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ENVIRONMENTAL MANAGEMENT ACCOUNTING AS A RISK MANAGEMENT TOOL IN TIMES OF GLOBAL INSTABILITY

Abstract: Global instability, characterized by climate change pressures, geopolitical tensions, energy market volatility, supply chain disruptions, and regulatory uncertainty, has significantly reshaped the contemporary business environment. In such conditions, organizations face increasing environmental and financial risks that require more sophisticated management tools and decision-support systems. Environmental Management Accounting (EMA) has emerged as a relevant mechanism for identifying, measuring, and managing environmental costs and risks within unstable economic contexts.

This paper examines the role of EMA as a risk management instrument in times of global instability. Drawing on the theoretical foundations of management accounting and sustainability governance, the study analyzes how EMA tools—such as environmental cost allocation, material flow cost accounting, and eco-efficiency indicators—support risk identification, enhance resource efficiency, and improve strategic decision-making under uncertainty. The analysis argues that EMA contributes to organizational resilience by reducing information asymmetry related to environmental exposures, increasing transparency in cost structures, and strengthening long-term economic sustainability.

By positioning Environmental Management Accounting within the broader debate on global instability and business environment resilience, the paper contributes to the understanding of how accounting practices can mitigate systemic risks and support sustainable value creation in volatile global conditions.

Keywords: environmental management accounting, risk management, global instability

1. INTRODUCTION

Global instability has become a defining feature of the contemporary economic landscape, driven by climate change, geopolitical tensions, energy market volatility, supply chain disruptions, and increasing regulatory pressures (World Economic Forum, 2024; United Nations Environment Programme, 2022). These developments have significantly affected the business environment, created new forms of uncertainty and exposed organizations to complex environmental and financial risks. In such conditions, traditional management approaches are often insufficient to support effective decision-making and long-term sustainability (Bhimani et al, 2021; Garrison et al, 2020).

In response to these challenges, increasing attention has been directed toward the role of accounting systems in managing uncertainty and supporting organizational resilience. Environmental Management Accounting (EMA), as a specialized branch of management accounting, provides tools for identifying, measuring, and analyzing environmental costs and resource flows (Schaltegger et al, 2013; United Nations Division for Sustainable Development, 2001). Despite its recognized importance in supporting sustainable decision-making, the role of EMA in the context of global instability remains insufficiently explored in the existing literature.

This paper addresses this gap by examining Environmental Management Accounting as a risk management tool in times of global instability. The study focuses on the ability of EMA to support organizations in identifying environmental risk

exposures, improving resource efficiency, and enhancing strategic decision-making under conditions of uncertainty (Medved & Jovanović, 2020). By integrating insights from management accounting and sustainability governance, the paper aims to contribute to a better understanding of the role of accounting practices in stabilizing business operations in volatile global environments (Bhimani et al, 2021; Garrison et al, 2020; Horngren et al, 2018; Weygandt et al, 2020). The remainder of the paper is structured as follows. The next section outlines the nature of environmental risks in the context of global instability. This is followed by an overview of key Environmental Management Accounting tools and their relevance for risk management. The final sections discuss the implications of EMA for organizational resilience and conclude with key insights and recommendations.

2. ENVIRONMENTAL RISKS IN THE CONTEXT OF GLOBAL INSTABILITY

Global instability has significantly intensified the scale and complexity of environmental risks faced by organizations. Climate change, energy market volatility, geopolitical tensions, and disruptions in global supply chains have contributed to increased uncertainty in both operational and strategic decision-making. These risks are no longer peripheral but have become central determinants of organizational performance and long-term sustainability.

Environmental risks can be broadly classified into physical and transition risks, in line with the TCFD framework (TCFD, 2017: 5-6). Transition risks include regulatory, market, technological, and reputational dimensions (EC, 2020; UNEP, 2022).

1. Physical risks arise from the direct impacts of climate change and environmental degradation on economic activities and organizational operations. These risks can be further divided into acute and chronic risks. Acute physical risks are associated with extreme weather events, such as floods, storms, heatwaves, and wildfires, which can cause immediate disruptions to production processes, infrastructure, and supply chains. Chronic physical risks, on the other hand, relate to long-term environmental changes, including rising temperatures, sea-level rise, and increasing resource scarcity, which gradually affect asset values, operational efficiency, and long-term planning. In the context of global instability, physical risks represent a direct source of operational vulnerability, as they can lead to unexpected costs, interruptions in production, and reduced reliability of resource supply.
2. Transition risks emerge from the process of adjusting to a low-carbon and more sustainable economy. These risks reflect changes in regulatory frameworks, market conditions, technological developments, and societal expectations, all of which can significantly affect organizational performance and strategic positioning.
 - a) Policy and legal (regulatory) risks - These risks arise from the introduction of new environmental policies, regulations, and legal requirements aimed at mitigating climate change and promoting sustainability. Examples include carbon pricing mechanisms, emissions limits, environmental taxes, and mandatory sustainability reporting standards. Such measures may increase compliance costs, require operational adjustments, and expose organizations to potential legal liabilities.
 - b) Market risks - Market risks result from changes in supply and demand dynamics driven by evolving consumer preferences, investor expectations, and stakeholder pressures toward environmentally responsible products and services. Organizations that fail to adapt may face declining demand, loss of competitiveness, or reduced access to capital (Dasinapa, 2024; Krstić et al, 2024).
 - c) Technological risks - Technological risks are associated with the development and adoption of new, more sustainable technologies. While such innovations can create opportunities, they may also render existing processes, assets, or business models obsolete, requiring significant investment and strategic adaptation (Latan et al, 2018).
 - d) Reputational risks - Reputational risks arise from changing public and stakeholder perceptions regarding environmental responsibility. Organizations that are perceived as environmentally unsustainable may experience damage to their brand, reduced customer trust, and increased scrutiny from regulators and investors.

These categories of environmental risks highlight the need for accounting systems capable of capturing both physical and transition-related exposures, which further emphasizes the relevance of Environmental Management Accounting in supporting risk identification and decision-making. Traditional accounting systems, primarily focused on financial performance, often fail to capture the full scope of environmental risks and their economic implications (Bhimani et al, 2021; Horngren et al, 2018; Weygandt et al, 2020). This limitation creates information gaps that can undermine effective risk management and strategic planning. Consequently, there is an increasing need for accounting frameworks capable of incorporating environmental cost information and supporting decision-making under conditions of heightened uncertainty. In this context, Environmental Management Accounting emerges as a relevant tool for addressing these challenges. Management accountants have devoted substantial academic and empirical research efforts

for more than two decades to the development of contemporary cost accounting systems, appropriate cost and production management models, as well as to the advancement of new and the improvement of existing techniques and tools for environmentally oriented business decision-making (Medved & Jovanović, 2020).

3. ENVIRONMENTAL MANAGEMENT ACCOUNTING: CONCEPT AND TOOLS

Environmental Management Accounting (EMA) has emerged as an important extension of traditional management accounting, aimed at integrating environmental considerations into organizational decision-making processes. Unlike conventional accounting systems, which primarily focus on financial outcomes, EMA incorporates both physical and monetary information related to environmental impacts, resource use, and associated costs. This dual perspective enables organizations to better understand the relationship between environmental performance and economic results.

EMA is grounded in the recognition that many environmental costs remain hidden within overhead accounts and are therefore inadequately addressed in decision-making processes. By systematically identifying and allocating environmental costs, EMA enhances cost transparency and supports more informed managerial decisions. In this sense, EMA contributes not only to environmental performance but also to improved economic efficiency and long-term sustainability (Schaltegger, 2018; Fousteris et al, 2018; Jasch, 2003).

A key feature of EMA is the use of specific tools and techniques designed to capture environmental information (Burritt et al, 2023). Among the most prominent are environmental cost accounting, material flow cost accounting (MFCA), and eco-efficiency indicators. Environmental cost accounting focuses on identifying, measuring, and allocating costs related to environmental protection, waste management, and resource consumption. MFCA provides a detailed analysis of material and energy flows within production processes, highlighting inefficiencies and potential cost savings (IFAC, 2021; ISO 14051, 2021; ISO 14031, 2021; IFRS S1, IFRS S2, 2023). Eco-efficiency indicators link environmental performance with economic outcomes, enabling organizations to evaluate the efficiency of resource use in relation to value creation (Christ & Burritt, 2015). The key Environmental Management Accounting tools and their relevance for risk management are summarized in Table 1.

Table 1: Key Environmental Management Accounting Tools and Their Role in Risk Management

EMA Tool	Main Focus	Type of Information	Role in Risk Management
Environmental Cost Accounting	Identification and allocation of environmental costs	Monetary	Improves cost transparency and identifies environmental cost drivers
Material Flow Cost Accounting (MFCA)	Analysis of material and energy flows	Physical & Monetary	Detects inefficiencies and reduces resource-related risks
Eco-efficiency Indicators	Relationship between environmental and economic performance	Combined indicators	Supports performance evaluation and sustainable decision-making

Source: Author's elaboration based on Burritt et al (2002), Schaltegger et al (2013), and UNDSO (2001).

As shown in Table 1, EMA tools provide both physical and monetary information that enhances the identification of environmental risks and supports more informed decision-making under conditions of uncertainty.

In the context of global instability, the relevance of EMA tools becomes particularly evident. Increased volatility in energy prices, disruptions in resource availability, and tightening environmental regulations require organizations to adopt more flexible and responsive management systems. EMA supports this need by providing timely and relevant information that can be used to assess environmental risks, optimize resource allocation, and support strategic decision-making under uncertainty.

Furthermore, EMA contributes to enhancing transparency and accountability within organizations, aligning internal management processes with external sustainability expectations. This is particularly important in an environment where investors, regulators, and other stakeholders increasingly demand reliable information on environmental performance and risk exposure. By bridging the gap between environmental and financial information, EMA strengthens the informational basis for both internal and external decision-making.

4. ENVIRONMENTAL MANAGEMENT ACCOUNTING AS A RISK MANAGEMENT MECHANISM

The broader framework for managing climate-related risks is reflected in the TCFD recommendations, which emphasize governance, strategy, risk management, and metrics and targets as core elements of organizational response to climate-related challenges (TCFD, 2017), as it's shown in Picture 1. Within this framework, Environmental Management Accounting can be positioned as an important internal tool that supports risk identification, measurement, and decision-making processes.

In conditions of global instability, organizations are increasingly exposed to complex and interrelated environmental risks that directly affect cost structures, operational stability, and long-term strategic positioning. These risks, driven by energy price volatility, resource scarcity, regulatory uncertainty, and climate-related disruptions, require more advanced and integrated approaches to management and decision-making. In this context, Environmental Management Accounting (EMA) can be understood as a relevant mechanism for risk identification, assessment, and mitigation.



Picture 1: Core Elements of Recommended Climate-related Financial Disclosures
Source: TCFD, Final Report, 2017, p. iv

EMA contributes to risk management primarily through improved transparency of environmental cost structures. By identifying and allocating costs related to resource consumption, emissions, and waste, organizations gain a clearer understanding of their exposure to environmental risks. This enhanced visibility enables more accurate cost forecasting and supports proactive responses to changes in external conditions, such as fluctuations in energy prices or the introduction of new environmental regulations.

Furthermore, EMA supports the identification of inefficiencies within production and operational processes. Tools such as material flow cost accounting (MFCA) allow organizations to detect losses associated with inefficient resource use, thereby reducing both environmental impact and financial risk. In times of instability, such insights are particularly valuable, as they enable organizations to optimize resource allocation and maintain operational continuity despite external disruptions.

Picture 2 illustrates the conceptual framework linking global instability, environmental risks, and the role of Environmental Management Accounting (EMA) as a mechanism for risk mitigation and organizational resilience.



Picture 2: Conceptual Framework: Environmental Management Accounting as a Risk Management Mechanism under Global Instability
Source: Author's conceptualization based on the literature.

EMA also plays a significant role in supporting strategic decision-making under uncertainty. By integrating environmental and financial information, it provides a more comprehensive basis for evaluating investment options, including those related to energy efficiency, cleaner technologies, and sustainable production processes. This integration enhances the organization's capacity to respond to emerging risks while simultaneously identifying opportunities for cost savings and value creation (Mukwarami et al, 2023).

EMA contributes to strengthening organizational accountability and transparency, which are essential for maintaining stakeholder trust in volatile environments. Reliable information on environmental costs and risks supports communication with investors, regulators, and other stakeholders, thereby reducing uncertainty and enhancing the credibility of organizational decisions.

Overall, Environmental Management Accounting functions as a mechanism that not only supports internal risk management but also contributes to broader organizational resilience. By enabling better-informed decisions and

fostering transparency, EMA helps organizations navigate the challenges of global instability and maintain sustainable performance in uncertain business environments.

5. CONCLUSION

Global instability has fundamentally reshaped the contemporary business environment, increasing the importance of effective risk management, transparency, and sustainability-oriented decision-making. In such conditions, environmental risks have become central to organizational performance, requiring accounting systems capable of capturing not only financial outcomes but also environmental cost structures and risk exposures.

This paper has emphasized that Environmental Management Accounting (EMA) represents a relevant and increasingly necessary tool for addressing these challenges. By integrating environmental and financial information, EMA enhances transparency, supports the identification and assessment of environmental risks, and improves strategic decision-making under conditions of uncertainty. In this way, EMA contributes not only to internal organizational efficiency but also to the broader stability of the business environment by strengthening institutional credibility and reducing information asymmetry.

The analysis further suggests that the role of EMA extends beyond operational support, positioning it as a mechanism that can facilitate organizational resilience in the face of global instability. Through improved cost visibility, resource efficiency, and alignment with sustainability requirements, EMA enables organizations to better respond to external shocks and adapt to evolving regulatory and market conditions.

From a policy perspective, the development and wider adoption of standardized environmental accounting frameworks may further enhance the capacity of organizations to manage environmental risks and contribute to more stable and transparent economic systems. In this context, the alignment of EMA practices with international sustainability reporting standards represents an important direction for future development.

This study is subject to certain limitations. As a conceptual analysis, it does not provide empirical evidence on the effectiveness of Environmental Management Accounting practices in managing environmental risks. In addition, the analysis is based on a general theoretical framework and does not account for sector-specific or country-specific differences that may influence the implementation of EMA.

Future research could extend this conceptual analysis by empirically examining the relationship between EMA practices, environmental risk management, and organizational resilience across different industries and institutional contexts, particularly in economies exposed to higher levels of global uncertainty.

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