

**ACCOUNTING AND ANALYTICAL SUPPORT FOR ENVIRONMENTAL RISK
MANAGEMENT IN THE SYSTEM OF STRENGTHENING INVESTMENT
ATTRACTIVENESS AND ESG STRATEGY OF THE ENTERPRISE**

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Abstract. The article examines the theoretical and methodological foundations for the formation of accounting and analytical support for environmental risk management in the context of implementing an enterprise's ESG strategy. The author proposes an algorithm for identifying and classifying environmental risks into physical and transition risks. Particular attention is paid to the methodology for discounting future environmental costs and the procedure for forming appropriate provisions (reserves) in accordance with the requirements of IAS 37 and ESRS standards. It has been proven that transparent disclosure of environmental liabilities in financial statements eliminates information asymmetry, contributes to a reduction in the risk premium, and directly increases the investment attractiveness of economic entities in the context of the global energy transition.

Keywords: environmental risks, ESG strategy, accounting, analytical support, investment attractiveness, discounting, non-financial reporting.

JEL Classification: M41, Q56, G32

Introduction

The modern architecture of the global economy is undergoing fundamental transformations, where the financial performance of a company is no longer the only measure of its success. The introduction of the ESG (Environmental, Social, Governance) concept has transformed environmental responsibility from an element of corporate image to a critical factor in financial stability. In 2026, when European regulators (in particular through the CBAM mechanism and the CSRD directive) are tightening requirements for non-financial reporting, a company's ability to identify, assess, and account for environmental risks is becoming a key indicator for international investors.

Ukrainian enterprises, integrating into the European economic space, face a challenge: the lack of comprehensive accounting and analytical support does not allow for a full reflection of the environmental component in the structure of business costs. This creates an information vacuum, which increases risks for investors and reduces the competitiveness of domestic capital. The transformation of environmental risks from a category of accompanying factors to the status of dominant financial threats is due to the synergy of three fundamental factors that determine the current landscape of corporate governance. First, global climate change has moved from the realm of theoretical predictions to that of direct material losses. Physical risks associated with extreme natural phenomena cause the destruction of non-current assets, destabilization of supply chains, and a sharp increase in insurance costs. In accounting terms, this requires businesses to review their approaches to assessing the usefulness of assets (in accordance with IAS 36) and to refine the liquidation value of assets that are subject to climate impact. Second, the introduction of the Carbon Border Adjustment Mechanism (CBAM) is radically changing the architecture of international trade. The environmental

component is becoming an integral part of calculating the cost of export products. For domestic companies focused on EU markets, the carbon footprint of products is turning into a real tax liability. The lack of proper analytical support for greenhouse gas emissions accounting leads to increased fiscal pressure and loss of price competitiveness, which directly affects profitability and investment attractiveness. Third, there is increasing pressure from key stakeholders and a shift in the investment paradigm. When making capital allocation decisions, modern institutional investors prioritize companies with a high level of environmental responsibility. The availability of verified non-financial reporting becomes a passport to green finance markets, which offer a lower cost of capital (WACC). Conversely, ignoring environmental risks is perceived by the market as a sign of poor corporate governance, leading to an increase in risk premiums and a decline in market capitalization. Thus, environmental risks have lost their “secondary” status and have become critically important from a financial perspective. This necessitates the creation of a new accounting and analytical framework that would not only record environmental facts but also serve as an effective tool for strategic management within the framework of ESG business transformation.

Basic Content of the Paper

The issue of sustainable development and its reflection in reporting has been studied by foreign scholars such as Mengdi Zhang, Qiao Shen, Zhiheng Zhao, Shuaian Wang, George Q. Huang, Sheela Sundarasan, Rajespari Kumar, Krishna Tanaraj, Ahnaf Ali Alsmady, Usha Rajagopalan, Yanqi Sun, Anna Agapova, Tatiana King, Mikko Ranta, and others. Among domestic researchers, it is worth noting Oksana Oliinyk, Iryna Polishchuk, Hanna Golovchak, Inna Shostak, Galina Plisenko, Oksana Oliinyk, Dmytro Zakharov, and others. At the same time, despite a significant number of studies, the mechanisms of direct connection between the accounting reflection of environmental reserves and the dynamics of investment ratings remain insufficiently covered.

The purpose of the article is to justify conceptual approaches to the formation of an accounting and analytical support system for environmental risk management, which will contribute to the implementation of the ESG strategy and increase the investment attractiveness of the enterprise.

In general, the current stage of accounting development is characterized by a transition from fragmented environmental reports to a standardized system of information disclosure. The key guidelines for building analytical support at an enterprise are:

1. IFRS S1 “General requirements for disclosure of financial information related to sustainable development.” This standard is the “constitution” of non-financial reporting. According to its provisions, an entity must disclose information about all risks and opportunities related to sustainable development that may affect its cash flows, access to financing, or cost of capital in the short, medium, and long term. According to this standard, environmental risk is a financial category. Therefore, accounting should not simply record expenses, but also predict the impact of environmental factors on the future viability of the business.

2. IFRS S2 “Climate-related disclosures.” This is the first thematic standard entirely devoted to environmental issues. According to it, physical risks (natural disasters) and transitional risks (changes in policy, technology, markets) must be detailed, and disclosure of the “carbon footprint” is mandatory. IFRS S2 provides a methodological basis for risk classification that entities can use in their accounting policies.

3. ESRS (European Sustainability Reporting Standards). These are European standards introduced by the CSRD Directive. They are stricter than the international IFRS. According to their provisions, a company must account not only for how the environment affects its profits (financial materiality), but also for how the company affects the environment (environmental materiality). As Ukraine pursues European integration, the implementation of ESRS becomes a mandatory benchmark for building analytical support for the management of environmental risks of domestic companies.

The process of Ukraine's European integration in 2025–2026 led to a transition from voluntary disclosure of environmental information to mandatory and standardized reporting [5]. The current state of environmental regulation in Ukraine is characterized by the implementation of key European directives into national law. A fundamental step was the adaptation of the provisions of the CSRD (Corporate Sustainability Reporting Directive). Due to the update of the Law of Ukraine “On

Accounting and Financial Reporting” in 2025, the circle of entities required to prepare a Management Report with a mandatory section on sustainable development was expanded [18]. Today, this obligation applies not only to companies of public interest, but also to all large companies that meet EU criteria. As of early 2026, the European Sustainability Reporting Standards (ESRS) have become the main methodological guideline for domestic companies. In particular, the environmental standards (ESRS E1–E5) are used as the basis for building analytical support for accounting: ESRS E1 “Climate Change” — defines requirements for disclosure of energy consumption and carbon footprint; ESRS E2–E5 — regulate reporting on pollution, water resources, biodiversity, and the circular economy.

An important factor ensuring the reliability of accounting data was the introduction in 2025 of Law No. 3855-IX “On Integrated Prevention and Control of Industrial Pollution” [19]. It introduced the concept of Best Available Technologies and Management Methods, which directly correlates with the qualitative indicators of a company's ESG strategy. The data generated within the framework of integrated permits is the primary basis for the formation of environmental reserves in accounting. Thanks to the functioning of the state platform “EcoSystem,” the accounting of environmental risks has received digital verification. The integration of the national MVR (monitoring, reporting, and verification) system with the requirements of the European CBAM mechanism has created conditions under which environmental reporting is subject to mandatory external confirmation (audit), which minimizes the risks of greenwashing and increases investor confidence [9].

Thus, Ukraine has established the necessary regulatory framework, which requires companies not only to record environmental data, but also to build a comprehensive accounting and analytical support system. This allows domestic economic entities to be transparent to international stakeholders and ensure a high level of investment attractiveness in the context of the global energy transition.

The effectiveness of environmental risk management directly depends on the quality of their identification and subsequent classification for accounting purposes. According to the recommendations of the International Sustainability Standards Board (ISSB), environmental risks that affect the financial condition of an enterprise should be divided into two large groups: physical risks and transition risks.

Physical risks are associated with the direct impact of climatic and natural phenomena on the material and technical base of the enterprise. In the accounting system, they are classified according to the nature of their occurrence:

- acute risks: caused by extreme events (floods, hurricanes, fires). In accounting, they are identified as events that lead to sudden loss of assets, requiring immediate write-off or recognition of losses from damage to assets.

- chronic risks: caused by long-term climate change (sea level rise, prolonged droughts, changing temperature patterns). These risks have a gradual impact and are reflected in: accelerated depreciation (revision of useful life); changes in the liquidation value of assets; infrastructure adaptation costs.

Transition risks arise in the process of adapting a business to a low-carbon economy. They do not physically destroy assets, but can radically change their economic value. This group of risks includes:

- regulatory and legislative risks: the introduction of new environmental taxes, emission quotas, or the CBAM mechanism. This creates new types of current liabilities and increases the costs of the reporting period;

- technological risks: obsolescence of existing equipment due to the emergence of more environmentally friendly alternatives. This requires impairment testing of non-current assets (IAS 36);

- market and reputational risks: changes in consumer preferences or investors' refusal to finance “dirty” industries, leading to a decline in revenues and an increase in the cost of capital.

The transformation of environmental risk into an accounting category occurs provided that it complies with the principle of prudence. According to IAS 37 “Provisions, Contingent Liabilities and Contingent Assets,” risk becomes subject to accounting (provisioning) if three criteria are met:

- 1) existence of a present obligation: the entity has a legal or constructive (voluntarily accepted through a published ESG strategy) obligation as a result of past events;

2) probability of resource outflow: an assessment that the probability of costs to cover environmental consequences exceeds 50%;

3) possibility of reliable assessment: the amount of future expenses can be calculated based on expert opinions, engineering calculations, or market prices for environmental technologies. If the risk is probable but its amount cannot be reliably estimated, it is not recognized in the balance sheet but must be disclosed in the notes to the financial statements as a contingent liability. This is critically important for providing analytical support to investors, as it allows them to independently assess the potential pressure on the company's capital. Table 1 shows how identified risks are transformed into accounting objects, providing an information base for managing investment attractiveness.

Table 1. Matrix of environmental risks' impact on the items of an enterprise's financial statements

Risk category	Specific risk factor	Impact on balance sheet items (statement of financial position)	Impact on income statement	Accounting effect (example)
Physical (acute)	Natural disasters (floods, fires)	Fixed assets, Inventories (decrease in value due to destruction or loss)	Other expenses (recognition of losses from extraordinary events)	Write-off of assets or accrual of losses from spoilage
Physical (chronic)	Climate change (drought, water shortages)	Non-current assets (revision of useful life and residual value)	Cost of goods sold (increase in depreciation and resource procurement costs)	Accelerated wear and tear of equipment operating in harsh conditions.
Transitional (regulatory)	Introduction of CBAM or carbon tax	Current liabilities (arising of debt to the budget for emissions)	Administrative expenses / Cost (direct reduction in net profit)	Accrual of environmental taxes based on carbon accounting data
Transitional (technological)	Transition to energy-efficient equipment	Non-current assets (impairment of obsolete technologies (IAS 36))	Other operating expenses (losses from impairment of assets)	Recognition of an asset as "dirty" or inefficient and its write-down
Transitional (market)	Investors/customers rejecting a "dirty" brand	Intangible assets (impairment of goodwill and brands)	Sales revenue (decline in sales volumes and margins)	Decline in market value of shares and capitalization
Legal risks	Lawsuits regarding environmental damage	Provisions (Reserves) (creation of reserves for compensation payments (account 47))	Other expenses (creation of a reserve for contingent liabilities)	Accrual of an estimated liability based on the principle of prudence

Source: compiled by the author

The matrix presented proves that environmental risks have a comprehensive impact on financial reporting. Using this classification within the analytical framework allows company management to:

- preventively assess the impact of ESG factors on liquidity and solvency indicators;
- demonstrate the sustainability of the business model to investors through transparent disclosure of reserves and estimated liabilities;
- develop a management strategy based on quantitative indicators of asset impairment or tax burden growth (CBAM).

The relationship between environmental reserves and investment attractiveness is particularly important. For investors, the presence of a reserve for environmental remediation in the financial statements is a sign of high-quality management, as it indicates that the company is aware of its risks and has already taken them into account in its current financial results.

The transformation of environmental risks into accounting items requires the implementation of specific assessment and provisioning procedures based on the principles of IAS 37 "Provisions, Contingent Liabilities and Contingent Assets."

Since environmental risks (e.g., land reclamation after production closure or decarbonization of assets) are often long-term in nature, their nominal value in the future does not reflect the actual current burden on capital. The following formula is used to calculate the present value (PV) of future environmental costs:

$$PV = \frac{FV}{(1 + r)^n}$$

where: FV (Future Value) — expected amount of environmental measures costs in n years (estimated by experts);

r — discount rate (usually the average market borrowing rate or the rate on government bonds adjusted for the company's risks);

n — period until the costs arise.

Reflecting the discounted value allows investors to see the actual amount of resources that the enterprise must “reserve” today to ensure its environmental sustainability in the future. The formation of an environmental reserve (provision) allows for the even distribution of future environmental costs between periods, preventing a sharp drop in profits at the time of actual payments.

The diagram shows the multi-step process of turning environmental risk into an accounting item (Fig. 1). The key feature of this algorithm is that it's tightly tied to the recognition criteria (IAS 37) [8]. The diagram clearly shows that if the “probability” (>50%) or “reliable estimate” criterion is not met, the risk is not ignored but is transformed into a contingent liability, which is disclosed in the Notes to the financial statements. This provides investors with a complete picture of the information, even if the amount of risk cannot yet be accurately calculated. The implementation of such an algorithm in an enterprise allows accounting to be transformed from a tool for recording past environmental costs into a tool for strategic management and strengthening investment attractiveness (elements of the G component in ESG).

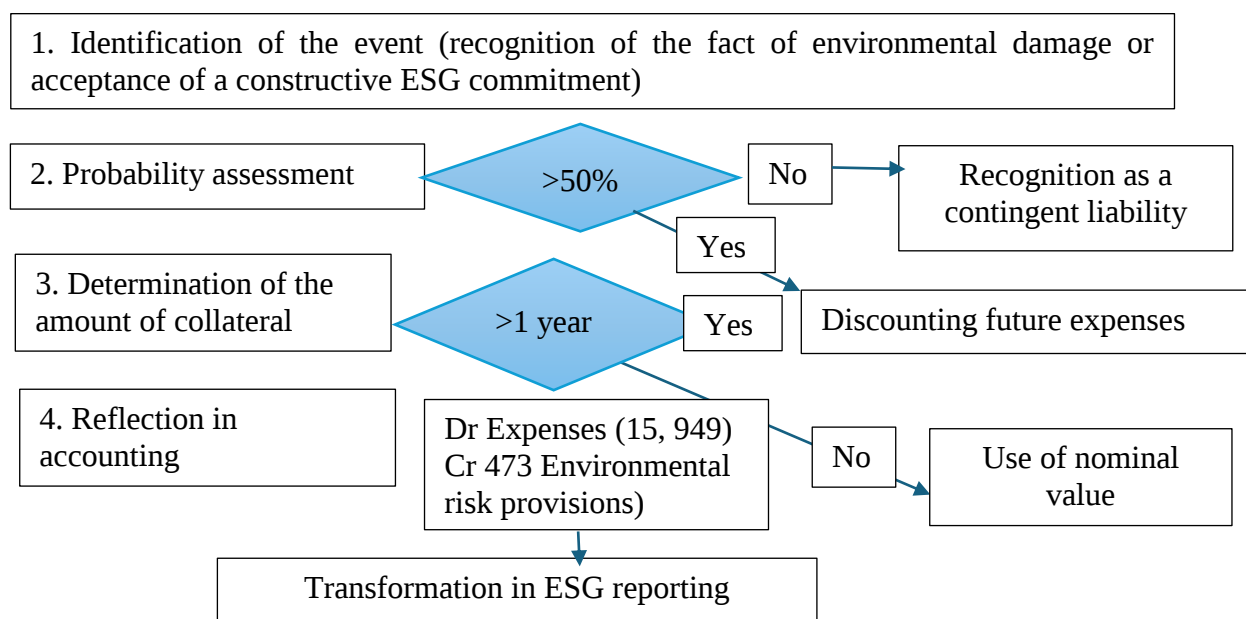


Fig. 1. Algorithm for forming environmental security (reserve) in the accounting system of an enterprise
Source: compiled by the author

Standard synthetic accounting is insufficient for the purposes of management and disclosure of information in ESG reporting. A multi-level system of analytical accounts needs to be implemented.

We propose the following analytical support structure:

Account 949 (Environmental component):

949.11 — Emission monitoring costs (carbon accounting);

949.12 — CBAM payments (export carbon adjustment);

949.13 — Environmental audit and certification costs;

Account 473 (Environmental risks):

473.1 — Reclamation reserve (long-term);

473.2 — Reserve for environmental lawsuits.

Table 2. Typical correspondence of accounts for the creation and use of an environmental reserve

No.	Content of the business transaction	Debit	Credit	Impact on ESG reporting
1	Creation of a provision for future land reclamation (when creating an asset)	15 "Capital investments"	473 "Provision for warranty obligations" (or separate subaccount)	Increases the environmental capitalization of the asset
2	Creation of a provision for current environmental risks (e.g., penalties)	949 "Other operating expenses"	473 "Environmental reserve"	Reduces current profit, showing the real risk
3	Accrual of financial expenses (unwinding of discount each year)	95 "Financial expenses"	473 "Environmental reserve"	Reflects the time value of money
4	Use of the reserve during actual environmental work	473 "Environmental reserve"	20, 63, 66, etc.	Shows fulfillment of environmental obligations

Source: compiled by the author

This level of detail allows analysts and investors to see not just "overall costs," but the structure of a company's environmental investments and risks. This ensures the transparency of the ESG strategy, confirming that every environmental risk has been identified, assessed, and provided with the appropriate financial resources.

Effective environmental risk management achieves its goal only when internal accounting information undergoes a transformation process and becomes available to external stakeholders in the form of standardized ESG reporting. The accounting and analytical information generated within the proposed algorithm is subject to comprehensive transformation to ensure its relevance to strategic investor groups. Unlike the initial recording of business transactions in accounting accounts, the reporting process involves aggregating data in two functional areas, which together create a complete picture of the company's environmental profile:

1. Financial disclosure. This area ensures verified reflection of the cost estimate of environmental provisions in the Statement of Financial Position (Balance Sheet) and corresponding expenses in the Statement of Financial Results. This allows potential and actual investors to make an objective assessment of the "value of environmental responsibility" of a business entity by integrating future environmental obligations into current business capitalization valuation models.

2. Non-financial disclosure. This serves as a contextual supplement to quantitative financial indicators, providing a detailed description of the strategy for minimizing identified risks. This approach allows stakeholders to assess the effectiveness of the corporate governance system and the level of adaptability of the business model to the conditions of the energy transition. High-quality non-financial disclosure neutralizes the effect of "information asymmetry," confirming that the digital indicators reflected in the accounting are the result of the conscious implementation of the ESG strategy, rather than random fluctuations in the external environment.

To demonstrate its readiness for environmental challenges, a company should use a system of key performance indicators (KPIs) based on accounting data. These can be divided into two groups, each of which may have its own set of key indicators. For example:

1) Quantitative indicators:

- Carbon intensity - the ratio of CO₂ emissions to net income. Shows the effectiveness of environmental investments.

- Reserve ratio - the share of environmental reserves in the overall structure of liabilities.

Indicates the level of risk recognition;

- return on investment in energy conservation measures.

2) Qualitative indicators:

- ISO 14001 certification to confirm the systematic nature of environmental management;

- level of compliance with CBAM criteria (assessment of readiness for cross-border regulation).

Conclusions

The study shows that in the context of global financial market transformation and stricter EU regulatory requirements (in particular, CSRD and CBAM), environmental risk accounting is no longer a secondary function but has become a strategic tool for ensuring business viability. It has

been proven that the identification of physical risks and transition risks in the accounting system is a prerequisite for the formation of relevant non-financial reporting. The implementation of the proposed algorithm allows converting environmental uncertainty into specific accounting categories — reserves, provisions, and estimated liabilities, which eliminates information asymmetry between management and investors. The proposed method of discounting future environmental costs and the system of analytical accounts ensure high accuracy in reflecting the cost of capital. This creates the basis for reducing the risk premium (WACC) through the transparency of the enterprise's ESG profile, which is a critical factor in attracting “green” investments. The integration of quantitative and qualitative KPIs into reporting allows not only to record past events, but also to model the future sustainability of the business model in the face of environmental challenges.

The developed accounting and analytical approach has high potential for extrapolation to other components of the ESG strategy. In particular, the social component (S — Social) requires a similar methodology for accounting for investments in human capital, occupational safety, and community development. Scaling the algorithm will allow the creation of a single accounting framework for sustainable development, where each social or environmental risk has its own cost estimate and source of coverage. Further scientific research should be directed towards the digitalisation of environmental accounting based on blockchain and artificial intelligence technologies, which will ensure the continuity of ESG indicator audits and their consistency for international stakeholders.

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