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The Quality of Environmental Data Disclosure. The case of Public Companies from the European Union Countries

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Abstract
In the 21st century business entities are required to change priorities and move to a sustainable relationship between environmental, social, and economic well-being. Climate and environment are phenomena of transnational and global nature, and for this reason, actions in this area should be taken at a supranational level. Nowadays, the European Union (EU) countries have been implementing directives concerning environmental changes and taxonomy for non-financial reporting. According to their requirements, public companies must disclose high-quality data in the ESG area, including the environmental indicator (E) and its components. The purpose of the study is to discuss the current state of disclosure of environmental data by public companies listed on the regulated markets of the European Union. Special emphasis is devoted to energy consumption, water, waste production, and CO2 emissions. To test the quality of environmental indicators, we used the Refinitiv database. The research period covers 2012–2021. The research sample consists of public companies listed on the leading stock markets in 27 EU member states. The findings support the clear advantage of the quality of environmental data disclosure in the 'old' EU member states (which joined before 2004) as to compared to the 'new' EU member states.

Keywords: environmental disclosure, environmental reporting, ESG, European Union, public companies.

1. Introduction

In recent years, the awareness of the importance of environmental protection in the processes of socio-economic development has increased significantly in the countries of the global economy. This means a gradual departure from the paradigm of economic development perceived through the prism of maximising the dynamics of economic growth and two key indicators: changes in GDP y/y and GDP per capita. Economic development 'at all costs' may lead not only to excessive use of natural resources but also to irreversible changes in the environment, including its degradation. This threat is generated mainly by the manufacturing and service sector, which not only uses natural resources (including water and energy) but also produces pollution (especially waste and carbon dioxide). Therefore, it is primarily the business sector that should change its functioning and limit the negative impact on the natural environment. In view of the growing social awareness of this fact, enterprises are under pressure to introduce changes that will limit this impact. Society also expects the information on the real impact of enterprises on the environment that would be transparent and publicly available.

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The purpose of the article is to discuss the current state of disclosure of environmental data by public companies listed on the regulated markets of the European Union. Special emphasis is put on energy consumption, water, waste production, and CO2 emissions. We focus on checking how many companies report this data in any given year, and those that present them in at least one, three, five years, or ten years. Our empirical research includes public companies listed on markets in 27 EU member states, which were divided into two groups:

- the 'old' EU member states (EU-14), which joined before 2004,
- the 'new' EU member states (EU-13), which joined in 2004 and later.

This approach allows us to maintain relative comparability between companies listed on these exchanges.

The research period covers 2012–2021. We initially established a 20-year research period (2002–2021), but between 2002 and 2011 only 1,322 of the 21,440 companies reported E measures (6%).

Our article is structured as follows. In the first section, we present a brief review of existing regulations of environmental disclosure in the European Union and their implementation. The second part outlines the methodology deployed, which especially includes the standards of reporting enterprises' impact on environment. The empirical results are analysed in the third part. The last part contains conclusions and recommendations.

2. Environmental disclosure in the European Union – regulations and their implementation

In September 2015, United Nations member states adopted the 2030 Agenda for Sustainable Development (Agenda 2030) (Transforming Our World, 2015), which was intended to transform economies and societies in accordance with the requirements of sustainable development. Numerous environmental aspects were among them, e.g. access to clean electricity, responsible production and consumption, preventing climate change, protecting seas and oceans, the sustainable use of their resources, sustainable land resource management, and protecting biodiversity.

In December 2019 the European Union (EU) prepared a programme to make Europe the first climate-neutral continent by 2050 – the European Green Deal (2019) was prepared in accordance with Agenda 2030 guidelines. In 'Fit for 55' document the EU indicated that energy consumption is responsible for 75% of greenhouse gas emissions in the EU. Moreover 50% of total greenhouse gas emissions and more than 90% of biodiversity loss can be attributed to resource extraction and the processing of materials, fuels, and food (Fit for 55, 2021: 11). Because the reduction of greenhouse gas emissions seems to be crucial to counteract climate change, the EU member countries were obliged to limit their greenhouse gas emissions by at least 55 per cent by 2030 compared to the 1990 levels. In consequence companies have to change how they operate and to consider environmental issues in their operations. In order to mobilise enterprises to introduce the expected changes, the EU countries begin to demand companies to publish information about their impact on the environment.

The EU wants to take the position of world leader when it comes to getting information of the actual impact of businesses on the environment and assessing whether the changes

are in the right direction. The requirement of enterprises to publish non-financial reports and information on their environmental impact, among others, was included in Directive 2014/95/EU on non-financial reporting (NFRD – Directive UE 2014). This directive defined the principles of disclosing non-financial information by selected companies. It should be noted that the provisions of the NFRD are still in force, although another directive has already been adopted. The current non-financial reporting requirements apply to large public interest companies that employ over 500 employees, among them public companies, banks, insurance companies, and other companies appointed by domestic authorities as public interest units. According to the NFRD, since 2018, large companies must report information on environmental questions, social affairs, employment relations, respecting human rights, diversity in companies' management, and counteracting corruption.

In 2017, the European Commission published a communication that contained non-binding guidelines for reporting non-financial information (Communication from the Commission, 2017). In June 2019 it was supplemented by the reporting of information related to the climate itself (Communication from the Commission 2019) and contained detailed guidelines for publishing information about energy consumption and greenhouse gas emissions.

Since the applicable regulations did not introduce standards in non-financial reporting, the EU started to work on the next directive. In December 2022 the Directive 2022/2464/EU on reporting of sustainable development of enterprises (Corporate Sustainability Reporting Directive – CSRD) was adopted, which entered into force in January 2023. The directive covers companies listed on regulated markets (approx. 49,000 companies), except for micro enterprises. Enterprises that are currently obliged to prepare non-financial reports under the NFRD, will have to apply its provisions from January 2024 (and publish reports from 2025), enterprises (listed and unlisted on stock market markets) employing over 250 people or/or have 40 million EUR net revenues and/or assets worth 20 million EUR – from January 2025 (reports from 2026), other enterprises listed on stock markets – from January 2026 (reports from 2027). Pursuant to the provisions of the new directive, all entities will be required to apply the EU reporting standards of sustainable development (European Sustainability Reporting Standards – ESRS), so the current freedom in the application of reporting standards will disappear. Despite the fact that there is already a new directive, non-financial reporting in the European Union is not standardized nowadays, and enterprises are still preparing various reports. The first reports in accordance with the requirements of the new directive will not appear until 2025. The directive indicates environmental areas, in relation to which companies should provide information, including, among others: water and sea resources, use of resources and a closed circulation economy, pollution, biological diversity and ecosystems. The environmental disclosure is especially important from the point of view of corporate responsibility towards stakeholders, as it can also help investors and other stakeholders better assess future financial performance and long-term environmental effects (Chung and Cho, 2018).

3. Standards of reporting enterprises' impact on the environment

Over the years, accounting has been recognised not only from the financial perspective, but more frequently, it has focused heavily on social reporting, sustainable reporting, or environmental reporting[1] (Marrone et al., 2020). Currently, there are many institutions that create standards, rules and guidelines for reporting enterprises' impact on the environment. N. Vukić et al. (2017) point to some of the most important initiatives and institutions creating standards used in the process of presenting non-financial information in relation to sustainable development: United Nations Global Compact (UNGC), The Organisation for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, ISO 26000, Global Reporting Initiative (GRI), International Integrated Reporting Council (IIRC), Sustainability Accounting Standards Board (SASB). One can also point to International Federation of Accountants (IFAC), European Federation of Financial Analysts Societies (EFFAS), etc. However, the GRI guidelines turned out to be a significant support for environmental reporting. The first version of the guidelines was defined as G1, and over the years it was replaced by their fourth generation (G4). From July 1, 2018, the previously used G4 guidelines were saved as a set of GRI Standards. The topic-specific GRI Standards are organized into three series: 200 (economic topics), 300 (environmental topics), and 400 (social topics). GRI 300 concerns information related to companies' impact on the environment, i.e. raw materials exploitation, use of energy and environmental resources, respect for biodiversity, assessment of pollutant discharges and emissions, environmental compliance, and supplier assessment (see Table 1).

Table 1. GRI standards to report the impact of enterprises on the environment (June 30, 2022)

GRI standards	Disclosures
301 – Materials (2016)	• Materials used by weight or volume • Recycled input materials used • Reclaimed products and their packaging materials
302 – Energy (2016)	• Energy consumption within the organization • Energy consumption outside of the organization • Energy intensity • Reduction of energy consumption • Reductions in energy requirements of products and services
303 – Water and Effluents (2018)	• Interactions with water as a shared resource • Management of water discharge-related impacts • Water withdrawal • Water discharge • Water consumption

[1] It should be noted that today companies use the term 'sustainable reporting' more often than 'environmental reporting'. See: Adams, Larrinaga-González (2007): 333–355.

304 – Biodiversity (2016)	• Operational sites owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas • Significant impacts of activities, products and services on biodiversity • Habitats protected or restored • IUCN Red List species and national conservation list species with habitats in areas affected by operations
305 – Emissions (2016)	• Direct GHG emissions • Energy indirect GHG emissions • Other indirect GHG emissions • GHG emissions intensity • Reduction of GHG emissions • Emissions of ozone-depleting substances • Nitrogen oxides, sulfur oxides, and other significant air emissions
306 – Waste (2020)	• Waste generation and significant waste-related impacts • Management of significant waste-related impacts • Waste generated • Waste diverted from disposal • Waste directed to disposal
307 – Environmental Compliance (2016)	• Non-compliance with environmental laws and regulations
308 – Supplier Environmental Assessment (2016)	• New suppliers that were screened using environmental criteria • Negative environmental impacts in the supply chain and actions taken

Source: Consolidated Set of the GRI Standards (2023). Global Sustainability Standards Board (GSSB). https://www.globalreporting.org/how-to-use-the-gri-standards/gri-standards-english-language/ (accessed on 2 June 2023).

It is worth adding that the evaluation of enterprises in terms of their incorporation of environmental data in their activities is presented by major data providers (e.g. Refinitiv, Bloomberg, MSCI) and ESG rating agencies. Currently, this information provider market is under construction (Avetisyan and Hockerts, 2017) and there is no consistent global taxonomy for the compilation of the methodology. As a result, data providers and credit rating agencies prepare their own rankings based on their own criteria. This raises a significant problem related to the comparability of the obtained data and the credibility of ratings. This is pointed out by, among others, Escrig-Olmedo et al. (2010), Amariei (2019), Amel-Zadeh and Serafeim (2018), Eccles and Stroehle (2018), and Boffo et al. (2020). As a consequence, environmental ratings may relate to different frameworks, measures, key indicators and metrics, data use, qualitative judgement, and weighting of subcategories, reweighting of scores to ensure 'best in class' in industry (Boffo et al., 2020).
When comparing the three main environmental data (Refinitiv, MSCI, and Bloomberg), it can be noted that they use different environmental pillar approaches (see Table 2).

Table 2. Environmental reporting by Refinitiv, MSCI, and Bloomberg

Data providers	Metrics	Key issue scores	Additional information
Refinitiv	• Emissions and carbon footprint • Energy, water and resource use/ intensity • Waste and outputs • Products and supply chains • Ecology and biodiversity	• Emissions • Resource use • Innovation	• Environment scandals • Environment lawsuits • Legislation disputes or fines related to environment
MSCI	• Emissions and carbon footprint • Energy, water and resource intensity • Waste and outputs • Products and supply chains • Renewable energy • Green operations	• Climate change • Natural resources • Pollution and waste • Environment opportunities	• Systemic risk management • Environmental vulnerabilities and opportunities
Bloomberg	• Emissions and carbon footprint • Energy, water and resource intensity • Waste and outputs • Renewable energy	• Emissions • Pollution and waste • Renewable investment	• Pollution and spills • Renewables and green innovation

Source: Boffo et al. (2020).

Some data providers focus on emissions and environmental performance, while others focus on systemic risk, energy management, climate adaptation, and transition opportunities. However, the three providers assessed the environmental metrics in the following broad categories: (1) emissions and carbon footprint, (2) energy, water, and resource use, (3) waste and output. On their basis, the significant metrics that have a negative impact on the environment can be distinguished from those that relate to the acquisition of energy and water and the production of carbon dioxide and waste. These four metrics are therefore our subject of research on the quality of environmental data disclosure.

We use Refinitiv because it is one of the industry's most comprehensive environmental databases, covering more than 80% of global market capitalisation over various environmental security indicators, with a history that dates to 2002. Refinitiv calculates the E scores of more than 9,000 companies worldwide, including more than 500 measures at a given company level, 186 of which are more comparable from an industrial point of view, and affects the overall assessment and rating of the company (Refinitiv, 2022). What is important, if we take into account the total amount of environmental information contained in the detailed analysed metrics (sub-metrics), it is clear that the largest number

is analysed by Refinitiv (115), and the smallest – by MSCI (26), Bloomberg is in between with a value above 27 (Boffo et al., 2020): 29. Furthermore, Refinitiv does not presume to define what 'good' looks like; it lets the data determine industry-based relative performance within the construct of its criteria and data model (Refinitiv, 2022). In addition to the percentage E scores, Refinitiv also assigns specific ratings to entities based on the commonly used letter code from D- to A+ (see Table 3).

Table 3. Environmental ratings by Refinitiv

Score range	Grade	Description
<0.000000;0.083333>	D-	The 'D' score indicates poor relative E performance and insufficient degree of transparency in reporting material E data publicly.
(0.083333;0.166666>	D	
(0.166666;0.250000>	D+	
(0.250000;0.333333>	C-	The 'C' score indicates satisfactory relative E performance and moderate degree of transparency in reporting material E data publicly.
(0.333333;0.416666>	C	
(0.416666;0.500000>	C+	
(0.500000;0.583333>	B-	The 'B' score indicates good relative E performance and an above-average degree of transparency in publicly reporting E data publicly.
(0.583333;0.666666>	B	
(0.666666;0.750000>	B+	
(0.750000;0.833333>	A-	The 'A' score indicates excellent relative E performance and high degree of transparency in reporting material E data publicly.
(0.833333;0.916666>	A	
(0.916666;1.000000>	A+	

Source: Refinitiv (2022).

Enterprises with D-level ratings are characterized by a poor relative E rating and an insufficient degree of transparency in environmental data. They are treated as so-called E-laggards, or "behindhand" in environmental reporting. On the other hand, 'leaders' E are enterprises that have been assigned ratings from group A. They are characterized not only by high E ratings, but also by above-average transparency in environmental reporting data. Nevertheless, it should be remembered that Refinitiv publishes scores based on reports and information provided by companies. If they provide incomplete or untrue information (so-called greenwashing), this is not reflected in the scoring of information providers in the ESG area, including Refinitiv. Among others for this reason, the European Union has enacted two directives to counteract both the incompleteness of submitted information (CSRD) and greenwashing (Taxonomy Directive).

4. Quality of environmental data disclosure by public companies in EU member states

In general, the analysis of environmental data indicates that adequate practises in this area have not yet been observed in European markets. Among the more than 21,000 public companies between 2012 and 2021, a number of financial reports are not associated with environmental reports. An in-depth analysis of the disclosure of environmental data

indicates two essential observations. Firstly, there are a variety of approaches to the disclosure of energy consumption, water use, waste production, and CO2 emissions. Secondly, there is a clear advantage of the quality of environmental data disclosure in the EU-14 ('old' EU member states) over the EU-13 ('new').

Table 4. Reporting of energy use by companies in EU-14 and EU-13 member states, 2012–2021

EU Countries	Financial reports	Energy use in any year		Energy use for 3 years and more		Energy use for 5 years and more		Energy use for 10 years	
	No. of companies		Share (%)	No. of companies	Share (%)	No. of companies	Share (%)	No. of companies	Share (%)
"Old" EU member states									
Austria	1,641	1,337	81.5	1,205	73.4	696	42.4	544	33.2
Belgium	344	126	36.6	108	31.4	78	22.7	58	16.9
Denmark	354	120	33.9	88	24.9	54	15.3	38	10.7
Finland	390	132	33.8	92	23.6	62	15.9	50	12.8
France	1,320	350	26.5	276	20.9	214	16.2	152	11.5
Germany	11,724	3,654	31.2	2,858	24.4	1,922	16.4	922	7.9
Greece	158	24	15.2	21	13.3	12	7.6	8	5.1
Ireland	76	34	44.7	22	28.9	14	18.4	8	10.5
Italy	609	291	47.8	256	42.0	204	33.5	138	22.7
Luxembourg	26	7	26.9	6	23.1	5	19.2	2	7.7
Netherlands	282	100	35.5	90	31.9	74	26.2	44	15.6
Portugal	83	34	41.0	28	33.7	18	21.7	10	12.0
Spain	589	206	35.0	195	33.1	141	23.9	102	17.3
Sweden	1,986	510	25.7	304	15.3	186	9.4	138	6.9
EU-14	**19,582**	**6,925**	**35.4**	**5,549**	**28.3**	**3,680**	**18.8**	**2,214**	**11.3**
"New" EU member states									
Bulgaria	212	0	0.0	0	0.0	0	0.0	0	0.0
Croatia	74	0	0.0	0	0.0	0	0.0	0	0.0
Cyprus	96	1	1.0	1	1.0	1	1.0	1	1.0
Czech Republic	56	33	58.9	31	55.4	26	46.4	18	32.1
Estonia	50	0	0.0	0	0.0	0	0.0	0	0.0
Hungary	123	54	43.9	52	42.3	50	40.7	46	37.4
Latvia	23	0	0.0	0	0.0	0	0.0	0	0.0
Lithuania	56	0	0.0	0	0.0	0	0.0	0	0.0
Malta	33	0	0.0	0	0.0	0	0.0	0	0.0
Poland	606	47	7.8	42	6.9	30	5.0	12	2.0
Romania	411	44	10.7	34	8.3	32	7.8	28	6.8
Slovakia	14	0	0.0	0	0.0	0	0.0	0	0.0
Slovenia	104	3	2.9	2	1.9	1	1.0	0	0.0
EU-13	**1,858**	**182**	**9.8**	**162**	**8.7**	**140**	**7.5**	**105**	**5.7**

Source: own study based on Refinitiv data.

Table 4 shows that ca. 35%, 28%, 19%, and 11% of companies in the EU-14 member states reported data on energy use for at least one, three, five years, and for all ten years, respectively. Countries where relatively the largest number of companies provided

information on energy use were Austria (the leader), Italy, Portugal, Belgium, and the Netherlands. It is interesting to note that companies belonging to OMX (Denmark, Finland, and Sweden) reported much worse. In the case of the "new" member states (EU-13), good quality environmental reports cannot be concluded. It is worth mentioning that only ca. 10%, 9%, 8%, and 6% of companies published information on energy consumption for at least one, three, five years, and for all ten years, respectively. The group's reporting leaders are the Czech Republic and Hungary. In five countries, that is, Bulgaria, Croatia, Estonia, Latvia, Lithuania, Malta and Slovakia, energy use has not been provided in any year examined.

Table 5. Reporting of water use by companies in EU-14 and EU-13 member states, 2012–2021

EU Countries	Financial reports	Water use in any year		Water use for 3 years and more		Water use for 5 years and more		Water use for 10 years	
	No. of companies		Share (%)	No. of companies	Share (%)	No. of companies	Share (%)	No. of companies	Share (%)
"Old" EU member states									
Austria	1,641	1,161	70.7	1,051	64.0	861	52.5	530	32.3
Belgium	344	108	31.4	94	27.3	68	19.8	56	16.3
Denmark	354	96	27.1	70	19.8	56	15.8	32	9.0
Finland	390	94	24.1	68	17.4	56	14.4	36	9.2
France	1,320	316	23.9	264	20.0	196	14.8	152	11.5
Germany	11,724	3,018	25.7	2,427	20.7	1,737	14.8	833	7.1
Greece	158	24	15.2	20	12.7	12	7.6	7	4.4
Ireland	76	16	21.1	14	18.4	12	15.8	10	13.2
Italy	609	259	42.5	228	37.4	182	29.9	124	20.4
Luxembourg	26	5	19.2	5	19.2	5	19.2	4	15.4
Netherlands	282	78	27.7	72	25.5	54	19.1	38	13.5
Portugal	83	34	41.0	28	33.7	18	21.7	10	12.0
Spain	589	205	34.8	186	31.6	129	21.9	96	16.3
Sweden	1,986	294	14.8	186	9.4	132	6.6	78	3.9
EU-14	**19,582**	**5,708**	**29.1**	**4,713**	**24.1**	**3,518**	**18.0**	**2,006**	**10.2**
"New" EU member states									
Bulgaria	212	0	0.0	0	0.0	0	0.0	0	0.0
Croatia	74	0	0.0	0	0.0	0	0.0	0	0.0
Cyprus	96	0	0.0	0	0.0	0	0.0	0	0.0
Czech Republic	56	27	48.2	23	41.1	20	35.7	15	26.8
Estonia	50	0	0.0	0	0.0	0	0.0	0	0.0
Hungary	123	52	42.3	46	37.4	42	34.1	37	30.1
Latvia	23	0	0.0	0	0.0	0	0.0	0	0.0
Lithuania	56	0	0.0	0	0.0	0	0.0	0	0.0
Malta	33	0	0.0	0	0.0	0	0.0	0	0.0
Poland	606	43	7.1	35	5.8	21	3.5	11	1.8
Romania	411	36	8.8	28	6.8	26	6.3	18	4.4
Slovakia	14	0	0.0	0	0.0	0	0.0	0	0.0
Slovenia	104	2	1.9	2	1.9	1	1.0	0	0.0
EU-13	**1,858**	**160**	**8.6**	**134**	**7.2**	**110**	**5.9**	**81**	**4.4**

Source: own study based on Refinitiv data.

The quality of water consumption is worse than that of energy use. Table 5 shows that ca. 29%, 24%, 18%, and 10% of companies in EU-14 and ca. 9%, 7%, 6%, and 4% of EU-13 companies reported data on water consumption in at least one, three, five years, and for all ten years, respectively. However, the highest share of energy use reports compared to financial statements was observed in Austria, Italy, Portugal, and Belgium (in EU-14), and in the Czech Republic, Hungary, and Romania (in EU-13).

Table 6. Reporting of CO2 emissions by companies in EU-14 and EU-13 member states, 2012–2021

EU Countries	Financial reports	CO2 emissions in any year		CO2 emissions for 3 years and more		CO2 emissions for 5 years and more		CO2 emissions for 10 years	
	No. of companies		Share (%)	No. of companies	Share (%)	No. of companies	Share (%)	No. of companies	Share (%)
"Old" EU member states									
Austria	1,641	1,433	87.3	1,299	79.2	1,041	63.4	665	40.5
Belgium	344	140	40.7	124	36.0	84	24.4	66	19.2
Denmark	354	128	36.2	94	26.6	64	18.1	44	12.4
Finland	390	134	34.4	88	22.6	68	17.4	52	13.3
France	1,320	358	27.1	284	21.5	224	17.0	154	11.7
Germany	11,724	4,056	34.6	3,179	27.1	2,221	18.9	1,174	10.0
Greece	158	24	15.2	19	12.0	13	8.2	6	3.8
Ireland	76	42	55.3	36	47.4	20	26.3	10	13.2
Italy	609	298	48.9	260	42.7	205	33.7	146	24.0
Luxembourg	26	8	30.8	7	26.9	6	23.1	1	3.8
Netherlands	282	118	41.8	98	34.8	70	24.8	42	14.9
Portugal	83	36	43.4	32	38.6	18	21.7	12	14.5
Spain	589	211	35.8	195	33.1	135	22.9	90	15.3
Sweden	1,986	612	30.8	380	19.1	214	10.8	148	7.5
EU-14	**19,582**	**7,598**	**38.8**	**6,095**	**31.1**	**4,383**	**22.4**	**2,610**	**13.3**
"New" EU member states									
Bulgaria	212	0	0.0	0	0.0	0	0.0	0	0.0
Croatia	74	0	0.0	0	0.0	0	0.0	0	0.0
Cyprus	96	1	1.0	0	0.0	0	0.0	0	0.0
Czech Republic	56	33	58.9	29	51.8	23	41.1	21	37.5
Estonia	50	0	0.0	0	0.0	0	0.0	0	0.0
Hungary	123	56	45.5	54	43.9	52	42.3	46	37.4
Latvia	23	0	0.0	0	0.0	0	0.0	0	0.0
Lithuania	56	0	0.0	0	0.0	0	0.0	0	0.0
Malta	33	0	0.0	0	0.0	0	0.0	0	0.0
Poland	606	50	8.3	36	5.9	23	3.8	12	2.0
Romania	411	40	9.7	34	8.3	32	7.8	18	4.4
Slovakia	14	0	0.0	0	0.0	0	0.0	0	0.0
Slovenia	104	4	3.8	2	1.9	1	1.0	0	0.0
EU-13	**1,858**	**184**	**9.9**	**155**	**8.3**	**131**	**7.1**	**97**	**5.2**

Source: own study based on Refinitiv data.

The analysis of CO2 emissions reported by companies in the EU-14 member states indicates that the quality is the highest among all resource consumption and pollutant emissions. For example, the total number of companies reporting CO2 emissions data for 10 years or more was only 2,610, representing approximately 13.3% of the published financial data (see Table 6).

On the contrary, the reporting quality of waste production data is the lowest, e.g., the share of waste reports compared to financial statements was only 8.9% (see Table 7). In general, the largest number of companies in EU-14 member states that have reliably submitted CO2 emissions was observed in the following countries: Austria, Italy, the Netherlands, and Belgium (in the category of CO2 emissions), and Austria, Belgium, Italy, the Netherlands, Portugal, and Spain (in the category of water use). In the EU-13 member states, the quality of reported CO2 emissions is very similar to that of energy consumption and waste reported on water use. Only two countries should be the subject of attention: the Czech Republic and Hungary.

Table 7. Reporting of waste production by companies in EU-14 and EU-13 member states, 2012–2021

EU Countries	Financial reports	Waste production in any year		Waste production for 3 years and more		Waste production for 5 years and more		Waste production for 10 years	
	No. of companies		Share (%)	No. of companies	Share (%)	No. of companies	Share (%)	No. of companies	Share (%)
"Old" EU member states									
Austria	1,641	1,021	62.2	939	57.2	777	47.3	454	27.7
Belgium	344	106	30.8	90	26.2	74	21.5	48	14.0
Denmark	354	74	20.9	54	15.3	44	12.4	32	9.0
Finland	390	118	30.3	84	21.5	58	14.9	46	11.8
France	1,320	288	21.8	214	16.2	176	13.3	122	9.2
Germany	11,724	2,695	23.0	2,068	17.6	1,454	12.4	706	6.0
Greece	158	19	12.0	17	10.8	6	3.8	2	1.3
Ireland	76	28	36.8	22	28.9	12	15.8	8	10.5
Italy	609	254	41.7	221	36.3	177	29.1	118	19.4
Luxembourg	26	6	23.1	5	19.2	5	19.2	2	7.7
Netherlands	282	86	30.5	70	24.8	54	19.1	34	12.1
Portugal	83	32	38.6	26	31.3	18	21.7	10	12.0
Spain	589	195	33.1	174	29.5	117	19.9	84	14.3
Sweden	1,986	324	16.3	206	10.4	146	7.4	78	3.9
EU-14	**19,582**	**5,246**	**26.8**	**4,190**	**21.4**	**3,118**	**15.9**	**1,744**	**8.9**
"New" EU member states									
Bulgaria	212	0	0.0	0	0.0	0	0.0	0	0.0
Croatia	74	0	0.0	0	0.0	0	0.0	0	0.0
Cyprus	96	0	0.0	0	0.0	0	0.0	0	0.0
Czech Republic	56	29	51.8	26	46.4	26	46.4	16	28.6
Estonia	50	0	0.0	0	0.0	0	0.0	0	0.0
Hungary	123	50	40.7	45	36.6	43	35.0	36	29.3
Latvia	23	0	0.0	0	0.0	0	0.0	0	0.0
Lithuania	56	0	0.0	0	0.0	0	0.0	0	0.0

Malta	33	0	0.0	0	0.0	0	0.0	0	0.0
Poland	606	39	6.4	34	5.6	21	3.5	10	1.7
Romania	411	38	9.2	26	6.3	26	6.3	18	4.4
Slovakia	14	0	0.0	0	0.0	0	0.0	0	0.0
Slovenia	104	3	2.9	2	1.9	1	1.0	0	0.0
EU-13	**1,858**	**159**	**8.6**	**133**	**7.2**	**117**	**6.3**	**80**	**4.3**

Source: own study based on Refinitiv data.

In conclusion, there are significant differences in reporting the quality of energy consumption, water use, waste production, and CO2 emissions by public companies from the EU countries. However, this quality depends on the date of accession of the EU member states, as a very clear difference was observed between the 'old' and 'new' member states. The most restrictive or least restrictive environmental reporting policy may be the result of the development level of a particular country. The largest stock exchanges and high-income economies are characterised by many formal and legal requirements and information on environmental metrics. The 'old' EU member states, which joined before 2004, are especially important as they differ from the "new" EU countries in terms of their role in the economy and the period of operation of their markets. This approach is not very different from the previous study (Ting et al., 2020) that divided EU member states into developed and emerging markets

5. Conclusions and recommendations

Over-exploitation of natural resources and environmental degradation mean irreversible changes in the ecosystem affecting societies and economies. Among the entities that have the most destructive impact on the environment are production and service companies that use its resources (water and energy) and produce pollution (waste and carbon dioxide). Currently, enterprises not only have to change their operations to be environmentally friendly, but also inform how they do it and how the expected pro-environmental changes are progressing. This information should be provided in the non-financial reports. Unfortunately, there are no uniform standards for such reporting on a global scale, and it is not mandatory. A significant change in this area should take place in the EU countries that have adopted legal solutions obliging most enterprises to provide information on their environmental impact. The lack of mandatory requirements and clarified standards resulted in a large diversity in the field of environmental reporting of the companies from the EU countries. This is clearly demonstrated by the conclusions of our research, which show that there is a huge difference in the quality of reporting between companies from the "old" and 'new' EU countries. In addition, companies publish reports when they want and provide the information which they want. Reporting on key environmental issues (water and energy consumption, waste production and carbon dioxide) is highly incomplete. As Braam et al. (2016) showed, companies often disclose incomplete information on the environmental aspects, so there should be obligatory requirements for environmental reporting. This means that the actions taken by the EU, which oblige enterprises to publish standardized information, are definitely necessary, especially in relation to the enterprises of the 'new' EU countries.

At the same time, it should be emphasized that the changes taking place in the EU include only the EU member states, i.e. there will remain a lack of comparability between the reports of enterprises from EU countries and non-EU countries, the so-called third countries. Standardization of reporting and the requirement to make it obligatory applies only to EU companies may be reflected in the competitive position of EU companies on the international markets. The improvement of the 'environmental" image of enterprises may be accompanied by the deterioration of their financial situation.

The introduction of new machines and technologies, as well as the employment of qualified staff will certainly be costly for EU enterprises. It will be also expensive to create departments dedicated to non-financial reporting within enterprises or to hire specialized companies that provide such services. Bearing all these costs can be difficult, especially for companies that have not yet recovered from the difficult experiences that have affected the global economy so far. It may therefore turn out that the need to meet pro-environmental requirements will prove to be another challenge for enterprises, just like the global crisis 2008+, the pandemic crisis that started in 2020, or the Ukrainian-Russian war that started in 2022. How difficult this challenge will be, it will be seen in the coming years.

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