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Review

Accounting Materialization of ESG Risks: Implications for Financial Reporting, Valuation and Investment Decisions

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Abstract: ESG risks are increasingly becoming financially material as their effects are transformed into accounting categories through provisions, impairments, cash flow adjustments and changes in the cost of capital. This study examines the mechanisms through which environmental, social and governance risks are transmitted into financial reporting, drawing on analytical modelling, sectoral comparisons and an illustrative case study. The findings indicate that the materialization of ESG risks occurs through standardized IAS/IFRS mechanisms, with IAS 37 and IAS 36 serving as central recognition pathways, complemented by expected credit loss estimations under IFRS 9. A valuation mini-simulation demonstrates that even moderate changes in profitability and discount rates can lead to substantial reductions in estimated firm value, confirming that ESG risks affect both balance sheet metrics and market valuations. The results contribute to a clearer understanding of how non-financial risks are integrated into accounting and valuation frameworks, emphasizing the need for systematic quantification. Research limitations highlight opportunities for empirical testing of sector-specific materiality thresholds and for advancing models that incorporate climate and reputational risks into valuation and accounting assessments.

Keywords: *ESG risk; financial materiality; IAS/IFRS; impairment; valuation.*

1. Introduction

Over the past decade, the business environment has been marked by increasing tension between emerging sustainability regulations and traditional financial reporting frameworks that were not designed to capture the complex risks associated with climate, social and governance factors. As corporations expanded their sustainability programs and public disclosures, a central conceptual gap persisted: how non-financial risks—developing largely outside the balance sheet—translate into financially material consequences capable of influencing a firm's valuation, performance and long-term risk profile. The literature increasingly emphasized the absence of a clear understanding of the mechanisms through which ESG events cross the accounting materiality threshold and become subject to mandatory recognition and measurement under international standards [1,2].

Although a broad consensus emerged that ESG risks affect profitability and the cost of capital, empirical findings remained fragmented and sector-specific. Market-reaction studies documented significant declines in firm value following ESG controversies, yet provided limited insight into the accounting pathways through which these market effects originated, or the conditions under which recognition obligations arise within the IAS/IFRS framework [3,4]. At the same time, European regulation—particularly Corporate Sustainability Reporting Directive (CSRD) and European Sustainability Reporting Standards (ESRS) —introduced the principle of double materiality, but empirical evidence on how this materiality translated into accounting and valuation outcomes remained scarce. These gaps pointed to the need for a conceptual model that systematically connects non-financial sustainability risks with their accounting and financial implications.

A further source of debate concerned whether existing IAS/IFRS standards are sufficient for capturing ESG-related exposures or whether a fundamental revision of the accounting framework is required. While some authors argued that standards such as IAS 37 and IAS 36 already provide mechanisms relevant for recognizing sustainability-induced obligations, questions persisted regarding their consistency of application, comparability across sectors and capacity to reflect transition-driven changes in asset values [5,6]. In parallel, intensifying transition risks—ranging from technological obsolescence to regulatory phase-outs—raised new issues related to the role of impairments, provisions and forward-looking disclosures within the emerging sustainability landscape.

Against this background, a key unresolved question emerged: how do ESG risks become accounting categories, and how can their financial impact be quantified and incorporated into firm valuation processes? This study addressed that problem by developing an analytical model that explains the transmission mechanisms through which ESG risks materialize as accounting and financial effects, illustrating these mechanisms through sectoral comparisons and a representative empirical case.

The aim of the research was to identify the accounting mechanisms by which ESG risks become financially material and to examine their influence on firm valuation. The initial hypothesis proposed that ESG risks are transmitted through established IAS/IFRS standards—particularly provisions, impairments and credit-risk adjustments—and that such materialization produces measurable effects on expected cash flows and the estimated value of the firm.

2. Theoretical framework and conceptual definition of ESG risk

2.1. Defining and Classifying ESG Risks

ESG risks represent a spectrum of environmental, social, and corporate governance exposures that can generate material financial consequences for a company by affecting profitability, cash flows, asset valuations or the cost of capital. Contemporary regulation and academic literature increasingly conceptualize ESG risks as an integral component of enterprise risk management systems, emphasizing their potential to influence traditional financial metrics rather than merely reputational or ethical dimensions of corporate behavior [1,4].

A clear distinction must be drawn between ESG performance and ESG risk. While ESG performance reflects how effectively a company adheres to sustainability standards (e.g., emissions reduction, quality of labor practices, transparency), ESG risks refer to potential adverse events with the capacity to negatively affect financial outcomes. High ESG performance does not eliminate exposure to risks

but may mitigate it, whereas weak performance increases the likelihood and magnitude of risk materialization [2]. Empirical evidence from the regional financial sector further demonstrates that climate-related and social risks increasingly affect business stability, expected losses, and business model vulnerability, confirming the growing relevance of ESG factors in assessing overall risk exposure [7]. Moreover, recent research shows that the relationship between risk and company performance is moderated by structural characteristics—particularly firm size—indicating that smaller enterprises may be disproportionately sensitive to regulatory pressures and transition costs [8].

European regulatory frameworks, most notably the CSRD and the ESRS, formally classify ESG risks into the following categories [5]:

- Environmental (E): physical climate risks, transition risks, resource degradation risks;
- Social (S): risks related to working conditions, occupational health and safety, societal expectations, reputational reactions;
- Governance (G): risks associated with non-compliance, corporate oversight, regulatory sanctions and greenwashing.

Within CSRD and ESRS, ESG risks are assessed through the principle of double materiality, which requires companies to evaluate: financial materiality (how ESG factors affect the company), and impact materiality (how the company's activities affect society and the environment).

Financial materiality is directly linked to the accounting recognition of liabilities, asset impairments and risk assessments embedded in financial instruments, while impact materiality informs qualitative disclosures and strategic sustainability reporting [5],[1]. Empirical research further indicates that the quality and consistency of sustainability disclosures significantly affect the assessment of ESG performance and related risks, a finding supported by an innovative model for sustainability report evaluation developed in the regional context [9].

A comprehensive conceptual understanding of ESG risks therefore enables their systematic identification, comparison and quantification, providing a robust analytical foundation for examining the financial mechanisms through which these risks materialize.

2.2. Mechanisms of ESG Risk Transformation into Financial Consequences

ESG risks become financially material when their effects translate into quantifiable changes in revenues, expenses, asset values, liabilities or the cost of capital. In academic literature and regulatory frameworks, these dynamics are conceptualized as *transmission channels* through which originally non-financial sustainability shocks acquire economic and accounting significance [3],[10].

The first transmission channel concerns cash flows because environmental and social risks may alter operating cash flows through increased labor, energy or compliance costs, or through reduced sales arising from reputational damage. They further influence investment cash flows, particularly via regulatory compliance expenditures and the need to invest in low-carbon technologies. Climate transition risks intensify this mechanism by accelerating technological obsolescence and generating *stranded assets* that require substantial replacement investment [11]. Financial cash flows may also be affected if lenders incorporate ESG considerations into loan pricing or capital availability.

The second mechanism relates to reputational effects, which, although initially non-financial, frequently manifest as measurable financial consequences. These include loss of market share, reduced pricing power, higher customer acquisition costs, intensified regulatory scrutiny and increased insurance premiums. Empirical studies show that negative ESG events—especially ethical

breaches, environmental incidents or governance failures—produce strong capital market reactions and re-shape expectations of future cash flows [4].

The third mechanism involves capital structure and the cost of capital (WACC) as a growing body of empirical research confirms that investors increasingly incorporate ESG risk exposure into the pricing of both equity and debt. Firms with higher ESG risk face higher required rates of return, less favorable credit terms and in some cases constrained access to external financing [2]. Higher ESG risk therefore increases the equity risk premium, can weaken credit ratings and ultimately modifies the WACC, exerting a direct influence on discounted cash flow valuation. Evidence from the insurance sector demonstrates that profitability is highly sensitive to risk-induced volatility [12], underscoring the need to incorporate sector-specific sensitivities into ESG risk quantification models.

Taken together, ESG risks influence financial outcomes through a combination of cash-flow disruptions, reputational adjustments and changes in financing costs. These mechanisms form the analytical foundation for understanding how sustainability-related exposures become embedded in financial reporting and valuation practices.

3. Accounting treatment and quantification of ESG risk

3.1. Normative Framework: IFRS and European Directives

A comprehensive accounting treatment of ESG risks relies on two complementary regulatory pillars: the IAS/IFRS framework, focused on financial materiality, and the European sustainability reporting system (CSRD, ESRS), built on the concept of double materiality. Although conceptually distinct, these frameworks are increasingly converging toward an integrated reporting architecture in which ESG risks become embedded within financial decision-useful information [5],[10]. IFRS standards provide the methodological foundation for recognizing ESG-related financial effects. Key standards include:

- IAS 37 — recognition of environmental and social obligations when they are probable and reliably measurable (e.g., remediation, compensation, litigation).
- IAS 36 — impairment testing when climate, regulatory or reputational factors reduce recoverable amounts.
- IAS 16 / IAS 38 — adjustments of asset lives and CAPEX due to technological substitution and sustainability requirements.
- IAS 19 — employee-related social risks.
- IFRS 7 / IFRS 9 — expanded risk disclosures and ECL models incorporating ESG-related PD/LGD effects.

The second regulatory pillar, CSRD and ESRS, standardizes ESG disclosures and explicitly links sustainability issues with accounting consequences through double materiality. ESRS thematic areas (E1–E5, S1–S4, G1) require quantification of financial effects and forward-looking risk assessment. The introduction of IFRS S1 and S2 further accelerates global harmonization by requiring identification and disclosure of ESG risks in a format consistent with financial reporting.

Overall, the normative framework increasingly recognizes ESG risks as accounting-relevant phenomena requiring transparent, quantified and comparable presentation.

3.2. Accounting Mechanisms for Recognizing ESG Risk

ESG risks become accounting items once they meet IAS/IFRS criteria of probability, reliable measurement and financial materiality. Through these mechanisms, sustainability-related exposures are transformed into liabilities, expenses or asset impairments [10]. As emphasized in recent literature, accountants play a central role in ensuring credible quantification and reporting of ESG risks [6].

Environmental and social events frequently create obligations recognized as provisions when outflows are probable and estimable. Typical examples are remediation costs, decontamination, asset retirement obligations and employee-related claims. Such events—particularly regulatory sanctions or environmental incidents—commonly satisfy IAS 37 criteria [5].

Impairment of assets (IAS 36) includes impairment tests triggered by: climate and transition risks, which may create stranded assets[11] and reputational risks, which reduce expected cash flows and goodwill values. IAS 36 recognizes ESG factors as impairment indicators requiring reassessment of recoverable amounts.

Off-balance sheet and contingent obligations include certain ESG exposures (future emission costs, carbon allowance obligations, regulatory phase-outs) do not meet recognition thresholds but require transparent note disclosures.

Financial instruments and expected credit losses (IFRS 9) due to ESG risks that affect:

- probability of default (PD), as firms exposed to high environmental or transition risks may face deteriorating credit quality;
- loss given default (LGD), since collateral values may decline if assets are exposed to environmental or regulatory vulnerabilities;
- exposure at default (EAD), as lenders may adjust credit limits for entities with elevated ESG risk.

Banks and investors increasingly integrate ESG factors into ECL models, affecting financing terms and the cost of capital [4],[2]. These mechanisms show that the IFRS system already provides a robust architecture for integrating ESG risks into financial statements, without requiring a new accounting paradigm—only a more systematic application of existing standards.

3.3. Methodology for ESG Risk Quantification

Quantifying ESG risks enables the translation of qualitative uncertainties into measurable financial effects. Contemporary approaches combine accounting estimates with economic and statistical models, consistent with IFRS S2 and ESRS E1 requirements [10,5].

Monetisation of Climate and Transition Risks - climate risks affect operating costs, CAPEX and long-term asset usability. Quantification typically relies on:

- cost-based models estimating damages, adaptation or compliance costs [11],
- scenario analyses (1.5°C–3°C trajectories) recommended by IFRS S2,
- internal carbon pricing to anticipate future transition costs.

These methods integrate transition risk into DCF valuations and strategic planning.

Quantification of Reputational Losses - although reputational risks often lack immediate legal obligations, they produce measurable economic effects through reduced revenue, market share and increased risk premia. Common methods include:

- willingness-to-pay models,

- expected market share loss models,
- event-study analysis estimating capitalization effects [3].

Carbon Accounting (Scope 1–3) - detailed emissions measurement under ESRS/IFRS S2 supports estimating: future carbon pricing costs, emissions-allowance needs, regulatory exposure and financial implications of low-carbon transitions.

Overall, ESG risk quantification relies on a structured combination of accounting and economic techniques that allow integration of sustainability risks into valuation, credit assessment and strategic decision-making.

4. Accounting materialization of ESG risk: analysis and models

ESG risks increasingly shape the financial health and market value of companies because they affect cash flows, the cost of capital and the structure of assets and liabilities, and thus become a material category in contemporary financial reporting and valuation practice. Their economic manifestation goes beyond purely reputational or regulatory dimensions and is realized through provisions, asset impairments, higher compliance and remediation costs, and changes in discount rates, as documented in recent empirical research [13,14]. Against the backdrop of expanding obligations stemming from the European sustainability framework (CSRD, ESRS) and growing climate and transition risks in energy-intensive and manufacturing sectors [5,15], it is therefore necessary to systematically trace how ESG risks are translated into accounting figures and how these translations feed into company valuation.

4.1. Methodological framework

Our analytical approach is based on combining three complementary methodological perspectives. First, desk-research is applied based on relevant international accounting standards (IAS 37, IAS 36, IFRS 9), the European sustainability regulatory framework (CSRD; ESRS) and empirical industry reports that document the materialization of ESG risks in the company's financial statements. Second, a comparative analysis of cases is used, with a focus on sectors where environmental, social and regulatory risks have generated measurable financial effects, which is in line with the recommendations of modern scientific findings on the valuation of ESG factors [2,14]. Third, in order to illustrate the impact of ESG risk on company valuation, DCF sensitivity analysis is applied, which quantifies the relationship between changes in risk, cost of capital and estimated company value. The methodological framework composed in this way enables an integrated observation of the accounting and economic effects of ESG risks, which contributes to the understanding of their materiality in the process of corporate reporting and investment decision-making and valuation.

4.2. Analytical model of ESG risk accounting mapping

ESG risks are financially recognized once their economic consequences translate into measurable accounting effects, which, according to international standards, result in the recognition of provisions, impairments, changes in fair value estimates or increases in the cost of capital [1,5]. For the sake of a more systematic presentation of these relationships, an analytical table was created that connects the types of ESG risks with their accounting and economic consequences.

Table 1. Analytical mapping of ESG risk into accounting and valuation effects.

Type of ESG Risk	Financial Effect	Accounting Treatment (IAS/IFRS)	Consequences in Financial Statements	Impact on Enterprise Valuation
Climate transition risk (carbon taxes, EU ETS regulations, phase-outs)	Increased compliance costs; higher operating expenses; CAPEX for green technologies	IAS 37 – Provisions; IAS 16 – Increased CAPEX; IAS 36 – Impairment of carbon-intensive assets	Lower EBITDA; higher long-term liabilities; reduced carrying amount of assets	Lower free cash flows → reduced valuation; higher WACC
Physical climate risk (floods, droughts, extreme weather events)	Asset losses; business interruption; remediation costs	IAS 36 – Impairment; IFRS 5 – Asset reclassification	Impairment of PP&E; higher period expenses	Lower terminal growth; increased risk premium
Regulatory ESG risk (CSRD, ESRS, EU Taxonomy)	Administrative and compliance costs; process adjustments; external assurance	IAS 1 – Disclosures; IFRS 7 – Risk and uncertainty reporting	Higher reporting costs; increased non-financial obligations	Moderate decrease in valuation due to rising costs and risk
Reputational risk (ethical breaches, pollution events, corporate scandals)	Decline in sales; loss of market share; compensation and legal settlement costs	IAS 37 – Provisions; IAS 38 – Goodwill impairment	Reduced intangible assets; higher profit volatility	Lower valuation multiples (P/E, EV/EBITDA); higher discount rates
Social risks (workplace safety, labor disputes, community impacts)	Work stoppages; increased labor costs; legal obligations	IAS 19 – Employee benefit obligations; IAS 37 – Legal provisions	Higher short-term and long-term liabilities	Lower net profit margins; higher operational risk
Governance risks (G-risk) (corruption, weak controls, transparency failures)	Fines, penalties, loss of investor confidence	IAS 37 – Penalties; IFRS 9 – Increased credit risk	Higher provisions; increased financing costs	Higher beta; increased WACC; reduced firm value

The analytical model demonstrates that ESG risks are realized through several accounting recognition pathways, affecting the balance sheet structure, performance indicators and the valuation of the firm. A clear illustration of this mechanism can be found in IAS 37, where decommissioning or environmental remediation obligations arising from regulatory or environmental risks must be recognized as provisions, directly increasing liabilities and reducing earnings in the period of recognition. Climate transition risks — including rising EU ETS prices, carbon taxes and stricter taxonomic compliance requirements — represent one of the most common sources of financial pressure. Their accounting manifestation is visible through increased provisions and the growth of investment expenditures for technological transformations, which according to IAS 37 and IAS 16 directly affects future costs, capital structure and profitability [1,5]. Such risks generate a reduction in operating margins, which is confirmed by empirical findings in the energy and transport sectors, where the costs of compliance with EU climate policies have increased by up to 40% in the period 2018–2023 [15].

Climatic physical risks, such as floods, droughts or extreme temperatures, often result in asset impairments due to plant losses or unusability. In accordance with IAS 36, this results in a significant impairment loss, which reduces the book value and affects the reduction of future cash flows. Empirical experience of energy companies (eg BP, Shell) shows that impairment losses associated with climate risks reached tens of billions of USD in some years, which directly reduced the value of capital and increased the risk for investors.

Reputational risks, often arising from environmental incidents or socially irresponsible practices, have extremely volatile and rapid effects. Accounting-wise, they most often lead to provisions for litigation and compensation, as well as impairment loss of goodwill, especially in industries based on brand and consumer trust (IAS 37; IAS 38). The example of Volkswagen ("Dieselgate") shows that a reputational ESG risk can generate extreme financial consequences: multi-billion EUR provisions, a fall in market capitalization of over 30% and long-term growth in financing costs [13].

Regulatory and governance risks increase uncertainty, compliance costs and potential penalties, which reduce net profitability and increase the risk premium. These risks affect disclosures (IFRS 7; IAS 1) and increase operational and reputational risks. The literature indicates that companies with weaker ESG management structures achieve statistically significantly higher capital costs and have a higher probability of financial irregularities [14].

The key value of the presented model is that it connects non-financial risks with specific accounting mechanisms and financial implications. This confirms that ESG risks are not an abstract category, but a concrete economic factor that affects the value of a company by reducing free cash flows, increasing risk and correcting the book value of assets. This is particularly important for investors, as it is shown that markets do not react to ESG narratives, but to materialized and quantified financial effects, which further justifies the need for risk assessment models that are integrated into the accounting system [2].

4.3. Desk analysis of sectoral cases and selection of a representative example

Empirical research shows that ESG risks materialize in different sectors and forms: energy companies like BP and Shell have recorded multi-billion impairment losses due to climate transition risks and long-term carbon price revisions (BP [16]; Shell [17]); food companies like Danone have faced increased compliance costs and declining profitability due to regulatory and social risks associated with sustainable supply chains [18]; while logistics and airline companies recorded a significant increase in emission costs and compliance risks due to the accelerated strengthening of European climate regulation [15]. These cases show that ESG risks materialize through impairment losses, provisions, increased operating costs and changes in the cost of capital.

However, among all the documented examples, the case of Volkswagen AG ("Dieselgate") represents the most complete and explicit form of ESG risk materialization, as it combines regulatory, reputational and financial consequences in a short period of time, with clearly documented accounting effects.While several companies across the energy, automotive and consumer goods sectors exhibit notable ESG-related accounting effects, Volkswagen represents the most analytically suitable case because the Dieselgate episode produced a single, clearly identifiable event with immediate and quantifiable accounting consequences, allowing for a consistent tracing of the risk-to-accounting pathway.

4.3.1. Representative case: Volkswagen AG

Reputational ESG risks are among the most frequent and fastest materialized risks in modern business, because they directly affect sales, market share and access to capital. The 2015 case of Volkswagen AG ("Dieselgate") is a paradigmatic example that caused huge financial consequences, including a drop in market capitalization of more than 30% and total costs of fines, settlements and damages exceeding EUR 30 billion [19]. In its 2015 Annual Report, the Group recognized EUR 16.2 billion in provisions related to legal risks, product recalls and technical measures, recorded under IAS 37, which immediately reduced profit and equity, and represented one of the largest single-year ESG-related accounting adjustments in the automotive industry.

From an accounting point of view, Volkswagen was forced to recognize extensive provisions according to IAS 37, which in some years exceeded EUR 18 billion, which significantly reduced profits and increased short-term and long-term liabilities Volkswagen AG, [20]. In parallel, the company conducted impairment losses on intangible assets, including the brand and licenses associated with diesel technology, in accordance with IAS 36 and IAS 38. These costs directly affected the balance sheet and income statement, but also reduced expected future cash flows, which was reflected in the company's valuation.

Empirical literature confirms that reputational shocks of this magnitude lead to an increase in the cost of capital (WACC), an increase in market volatility and a decrease in valuation multipliers [14,4]. Therefore, the case of Volkswagen represents an optimal empirical example of how a non-financial ESG risk is transformed into a financial material event with long-term economic consequences.

4.4. Valuation mini-simulation: the impact of ESG risk on DCF valuation

Theoretical valuation models clearly indicate that the valuation of a company depends on the expected free cash flows and the discount rate that reflects the risk of the business. ESG risks affect both elements: they increase the cost of capital due to higher regulatory, operational and reputational risk, and simultaneously reduce expected future cash flows through provisions, CAPEX adjustments, declining profitability and asset impairment [4,13]. In line with contemporary empirical findings, companies with high exposures to climate and reputational risks experience an increase in WACC ranging from 30 to 150 basis points and a decrease in terminal growth due to lower expectations of long-term profit sustainability [21,2].

Table 2 illustrates this mechanism. A mini-simulation of the sensitivity of the DCF model was carried out, in which Scenario A refers to business without materialized ESG risks, while Scenario B includes increased capital costs, lower operating margins and slower cash flow growth. The results are shown in Table 2. The simulation is based on standard DCF assumptions, including a constant WACC over the forecast horizon, linear FCFF growth, and a stable operating structure after Year 5. These assumptions allow the comparison of scenarios to reflect only the incremental effect of ESG-related shocks. All numerical values are illustrative and do not represent an empirical valuation of any specific firm; their purpose is to isolate the directional impact of ESG risks on discounted cash flow outcomes.

Table 2. Illustrative DCF simulation of the impact of ESG risks on company valuation.

Parameter	Scenario A (without ESG risk)	Scenario B (with ESG risk)	Change
WACC	7.0%	8.2%	+1.2 p.p.
Operating margin (EBIT margin)	12%	9%	–3 p.p.
Annual FCFF growth rate	3.0%	1.5%	–1.5 p.p.
FCFF in Year 5 (indexed)	100	84	–16%
Terminal value	100%	72%	–28%
Estimated firm value	1.00	0.74	–26%

The simulation shows that a relatively moderate increase in the discount rate (WACC +1.2 p.p.) and a drop in profitability (–3 p.p. EBIT margin) can lead to an almost 30% lower valuation of the company. In this way, the conclusions of European climate stress-tests are confirmed: companies exposed to transition risks may experience a decline in value even before physical risks materialize (ECB, 2022). In practice, it is the terminal value that appears as the most sensitive component of the valuation, as investors adjust their long-term growth expectations due to increased regulatory uncertainty and possible limitations of the business model.

The simulation results also confirm the findings from financial empirics: markets penalize high ESG risks through an increase in the beta coefficient, an increase in equity risk and a correction of the valuation multiplier [4]. This effect is particularly pronounced in industries with high regulatory pressures — energy, the automotive industry and logistics — where the costs of complying with EU climate policies are already a significant factor influencing profitability and investment decisions.

4.5. Synthesis of findings and implications for accounting and valuation

The integration of findings from analytical models, sector cases and valuation simulations confirms that ESG risks represent material economic and accounting events with immediate implications for balance sheets and company valuations. The common feature of all analyzed cases is that non-financial risks are transformed into financially significant consequences through three dominant mechanisms: (1) provisions and legal obligations in accordance with IAS 37, (2) impairment of the value of assets due to changes in expected economic benefits (IAS 36), and (3) increase in capital costs due to higher perceived risk and regulatory pressures [4],[21]. Together, these mechanisms affect the reduction of operating margins, the reduction of future cash flows and the decline of the terminal value, which is clearly seen in the performed DCF simulation.For management, this underscores the importance of early identification and internal quantification of ESG-related exposures, since delayed recognition of provisions, impairments or compliance obligations can amplify financial volatility and reduce the credibility of reported performance.

The sectoral analysis shows that transitional climate risks are particularly pronounced in energy and heavy industry, while reputational risks are most visible in the automotive and food industries. However, regardless of the sector, the accounting treatment of ESG risks in accordance with international standards leads to a decrease in net assets and an increase in liabilities, which affects the financial stability and credit rating of the company. The literature confirms that markets react more strongly to materialized financial effects (provisions, impairment, decline in CF) than to

declarative ESG indicators, which makes ESG risks a key factor that investors take into account in valuation [2,13].

From the perspective of management structures and accounting policy, the results indicate the need for timely identification and quantification of ESG risks, as late recognition of provisions or impairments can lead to incorrect reporting and subsequent corrections that further damage the reputation and value of the company. In the context of the European regulatory framework (CSRD; ESRS), the integration of ESG risks into accounting processes becomes a mandatory element of corporate reporting, with direct implications for strategy, investment decisions and access to capital. This confirms that ESG risks are not only sustainability-related factors, but fundamental determinants of economic sustainability, which justifies the need for further development of models for their accounting mapping and integration into valuation processes.From a regulatory perspective, the findings also align with the ongoing efforts of EFRAG and the IASB to enhance the visibility of sustainability-related risks in financial reporting, suggesting that future standard-setting may further formalize the connection between ESG risk assessment and accounting recognition.Future research could extend this framework by empirically testing sector-specific thresholds at which ESG risks become financially significant, or by integrating scenario-based climate metrics into accounting recognition models.

5. Discussion and Implications

Building on the analytical and empirical results from the previous chapter, this section synthesizes the broader significance of the findings and outlines their implications for accounting practice, corporate governance, regulatory policy and investment decision-making.

5.1. Discussion of Findings

The findings of this study demonstrate that ESG risks become financially material once they produce measurable accounting effects that alter asset values, liabilities, profitability and cash flows. The analytical model presented in the previous part of this research shows that ESG risks are spread through identified recognition mechanisms – primarily provisions, impairment losses, compliance costs, and adjustments to capital and operating expenditures. The case analysis confirms that firms across diverse industries experience similar pathways of ESG risk materialization, although the magnitude and speed of these effects depend on business model characteristics, technological exposure and sector-specific regulation. The Volkswagen case provides a clear example of how reputational and regulatory failures can generate substantial accounting consequences through provisions under IAS 37 and impairments under IAS 36, consistent with earlier empirical evidence on ESG controversies [3].

These mechanisms reveal that ESG risks are not peripheral disclosures or narrative elements within sustainability reporting. Instead, they function as core accounting risks once they satisfy the probability and measurability thresholds defined by IFRS. When a sustainability-related obligation becomes probable and can be reliably estimated, IAS 37 requires its recognition as a liability. Likewise, reductions in recoverable amounts resulting from regulatory sanctions, reputational damage or technological obsolescence trigger impairment testing under IAS 36. In transition-intensive sectors, increased capital expenditures and revisions of asset useful lives fall under the scope of IAS 16. These findings demonstrate that ESG factors exert a direct and material

influence on key financial statements, supporting arguments that sustainability-related risks must be integrated into mainstream accounting processes [22].

More broadly, the findings align with established empirical research. Prior studies show that ESG controversies elevate firm-specific risk, increase cost-of-capital premiums and heighten market volatility [4]. Capital markets also react negatively to sustainability failures due to downward revisions in expected cash flows and upward adjustments in discount rates [23,3]. The contribution of this study lies in detailing the specific accounting channels through which ESG risks affect financial reporting—an aspect often underexplored in ESG-finance literature. While much of the prior research focuses on market-based reactions, this study links ESG events to provisions, impairments, cost structures and internal performance indicators, thereby connecting sustainability materiality with financial reporting materiality.

The theoretical implications are significant. The results support the conceptualization of ESG risks as accounting risks embedded within the established IAS/IFRS measurement framework. This suggests that sustainability considerations should not be treated as a parallel reporting layer but as part of the fundamental valuation logic governing financial reporting. ESG materiality can thus be operationalized through traditional accounting constructs such as probability assessment, estimability, recoverable value and fair presentation. This perspective aligns with a growing body of research arguing for the integration of sustainability risks into valuation and corporate finance models, given their impact on cash flow expectations and discount rates [2]. The findings also intersect with emerging concepts in regulatory theory, particularly financial materiality and double materiality, which shape recognition, measurement and disclosure requirements under the CSRD and ESRS frameworks. Taken together, the results show that ESG risks exert a dual influence:

(1) they reshape current-period financial statements through accounting recognition mechanisms; and

(2) they affect future valuations through adjustments in expected cash flows, growth assumptions and cost of capital.

These conclusions form the basis for the practical, regulatory and methodological implications discussed below.

5.2. Implications

The findings have several important implications for corporate management, financial reporting practice, regulatory development and investment processes.

From a managerial perspective, the results underscore the need for timely identification and quantification of ESG risks within enterprise risk management systems. Delayed recognition of provisions, liabilities or impairments—typical of severe reputational or regulatory failures—can produce significant earnings volatility and disrupt capital allocation [3]. Incorporating ESG risk assessment into planning, budgeting and internal reporting can mitigate abrupt financial shocks and contribute to more stable business performance.

The implications for financial reporting are particularly strong. ESG risks materialize through specific accounting mechanisms embedded in IAS/IFRS, including provisions (IAS 37), impairments (IAS 36), revisions of useful lives and capital expenditures (IAS 16), employee-related obligations (IAS 19) and risk adjustments under IFRS 7/9. These findings highlight the need for stronger internal controls, more rigorous estimation processes and enhanced disclosure quality. Prior research confirms that transparent sustainability reporting reduces information asymmetry and improves

firms' access to capital [22,4]. The study contributes practical value by offering a structured analytical model that firms can use to map ESG risks into accounting and valuation outcomes.

Regulatory implications closely align with ongoing developments in the European reporting landscape. The CSRD and ESRS frameworks require firms to quantify and disclose the financial impacts of ESG risks, while the IFRS S1 and S2 standards promote global alignment between financial and sustainability reporting. The results suggest that regulatory evolution may move toward deeper integration of sustainability assessments into recognition and measurement criteria, consistent with ongoing EFRAG and IASB initiatives [2].

From an investor perspective, the implications arise directly from the valuation dynamics identified in this study. ESG-related shocks influence profitability, cash flows, terminal growth and discount rates, thereby reshaping both short-term performance expectations and long-term value projections. Empirical evidence consistently shows that higher exposure to ESG risks leads to an increased cost of capital and lower firm valuations [2,23].Analysts and investors should therefore incorporate explicit ESG risk adjustments into discounted cash flow models and multiplier-based valuation approaches, particularly in sectors subject to significant regulatory or environmental uncertainty.

This research has certain limitations. The use of a single illustrative case limits generalizability across industries; the valuation simulation is conceptual rather than calibrated; and reliance on secondary data constrains broader empirical validation. These limitations nevertheless highlight promising avenues for future work.

Potential directions for further research include empirical testing of ESG materiality thresholds across industries, development of ESG-related accounting risk indices, integration of climate scenarios into impairment models and comparative analyses of European and non-European reporting regimes. Such research would enhance understanding of how sustainability considerations are operationalized within financial reporting and valuation.

6. Conclusions

The research presented in this paper demonstrates that ESG risks, although originating as non-financial exposures, become financially material once their effects are transformed into accounting measures—through provisions, impairments, compliance costs and adjustments in the cost of capital. The analytical model, sectoral comparisons and the representative Volkswagen case collectively confirm that the process of ESG risk materialization follows a recognizable and repeatable pattern across industries: non-financial shocks cross the threshold of accounting recognition and reshape the firm's balance sheet, performance indicators and valuation. In doing so, the study addresses the central research question by showing that ESG risks enter the financial domain through standardized IFRS mechanisms rather than through narrative sustainability disclosures.

The theoretical foundation of the analysis highlights that ESG risks are embedded within contemporary regulatory concepts of financial and double materiality, which increasingly structure corporate reporting obligations and risk management practices. The empirical–conceptual findings further show that existing accounting standards—ranging from IAS 37 and IAS 36 to IFRS 9 and the emerging IFRS S1/S2—already provide a coherent architecture for translating sustainability-related events into financial outcomes. Accordingly, the paper contributes to the literature by demonstrating that the integration of sustainability does not require a new accounting paradigm but a more

consistent and forward-looking application of established recognition, measurement and disclosure principles.

A key contribution of this study lies in linking the accounting mechanisms of ESG risk materialization with the dynamics of firm valuation. The mini DCF simulation illustrates that even moderate adjustments in risk, profitability or discount rates can lead to substantial reductions in estimated firm value, reinforcing empirical findings on the valuation sensitivity to ESG exposures. This perspective offers practical insights for companies, investors and regulators seeking to understand the financial logic through which sustainability considerations influence corporate decision-making.

Despite its contributions, the study has certain limitations. The analysis is based on a single representative case, which may restrict the generalizability of conclusions to industries with different risk structures. The valuation simulation is illustrative rather than empirically calibrated, and the reliance on secondary data limits the scope for quantitative validation. These limitations nonetheless open avenues for further research.

Future research may empirically examine sector-specific ESG materiality thresholds, develop composite accounting risk indices incorporating ESG factors, integrate climate scenarios into impairment testing models or compare the evolution of regulatory frameworks across European and non-European markets. Such studies could advance understanding of how sustainability considerations are operationalized within accounting, finance and valuation practices.

More broadly, the findings suggest that ESG risks are emerging as fundamental determinants of corporate financial resilience and long-term sustainability. Their timely identification and quantification are not merely regulatory requirements but essential components of competitive strategy and responsible resource management. In this sense, ESG risks have moved beyond their role as supplements to traditional financial analysis and have become structural elements shaping corporate strategy, performance trajectories and future firm value.

Conflicts of Interest: The authors declare no conflict of interest.

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