



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

ENVIRONMENTAL COST ACCOUNTING UNDER CONDITIONS OF SUSTAINABLE DEVELOPMENT

Fotima Xaitova

Teacher of International School of Finance
Technology and Science, Uzbekistan

ABSTRACT

The transition to sustainable development has changed the role of accounting from a narrow financial recording system into a broader information infrastructure capable of capturing the economic consequences of environmental use, degradation, and restoration. Environmental cost accounting has therefore become an essential component of modern management and policy design because it helps organizations identify, measure, classify, and allocate environmental costs that are often hidden within overheads or dispersed across production processes. International practice increasingly connects environmental accounting with environmental management accounting (EMA), material flow cost accounting (MFCA), sustainability disclosure systems, and natural capital accounting. The International Federation of Accountants defines EMA as a framework that supports professional accountants and organizations in identifying and using both physical and monetary environmental information, while ISO 14051 formalizes MFCA as a method for tracing material flows and attaching cost values to both product output and material losses. At the macro level, the United Nations' System of Environmental-Economic Accounting (SEEA) provides an internationally recognized framework for linking ecosystems, environmental assets, and economic activity. At the disclosure level, IFRS S2 requires organizations to report climate-related risks and opportunities that could affect cash flows, access to finance, and cost of capital.



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

Keywords: environmental cost accounting, sustainable development, environmental management accounting, material flow cost accounting, natural capital accounting, sustainability reporting, green transition, resource efficiency.

1. Introduction

Sustainable development has fundamentally altered the information demands placed on accounting systems. Traditional accounting was designed primarily to register transactions affecting the financial position and performance of an entity in monetary terms. While this remains central, such systems often fail to reveal the real economic cost of waste generation, inefficient resource use, pollution control, environmental restoration, emissions exposure, and ecosystem dependency. As a result, many firms appear more profitable than they actually are because environmental burdens are externalized to society, deferred to future periods, or aggregated into general overhead accounts where management cannot trace their origin. In the context of sustainable development, this informational gap is no longer acceptable because environmental pressures increasingly shape competitiveness, regulatory exposure, financing conditions, and long-term viability. IFRS S2 explicitly reflects this shift by requiring climate-related information that could reasonably be expected to affect an entity's prospects, including its cash flows, access to finance, or cost of capital.

The movement toward environmental cost accounting is therefore not merely an ethical or ecological initiative; it is an economic necessity. The IFAC guidance on Environmental Management Accounting established an important foundation by framing environmental accounting as a practical managerial tool rather than a symbolic reporting add-on. It emphasizes that organizations need both physical information on the use, flows, and destinations of energy, water, and materials, and monetary information on environment-related costs, earnings, and savings.



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

This integration is crucial because many environmental inefficiencies are first visible in physical terms but only become decision-relevant when translated into financial consequences. ISO 14051 advances this logic through material flow cost accounting, under which materials are traced in physical units and the costs associated with those flows are evaluated, allowing firms to see that waste is not merely a compliance issue but also a loss of purchased material, energy, labor, and capital.

At the macroeconomic level, the same transformation is visible in the rise of environmental-economic accounting. The SEEA framework, adopted by the United Nations Statistical Commission, links environmental assets, ecosystem services, and economic activity in a consistent statistical structure. This is significant because it extends accounting logic beyond the firm and into national development strategy. When ecosystems are degraded, the costs do not disappear; rather, they reappear as health losses, lower agricultural productivity, infrastructure damage, water stress, biodiversity decline, and rising public expenditure. In other words, sustainable development requires accounting systems that can reveal not only internal production costs but also broader economic dependencies on nature.

The practical relevance of this issue is especially acute in emerging and transition economies. Rapid industrialization, urbanization, and energy demand can generate growth, but without adequate environmental accounting they may also produce hidden liabilities. Uzbekistan offers a particularly instructive setting. According to the World Bank, the annual health damages from ambient PM2.5 pollution in Uzbekistan have reached 6.5% of GDP, while a separate assessment for Tashkent links PM2.5 pollution to health costs equivalent to 0.7% of national GDP. These figures show that environmental impacts are not abstract future concerns; they already impose macroeconomically significant costs. At the same



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

time, the country's green transition agenda is advancing. World Bank and UNDP materials show that Uzbekistan's policy framework increasingly emphasizes green growth, climate budgeting, renewable energy, and more efficient resource use.

The relevance of environmental cost accounting is also reinforced by international investment trends. The IEA reports that in 2024 clean energy investment in emerging market and developing economies outside China is expected to approach USD 320 billion, more than 50% above the 2020 level, yet still far below what is needed. The same report notes that the ratio of clean power investment to unabated fossil-fuel power investment is set to reach 10:1 in 2024. These changes imply that firms and governments increasingly operate in an environment where access to capital, technology, export markets, and policy support depends on credible sustainability-related information. Environmental cost accounting can provide the internal measurement base needed to align managerial decisions with these external financing and disclosure trends.

Another reason the topic is urgent lies in the inadequacy of conventional cost systems. Traditional costing methods often obscure environment-related expenditures by treating them as fixed overheads or compliance costs. This creates four distortions. First, pollution-intensive products may be undercosted because their waste disposal, remediation, or emissions-control expenses are pooled and not product-attributed. Second, cleaner alternatives may appear less competitive because their cost-saving environmental benefits are not properly measured. Third, capital budgeting may favor short-term returns over long-term resilience because avoided environmental losses are excluded. Fourth, management may overlook efficiency opportunities because material losses are not interpreted as lost value. MFCA directly addresses these problems by



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

assigning value to non-product output, thereby converting waste from an invisible by-product into an economically measurable inefficiency.

2. Main part

The literature on environmental cost accounting has evolved from relatively narrow discussions of pollution-related expenditures into a broad interdisciplinary field encompassing management accounting, sustainability accounting, eco-efficiency analysis, material flow analysis, and natural capital accounting. One of the foundational contributions remains the comprehensive framework proposed by Burritt, Hahn, and Schaltegger, who developed a structure linking business actors and environmental management accounting tools. Their work helped establish EMA as a field concerned not only with environmental reporting but with internal decision support across planning, control, and strategic management. Later literature continued this trajectory by emphasizing that environmental accounting should integrate monetary and physical information rather than rely exclusively on end-of-pipe compliance expenditures.

The literature also shows that environmental accounting has expanded toward natural capital accounting and ecosystem accounting. This extension responds to the recognition that firms and economies depend on stocks of natural assets and ecosystem services that are rarely recognized in standard accounts. The SEEA framework provides an internationally recognized statistical architecture for measuring ecosystem services, tracking changes in ecosystem assets, and linking those changes to economic activity. Corporate natural capital accounting studies similarly argue that environmental accounting must move from narrow emission and waste metrics toward a broader appreciation of dependencies on land, water, biodiversity, and ecological resilience. This strand of literature is particularly



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

relevant under sustainable development because it links accounting with intergenerational welfare and long-term value preservation.

A further development is the convergence between environmental accounting and sustainability disclosure frameworks. IFRS S2 requires firms to disclose climate-related risks and opportunities that can affect their prospects, including governance, strategy, risk management, and performance dimensions. This has two important implications in the literature. First, environmental costs are no longer treated as peripheral operating details; they are increasingly material to financial decision-making. Second, disclosure quality depends on internal measurement quality. A firm cannot credibly disclose transition risks, physical risks, or climate-related performance if its internal accounting system does not capture energy use, emissions-related exposures, pollution abatement costs, or low-carbon investment returns in a structured way. Thus, the literature increasingly treats environmental cost accounting as an upstream input into sustainability reporting rather than as a separate or competing practice.

Scholars have also debated the limits of monetization. One critique is that placing environmental effects into monetary terms risks oversimplifying ecological values or privileging market logic over ethical and ecological considerations. Another critique is practical: many environmental impacts are uncertain, long-term, or difficult to attribute to a single product, entity, or reporting period. Yet the literature generally does not conclude that monetization should be abandoned. Rather, it argues for plural measurement systems where monetary data are used alongside physical indicators. This is consistent with IFAC's emphasis on dual information streams and with SEEA's integration of physical and monetary accounts. The strongest literature therefore does not promote a single universal metric but a layered system of complementary measurements for internal and external decision-making.



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

The literature on emerging economies highlights additional implementation barriers. The systematic review of MFCA in developing countries reports a strong research bias toward Asian cases and identifies current accounting systems as a major obstacle to adoption. In many developing settings, environmental costs remain hidden because management accounting systems are not designed to trace material losses, environmental overheads are not separated from general costs, environmental data are fragmented across departments, and managers view environmental spending primarily as a compliance burden. This is a critical insight for policy-oriented research because it suggests that the problem is not only methodological but institutional. Training, digital systems, environmental regulation, and accounting guidance all influence whether environmental cost accounting becomes operational.

The analysis shows that environmental cost accounting under sustainable development conditions produces five major result areas: cost visibility, resource-efficiency gains, improved disclosure readiness, better public-policy alignment, and stronger strategic resilience. These results emerge from combining the international standards literature with evidence from official reports and reviews.

Table 1. Core international frameworks relevant to environmental cost accounting

Framework / Source	Main focus	Relevance for environmental cost accounting
IFAC Environmental Management Accounting	Integrates physical and monetary environmental information	Provides conceptual basis for identifying hidden environmental costs and linking them to managerial decisions
ISO 14051 MFCA	Traces material flows in physical units and values associated costs	Makes waste and non-product output financially visible
UN SEEA Ecosystem Accounting	Links ecosystems, ecosystem services, and economic activity	Extends accounting logic to natural capital and sustainable development planning
IFRS S2	Requires climate-related disclosures affecting cash flows, finance access, and cost of capital	Connects internal environmental accounting with external investor-oriented reporting



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

Source: Synthesized from IFAC, ISO, UN SEEA, and IFRS materials.

The first result concerns **cost visibility**. The literature consistently shows that many environment-related costs remain hidden in traditional accounting systems. IFAC's EMA guidance and ISO 14051 both imply that once organizations track physical flows and reclassify related monetary values, they begin to see that waste, energy overuse, and inefficient material conversion are not marginal side effects but direct economic losses. This is especially important in industries where raw materials represent a large share of total cost. When environmental costs are made visible, management can redesign processes, change input mixes, improve product design, or adjust pricing policies.

The second result area is resource-efficiency improvement. MFCA literature shows that assigning cost values to non-product output transforms waste reduction into a financially attractive strategy. The systematic review of MFCA in developing countries also concludes that MFCA has relevance beyond eco-efficiency and supports strategic decision-making, even though institutional adoption remains incomplete. In practical terms, this means environmental cost accounting can improve both sustainability and competitiveness. It allows managers to recognize that environmental performance is often inseparable from process efficiency.

The third result concerns external reporting and financial relevance. IFRS S2 demonstrates that climate-related risks and opportunities must now be disclosed where they could affect cash flows, access to finance, or cost of capital. This means internal accounting systems that fail to capture environmental costs are increasingly inadequate for external reporting obligations. Firms that cannot trace pollution control costs, carbon-related exposures, adaptation spending, or transition investments may struggle to provide credible climate-related



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

disclosures. Environmental cost accounting thus becomes a foundational capability for sustainability reporting rather than a purely internal technique. The fourth result is policy and budgeting relevance, particularly for countries pursuing green transition. The World Bank and UNDP evidence for Uzbekistan shows that environmental and climate pressures already generate macroeconomic burdens and policy responses. World Bank reporting indicates that ambient PM2.5 pollution in Uzbekistan causes annual health damages equal to 6.5% of GDP, while in Tashkent the health cost of PM2.5 pollution is estimated at 0.7% of GDP. UNDP materials show that Uzbekistan is integrating climate and green priorities into planning and budget processes, and World Bank policy dialogue materials emphasize circular economy action, climate-smart agriculture, resilient cities, and incentives for green investment. These findings imply that environmental cost accounting is relevant not only inside firms but also in public expenditure systems and national development strategies.

Table 2. Selected official indicators showing why environmental cost accounting matters

Indicator	Reported figure	Interpretation for accounting and policy
Health damage from ambient PM2.5 pollution in Uzbekistan	6.5% of GDP	Environmental externalities are macroeconomically material and justify integration into planning, budgeting, and regulation
Health cost of PM2.5 pollution in Tashkent	0.7% of GDP	Urban environmental costs are measurable and should inform city-level and firm-level cost management
Energy sector share of total GHG emissions in Uzbekistan	About 80%	Energy accounting, emissions-related costs, and transition investment analysis are central to sustainability strategy
Targeted new generation capacity by 2030 in Uzbekistan	About 16 GW, including 7 GW solar and 5 GW wind	Green transition requires better cost accounting for capital allocation and performance measurement



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

Source: Synthesized from World Bank country materials on Uzbekistan.

Table 3. Analytical comparison of traditional accounting and environmental cost accounting

Dimension	Traditional accounting approach	Environmental cost accounting approach
Waste	Often treated as overhead or disposal expense	Treated as loss of material, energy, labor, and capital value
Energy use	Recorded mainly as utility expense	Analyzed as process-specific efficiency and environmental burden
Environmental compliance	Seen as regulatory cost	Combined with prevention, restoration, risk, and resource-efficiency analysis
Product costing	Pollution-intensive products may be undercosted	Products absorb a more realistic share of environment-related costs
Strategic decisions	Short-term financial returns dominate	Long-term resilience, transition risk, and eco-efficiency are considered
Reporting	Limited to financial statements	Supports sustainability and climate-related disclosures

Source: Author’s synthesis based on IFAC, ISO 14051, and the academic literature.

Overall, the results indicate that environmental cost accounting is not simply an additional reporting layer. It changes how cost is defined, how value loss is identified, and how sustainability is translated into economically actionable information.

5. Discussion

The findings of this study confirm that environmental cost accounting is a structural necessity in economies and enterprises operating under sustainable development conditions. The discussion can be organized around three



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

interrelated arguments: the economic rationality of environmental cost recognition, the institutional conditions of implementation, and the strategic implications for countries such as Uzbekistan.

First, the evidence strongly supports the economic rationality of environmental cost accounting. A persistent misconception in managerial practice is that environmental accounting is mainly a social-responsibility exercise with limited relevance to competitiveness. The reviewed standards and literature contradict this view. IFAC and ISO-based approaches show that many environmental costs are in fact production inefficiencies that reduce profitability. Once waste is interpreted as non-product output carrying purchase value, process cost, and disposal burden, it becomes clear that better environmental performance can coincide with lower costs. This insight helps explain why MFCA has gained traction as a resource-efficiency tool: it does not require managers to choose between ecology and profitability; rather, it reveals that the two are often linked. Second, the study highlights the importance of institutional conditions. Environmental cost accounting cannot function effectively if accounting systems remain fragmented, environmental data are isolated from financial data, or organizations lack technical capacity. The systematic review of MFCA in developing countries identifies current accounting systems as one of the key barriers to adoption. This means implementation is not only a matter of managerial willingness but also of organizational design. Firms need chart-of-account revisions, process-level data collection, cross-departmental coordination, digital tracking tools, and personnel able to interpret both environmental and accounting information. The same applies in the public sector, where green budgeting and climate expenditure tagging require coherent classification systems and policy-accounting linkages.



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

Third, the Uzbekistan-related evidence gives the discussion a particularly concrete policy dimension. When ambient air pollution damage reaches 6.5% of GDP, environmental costs are not merely firm-level concerns; they become matters of national economic efficiency and welfare. In such circumstances, the absence of environmental cost accounting creates a double invisibility problem. At the enterprise level, firms may fail to recognize the real cost of pollution, waste, and resource depletion. At the policy level, governments may understate the economic returns from prevention, cleaner technology, and green infrastructure. This is why the integration of green priorities into planning and budgeting, as reported by UNDP, is significant. It points toward a broader transition from reactive environmental spending to proactive environmental cost management.

The discussion also suggests that environmental cost accounting should be understood as a bridge between micro-accounting and macro-sustainability governance. At the micro level, firms need detailed cost information for pricing, investment, process redesign, and reporting. At the macro level, policymakers need aggregated and comparable information about environmental degradation, resource depletion, and the costs of transition. The SEEA framework is important here because it provides a language for aligning environmental-economic measurement with national development planning. When corporate environmental cost accounting is weak, macro-level sustainability governance also suffers because national policy lacks reliable information from production systems. Conversely, when governments promote better measurement frameworks, enterprise practice can improve.

A further implication relates to finance and capital markets. IFRS S2 shows that climate-related information is increasingly tied to investor decision-making. This makes environmental cost accounting relevant not only for internal efficiency but



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

also for external legitimacy and financing terms. Organizations that can quantify environmental expenditures, avoided losses, transition investments, and climate-related risks are better positioned to communicate resilience and attract capital. Those that cannot may face a higher cost of capital or reduced credibility. The IEA's evidence on the scale and direction of clean energy investment reinforces this point: global capital is increasingly moving toward low-carbon and efficiency-enhancing sectors, but competition for that capital depends on information quality and institutional readiness.

However, the discussion must also acknowledge the limitations and cautions raised in the literature. Not all environmental values can be precisely monetized, and excessive reliance on monetary valuation may underrepresent biodiversity, ecosystem resilience, or intergenerational justice. For this reason, environmental cost accounting should not be reduced to a single monetary figure. The better approach is a hybrid system combining physical flow indicators, monetary cost measures, and strategic narrative disclosures. This is broadly consistent with IFAC's dual-information logic and with SEEA's combination of physical and monetary accounts. In practice, firms and governments should therefore avoid the false choice between financial quantification and ecological complexity; both are necessary.

For implementation in Uzbekistan and similar economies, the discussion points to several priorities. Enterprises should begin by identifying environmental cost centers, tracing material and energy losses, and separating environmental expenditures from general overhead. Sector regulators and ministries should encourage standardized environmental cost classifications, pilot MFCA in resource-intensive sectors, and connect accounting reforms with green investment incentives. Universities and professional training institutions should integrate environmental accounting into accounting and finance curricula. Public



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

budgeting systems should expand green and climate tagging so that environmental expenditure can be assessed not only by amount but also by efficiency and outcome. These measures would help transform environmental cost accounting from a specialized technique into a mainstream instrument of sustainable economic management.

3. Conclusion

Environmental cost accounting has become indispensable under conditions of sustainable development because conventional accounting systems are no longer sufficient to capture the real economic consequences of environmental use, pollution, resource inefficiency, and climate-related risk. The analysis in this paper shows that international standards and institutional practice are converging toward a broader understanding of accounting in which physical environmental flows, monetary environmental costs, ecosystem dependencies, and climate-related disclosures are increasingly interconnected. IFAC's EMA guidance, ISO 14051 MFCA, the UN SEEA framework, and IFRS S2 together demonstrate that environmental cost accounting now occupies a central place in management, reporting, and policy.

The study finds that environmental cost accounting improves cost visibility, strengthens product costing, supports eco-efficiency, enhances sustainability disclosure readiness, and informs public policy. For countries undergoing green transition, including Uzbekistan, its relevance is especially strong because environmental damage already imposes large economic costs while climate and green reforms are becoming more central to budgeting, investment, and sector strategy. Official evidence showing substantial pollution-related health damage and growing emphasis on green transition policy confirms that environmental



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

costs must be recognized systematically rather than treated as incidental or external.

In theoretical terms, environmental cost accounting should be seen not as a replacement for financial accounting but as a necessary correction to its traditional blind spots. In practical terms, it should be embedded in enterprise information systems, management accounting routines, public budgeting mechanisms, and sustainability reporting practices. Future research may deepen this foundation through sectoral case studies, firm-level datasets, and econometric analysis of how environmental cost accounting affects profitability, emissions intensity, investment efficiency, and access to green finance. For now, the central conclusion is clear: sustainable development requires accounting systems that can make environmental costs visible, measurable, and actionable.

References

1. International Federation of Accountants. (2005). International guidance document: Environmental management accounting. IFAC.
2. International Organization for Standardization. (2011). ISO 14051:2011 Environmental management-Material flow cost accounting-General framework. ISO.
3. IFRS Foundation. (2023). IFRS S2 Climate-related disclosures. IFRS Foundation. IFRS S2 is effective for annual reporting periods beginning on or after 1 January 2024.
4. United Nations. (2021). System of Environmental-Economic Accounting-Ecosystem Accounting (SEEA EA). United Nations Statistical Commission. The SEEA EA was adopted by the UN Statistical Commission in March 2021.
5. Burritt, R. L., Hahn, T., & Schaltegger, S. (2002). Towards a comprehensive framework for environmental management accounting-Links between



International Congress on Economics, Management and Business Studies

Hosted Online from New York, USA

Date: 23rd April, 2026

Website: <https://econferencia.com>

-
- business actors and environmental management accounting tools. *Australian Accounting Review*, 12(27), 39–50.
6. Burritt, R. L. (2004). Environmental management accounting: Roadblocks on the way to the green and pleasant land. *Business Strategy and the Environment*, 13(1), 13–32.
 7. Burritt, R. L., Schaltegger, S., Bennett, M., Pohjola, T., & Csutora, M. (2009). Environmental management accounting and eco-efficiency: Case studies from Japan. *Journal of Cleaner Production*, 17(14), 1206–1215.
 8. Tran, T. T., Herzig, C., Zhu, Q., Zabel, T., & Ahsan, K. (2020). Material flow cost accounting in developing countries: A systematic review. *Sustainability*, 12(13), 5413.
 9. Schmidt, M. (2013). Material flow cost accounting as an approach to improve resource efficiency in manufacturing companies. *Resources*, 2(3), 358–369.
 10. Huang, S. Y., Chiu, A. A., Chao, P. C., & Wang, C. N. (2019). The application of material flow cost accounting in waste management. *Sustainability*, 11(5), 1270.
 11. United Nations Development Programme Uzbekistan. (2023). Climate public expenditure and institutional review: Support to Green Economy Transition Strategy until 2030. UNDP Uzbekistan.
 12. United Nations Development Programme Uzbekistan. (2024). Report on integration of climate and green priorities into the strategic planning and budgetary process in Uzbekistan. UNDP Uzbekistan.
 13. World Bank. (2023). Green growth and climate change in Uzbekistan: Policy dialogues compendium. World Bank.