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## Integrating Environmental Economics into ESG Reporting in Europe: The environmental topic-specific cross-sector European Sustainability Reporting Standards (ESRS)

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## Abstract

This report examines the interlinkages between the environmental topic-specific cross-sector European Sustainability Reporting Standards (ESRS) within the broader frameworks of Corporate Social Responsibility (CSR) and Environmental, Social, and Governance (ESG) principles. The environmental ESRS offer a structured approach for companies to assess and disclose their environmental impacts, risks, and opportunities (IROs), focusing on five key areas: (i) climate change, (ii) pollution, (iii) water and marine resources, (iv) biodiversity, and (v) resource use. These standards aim to enable transparent and comparable sustainability reporting across sectors while aligning corporate strategies with EU sustainability objectives. The integration of such standards can support companies' efforts in implementing more effectively CSR initiatives and ESG performance; thus, fostering accountability, resilience, and long-term value creation. Ultimately, the interconnections between the environmental ESRS underscore the complexity and interdependence of environmental challenges, promoting a holistic approach to further achieve Sustainable Development Goals (SDGs).

Keywords: CSR; ESG; CSRD; SDGs; European green deal.

**JEL Codes:** M14; Q01; Q56

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#### Abbreviations

best available technology (BAT)	Circular Economy Action Plan (CEAP)
Corporate Social Responsibility (CSR)	Corporate Sustainability Reporting Directive
	(CSRD)
Environmental, Social, and Governance (ESG)	European Financial Reporting Advisory Group
	(EFRAG)
European Green Deal (EGD)	European Sustainability Reporting Standards
	(ESRS)
European Union (EU)	Global Reporting Initiative (GRI)
impacts, risks, and opportunities (IROs)	International Financial Reporting Standards
	(IFRS) Foundation
International Sustainability Standards Board	key performance indicators (KPIs)
(ISSB)	
Metrics and Targets (MT)	Nature based solutions (NBSs)
non-financial reporting directive (NFRD)	small and medium-sized enterprises (SMEs)
Sustainable Development Goals (SDGs)	Task Force of Climate-related Financial
	Disclosures (TCFD)
United Nations (UN)	Waste Framework Directive (WFD)

## 1. Introduction

In recent decades, a series of overlapping crises, referred to as a multi-crisis, have placed significant pressure on national economies, underscoring the urgent need for resilience among individuals, corporations, and governments (Halkos and Aslanidis, 2023a; Kuzemko et al., 2020; Tooze, 2022). This raises a critical question: how can the corporate world enhance its resilience in the face of multi-crisis? One potential answer lies in with the advancement of corporate social responsibility (CSR) or its extension, i.e., the Environmental, Social, and Corporate Governance (ESG) (Halkos and Aslanidis, 2024a).

The European Union (EU) has taken significant legislative steps to enhance corporate transparency, particularly in relation to sustainability. Initial efforts began in 2000 with a directive on securities and financial markets, which was amended in 2003 to introduce a new organizational framework for financial services committees and impose transparency requirements on issuers trading in regulated markets. A major turning point came with the adoption of the accounting directive<sup>1</sup> in 2013 and the non-financial reporting directive (NFRD<sup>2</sup>) in 2014, which laid the foundations of sustainability reporting in the EU. Over the following decade, through continued collaboration and policy refinement, these efforts culminated in the development of the European Sustainability Reporting Standards (ESRS) (European Union, 2023). The ESRS are a set of mandatory reporting standards developed by the European Financial Reporting Advisory Group (EFRAG) under the mandate of the European Commission. More specifically, they are part of the Corporate Sustainability Reporting Directive (CSRD<sup>3</sup>), which came into effect in January 2023.

The ESRS primarily apply to large companies and listed small and medium-sized enterprises (SMEs) operating within the EU, encompassing over 50,000 businesses, marking a substantial increase from those previously covered under the NFRD. Unlike the NFRD, the newly introduced ESRS, under the CSRD, significantly broadened the scope and depth of sustainability reporting. More specifically, the ESRS framework brought more businesses under rigorous reporting obligations, enhancing alignment with the EU's climate objectives and social priorities. As a result, the ESRS framework promotes greater transparency, consistency, and accountability in how companies disclose their environmental and social impacts.

To recapitulate, the ESRS are designed to make sustainability reporting clear and comparable across companies, helping investors, consumers, and other stakeholders to better understand the risks and impacts related to sustainability, aligning with important EU frameworks for sustainable development, like the European Green Deal (EGD). For example, the EGD was designed as the EU's compass to achieve those goals, aiming to ensure zero emissions by 2050, making Europe the first climate-neutral continent in the world (Halkos and Aslanidis, 2023b; Von-der-Leyen, 2019). The next sections are going to present the interconnections of ESRS with other standards, as well as to present the five environmental parameters of ESRS in more detail to present potential tools for policymakers and managers.

<sup>&</sup>lt;sup>1</sup> The accounting directive (2013/34/EU) aimed to ensure clarity and comparability of financial statements (European Union, 2013).

<sup>&</sup>lt;sup>2</sup> The NFRD (2014/95/EU) was the earlier EU rule requiring certain large companies to disclose information on ESG issues (European Parliament, 2014).

<sup>&</sup>lt;sup>3</sup> The CSRD requires companies to report on the impact of corporate activities on the environment and society and requires the audit (assurance) of reported information (European Parliament, 2022).

## 2. Interoperability of ESRS with other standards

The ESRS framework covers the full range of ESG issues, including climate change, biodiversity and human rights. The ESRS also take account discussions with the Global Reporting Initiative (GRI) and the International Sustainability Standards Board (ISSB), allowing for interoperability between EU and global standards and preventing unnecessary double reporting by companies. Moreover, the ESRS can be also linked to the Task Force of Climate-related Financial Disclosures (TCFD) and Sustainable Development Goals (SDGs) in order to cover relevant environmental and social issues that go beyond the typical corporate boundaries and adopt the CSR and ESG mentality.

The ESRS try to follow the GRI based on the supporting companies to identify, gather, and report this information in a clear and comparable manner. The GRI provide international independent standards that can support corporations, public governments, or other stakeholders to build a common understanding regarding their impacts on social cohesion, climate change management, protection of human rights, and dealing with corruption (GRI, 2025).

The ESRS is also linked to the ISSB in terms of following the international frameworks of sustainability reporting. In 2021-2022, the International Financial Reporting Standards (IFRS) Foundation have created the ISSB aiming to cover four objectives: (i) to create standards for sustainability disclosures statements globally, (ii) to cover stakeholders' needs on sustainability (e.g., investors), (iii) to align global capital markets' needs to corporate sustainability reporting, and (iv) to make more comprehensible the corporate financial disclosures to all stakeholders (IFRS, 2022).

Additionally, most of the environmental-related aspects of ESRS are linked to multi-crisis aspects that have been highlighted by the TCFD. Climate-related risks must be answered in the sustainability reporting as external factors that can pressure business operations. The TCFD categorized climate-related risks into (i) transition, (ii) and physical (TCFD, 2017). The transition risks include issues such as (a) policy and legal risks, (b) technological risks, (c) markets risks, and (d) reputation risks; whereas, the physical risks are composed of acute (e.g., floods etc.) and chronic (e.g., chronic heatwaves etc.) risks.

Last but not least, even from 2015, there is an effort to combine ESG with the United Nations (UN) Sustainable Development Goals (SDGs). The SDGs are a broader framework than ESG, let alone the ESRS. The SDGs show the general guidelines to achieve sustainable development till 2030 (Agenda 2030) (UN, 2015). Therefore, the ESG can underpin the efforts to achieving SDGs through corporate sustainability commitments and actions (Franco et al., 2021; Kumar Soni, 2023). Comparing the ESG and SDGs, SDGs must be achieved till 2030 (even though it is not probable based on the current pathway), whereas an ESG framework does not follow a specific timeline (Halkos and Aslanidis, 2024a). Overall, the ESG framework can be a significant driving force for SDGs achievement.

#### 3. The Structure of ESRS

There are three types of ESRS (see Fig. 1): (i) the general cross-sector standards, (ii) the topic specific, and (iii) the sector specific standards, where the general and topic-specific are independent from sector-specific standards while the sector specific standards refer to all businesses that can be found in one sector at a time. Initially, the horizontal standards are ESRS

1 (on general requirements) and ESRS 2 on general disclosures. Moreover, the topic-specific standards are aligned with the ESG scopes, including 10 different standards, i.e., five environmental-oriented standards, four social-related standards, and one standard regarding the corporate governance.





Another important issue in ESRS is the categorization of disclosure requirements based on the reporting areas (see Fig. 2). More specifically, there are four disclosure requirements that observe: (i) the "governance processes" that refer to the management of IROs, (ii) the monitoring of how the "strategy and business model" interacts with the IROs, (iii) the *IROs* management on materiality issues and under the "sustainability matters" scope (mainly in ESRS2), and (iv) the "metrics and targets" that focus on performance.

Fig. 2. The reporting areas of disclosure requirements



In the ESRS framework the notion of "*double materiality*" is important and includes the impact (i.e., impact towards the environment and society) and the financial materiality (i.e., impact on the company). Having in mind the IROs management, the double materiality further

extends their management in corporate governance. The "*impact materiality*" refers to both actual and potential future – positive or negative – business impacts. Moreover, the "*financial materiality*" refers to the financial risks and opportunities from a business's external environment (e.g., natural environment issues). Another issue in ESRS, except the Disclosure Requirements, there are also the Application Requirements.

Corporate disclosure obligations typically fall into three categories: mandatory disclosure, voluntary disclosure, and non-disclosure where no obligation exists. The two degrees of obligation are distinguished by the notions, "shall disclose" which is imperative under the Disclosure Requirements, and the "may disclose" that shows voluntary actions from the part of a business under its good faith. However, there is also the "shall consider" statement that covers the methodological or practical issues that might be considered in the preparation of disclosures (if there is applicability). Next in order, there is the delving into the five environmental ESRS.

## 4. The environmental cross-sector standards

This section will overview the environmental-related issues in the ESRS; however, aspects that are linked to the general cross-sector standards would be neglected in order to focus mainly on the aspects that target mainly the environmental issues. Therefore, this section will summarize the key points in environmental (E) ESRS (see Fig. 3), such as the E1 on climate change, E2 on pollution, E3 on water and marine resources, E4 on biodiversity and ecosystems, and E5 on resource use and circular economy.



### Fig 3. The five environmental cross-sector standards

#### 4.1. The ESRS E1 on climate change

In Figure 4 there is a brief presentation of ESRS E1 on climate change. The objective is to target on how a corporation's strategy can apply mitigation measures that align with the Paris Agreement on climate change, aiming to achieve carbon neutrality by 2050. Hence, the objective targets specifically a business's issues regarding the use of coal, oil or gas in its operations.

Fig. 4. ESRS E1 on climate change



Apparently, the objective of ESRS E1 is based on the "sustainability matters" notion that considers both actions for mitigation and adaptation to climate change. Moreover, the ESRS E1 can be linked with air, soil, or water pollution substances (as in E2), with the pressures of climate change on water and marine resources (as in E3), with pressures on biodiversity (as in E4).

Fig. 5. The metrics and targets on climate change



This standard includes the anticipated financial effects from both material physical risks and material transition risks, as well as potential benefits from material climate-related opportunities.

The IROs management of E1 refers to policies related to climate change mitigation and adaptation. More specifically, the E1-2 standard includes policies that address five categories: (i) climate change mitigation; (ii) climate change adaptation; (iii) energy efficiency; (iv) renewable energy deployment; and (v) other similar issues. Additionally, the E1-3 aims on business actions and resources that are linked to broader climate change policies. In Figure 5 there are the metrics and targets for dealing with climate change, whereas the GHG protocol scopes on a business level are presented in Figure 6.

![](_page_7_Figure_1.jpeg)

Fig 6. The GHG Protocol scopes and emissions

Source: Greenhouse Gas Protocol (2013, p.6).

#### 4.2. The ESRS E2 on pollution

The IROs management of E2 is presented through the standards the E2-1 and E2-2, which cover the necessary policies and actions related to each form of pollution respectively (see Fig 7). In more detail, the E2-1 includes policies that address the identification, assessment, management and/or remediation of material pollution-related IROs, aiming to minimize both upstream and downstream operations that create negative externalities and avoid emergency situations. Furthermore, the E2-2 paves the way for key actions that aim to achieve the pollution-related policy objectives and targets, actions can include the avoidance of pollution at the source, adopt best available technology (BAT) requirements, prevent pollution based on the "do not significant harm" principle, and apparently restore the polluted ecosystems.

The ESRS from E2-3 to E2-6 mandate the disclose of pollution-related targets, emissions, use of harmful substances, and anticipated financial effects of pollution-related IROs. Firstly, the E2-3 requires companies to report pollution targets, aligning them with specific pollution types (air, water, soil, hazardous substances) and to clarify whether targets are voluntary or legally mandated, possibly incorporating ecological thresholds. In addition, the E2-4 focuses on disclosing the types and amounts of pollutants and microplastics emitted, referencing EU regulations, and requires contextual information on methodologies and data reliability.

## Fig. 7. ESRS E2 on pollution

![](_page_8_Picture_1.jpeg)

Furthermore, in Figure 8, the E2-5 requires disclosure of the handling and impacts of substances of concern and very high concern, including quantities used, emitted, or included in products, emphasizing transparency on health and environmental risks. Lastly, E2-6 requires companies to report the anticipated financial effects of material pollution-related risks and opportunities, including quantitative or qualitative data on impacts to financial performance, assumptions used, and any relevant incidents or expenditures related to pollution.

Fig 8. The metrics and targets on pollution

## E2-3: Targets related to pollution

Co-evaluation of ecological thresholds (e.g., the biosphere integrity etc) and entity-specific allocations were taken into consideration when setting targets. The corporation specifies whether the targets that it has set and presented are mandatory (by legislation) or voluntary.

E2-4: Pollution of air, water and soil

The corporation disclises each emission (except GHGs, as in ESRS E1) and microplastics that have been generated or utilized.

## E2-5: Substances of concern and substances of very high concern

Includes the production, use, distribution, commercialisation and import/export of substances of concern and substances of very high concern, on their own, in mixtures or in articles.

## E2-6: Anticipated financial effects from material pollution-related risks and opportunities

The disclosure includes negative financial effects due to material risks (due to pollution) and dependencies that impact the financial position, performance, in each period of operation (short-, medium-, and long-term) as well as positive anticipated financial effects due to material opportunities linked to the prevention or control of pollution.

The topic of pollution is highly interconnected with the other environmental issues as noted in E1, E3, E4, and E5. The linkages with E1 can be found in the common characteristics of climate change due to air pollution because of the high concentration of harmful emissions. Similarly, the pollution in water bodies such as the generation of microplastics shows the significant impact of pollution towards the marine ecosystems and especially the oceans. Undoubtedly, the soil pollution can be detrimental to the safeguarding of local biodiversity. Apparently, the impact of pollution due to waste generation is interlinked with E5 regarding the efforts towards circular economy transition.

#### 4.3. The ESRS E3 on water and marine resources

The IROs management of E3 is presented through the standards the E3-1 and E3-2, which cover the necessary policies and actions related to water and marine ecosystems protection (see Fig 9). In more detail, the E3-1 includes policies to manage its material IROs related to water and marine resources. Furthermore, the disclosure in E3-2 refers to actions towards water and marine resources-related as well as the allocation of resources for the implementation of these actions. The water management includes policies regarding the use and treatment of water or marine resources as well as the prevention or abatement of water pollution. It should be mentioned that resources that can be allocated are targeting issues such as the avoidance or reduction of water use through efficiency metrics. An important aspect of actions can be the reclamation or reuse of water or even the restoration of aquatic ecosystems.

![](_page_9_Figure_3.jpeg)

![](_page_9_Figure_4.jpeg)

The metrics and targets of ESRS for the water and marine resources management is illustrated in Figure 10. Essentially, companies must disclose targets related to water and marine resources, including how these can support their policies and address material IROs, especially in water-stressed areas and in the use of marine resources. Additionally, companies should indicate whether targets are mandatory or voluntary and may include ecological thresholds and allocation methods. For instance, companies must report on their water consumption performance, detailing total use, use in high-risk areas, recycling, storage, and water intensity per revenue, along with relevant context and data methodologies. Finally, they must disclose anticipated financial effects of water- and marine-related risks and opportunities, including potential impacts on financial performance, the assumptions behind projections, and associated uncertainties.

#### Fig 10. The metrics and targets on water and marine resources

E3-3: Targets related to water and marine resources

Management of material IROs related to areas at water risk.

Responsible management of marine resources IROs including the nature and quantity of marine resources-related commodities (e.g.,deep-sea minerals, seafood).

Water consumption reduction, including areas of high water-stress.

E3-4: Water consumption

Total water consumption (e.g., in areas at water risk); total water recycled, reused, stored and changes in storage in m<sup>3</sup>. The corporation discloses its water intensity as total water consumption in its own operations in m<sup>3</sup> per million EUR net revenue.

E3-5: Anticipated financial effects from material water and marine resources-related risks and opportunities

Anticipated financial effects of IROs on the financial position, financial performance and cash flows, over the short-, medium- and long-term.

Several ESRS standards address water and marine-related issues from different perspectives. Initially, E1 on climate change focuses on physical risks linked to water and ocean-related hazards intensified by climate change, such as rising sea levels, droughts, floods, and changing precipitation patterns. Secondly, E2 on pollution covers emissions into water bodies, including oceans, and the problem of microplastics in water bodies. Similarly, E4 on biodiversity and ecosystems emphasizes the protection and sustainable use of freshwater and marine ecosystems. Lastly, E5 on circular economy addresses waste management, particularly plastic waste, the sustainable use of wastewater, and the shift toward recycling and reducing reliance on non-renewable water resources.

## *4.4. The ESRS E4 on biodiversity and ecosystems*

The strategy and the IROs for the ESRS E4 are presented in Figure 11. The strategy in E4-1 shows that a business shall disclose the linkage between its business model and its IROs from and towards issues of biodiversity and ecosystems protection. More specifically, the resilience assessment is important on showing the vulnerability of the business model to physical, transition and systemic risks, including the scope of the resilience analysis, the assumptions made, the time period, the results, and the stakeholders involvement.

Fig. 11. ESRS E4 on biodiversity and ecosystems

![](_page_10_Figure_13.jpeg)

Considering the IROs in E4-2 and E4-3, several targets and metrics should be monitored in order to conserve the biodiversity in the proximity of the business. To exemplify, targets on biodiversity and ecosystem protection for sites owned, leased, or managed in or near a biodiversity sensitive area, sustainable land / agriculture practices or policies, sustainable oceans / seas practices or policies, and policies to address deforestation. Moreover, metrics on avoidance, minimisation, restoration/rehabilitation, and compensation or offsets. Hence, the company shall disclose whether it used biodiversity offsets in its action plans, if yes, it has to disclose the aim of the offset and KPIs used; the financing effects (direct and indirect costs); and a description of offsets (e.g., area, type). Additionally, the company shall describe if local and indigenous knowledge or NBSs have been incorporated in actions.

Fig 12. The metrics and targets on biodiversity and ecosystems

E4-4: Targets related to biodiversity and ecosystems

The company shall identify the ecological thresholds and the methodology used, shall inform if the targets are in line with the Kunming-Montreal Global Biodiversity Framework, relevant aspects of the EU Biodiversity Strategy for 2030 and other biodiversity and ecosystem-related national policies and legislation; as well as the geographical scope of the targets.

E4-5: Impact metrics related to biodiversity and ecosystems change

The conversion over time of land cover (e.g. deforestation); in the ecosystem management (e.g., forestry harvesting); in spatial parameters (e.g. fragmentation of habitats); in ecosystem structural connectivity; and the functional connectivity.

E4-6: Anticipated financial effects from biodiversity and ecosystem-related risks and opportunities

Anticipated financial effects due to material IROs arising from biodiversity- and ecosystem-related impacts and dependencies and how these risks (potentially) have a material influence on the financial position, performance and cash flows over the short-, medium- and long-term.

Companies are required to disclose biodiversity and ecosystem-related targets, detailing how they support relevant policies and address material impacts of IROs (see Fig 12). Such metrics and targets include information disclosure on whether ecological thresholds were applied, alignment with global and EU biodiversity frameworks (e.g., Kunming-Montreal<sup>4</sup>), use of biodiversity offsets, and links to the mitigation hierarchy. They must also report metrics on their material impacts on biodiversity, such as the number and area of sites near sensitive ecosystems, land-use changes, ecosystem condition and extent, species population trends, invasive species management, and changes in ecosystem connectivity. Additionally, companies must disclose anticipated financial effects of biodiversity-related risks and opportunities, including expected impacts on financial performance over different time horizons, supported by quantitative or qualitative data, relevant assumptions, and the level of uncertainty involved.

<sup>&</sup>lt;sup>4</sup> The Kunming-Montreal Global Biodiversity Framework, adopted in 2022, aims to halt and reverse biodiversity loss by 2030. Its main objectives include protecting 30% of the world's land and oceans, restoring degraded ecosystems, reducing pollution and biodiversity threats, and promoting sustainable use and equitable benefitsharing of natural resources Kunming-Montreal (CBD, 2022).

To gain a comprehensive understanding of material impacts and dependencies on biodiversity and ecosystems, the disclosure requirements of the E4 standard, it should be considered alongside those of the rest environmental ESRS standards. These include E1, which focuses on greenhouse gas emissions and energy use, for the E2, addressing contamination of air, water, and soil. In addition, the E3 on water and marine resources, covering water consumption and marine ecosystem impacts; and the E5 on resource use and circular economy, which emphasizes reducing reliance on non-renewable resources and minimizing waste generation and related pollution that can negatively affect natural ecosystems. Together, these standards provide an integrated view of environmental impacts relevant to biodiversity.

#### 4.5. The ESRS E5 on resource use and circular economy

The objective of the E5 is to define disclosure requirements that help stakeholders understand how an undertaking impacts and manages resource use and circular economy practices. It covers actions taken to reduce negative impacts, align strategies with circular principles, and address related IROs and financial effects over time (see Fig 13). The E5 focuses on resource inflows (renewable and non-renewable), outflows (products and materials), and waste. Circular economy is defined as a system that maximizes resource value through reuse, recycling, and minimal waste. The E5 standard aligns with EU policies such as the new Circular Economy Action Plan<sup>5</sup> (CEAP) and Waste Framework Directive (WFD) and uses physical resource flow data to assess the transition from linear to circular business models (EC, 2020, 2008).

![](_page_12_Figure_3.jpeg)

![](_page_12_Figure_4.jpeg)

The ESRS E5 can be pivotal in guiding companies in disclosing metrics and targets on how they manage, measure, and plan for responsible resource use and circular economy practices (see Fig 14). Organizations must report their targets for reducing resource dependency and waste, covering goals like circular product design, sustainable sourcing, and minimizing primary raw materials. It should be also considered that disclosures should include details on

<sup>&</sup>lt;sup>5</sup> The new CEAP is the EU's strategy to promote sustainable growth by prioritizing resource efficiency, waste reduction, and the transition to a circular, low-carbon economy; moreover, the WFD establishes the legal framework for waste management in the EU, promoting waste prevention, reuse, recycling, and recovery to protect the environment and human health (Halkos and Aslanidis, 2024b).

resource inflows (e.g., materials, water, and packaging), highlighting the proportion of recycled and sustainably sourced materials. On the outflow side, firms ought to report on how they design products for durability and recyclability, and how they manage waste (e.g., hazardous elements). The aim is to encourage circular practices while informing stakeholders about a company's contribution to sustainability. Finally, firms should also reveal the financial implications of risks and opportunities linked to resource use, quantifying their anticipated impacts on performance and cash flow across timeframes. Altogether, the goal of E5 is to boost transparency in companies and facilitate the information dissemination towards stakeholders (e.g., investors and regulators) in order to assess environmental performance and resilience.

## Fig 14. The metrics and targets on resources and circular economy

#### E5-3:Targets related to resource use and circular economy

Metrics to increase circular material use rate, minimisation of primary raw material, sustainable sourcing and use of renewable resources, waste management, including preparation for proper treatment, and other related matters

#### E5-4:Resource inflows

Resource inflows are based on material sustainability matter and refers to materials used to manufacture products and services (in tonnes or kilogrammes) such as the overall total weight, the technical and biological (e.g., biofuels) materials used, the weight of secondary reused or recycled components, secondary intermediary products and secondary materials used.

#### E5-5:Resource outflows

• The disclosure requirements include the contribution towars circular economy through responsible designing of products and materials based on closed-loop principle which considers the waste management strategy of the business.

E5-6:Anticipated financial effects from resource use and circular economy-related risks and opportunities

• Anticipated financial effects from material IROs related to resource use and the circular economy, including how these may impact the financial position, performance, and cash flows over the short-, medium-, and long-term.

Understanding resource use and the circular economy requires looking beyond isolated issues and recognizing the interconnected nature of environmental challenges; therefore there is interconnectedness with the rest environmental standards. Firstly, the E1 highlights how energy consumption and greenhouse gas emissions influence climate change, next, the E2 focuses on pollution across air, water, and soil, including hazardous substances as in waste management. Furthermore, the E3 explores the sustainable use of water and marine ecosystems that can be linked to microplastic waste generation from companies as in E5, and finally, the E4 delves into the preservation of biodiversity, ecosystems, and the responsible sourcing of raw materials. To conclude, circular economy practices are influenced by, and can impact, broader environmental priorities as in the other environmental standards.

## 4.6. The interconnectedness in environmental ESRS

The ESRS environmental standards are intricately connected, reflecting the complex interplay between various environmental issues such as climate change, pollution, biodiversity loss, water resource management, and circular economy initiatives (see Fig 15). The E1 is

centered on climate change, focusing on both mitigation and adaptation efforts, while also linking to pollution concerns as addressed in E2, including harmful emissions affecting air, water, and soil quality. This connection highlights how air pollution contributes to climate change and how pollutants like microplastics harm marine ecosystems, a key focus of E3. Additionally, the E4 emphasizes the protection of biodiversity and ecosystems, which are vulnerable to pollution and climate-related pressures. Waste generation and management, covered in E5, further illustrate the relationship between pollution and circular economy practices, showing how the reduction in waste volumes by promoting recycling can mitigate negative environmental impacts.

![](_page_14_Figure_1.jpeg)

![](_page_14_Figure_2.jpeg)

Together, these standards form a comprehensive and integrated framework that encourages organizations to view environmental issues not in isolation but as interconnected elements of a larger system. For example, the sustainable use of water resources addressed in E3 is directly impacted by waste management practices in E5, while biodiversity conservation in E4 depends on effective climate action and pollution control from E1 and E2. This multidisciplinary approach enables companies to develop more robust sustainability strategies that align with multiple environmental priorities, supporting the transition to a circular economy while addressing climate risks, reducing pollution, and preserving ecosystems. Therefore, these interdependencies show how the ESRS framework can foster a deeper understanding of how corporate actions can drive systemic change toward long-term environmental resilience and sustainability.

#### 5. Conclusions and Policy Implications

This report explores the intricate interlinkages among the environmental topic-specific cross-sector ESRS within the broader context of CSR and ESG frameworks. The environmental ESRS provide companies with a comprehensive and structured methodology to identify, assess, and disclose their environmental IROs. These standards focus on five critical areas: climate change, pollution, water and marine resources, biodiversity, and resource use. By fostering transparent and comparable sustainability reporting across various industries, the ESRS can

enable companies to align their strategies with the EU's ambitious sustainability goals, thus reinforcing corporate commitment to environmental stewardship.

Implementing the ESRS has significant policy implications that encourage organizations to adopt transparent and eco-responsible practices, cultivating trust among stakeholders. Accordingly, the companies can enhance their transparency and demonstrate commitment to environmental stewardship, which in turn boosts investor confidence and provides higher investing assurance. Essentially, this transparency and accountability also contribute to a competitive advantage by differentiating companies in an increasingly sustainability-conscious market. Furthermore, aligning ESRS with international standards (e.g., GRI etc) ensures consistency and comparability of sustainability disclosures globally, facilitating cross-border investments and collaborations. Therefore, compliance with ESRS can underpin robust risk management and can facilitate organizations to meet evolving regulatory requirements, reducing legal and financial uncertainties. The most important factor that policymakers and managers should take into account is the integration of these standards in their corporate reporting, because it can also enhance their corporate efficiency and effectiveness by promoting streamlined sustainability processes and informed decision-making, ultimately contributing to long-term value creation and resilience.

![](_page_15_Figure_2.jpeg)

Fig. 16. Overview of the main benefits organizations gain by complying with the ESRS

To recapitulate, the integration of these topic-specific standards plays a pivotal role in supporting companies to effectively implement CSR initiatives and showcase their ESG performance. This alignment promotes greater accountability, enhances resilience against environmental risks, and drives long-term value creation for both businesses and their stakeholders. The interconnected nature of the environmental ESRS highlights the complexity and interdependence of environmental challenges, urging companies to adopt a holistic perspective. In short, the integrative approach of ESRS is key to driving the EU's EGD and UN SDGs forward, as non-financial reporting empowers companies to show leadership beyond their operations, actively shaping a more sustainable, equitable, and environmentally responsible future.

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