,5	23,7	+26,7%	+30,01%

**Table 7**  
Relevance given to biodiversity by companies.

Relevance/ Country	Top		Strategic		Operational		Minor	
	2018	2021	2018	2021	2018	2021	2018	2021
<b>Total</b>	<b>4,12%</b>	<b>8,82%</b>	<b>10,59%</b>	<b>15,29%</b>	<b>28,24%</b>	<b>34,12%</b>	<b>53,53%</b>	<b>71,18%</b>
Spain	14,29%	5,71%	17,14%	22,86%	37,14%	51,43%	60,00%	82,86%
Netherlands	0,00%	4,00%	8,00%	4,00%	16,00%	20,00%	44,00%	60,00%
France	2,50%	20,00%	10,00%	27,50%	45,00%	42,50%	82,50%	92,50%
Italy	0,00%	7,50%	12,50%	12,50%	22,50%	27,50%	37,50%	60,00%
Germany	3,33%	3,33%	3,33%	3,33%	13,33%	23,33%	36,67%	53,33%

**Table 8**  
Relevance per sector and impact.

Relevance/ sector	Top		Strategic		Operational		Minor	
	2018	2021	2018	2021	2018	2021	2018	2021
Energy (21)	14,3%	28,6%	42,9%	52,4%	76,2%	76,2%	85,7%	95,3%
Financial S. (35)	2,9%	8,6%	2,9%	2,9%	8,6%	14,3%	37,1%	51,4%
Heavy Industry (7)	0,0%	0,0%	14,3%	14,3%	14,3%	14,3%	14,3%	85,7%
Infrastructures (8)	25,0%	12,5%	37,5%	37,5%	75,0%	62,5%	87,5%	87,5%
Manufacture (29)	3,5%	13,8%	10,4%	13,8%	34,5%	51,7%	69,0%	82,8%
Media & Telecom (10)	0,0%	0,0%	0,0%	0,0%	0,0%	30,0%	60,0%	90,0%
Pharmaceutical (17)	0,0%	0,0%	0,0%	23,5%	29,4%	29,4%	47,1%	64,7%
Services (20)	0,0%	5,0%	5,0%	5,0%	20,0%	20,0%	55,0%	60,0%
Technology (15)	0,0%	0,0%	0,0%	0,0%	6,7%	6,7%	20,0%	53,3%
Transport & Logistics (8)	0,0%	0,0%	0,0%	12,5%	25,0%	37,5%	50,0%	75,0%
Low (80)	1,25%	5,00%	2,50%	2,50%	10,00%	16,25%	41,25%	58,75%
Medium (75)	5,33%	13,33%	16,00%	26,67%	44,00%	52,00%	66,67%	81,33%
High (15)	13,33%	6,67%	26,67%	26,67%	46,67%	40,00%	53,33%	86,67%

the methods section, which brings in a different approach to disclosure since it relates to the objective importance the topic has for the company according to its activity and responsibility, and not that much to questions such as the company values, culture or strategy. Furthermore, the idea of testing materiality does already talk about the soundness of disclosure, and of a systemic approach to what shall be disclosed. In this respect, [Table 9](#) shows how around 60% of companies state they tested the materiality of biodiversity both, in 2018 and 2021, considering it to be material in 73% and 80% of cases respectively. Therefore, biodiversity was material to reporting in 45% of all companies in 2018 and 49% in 2021. As for countries, France and Spain lead the table followed by Italy, but it is in the Netherlands and Germany where relevant increases can be seen from 2018 to 2021.

The sectoral analysis ([Table 10](#)), however, shows interesting results, since the percentages for companies testing materiality and for companies considering biodiversity as a material topic, differ notably from 2018 to 2021. Indeed, some sectors present a consistent approach (*Energy, Infrastructures, Technology and Services*), with similar percentages

**Table 9**  
Materiality of biodiversity for companies.

Materiality/ Country	2018			2021		
	Tested	Material	Over all	Tested	Material	Over all
Total	61,7%	73,3%	45,3%	61,7%	80,0%	49,4%
Spain	85,7%	70,0%	60,0%	77,1%	70,4%	54,3%
Netherlands	36,0%	66,7%	24,0%	44,0%	72,7%	32,0%
France	87,5%	82,9%	72,5%	80,0%	87,5%	70,0%
Italy	52,5%	57,1%	30,0%	57,5%	73,9%	42,5%
Germany	33,3%	90,0%	30,0%	40,0%	100,0%	40,0%

for testing and assuming materiality over the years. In some other cases (*Financial services, Heavy Industry, Manufacture and Media & Telecom*), an overall increase can be noted whether by higher percentage of testing or by higher percentage on materiality. However, in the case of *Pharmaceutical* and *Transport and Logistics* sectors, 2021 reports show a

**Table 10**  
Materiality of biodiversity per sectors.

Materiality/ Country	2018			2021		
	Tested	Material	Over all	Tested	Material	Over all
Energy (21)	95,3%	95,0%	90,5%	90,5%	100,0%	90,5%
Financial S. (35)	45,7%	31,3%	14,3%	45,7%	81,3%	37,1%
Heavy Industry (7)	57,1%	25,0%	14,3%	28,6%	100,0%	28,6%
Infrastructures (8)	75,0%	100,0%	75,0%	75,0%	100,0%	75,0%
Manufacture (29)	62,1%	88,9%	55,2%	82,8%	79,2%	65,5%
Media & Telecom (10)	70,0%	42,9%	30,0%	50,0%	100,0%	50,0%
Pharmaceutical (17)	52,9%	100,0%	52,9%	47,1%	75,0%	35,3%
Services (20)	50,0%	90,0%	45,0%	55,0%	72,7%	40,0%
Technology (15)	53,3%	50,0%	26,7%	53,3%	50,0%	26,7%
Transport & Logistics (8)	87,5%	71,4%	62,5%	75,0%	33,3%	25,0%
Low (80)	51,25%	51,22%	26,25%	50,00%	75,00%	37,50%
Medium (75)	72,00%	90,74%	65,33%	76,00%	80,70%	61,33%
High (15)	66,67%	70,00%	46,67%	53,33%	100,00%	53,33%

remarkable downfall in companies testing and assuming materiality, compared to 2018 reports. As for impact, the number of companies testing materiality decreases among low and high impact groups, although with higher percentages of materiality assumption. For medium impact companies, the trend is just the opposite.

The overall results for materiality are heterogeneous and apparently not connected to the increasing trend observed in engagement. Indeed, materiality testing has increased slightly over the period, but with significant differences among countries and sectors.

When addressing performance indicators, even though the GRI standard is the most extended and used standard for reporting, there are significant differences among countries in regards to its adoption. Therefore, to analyse the disclosure of biodiversity indicators by companies, we look at the existence of quantitative indicators of any sort, as well as the existence of GRI indicators for biodiversity. The results are shown in Table 11, illustrating a very low level of quantitative data reporting, together with a negative trend from 2018 to 2021. At a country level, the trend is rather homogeneous, showing a similar percentage from 2018 to 2021 in what refers to the reporting of quantitative data, and a significant decrease in the use of GRI indicators (except for Spain).

The sectoral analysis is consistent with the country perspective (Table 12), with a few differences such as the positive increase in quantitative indicators from the *Media & Telecom* and the *Transport and Logistic* sectors, or the diverse trends observed in the use of GRI biodiversity indicators. As for impact, the companies with high impact are the ones with higher percentage of quantitative and GRI indicators, while the relatively high percentages shown by medium impact companies in 2018 tend to decrease over the period.

There is a wide range of topics in regards to the quantitative indicators reported, mostly linked to specific actions or projects developed by the companies. However, some trends were observed, as described next:

- The top companies in using biodiversity indicators (top 10%) report on the impact (over) and use of natural resources and water,

**Table 11**  
Biodiversity indicators reported by companies.

Use of indicators/ Country	Quantitative Indicators		GRI Indicators	
	2018	2021	2018	2021
Total	22,3%	21,8%	36,5%	30,0%
Spain	25,7%	25,7%	68,6%	71,4%
Netherlands	12,0%	12,0%	20,0%	8,0%
France	35,0%	37,5%	27,5%	17,5%
Italy	20,0%	17,5%	32,5%	27,5%
Germany	13,3%	10,0%	30,0%	20,0%

**Table 12**  
Biodiversity indicators reported by companies per sector.

Use of indicators/ Country	Quantitative Indicators		GRI Indicators	
	2018	2021	2018	2021
Energy (21)	61,9%	61,9%	80,9%	61,9%
Financial S. (35)	5,7%	2,9%	17,1%	14,3%
Heavy Industry (7)	14,3%	14,3%	14,3%	28,6%
Infrastructures (8)	62,5%	62,5%	62,5%	75,0%
Manufacture (29)	31,0%	27,6%	48,3%	27,6%
Media & Telecom (10)	0,0%	20,0%	30,0%	40,0%
Pharmaceutical (17)	23,5%	11,8%	35,3%	23,5%
Services (20)	20,0%	20,0%	20,0%	15,0%
Technology (15)	0,0%	0,0%	26,7%	26,7%
Transport & Logistics (8)	0,0%	12,5%	25,0%	25,0%
Low (80)	7,50%	8,75%	21,25%	20,00%
Medium (75)	34,67%	32,00%	43,24%	36,00%
High (15)	40,00%	40,00%	40,00%	53,33%

especially when linked to vulnerable areas, about protection and restoration of ecosystems, as well as on evaluation systems.

- Around half of companies using biodiversity indicators focus on risk assessment and compliance with institutional plans and projects, especially those which activity is associated to biodiversity impacts.
- A large number of companies do only refer to biodiversity in relation to the commitment with Sustainable Development Goals (SDG) or similar institutional targets.
- In 2021, around 75% of companies referred to biodiversity within the Circular Economy chapter, reporting about them as a whole, while in 2018, just a third of companies did so.
- A significant number of companies reporting about biodiversity in 2021 and not in 2018, did only refer to biodiversity in relation to the EU taxonomy for sustainable activities, with no specific or internal information about it.
- Regarding GRI indicators:
  - o A large number of companies listing all sort of GRI indicators do not include the 304 series, referred to biodiversity.
  - o Among the most important GRI environmental indicators (301 to 308), the 304 for biodiversity is the one less frequently reported in the companies' sample.
  - o In most cases, the companies reporting about GRI 304 indicators, do not necessarily include quantitative or specific data, but rather general statements.

In general, the amount and level of detail of information disclosed is rather low and comparatively below the information provided for other topics within the environmental realm such as climate change, circular economy, waste and effluents or use of resources.

#### 4. Discussion

The previous analyses performed in this research bring in interesting aggregated results linked to the current situation of biodiversity reporting in EU listed companies. The analyses results can be grouped after the two research questions, jointly presenting both, the situation in 2018, and its evolution until 2021 (Table 13):

Addressing the first research question, linked to the evolution of companies' engagement with biodiversity in reporting, the aggregated view of the results describes a situation where biodiversity reporting has been gaining weight among EU listed companies in all studied countries during the past few years. Even though it is still not a key topic for most sectors (*energy and infrastructures aside*), it is now considered more relevant and important for companies. In this respect, our findings show an interesting difference with those of Skouloudis et al. (2019), as proved by the increased presence in reporting of the *Pharmaceutical* sector and the *Technology* sector.

The relevance of biodiversity reporting, however, is mostly restrained to minor activities, although a positive trend to gain relevance can be observable, especially in Spain, France and Italy. From the sectoral perspective, again, the gain in presence of the topic is mostly associated to minor activities and projects. The trend observed in reporting suggests biodiversity is perhaps becoming more interesting for companies, as stated by Tregidga, 2013, but still as a minor topic within the sustainability realm, in line with Adler et al. (2018) results for US companies.

On the subject of reporting quality, the literature about social and environmental information distinguishes between hard information and soft information. In the study we observe how high quality information, typically associated to quantitative indicators, is rarely reported for biodiversity. Furthermore, our results show that this incidence has actually decreased over the period of study, with barely 22% of companies including quantitative indicators in 2021. Looking to the sectorial approach, the *Energy* sector stands out, possibly responding to its impact on biodiversity in the 80's, which eroded its public image and legitimacy. However, the fact that companies of medium impact intensity in biodiversity are the only ones showing an increasing commitment to disclosure on biodiversity, suggests that other factors such as public exposure or stakeholders' pressure could be having a stronger influence in disclosure than legitimacy.

Indeed, despite the statement of Hassan et al. (2020), arguing the need for indicators to report useful information, and the risk faced by corporations associated to loss of biodiversity (WBCSD World Business Council for Sustainable Development, 2011a), our results show that no significant changes can be observed in the way most companies reports on the materiality of biodiversity, although the trends across the different countries slightly differ. Neither the relevance given nor the positive materiality reported by companies are reflected in the use of indicators. Indeed, quantitative indicators and standardized GRI indicators are very seldom used in reports, and the trend over the years is slightly negative, especially in Germany and the Netherlands, and most notably for all countries except Spain, in the use of GRI indicators.

Furthermore, in most cases, the information reported lacks of detail, specificity and applicability, being frequently associated to other topics (circular economy) or to institutional targets (EU taxonomy, SDG). From the sectoral point of view, the stagnation of materiality testing is also visible, although interesting differences can be observed in regards to the use of indicators, being rather low except for the *energy and infrastructures* sectors. However, the *Heavy Industry* and *Infrastructures* sectors reflect a tiny increase in the use of indicators, possible linked to the significant impact their activity has on biodiversity, while the *Media & Telecom*, *Technology* and *Transport & Logistics* sectors show a relevant increase, possibly to catch up with the other sectors, since in 2018 those sectors were far below the average.

Although we also find some degree of improvement in companies' reporting on biodiversity, our results cannot support Usher and Maroun (2018) conclusions on 'higher levels of reporting quality' and on 'companies are beginning to appreciate the importance of preserving biodiversity for ensuring long-term sustainability'. On the contrary, our findings for EU listed companies confirm those of Addison et al. (2018) for the 100 top companies in 2016 Fortune Global, and those of Anthony and Morrison-Saunders (2023), linking disclosure to protecting company reputation and, thereby legitimizing operations.

#### 5. Conclusions

The current work aims at studying the relationship between EU listed companies and their biodiversity commitment through the disclosure of data and indicators. From an exploratory approach based on the analysis of a large number of EU listed companies reporting, our goal has the double objective of assessing the companies' engagement with biodiversity as well as determining the quality and usefulness of the indicators disclosed.

Despite the launching of the EU, 2010 Strategy for Biodiversity, our study shows that, even though more interest in the topic can be noted, EU listed companies' engagement is still rather low, suggesting the EU strategy has not reached the companies' policies and commitment towards biodiversity. This first outcome is already a significant conclusion for policy makers willing to adjust institutional strategies promoting biodiversity protection. The low level of reporting on biodiversity before the strategy launching (Liempd and Busch, 2013), has slightly changed, but in a rather limited way, especially concerning meaningful and useful information.

Nevertheless, the research has produced interesting results concerning the different behaviour of companies after their country, sector and activity impact. A number of reasons could explain why Spanish, French, and to a lower extent, Italian listed-companies present significantly higher levels of reporting in biodiversity than German or Dutch ones. Our results point at differences in local biodiversity conservation plans in every country having more influence than the EU Strategy, and different social perceptions about the biodiversity stress in every country, in line with Skouloudis et al. (2019) arguments for mega-diverse countries.

The inconsistency between the relevance given by the EU listed

**Table 13**  
Evolution in biodiversity reporting per country.

	Engagement		Specific and quantitative information			
	Relevance/ importance		Materiality		Indicators	
	In 2018	In 2021	In 2018	In 2021	In 2018	In 2021
<b>Total</b>	<b>Medium/Low</b>	<b>Increases</b>	<b>50% of comp.</b>	<b>Remains</b>	<b>Low</b>	<b>Decreases</b>
<i>Spain</i>	<i>Medium</i>	<i>Increases</i>	<i>More than half</i>	<i>Remains</i>	<i>Low</i>	<i>Decreases</i>
<i>Netherlands</i>	<i>Low</i>	<i>Increases</i>	<i>Less than half</i>	<i>Increases</i>	<i>Low</i>	<i>Decreases</i>
<i>France</i>	<i>Medium</i>	<i>Increases</i>	<i>More than half</i>	<i>Remains</i>	<i>Low</i>	<i>Decreases</i>
<i>Italy</i>	<i>Medium/Low</i>	<i>Increases</i>	<i>Less than half</i>	<i>Increases</i>	<i>Low</i>	<i>Decreases</i>
<i>Germany</i>	<i>Low</i>	<i>Increases</i>	<i>Less than half</i>	<i>Increases</i>	<i>Low</i>	<i>Decreases</i>

companies in terms of materiality, and the little information disclosed by specific indicators, suggest a limited interest, know-how or need to provide information about biodiversity, rather than lack of awareness about its importance. Our findings for EU listed companies are partly in line with Addison et al. (2018) results for Fortune Global companies, on the idea that big businesses are giving biodiversity limited treatment in sustainability reports. However, while Addison et al. (2018) found that lack of clarity on the matter and insufficient transparent and comparable biodiversity indicators could be in the root of the problem in 2016, our findings for 2021 suggest that companies are well aware of the matter relevance and count with a developed body of standardized biodiversity indicators to use. In line with Anthony and Morrison-Saunders (2023), we find that biodiversity disclosure is mostly seen as a corporate reputation matter, thus constrained to direct activities requiring legitimacy. Indeed, companies' assumption of the topic materiality has increased over the years, pointing out to the third cause stated by Addison et al. (2018), linked to insufficient corporate action on biodiversity, which is basically absent from management strategy.

From the sectoral perspective, our research confirms Adler et al. (2018) findings in terms of heterogeneity, suggesting a similar worldwide behaviour for large or listed companies regarding biodiversity reporting. However, our findings point out at interesting changes over the last few years, with typically low reporting sectors such as Pharmaceutical, Technology or Services (Skouloudis et al., 2019), notably increasing its public interest in the topic. The recent increase in prominence and scrutiny experienced by these sectors during the COVID-19 pandemics may explain their step forward, but an in-depth study would be needed to confirm it.

Nevertheless, further research is desirable and necessary in this field to help both, practitioners and scholars, to understand what is needed to engage companies in biodiversity protection, and what theories could explain the companies' behaviour. The paper limitations linked to the limited volume of information on biodiversity indicators disclosure, and the scarcity of previous works relating business and biodiversity from a holistic and general approach, have been offset by studying a large number of companies from different countries, as well as by keeping an open mind approach to study the matter. However, the different lines of research opened in this paper are worthwhile in-depth studies looking to advance in defining the companies' role and levers to protect biodiversity.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

No data was used for the research described in the article.

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