LEX LOCALIS-JOURNAL OF LOCAL SELF-GOVERNMENT
ISSN:1581-5374 E-ISSN:1855-363X
VOL. 23, NO. S4(2025)

ANALYSIS OF FINANCIAL AND ENVIRONMENTAL SYNERGY THROUGH THE INTEGRATION OF ENVIRONMENTAL ACCOUNTING INTO FINANCIAL REPORTING

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ABSTRACT
Professionals' perceptions of environmental accounting are hindered by limited awareness, competing priorities, and a lack of standardized practices. This leads to underestimation of environmental impact, ambiguity, and resistance to change. Addressing these issues requires education and industry-specific standards. This analysis explores the history, practices, and integration of environmental accounting with financial reporting. It focuses on environmental cost accounting, environmental performance indicators (EPIs), and environmental reporting frameworks. This study investigates the integration of Environmental Accounting with Financial Accounting, exploring the implications for organizations. Integrating environmental accounting with financial reporting is explored, highlighting benefits, challenges, and potential solutions. The analysis also examines the mapping and alignment of environmental indicators within financial reporting structures and the role of technology in facilitating this integration. The analysis synthesizes key findings, elucidating the implications of an organization's environmental accounting practices on its sustainability strategy.

Key Words: Environmental Accounting (EA), Cost Accounting, Performance Indicators, Reporting Frameworks, Financial Accounting.

INTRODUCTION

Environmental accounting is a specialized branch of accounting that focuses on the identification, measurement, and reporting of an organization's environmental costs and impacts. By incorporating ecological considerations into financial decision-making processes, this discipline goes beyond traditional financial accounting [1]. Environmental accountants assess an organization's environmental footprint by taking into account factors such as energy consumption, emissions, water usage, and waste generation. The main objectives of environmental accounting include providing a comprehensive understanding of an organization's environmental performance, facilitating sustainable business practices, and increasing transparency and accountability.EA helps organizations manage resources, comply with regulations, and communicate sustainability commitments to stakeholders. It balances economic growth with ecological preservation, aligning business operations with environmental stewardship, contributing to a more sustainable and responsible global economy.

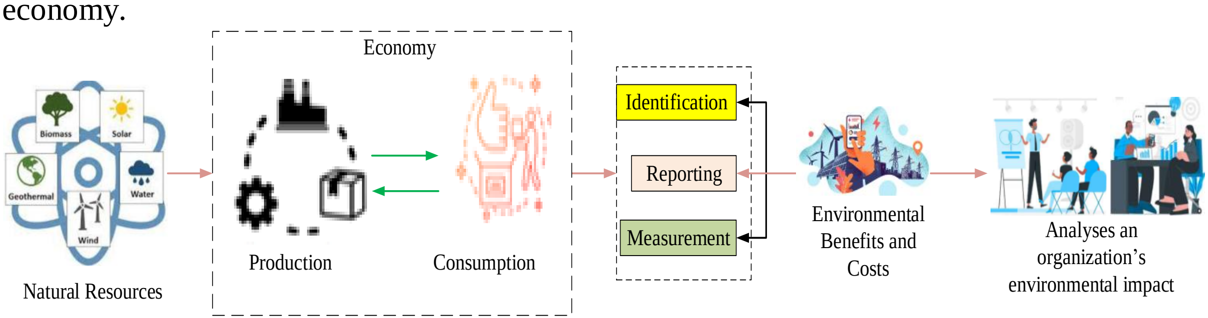


Figure 1: Environmental Accounting

EMA also known as green accounting, is a method of tracking the environmental impact of a company's actions. It entails modifying the System of National Accounts to account for natural resource use and depletion.It is a field that identifies resource use, and measures and communicates the costs of a company's or national economy's environmental impact.

Accounts Department

Focusing on Environmental and social factors

Decision making process for Financial

Figure 2: Green Accounting

EA comprises four forms: Environmental Financial Accounting (EFA), Environmental Cost Accounting (ECA), Environmental Management Accounting (EMA), and Environmental Nation Accounting (ENA), all related to corporate accounting. EA includes many aspects, such as quantifying resource usage, tracking emissions, estimating EC, and assessing the effectiveness of sustainability initiatives. Organizations that use EA practices can not only comply with regulatory requirements but also make informed decisions that align with corporate responsibility and sustainable development principles. This introduction emphasizes the importance of taking environmental factors into account in addition to financial considerations, emphasizing the role of EA in fostering transparency, accountability, and responsible business practices.

EA is an important aspect of cost accounting that focuses on the environmental aspects of business operations. It entails identifying and categorizingEC, such as pollution control, waste management, and resource conservation, and incorporating them into the larger cost accounting framework. It distinguishes between environmental and general operating costs, ensuring that they are allocated and accounted for separately. It assessesthe efficiency and effectiveness of environmental initiatives about costs by measuring and reporting environmental performance metrics such as emissions, resource usage, and waste generation. It also assesses the cost-effectiveness of environmental initiatives by comparing the environmental benefits obtained with the associated costs, thereby determining their effectiveness in achieving sustainability goals.It improves the organization's transparency and accountability by facilitating transparent reporting of EC and performance. Overall, EA is an important component of cost accounting because it allows organizations to make more informed decisions, improve cost-effectiveness, and align financial and environmental goals.

Environmental sustainability has emerged as a critical paradigm shift in recent years, driven by a combination of ethical considerations, regulatory pressures, and a growing awareness of the long-term effects of climate change. Consumers, investors, and governments are demanding that businesses adopt environmentally friendly practices as societies become more aware of the world's environmental challenges.Businesses are increasingly incorporating sustainability into their operations to meet societal expectations and provide tangible benefits. Consumers are more likely to support businesses that use ethical business practices, which improves brand reputation and customer loyalty. Businesses address sustainability issues proactively as governments enact stricter environmental regulations in order to navigate regulatory landscapes and avoid legal and financial risks. When making investment decisions, investors consider environmental, social, and governance factors, emphasizing the financial benefits of sustainable practices.

SIGNIFICANCE OF EA

Accounting and reporting on environmental performance are critical for businesses to measure, monitor, and communicate their environmental performance. Accounting means identifying and quantifying EC and benefits associated with a company's operations, whereas reporting entails communicating this information transparently to stakeholders such as investors, customers, regulators, and the general public. Firms can better understand their environmental impact, identify areas for improvement, and implement sustainable practices by implementing these practices [2]. This not only saves money by utilizing resources more efficiently, but it also improves the preservation of the environment. Environmental performance reporting demonstrates transparency and accountability, fostering stakeholder trust and aligning with the growing demand for corporate responsibility. Environmentally conscious businesses are more likely to attract investment and access capital.In general, these practices promote sustainability, risk mitigation, corporate reputation enhancement, and longterm viability in an era where environmental considerations are critical for business success.

OBJECTIVE

The assessment seeks to assess professionals' understanding of environmental impact, regulations, and decision-making processes in selected firms. It identifies gaps, opportunities for improvement, and potential training requirements. The goal is to ensure that professionals have the knowledge and skills required to effectively contribute to EA and reporting, foster sustainability, and align corporate practices with global environmental goals.

Analyzing EA with a focus on awareness practices involves assessing how organizations incorporate and communicate their environmental performance and impacts. Hence our study focuses on the following approach

- ❖ First examines the use of Environmental Performance Indicators (EPIs), which are critical metrics for accurately measuring a company's environmental performance.
- ❖ Following EPIs, our analysis focuses on Environmental Reporting Frameworks ERF developed by global standards organizations, which are examined to understand how firms structure and disclose their environmental impacts.
- ❖ The analysis aims to contribute to the evolving discourse on environmental and financial integration within the corporate landscapeto enhance resource efficiency, transparency, accountability, and strategic decision-making, leading to cost savings by reducing resource consumption, waste, and energy use.

Following the Introduction, Section 2 study provides a concise account of EA and CA, setting the foundation for subsequent analysis.Section 3 delves into the performance indicators and frameworks utilized in EA practices. Section 4examines the integration of EA with Financial Accounting. Section5provides a summary of the main conclusions and predictions for the development of sustainable accounting practices.

2. BACKGROUND OF ENVIRONMENTAL ACCOUNTING

The complex of variables that affect an organism or an ecological community and decide its form and survival can also be referred to as the environment. Living creatures engage in constant environmental interaction and environmental adaptation. The term "green accounting," or "EA," describes how the System of National Accounts is changed to account for the use or depletion of natural resources. An essential tool for managing the environmental and operational costs of natural resources is EA.

Acquiring a thorough grasp of how corporate operations affect the environment is the aim of EA. This helps companies make well-informed decisions that support environmental goals, lower risks to the environment, and strengthen sustainability. Businesses are starting to realize how important it is to include environmental factors in their overall financial and strategic planning, hence because this practice has become more popular.

2.1 IMPORTANCE OF ENVIRONMENTAL SUSTAINABILITY IN BUSINESS

In business, environmental sustainability is critical because it not only deals with pressing global problems but also builds resilience and sustainable profitability in organizations.One of the most important requirements for global sustainability is the mitigation of climate change, and companies, through their sustainable practices, are essential to this effort. These actions, which include lowering carbon emissions and improving energy efficiency, are essential parts of corporate responsibility. Businesses that embrace sustainable business models actively aid in the shift to a low-carbon economy. This proactive strategy addresses the pressing need to mitigate the negative effects of climate change while also being in line with environmental goals. Businesses have a significant impact on greenhouse gas emissions, so reducing their environmental impact is crucial to meeting global climate targets.

Sustainable business practices prioritise resource conservation by minimising resource consumption and optimising the efficient use of materials, water, and energy. By practicing responsible resource management, companies can cut down on their environmental effect considerably. This strategy is vital for preserving limited resources for the benefit of future generations in addition to helping to immediately reduce ecological footprints. Businesses can support responsible stewardship of natural resources and environmental preservation at the same time by implementing sustainable practices that put an emphasis on resource efficiency. This dual emphasis on immediate outcomes and long-term viability highlights the critical role that companies play in tackling the global issue of resource scarcity and guaranteeing a more sustainable future.

Companies that place a high priority on environmental sustainability are finding it easier to attract customers and investors. This pledge puts businesses in a better position to attract ethical investors and is in line with worldwide objectives for a more environmentally friendly future. Access to markets where ethical and sustainable practices are highly valued is made possible by this, as well as by opening doors to a variety of capital sources and strengthening partnerships. Companies that put environmental concerns first increase their competitiveness and strategic advantage as the market for ethical businesses expands.

2.2 COST ACCOUNTING

The field of cost accounting is concerned with the identification, measurement, analysis, and interpretation of expenses related to the regular operations of a business. Cost accounting's main goal is to give management information for planning, controlling, making decisions, and assessing performance.

Cost accountants categorize expenses into different categories, including direct costs, which are associated with producing a good or providing a service, indirect costs, also known as overhead costs, and other costs (like taxes, insurance, and administrative expenses) that are not directly related to production.

2.2.1 Types of Cost Accounting

Cost accounting involves various types of accounting techniques and systems that are tailored to a company's needs and goals.

1. Standard costing

   Standard costing employs standard costs for inventory and cost of goods sold (COGS) as opposed to actual costs. It entails estimating costs for overhead, direct labor, and direct materials, which are then contrasted with actual costs to identify any variations. This method aids companies in evaluating performance, managing expenses, and pinpointing areas where their production processes need to be improved.

2. Activity-based costing
   ABC method of cost accounting allocates indirect costs to goods and services according to the activities that generate them. Because costs are associated with particular activities, it offers a more precise and comprehensive understanding of cost structures. When different products or services may not accurately reflect the actual consumption of resources, ABC can be especially helpful in situations where traditional costing methods may not be applicable.
3. Lean accounting
   Aiming for simplicity, waste reduction, and the elimination of non-value-added activities, lean accounting is a methodology that combines financial and management accounting practices with lean manufacturing principles to provide accurate financial information for decision-making in lean organizations.
4. Marginal costing
   By treating fixed costs as costs over a period, marginal costing focuses on analyzing the variable costs related to producing each additional unit. It is especially helpful when making snap decisions about pricing and the best possible product mix.

2.2.1 **Financial Accounting and Cost Accounting:**

The creation of financial statements, which summarise operating results for a chosen period and display the company's financial status at specific dates, is the main focus of financial accounting. Stated differently, financial accounting provides information on the resources that are available on balance sheet and the results of using these resources (profit and loss account). The requirements of creditors, shareholders, the government, potential investors, and other non-management parties are the primary concerns of financial accounting.

- The purpose of cost accounting is to determine and control the cost of producing goods or services within a corporation. It focuses on internal reporting and decision-making by providing detailed cost information for various activities, products, or services.
- In contrast, financial accounting is primarily concerned with providing information to external stakeholders such as investors, creditors, and regulatory authorities. Its purpose is to present a company's financial performance and position using financial statements such as the income statement, balance sheet, and cash flow statement.

The following section investigates EA performance indicators, which measure the environmental impact of business activities and provide organizations with actionable data to monitor, assess, and improve sustainability practices.

3 ENVIRONMENTAL PERFORMANCE INDICATORS (EPI)

EPI plays an essential role in assessing and communicating an organization's environmental impact. These metrics provide quantifiable measures of factors such as carbon emissions, energy consumption, water consumption, and waste generation, providing valuable insight into a company's environmental footprint. Businesses can identify areas for improvement, set targets for environmental sustainability, and demonstrate transparency to stakeholders by tracking and analyzing EPIs.

EPIs are an important tool for aligning business practices with environmental goals, ensuring regulatory compliance, and cultivating a culture of responsible corporate stewardship. The incorporation of EPIs into environmental accounting improves decision-making processes, allowing businesses to manage resources strategically, reduce environmental risks, and contribute to a more sustainable and resilient future.

3.1 ENERGY CONSUMPTION

In environmental accounting, energy consumption refers to the measurement and analysis of the amount of energy used by an organization in its various operations and activities. This metric is a key EPI that is used to assess the environmental impact of business practices.Tracking energy consumption is necessary for a variety of reasons, including improving resource efficiency, cost management, reducing carbon emissions, regulatory compliance, benchmarking and performance improvement, and stakeholder communication. Businesses can implement waste reduction measures and optimize energy utilisation by understanding energy usage in various processes. EA assists businesses in assessing their energy consumption patterns and implementing cost-cutting initiatives.

According to the study by Usman et al. [3], the impact of renewable energy consumption, economic growth, biocapacity, and trade policy on environmental degradation in the United States from 1985Q1 to 2014Q4 is investigated. To obtain long-run and short-run dynamic coefficients, the researchers used the autoregressive distributed lag (ARDL) model. The study found that renewable energy accounts for 14.79% and 8.41% of total energy consumption reducing environmental degradation with economic growth and biocapacity increasing it, while trade policy decreases it.

Globalization and financial development have a variety of environmental effects, with carbon dioxide emissions serving as an indicator. The ecological footprint (EF) indicator is a comprehensive tool for assessing the state of the environment. According to Shah et al. [4] research, a 1% increase in financial development causes an EF of 0.0211 percent global hectares in selected countries, while a 1% increase in globalization reduces it by 0.0038 percent gha in the long run from 1990 to 2014. The EF rises due to increases in both financial development and globalization in 29 countries, while it falls due to increases in both financial development and globalization in 14 countries. Environmental degradation is influenced by the EF, and efforts to reduce it and implement immediate intervention measures are critical for a sustainable environment.

Liping et al. [5] study examine the relationship between remittances inflow, foreign direct investment, and ecological footprint in top ten remittance-receiving countries over 1990-2018. They use the Environmental Kuznets Curve (EKC) hypothesis to analyze the impact of economic growth, renewable and non-renewable energy utilization. The results show that remittance inflow, foreign direct investment, and non-renewable energy utilization positively affect ecological footprints, while renewable energy utilization negatively impacts it. The study also supports the pollution haven hypothesis and inverted U-shaped EKC hypothesis, with robust results for various countries.

Nan et al. [6] propose metrics to assess building users' environmental footprints, using smart contracts on a blockchain network to normalize energy usage and carbon intensity. The smart contract system allocates tokens based on reward algorithms to incentivize energy conservation and influence occupant consumption patterns toward carbon reduction goals. The study tests the smart contract algorithm in real sensor data from single-unit households and the energy market, demonstrating upper and lower limits and potential for load shifting to minimize carbon emissions without considering consumption scale.

The building sector is a significant energy consumer, accounting for over a third of the world's energy consumption by Kim et al [7]. In 1950, the industrial sector's energy use was

48%, but it decreased to 31% in 2010 by Azari et al [8]. Commercial energy consumption increased from 11% in 1949 to 19% in 2010. The US Department of Energy reports that commercial and residential buildings contributed 41.10% to energy consumption and 40% to greenhouse gas emissions in 2010. The Chinese building energy sector has seen a 1.7-fold increase in demand, while the energy consumption ratio is between 17.70% and 20.30% Tian et al [9]; Huo et al, [10] of total energy demand remain relatively stable. Hisham Khatib [11] reviewed nuclear energy demand in the immediate aftermath of the Fukushima incidentwith the strategic energy challenges of energy poverty. Farah et al [12], examined the most recent developments in solar thermal technology, such as process configuration, membrane materials, energy storage, and energy recovery devices, which are also being explored.

3.1.1 Summary

Studies reveal a complex relationship between energy consumption and environmental impact. Renewable energy consumption can reduce degradation by decreasing ecological footprints, while economic growth and biocapacity contribute to environmental footprint growth. Trade policy can reduce it. Globalization and financial development have nuanced impacts on carbon dioxide emissions. Remittances, foreign direct investment, and ecological footprint in top remittance-receiving countries have both positive and negative impacts. Blockchain-based metrics can incentivize energy conservation and minimize carbon emissions. The building sector's significant energy consumption, nuclear energy demand, and advancements in solar thermal technology provide insights into energy and environmental sustainability challenges and potential solutions.

3.2 GREENHOUSE GAS EMISSION (GHG)

Greenhouse gas emissions (GHG) are the emissions of gases into the Earth's atmosphere that trap heat and contribute to the greenhouse effect, resulting in global warming and climate change. Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2, fluorinated gases, and other gases form a "greenhouse" around the Earth, allowing sunlight in but trapping heat.

CO2 produced by the combustion of fossil fuels such as coal, oil, and natural gas is one of the most significant contributors to climate change. China is the largest emitter, followed by the United States. The United States has higher per capita emissions. Large oil and gas companies are the primary contributors to global emissions. Human-caused emissions have increased atmospheric carbon dioxide by about 50% over pre-industrial levels. The rising levels of greenhouse gas emissions have varied, but have remained consistent across all greenhouse gases.Emissions in the 2010s were higher than in any previous decade, averaging 56 billion tonnes per year. Meena et al. [13] From 1870 to 2017, total cumulative emissions from fossil fuels and industry were 425 ± 20 GtC (1539 GtCO2), and land use change was 180 ± 60GtC (660 GtCO2).Land usage change, such as deforestation, accounted for approximately 31% of total emissions from 1870 to 2017, with coal accounting for 32%, oil for 25%, and gas for 10%.

Khalili et al. [14], explore that electricity generation, heat generation, and transportation are major emitters; energy accounts for approximately 73% of total emissions.Bataille et al. [15], Deforestation and other land-use changes emit carbon dioxide and methane. Agriculture is the largest source of anthropogenic methane emissions, followed by petrol venting and fugitive emissions from the fossil-fuel industry. Livestock is the most significant agricultural methane source. Fertilizers contribute to nitrous oxide emissions in agricultural soils. Similarly, fluorinated gases emitted by refrigerants play an unusually significant part in total human emissions.

He et al. [16], the carbon footprint, or GHG footprint, compares the amount of GHG emitted over the entire life cycle of a good or service, from its production along the supply chain to its final consumption.Carbon accounting or GHG accounting is a set of procedures for measuring and tracking how much greenhouse gas an organization emits.Sanjay et al. [17] explored the theoretical perspective on carbon accounting and reporting in financial statements, examining carbon emissions sources, measurement procedures, and disclosure according to stewardship theory for a sustainable future. The findings have practical implications for corporations, accounting standard setters, and policymakers to establish effective carbon measurement and reporting standards and corporate accountability for environmental behavior.

High socioeconomic status individuals significantly contribute to energy-driven greenhouse gas emissions through consumption and financial and social resources. However, few climate change mitigation initiatives target this population segment. Nielsen et al. [18] studied their disproportionate impact via consumption and potential influence on greenhouse gas emissions through five roles: consumers, investors, role models, organizational participants, and citizensfor future focusing on strategies to reduce emissions and aligning their investments, organizational choices, and actions with climate change mitigation goals. Organizations are increasingly focusing on strategies to reduce emissions while aligning their investments with sustainability goals to effectively address the urgent need for climate change mitigation. Transitioning to renewable energy sources and improving energy efficiency across operations are two key approaches by Bogdanov et al. [19].Investing in solar or wind energy projects, implementing energy-efficient technologies, and optimizing supply chain processes can all help to reduce carbon footprints. Companies are also prioritizing sustainable transportation solutions, such as electric vehicles and efficient logistics, to reduce emissions associated with transportation, Gielen et al. [20].

To evaluate sustainable plastic technologies, it's crucial to compare bio-based and circular plastic flows to current manufacturing paradigms. Estimating supply chain energy requirements and greenhouse gas emissions associated with US-based plastic consumption is essential. Major commodity polymers consume at least 1 MMT per year, generating 3.2 quadrillion Btutus of energy and 104 MMTCO2e of GHG emissions in the US alone. Nicholson et al. [21] provided a foundation for comparing current plastic manufacturing energy requirements and emissions to future disruptive technologies, guiding the development of bio-based plastics and the circular economy for synthetic polymers. Alessi et al. [22] found a negative geranium, a risk premium related to a firm's greenness, based on European individual stock returns. They defined a 'greenness and transparency' factor based on companies' greenhouse gas emissions and environmental disclosures. The market price is the combination of environmental performance and transparency. They offer a tool to assess portfolio exposure to low-carbon transition risk and hedge against it. They estimate that in a stressed scenario where greener firms outperform brown stocks, global losses could occur, including for European large banks. They recommend climate stress tests for systemically important financial institutions.

Sarkodie et al. [23] conducted a study to assess the impact of foreign direct investment, economic development, and energy consumption on greenhouse gas emissions in developing countries like China, India, Iran, Indonesia, and South Africa. The research used panel data regression, U test estimation approach, and panel quantile regression. The results confirmed the pollution haven hypothesis and confirmed the positive effect of energy consumption on emissions. Jaganger et al. [24] suggested that foreign direct investment, clean technological transfer, and improved labor and environmental management practices can help developing countries achieve sustainable development goals. Mitigation of greenhouse gas emissions requires enhanced energy efficiency, adoption of clean technologies, and carbon capture and storage.

3.2.1 Summary

Governments worldwide are focusing on reducing greenhouse gas emissions through stringent environmental regulations and renewable energy initiatives. The Paris Agreement, signed by many nations, emphasizes the need for collective efforts to limit global temperature increases. Market-based mechanisms like carbon pricing and emissions trading are gaining prominence as tools to incentivize industries to reduce their carbon footprint. Technological innovations, such as renewable energy technologies and sustainable agricultural practices, are also playing a crucial role in emission reduction strategies. The circular economy concept is gaining prominence as a sustainable alternative to traditional production models. The financial sector is also fostering sustainability by integrating environmental, social, and governance criteria into decision-making processes. By fostering a global commitment to sustainability, societies can work towards mitigating climate change and ensuring a more resilient future.

3.3 WATER USAGE

The annual water consumption of the world is approximately 4 trillion cubic meters. This includes water used in the home as well as in the production of goods and services.The consumption of water varies by country and region. Agriculture can consume 75-90% of a region's freshwater supply. The global water demand is expected to rise by 20-30% by 2050.According to world data water usage statistics, China is the largest consumer of water for domestic purposes such as cleaning, cooking, drinking, and washing, using over 70 billion m^3 per year.India is the world's second-largest water consumer, with an average urban Indian using 150 liters daily. In 2021, individuals aged 19 and below consumed 1.97 liters, while those aged 30 to 44 consumed 2.26 liters.

In India, some of the water sources such as Groundwater, Surface water, and Rainwater are used for agriculture, manufacturing and food processing. With the world's largest total water footprint of 1047 billion cubic meters per year, India ranks 133rd in the world for water availability per person per year, resulting in a "water-stressed" situation with annual per capita water availability below 1,700 cubic meters.

The study by Rosa et al. [25] evaluated the impact of trade on unsustainable irrigation water consumption (UWC) and its role in international trade. It reveals that 52% of global irrigation is unsustainable, with 15% being virtually exported, with an average 18% increase between 2000 and 2015. 60% of global UWC transfers are driven by exports of cotton, sugar cane, fruits, and vegetables. One-third of UWC in Mexico, Spain, Turkmenistan, South Africa, Morocco, and Australia is associated with demand from export markets. The globalization of water through trade contributes to running rivers dry, an environmental externality often overlooked by trade policies. Instead of the usage of water in limit excess, it may cause the issue of water scarcity.

The issue highlights the need for revised water management, particularly in areas prone to demographic change and climate vulnerability, to ensure a sustainable and secure water supply. Furthermore,general guidelines and potential solutions, Tzanakakis et al. [26], and Van et al. [27] such as the adoption of advanced technological solutions and practices that improve water use efficiency and the use of alternative (non-conventional) water resources, are highlighted and discussed to address growing environmental and health issues and reduce emerging water user conflicts. Due to a shortage of water saving technologies or practices that have been implemented by an organization to enhance water efficiency.Mohapatra et al. [28].

Thiam et al. [29]studied the factors driving water-saving equipment adoption in Cape Town, South Africa, following the 2018 "Day Zero" water crisis. They use a disaggregated technology diffusion model and choice experiments to determine attribute levels and socioeconomic characteristics. Data from 465 households is used in a choice modeling framework. Latent class analysis reveals three households with distinct preferences, suggesting divergence in water-saving equipment adoption.Chathuranika et al. [30] explored water-saving irrigation practices in agriculture, including Uzbekistan, using ancient and modern technologies. They discussed suitable practices for arid countries, including Uzbekistan, and presented an experiment using "mulching" agro-technology, promoting sustainable water usage.Regular assessments or audits are carried out to identify and address water losses or leaks.

For estimating water losses in distribution networks, focusing on their accuracies and uncertainties. Taha et al. [31] applied these methods to three case studies in developing countries. Results showed that different methods estimate water loss components differently, leading to different reduction measures. The least accurate methods had low uncertainty, while more realistic assumptions led to higher uncertainties. Hence, Adegboye et al. [32] suggested that water loss components should be assessed using at least two methods for effective modeling and monitoring.

3.3.1 Summary

The study emphasizes the need for global and local strategies for sustainable water management, particularly in agriculture. It highlights the interconnectedness of water resources and the need for advanced technologies, alternative resources, and water-saving practices. It also emphasizes the importance of proactive water accounting, regular assessments, and collaborative efforts to ensure a secure water supply for the planet's growing population.

3.4 BIODIVERSITY IMPACT

The impact of biodiversity on EPI is critical because it assesses the effects of human activities on the variety and abundance of species in ecosystems. The assessment of biodiversity impact consists of several components, each of which contributes to a comprehensive understanding of the ecological consequences of a specific process.Many factors influence biodiversity, including habitat loss, invasive species, overfishing, pollution, and climate change.

Threats to biodiversity include pollution, climate change, and population growth Prakash et al. [33]. These threats have resulted in an unprecedented increase in the rate of extinction of species. According to some scientists, half of all species will be extinct within the next century.Biodiversity positively impacts energy capture, organic matter decomposition, nutrient cycling, and biological production throughout the food chain, contributing to soil fertility, pollination, plant growth, predation, and waste decomposition.Biodiversity is crucial for Earth's life support, including humans, as it ensures healthy ecosystems by encompassing a diverse range of animals, plants, and microorganisms.

One common method is to compute biodiversity indices, such as the Simpson's Diversity Index or the Shannon-Wiener Index Fedor et al. [34], which take into account the richness and evenness of species in a given area.

The Simpson's Diversity Index (D) Das et al. [35] is a widely used formula for calculating the impact of biodiversity. It considers both the number of species (S) and the proportion of each species to the total number of individuals (N) in a given habitat. The formula Thukral et al. [36] is follows

$$D = 1 - \sum_{i=1}^{s} \frac{n_i(n_i-1)}{N(N-1)} \tag{1}$$

This index ranges from 0 to 1, with higher values indicating greater biodiversity. A lower index suggests a higher impact on biodiversity, signifying a dominance of a few species over others, Nisa et al. [37].In EPIs, measuring biodiversity impact may entail calculating species abundance, species richness, or assessing changes in the population size of indicator species.the percent change in **species richness** over a given time period can be calculated using the following formula:

$$\Delta SR = \left(\frac{SR_{final} - SR_{initial}}{SR_{initial}}\right) \times 100 \quad (2)$$

A positive ΔSR indicates an increase in species richness, while a negative value suggests a decrease. Thus EPIs incorporate biodiversity impact using indices like Simpson's Diversity Index to measure species diversity, abundance, and changes over time, guiding sustainable practices and conservation efforts.

3.4.1 Summary

The EPI measures the impact of human activities on species diversity and abundance in ecosystems. Threats to biodiversity include pollution, climate change, and population growth, leading to species extinction rates. Biodiversity is crucial for energy capture, nutrient cycling, and biological production. Simpson's Diversity Index is used to calculate biodiversity impact, ranging from 0 to 1, and helps inform sustainable practices and conservation efforts.

4. ENVIRONMENTAL REPORTING FRAMEWORKS

EPIs are critical in assessing and communicating an organization's environmental impact. These indicators provide quantitative measures of an entity's environmental footprint. An ERF is used to communicate this information effectively. This framework establishes guidelines and standards for consistently and similarly reporting environmental data.EA involves EPI and ERF, which are interconnected to enhance transparency and accountability in sustainability practices. ERFs provide structured guidelines for reporting, ensuring consistent communication of environmental information to stakeholders, investors, and the public.

The most widely recognized ERFs are the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB).These frameworks define what data should be reported, ensuring a consistent and comparable presentation of environmental performance data. In turn, organizations use performance indicators aligned with these established frameworks to measure and report their environmental impact. In this section, we focus on analyzing the two reporting frameworks with different studies including their results.

4.1 GLOBAL REPORTING INITIATIVE

It is a comprehensive framework that establishes reporting guidelines for a variety of sustainability issues, including environmental performance. The GRI methodology consists of a set of principles and indicators classified as environmental, economic, social, and governance. Energy, water, emissions, and biodiversity are all included in the environmental category. GRI-enabled organizations typically use a structured reporting process that includes identifying material topics, defining report content, and reporting on performance indicators. The GRI Standards offer a flexible yet standardized approach that enables organizations to tailor their reports to their specific industry and context.

4.1.1GRI-Based Sustainability Reporting in Emerging Economy

The studyby Orazalin et al. [38] examined the determinants of sustainability performance disclosures by publicly traded companies in Kazakhstan using the Global Reporting Initiative (GRI) framework. Determinants include stand-alone reporting, reporting language, leverage, cash flow capacity, profitability, size, age, and auditor type. The results show that these factors significantly influence the quality and extent of sustainability-reporting practices. The study suggests that managers, practitioners, regulators, and policymakers in emerging economies should adopt GRI guidelines to improve sustainability disclosure quality.

The study examined sustainability performance in publicly traded companies on the Kazakhstani Stock Exchange from 2013-2015, using data from 53 companies across energy, manufacturing, and service industries. The dimensions include economic, environmental, and social performance indicators. The overall SR index is calculated using GRI guidelines and standards, with only five out of 53 companies reporting in accordance with GR4 guidelines for 2015.

The factors influencing sustainability information dissemination, including SAREP, reporting language, leverage, financial capacity, profitability, firm age, size, and auditor type. It uses panel regression models to control for unobserved heterogeneity and estimates the dependence of these factors on sustainability performance disclosures.Table1 shows Kazakhstani companies' sustainability practices, with energy accounting for 18.87%, followed by manufacturing and service. Energy companies disclose sustainability information in English, while manufacturing companies have the highest economic and social performance indicators.Table 2 shows SR practices from 2013-2015, with companies providing more economic, environmental, and social information. The average SR index is 9.88%, with 10.28% revealing stand-alone reports and 33.55 percent presenting information in English. Independent variables include ROE, audited firms, firm size, and age of Kazakh firms.

Table 1: Sustainability

Industry	Freq. (N)	Percent (%)	SAREP (%)	SRLNG (%)	ECON (%)	ENVI (%)	SOCI (%)	SPIND (%)
Energy	10	18.87	10.00	50.00	16.67	9.62	8.46	9.83
Manufacturing	23	43.40	17.39	25.00	25.03	9.49	10.64	11.29
Service	20	37.73	5.00	30.00	17.29	6.68	7.35	8.24
Total	53	100.00	21.44	26.78	18.49	8.48	9.05	9.88

ECON, performance score one economic dimension; ENVI, performance score on environmental dimension; SOCI, performance score on a social dimension; SPIND, a composites core on sustainability performance; SAREP, separate stand-alone SR; SRLNG, SR language. All SR variables are denoted in percentages

Table 2: Descriptive Statics

Variables	Obs	Mean	SD	Min	Max
ECON	146	18.49	12.55	1.27	67.68
ENVI	146	8.48	12.48	0.00	80.00
SOCI	146	9.05	8.84	1.27	47.51
SPIND	146	9.88	9.40	1.27	51.89
Dichotomous variables		Yes(1)	No(0)		
SAREP (%)	146	10.28	89.74		
SRLNG (%)	146	33.55	66.45		

ECON, performance score on economic dimension; ENVI, performance score on environmental dimension; SOCI, performance score on social dimension; SPIND, a composite score on sustainability performance; SAREP, separate stand-alone SR; SRLNG, SR language. All SR variables are denoted in percentages.

The Hausman test determines that random effect (RE) models are most appropriate for longitudinal data analyses, with estimated results presented in Table3.

Table 3: Descriptivestatistics onindependent variables

Variables	Obs	Mean	SD	Min	Max
ROV	146	12.32	29.35	-116.07	150.60
LEV	146	2.02	3.67	0.10	33.64
FCF	146	9.26	16.78	-79.17	80.79
AGE	146	12.58	6.26	1.00	26.00
SIZE (In)	146	12.39	2.01	7.90	17.73
SIZE (in US$, thousands)	146	1,871,246	7,162,200	2,694	49,682,417
Dichotomousvariables		Yes (1)	No (0)		
AUDIT(%)	146	78.22	21.78		

ROE,theturnonequityratio;LEV,aleverageratio;FCF,freecashflowstototalassetratios;AGE, thenumberofyearssincetheestablishmentofthecompany;SIZE(ln),thelogarithmofthetotalassets; SIZE, totalassetsofthecompanyinUS$;AUDIT,auditortype(BigFourorothers)

Therefore, the study found there was no significant relationship between factors influencing sustainability disclosure and information levels, as confirmed by cross-sectional ordinary least square regressions and variance inflation factor tests which was reported in Table 4.

Table 4: Analysis of OLS Regression

	ECON	ENVI	SOCI	SPIND
SAREP	25.98***(4.47)	15.94**(2.42)	15.21***(3.79)	16.71***(5.78)
SRLNG	0.0425(0.01)	6.911*(1.90)	4.946***(3.34)	5.134***(2.75)
LEV	0.00307*(1.66)	−0.00355**(−2.19)	−0.00251**(−2.38)	−0.00227*(−2.13)
FCF	0.0374(0.76)	−0.0342(−0.56)	0.00911(0.26)	−0.00412(−0.10)
ROE	0.0811***(3.00)	0.0735**(2.44)	0.0363**(2.43)	0.0555***(3.03)
AGE	0.224(1.10)	−0.372**(−2.25)	−0.0929(−0.82)	−0.163*(−1.68)
SIZE	0.292(0.49)	0.642(1.18)	0.186(0.50)	0.371(1.42)
AUDIT	4.571**(2.01)	3.130(1.48)	2.690(1.52)	3.071**(2.11)
Industry effects	Included	Included	Included	Included
Constant	−0.849(−0.14)	−5.028(−0.95)	−1.055(−0.27)	−2.540(−0.88)
n	146	146	146	146
F-stat	8.64***	5.58***	6.72***	17.03***
R2	0.4735	0.4696	0.5979	0.6509

Summary:

The study on sustainability performance disclosures in Kazakhstan's public companies has limitations, including focusing on financial institutions and examining firm-specific determinants. Further research should consider macro-level factors affecting CSR practices in emerging markets like Kazakhstan.

4.1.2Standardizing CSR Reporting with Gri Framework

The article by Michalczuk et al. [39] aimed to standardize **corporate social responsibility** reporting using the GRI Framework. The research method involved analyzing data from the GRI Sustainability Disclosure Database. Results showed diverse disclosure levels and highlighted the GRI Framework's importance in CSR report preparation, despite Poland's early development.

The article looked at how the GRI Framework can be used to standardize corporate social responsibility reporting. The GRI Framework is a toolkit that can be used by any organization, regardless of its legal status, business profile, size, or location. It includes reporting principles and guidelines, as well as indicators that allow businesses to measure and report on their operations' economic, social, and environmental outcomes. Using these tools helps improve the quality and usefulness of data in CSR reports, making it an important criterion for assessing the maturity of corporate social responsibility reporting systems in individual companies, countries, and regions around the world.

The study used a descriptive method to analyze literature on CSR reporting and a desk research method to analyze existing data from various sources. Desk research is commonly used in economic sciences due to its low costs and ability to compare results. The research focused on data published by the Global Reporting Initiative in the GRI Sustainability Disclosure Database, aiming to show territorial diversification in terms of published reports and the use of the GRI Framework.

The Global Reporting Initiative (GRI) launched the GRI Sustainability Disclosure Database in 1999 to promote CSR reporting globally. The database contains over 50,000 CSR reports submitted by companies worldwide, including those not requiring GRI Reporting Framework requirements or references to other regulations. The database has seen a significant increase in published reports, from 2,000 in 2009 to 7,000 in 2016-2017 is represent in chart (Figure 3).

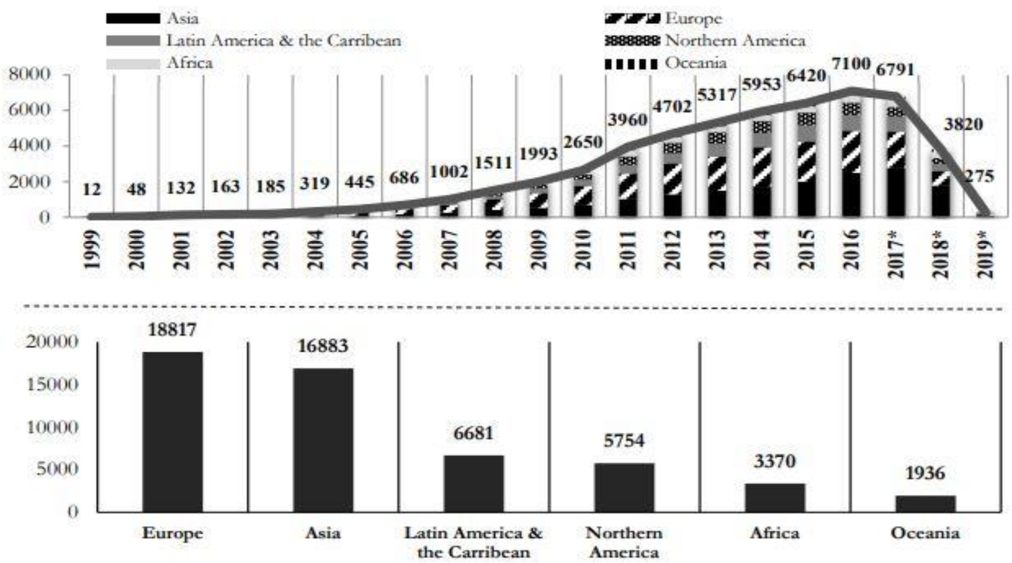


Figure 3: The number of reports submitted to the GRI Sustainability Disclosure Database between 1999 and 2019.

The European market has the largest share of CSR reports, with 35.2% of all GRI Sustainability Disclosure Database reports. Asia follows with 16.8% of reports. Latin America and the Caribbean 12.5%, Northern America 10.8%, Africa 6.3%, and Oceania

3.6% follow. CSR reporting develops at a different pace in each region, with the European and American markets experiencing stable growth. Asia has seen significant changes in CSR reporting, with major Asian stock exchanges reporting ESG data.The development of CSR reporting varies across regions and countries, as shown in the chart (Figure 4).

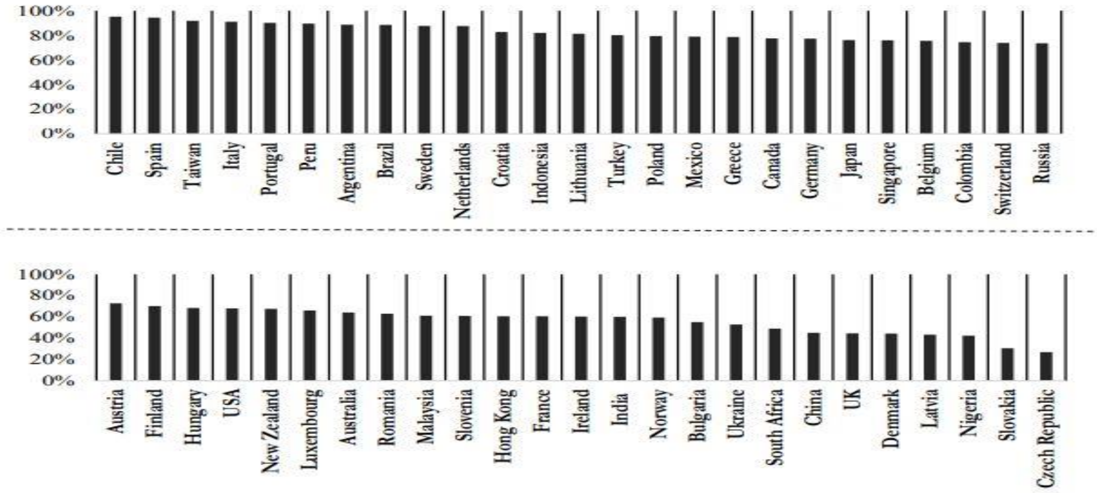


Figure 4: The number of reports submitted to the GRI Sustainability Disclosure Database by companies from selected countries between 1999 and 2019.

Poland, despite deviating from the world's best results, stands out in corporate social responsibility reporting among Central and Eastern European countries. Despite a significant number of reports submitted to the GRI database, Poland has experienced intense development in recent years. Currently, 335 Polish companies have registered 335 reports, with 246 submitted between 2013 and 2018. Around 70% of all reports in the database adhere to the GRI Reporting Framework (Figure 5).

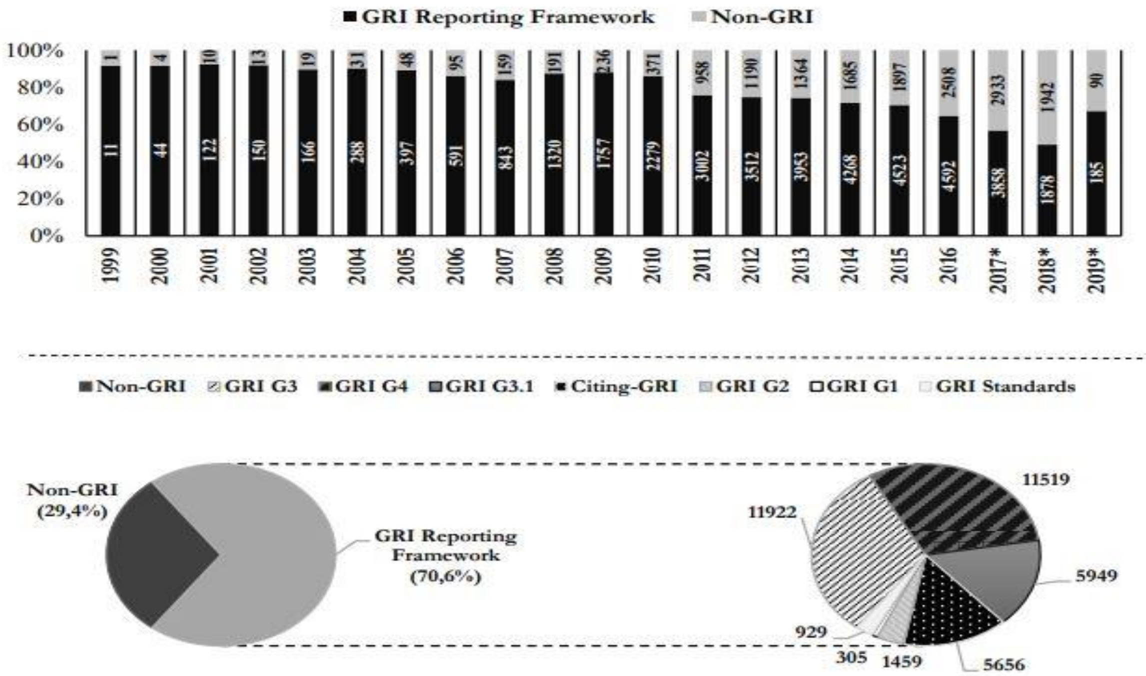


Figure 5: GRI Framework application in reports submitted to the GRI Sustainability Disclosure Database

The GRI Reporting Framework, which was first used in 1999-2019, has been primarily used by companies from Latin America and the Caribbean (84%), followed by Asia (74%), Europe

(73%), Northern America (70%), and Oceania (65%). The newest GRI Standards, which were only accepted in July 2018, are the only acceptable version. The lowest rate of use of GRI tools is found in reports from Africa (39%). The framework's usage can be observed by analyzing data from selected countries worldwide (Figure 6).

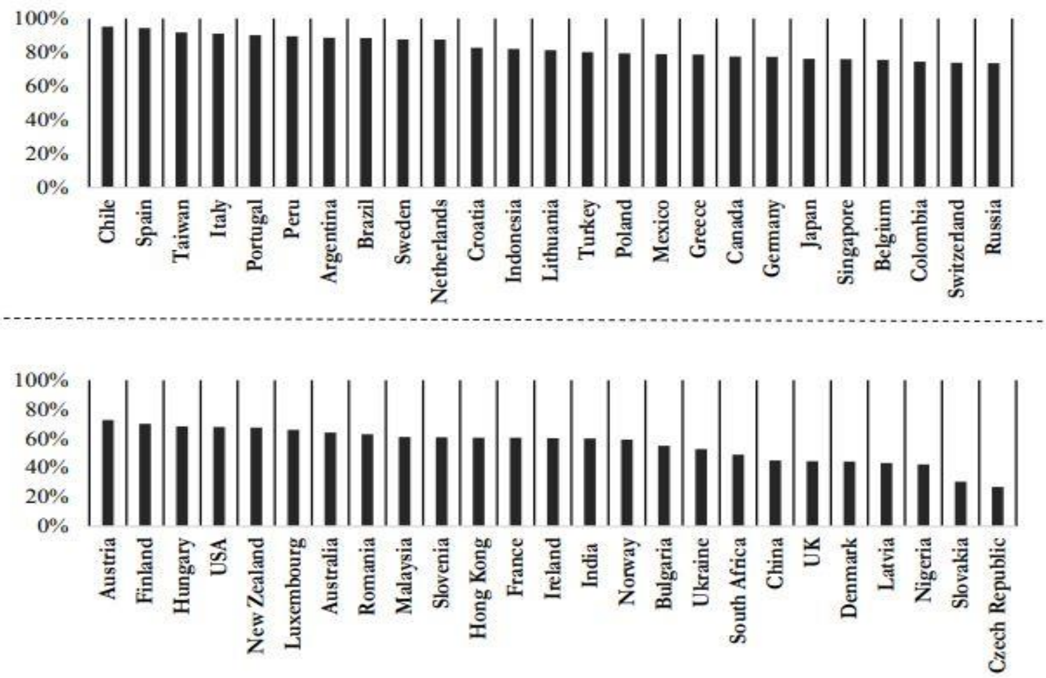


Figure 6: The GRI Sustainability Disclosure Database reports reveal the national rates of use of the GRI Framework.

Hence, Poland was in the early stages of developing corporate social responsibility reporting, with 80% of companies using the GRI Framework. The growth in published reports and use of the framework was largely due to the 2014/95/EU Directive.

4.1.3 Summary:

The increasing demand for transparent, consistent, and clear information about companies' achievements in both financial and non-financial aspects has led to the need for corporate social responsibility reporting. However, this type of reporting faces practical difficulties, such as the lack of uniform legal regulations, which limits the materiality, coherence, and comparability of reports. The authors evaluated the development of CSR reporting using data from the Global Reporting Initiative and its Framework. They found that Poland is in the initial stage of developing CSR reporting, and the GRI Reporting Framework plays a crucial role in this process

4.2 SUSTAINABILITY ACCOUNTING STANDARD BOARDS

SASB focuses on industry-specific standards for reporting financially significant sustainability data. SASB standards are particular industries, providing guidelines for reporting on environmental, social, and governance factors considered financially significant to a specific sector. The SASB process entails identifying material sustainability factors for each industry, determining disclosure topics and metrics, and aligning these with financial reporting as appropriate. The SASB approach incorporates environmental factors into financial reporting, focusing on the financial impact of sustainability issues.

4.2.1.Application of SASB in Iraqi Insurance Companies

The research by Sahib et al. [40] examined the application of FNO103 sustainability accounting standards in Iraqi insurance companies. The study found a weak percentage of sustainability accounting indicators in the annual reports of these companies from 2016 to 2020. Recommendations include raising awareness about sustainability accounting through research and case studies, training Iraqi negotiators to improve their skills, dealing with local and foreign investors to ensure sustainability-related guarantees, and reporting substantial sustainability issues in annual financial reports for informed decision-making.This research examined sustainability accounting standards and their application in local business units to improve financial reporting quality. It identified deficiencies in current financial reporting and used a framework for Iraqi business units. The study emphasized the importance of sustainability standards in enhancing investor confidence and improving profits.

The SASB is a non-profit organization established in 2012 to draft and issue sustainable development accounting standards. It focuses on governance, social, and environmental issues, using segment classification to determine materiality for specific standards. SASB sets sustainability standards across 11 sectors, enabling investors, analysts, and companies to compare performance, assess sustainability risks, and improve performance through industry-specific indicators.

The researcher measured variables and coded them for testing hypotheses in Table 5. They ensured data integrity and validity by avoiding missing values, following normal distribution, and forming a correlation matrix in Table 7. Descriptive statistics summarize the data for the variables used in the research.

Table 5: Research variables coding

Variable name	Variable type	No
Sustainability accounting standards	Independent	1
Quality of financial reporting	Follow	2

Table 6: Descriptive Statistics

Descriptive statistics					
	N	**Min**	**Max**	**Mean**	**Std Dev**
SAS	85	.143	.778	.46415	.198324
FRQ	85	-3.48763	22.2455	0.0000000	1.00000000
Valid N(listwise)	85				

Table 7: Binary correlation matrix between research variables

Correlations			
		FRQ	**SAS**
FRQ	Pearson correlation	1	.378**
	Sig.(2-tailed)		.000
	N	85	85
SAS	Pearson correlation	.378**	1
	Sig.(2-tailed)	.000	
	N	85	85
**. Correlation is significant at the 0.01 level (2-tailed).			

The study found weak bilateral correlation coefficients between two variables, indicating different dimensions. The researcher conducted a normal distribution test using the One Sample Kolmogorov-Smirnov test, revealing these findings.

Table 8: Normal distribution data testing

One-Sample Kolmogorov-Smirnov Test			
		SAS	**FRQ**
N		85	85
Normal Parameters	Mean	.46415	.0000000
	Std Dev	.198324	1.00000000
Most extreme differences	Absolute	.143	.119
	Positive	.136	.080
	Negative	-.143-	-.119
Test Statistic		.143	.108
Asymp.sig. (2-tailed)		.000	.016

The data, with a significance level of less than 0.05, is not close to the normal distribution. However, if the sample size exceeds 30 observations, it is considered normal. Statistical analyses using SPSS were performed to test hypotheses. This will be tested using a one sample T-test to determine the significant difference in the population average. A confidence interval of 0.50 will be used, with the acceptable level of application of sustainability accounting standards as the test value.

Table 9: Hypothesis testing result

One Sample Statistics						
SAS	**N**	**Mean**	**Std Dev**	**Std. Error Mean**		
	85	.4641	.198324	.021511		
	Test value=.5					
	T	Df	Siq. (2-tailed)	Mean Difference	95% confidence interval of the difference	
					Lower	Upper
	1.667	84	.099	-.035854	-.07863	.00692

4.2.1.1 Summary:

Thus, reporting on sustainability helps reduce earnings management manipulation, accounting preservation, and information asymmetry by showcasing adherence to sustainability standards. It captured environmental, social, and economic aspects beyond financial statements. However, challenges arise in preparing sustainability reports, such as discrepancies between annual reports and reporting methods. However, reporting on sustainable development practices offers benefits like comprehensive information, improved company image, and positive investment sentiment.

4.2.2.SASB Standards and Information Quality Disclosure in Mexican Construction

The research by Vazquez [41] evaluated the quality of information disclosure in Mexico's construction sector using SASB's international standards. It focused on three sectors: Construction Materials, Real Estate, and Home Builders. The research revealed significant variances in information disclosure quality across industries and companies. It emphasized the importance of company-focused descriptive language in assessing quality and communicating financial impact to stakeholders.This paper analyzed Mexico's construction sector's disclosure situation by classifying industries based on sustainability reports. Three industries, Construction Materials, Extractives and minerals Processing, Real Estate, and Home Builders, are identified as reporting with SASB standards, aiming to communicate financial material sustainability information to investors.

This paperanalyzed reports of 10 companies related to the construction sector, including Construction Materials, Extractives and minerals Processing, Real Estate, Infrastructure, and Home Builders, listed on SASB's official website for 2022. The methodology used is a quality classification scheme consisting of four metrics, evaluating the effectiveness of information disclosure in these sectors.

1. No Disclosure: The company is not providing any information pertinent to the topic under consideration.
2. Boilerplate: The company's disclosure is generic and lacks tailored information, making it difficult to differentiate it from its peers in the industry.
3. Company-tailored narrative: The company's disclosure, tailored to its unique circumstances, applies only to the issuer's context, but does not enable quantitative comparisons of performance between companies.
4. Metrics: The company uses quantitative performance indicators for disclosure, which are only applicable within the issuer's context.

This research classified sustainability disclosure topics and accounting metrics for various industries using weights and evaluation scales, with 13 metrics for construction materials, 14 for Real Estate, and 3 for Home Builders which is shown in following table.

Table 10: Initial Metrics by Industry

	Construction Materials	Real Estate	Home Builders
Number of accounting metrics	13	14	14
Total SASB	39	42	42

The classification of "high quality", "medium quality", and "low quality" was determined, with variations based on the scores obtained, as illustrated in Table 11.

Table 11: Initial Classification for Disclosure Quality

Disclosure quality	Construction Materials	Real Estate	Home Builders
High	39-35	42-37	42-37
Medium	34-25	36-26	36-26
Low	23-0	25-0	25-0

The metric focused on providing quality information and metrics, excluding no disclosure, boilerplate, company-tailored narrative, and metrics, rather than merely measuring or classifying information quality.

Table 12: Second metrics by Industry

	Construction Materials	Real Estate	Home Builders
Number of accounting metrics	13	14	14
Total	26	28	28

Table 13: Second classification for Disclosure quality

Disclosure quality	Construction Materials	Real Estate	Home Builders
High	26-24	28-26	28-26
Medium	23-16	25-17	25-17
Low	15-0	17-0	17-0

The sector of 2021 reports showed a dominant trend with 6 companies evaluating their disclosure quality. Three companies had low quality, two had medium quality, and one had high quality. The most prevalent metrics were flood zone information, with one company providing comprehensive information. Companies with high disclosure levels were considered larger enterprises. Energy star certification use was also observed, with some companies sharing information without explanation, while others explained that it does not apply in Mexico.

Table 14: Companies Information Disclosure by Scale Classification

	CM-E&M				**RE-1**												**HB-1**			
Scale Classification	**Initial Scale**		**Second Scale**		**Initial Scale**						**Second Scale**						**Initial Scale**		**Second Scale**	
0	1	4	1	4	7	3	4	1	1	9	7	3	4	1	1	9	6	3	6	3
1	0	2	0	2	2	2	0	0	7	3	2	2	0	0	7	3	3	0	3	0
2	0	0	12	7	1	1	0	0	2	0	5	9	10	13	6	2	1	2	5	11
3	12	7	-	-	4	8	10	13	4	2	-	-	-	-	-	-	4	9	-	-
Total	13	13	13	13	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14

4.2.3 Summary:

The quality of information and performance of companies are closely linked, but it is crucial to include graphs and be explicit about actions to avoid ambiguity and provide investors with accurate decision-making tools. A rigid evaluation method may limit companies that cover SASB standards, but some explain their situation and future action plans. A second evaluation metric, such as Tables13 and 14, was established where companies reported information to stakeholders without using metrics, resulting in a slight increase in evaluation results. However, some companies have clearly communicated their future plans, improving the quality of information disclosure.The investigation found that information disclosure depends on external factors, such as the company's capacity to conduct flood studies or the use of certifications not applicable in Mexico. Companies should share detailed information, considering other evaluation standards and considering the situation of aspects recommended by SASB. It is recommended to mention these aspects in company reports for stakeholders' understanding.

4.3 OVERALL SUMMARY

Both GRI and SASB stress the importance of identifying material environmental issues relevant to the organization's industry and stakeholders. This entails determining the importance of environmental factors in financial performance and stakeholder expectations.Specific performance indicators for each relevant aspect are provided by environmental reporting frameworks. GRI may specify indicators for energy consumption, greenhouse gas emissions, or water usage, for example. Because SASB is industry-specific, it tailors indicators to factors that are financially significant for each sector.After organizations have identified and measured their environmental impacts using performance indicators and followed reporting frameworks, incorporating this information into financial accounting practices becomes critical for a more comprehensive understanding of overall business performance.Incorporating environmental considerations into financial accounting is undertaken to enable stakeholders to make more informed decisions by understanding the financial implications of environmental activities and to enhance the overall reporting accuracy of organizations.

4.4 WHY EPI AND REPORTING FRAMEWORKS ARE IMPORTANT FOR INTEGRATION:

EPI is crucial for integration because it provides measurable metrics that reflect an organization's environmental impact. The use of EPI allows for a comprehensive understanding of an organization's sustainable efforts and enables effective tracking of environmental performance over time.

ERF provides standardized guidelines for disclosing environmental information in financial reports. By using this framework companies can align environmental data with financial reporting ensuring that both financial and environmental considerations are integrated into decision making process and communicated transparently to stakeholders.

These integrationspromote a more holistic view of organizational performance, fostering sustainable practices and accountability.

5. INTEGRATION OF EA WITH FINANCIAL ACCOUNTING

The integration of EA with FA is crucial for a comprehensive reporting approach. It quantifies and monetizes an organization's environmental impacts, providing a holistic view of performance. This allows stakeholders like investors and regulatory bodies to make informed decisions about environmental activities' financial implications and potential risks. This synergy contributes to a more sustainable and responsible business approach.This integration allows for a more accurate assessment of the true cost and value of the organization's activities, incorporating environmental considerations into the broader financial landscape.

The integration of environmental and financial accounting improves stakeholders' informed decision-making by allowing investors, regulators, and other interested parties to understand the impact of environmental factors on business sustainability, thereby promoting a balanced and responsible approach to business operations. Consider the study of integrating Social, Environmental and Financial Consideration by Nicholls, [42], which advocated for a revision of traditional financial accounting practices to align with global needs, investor motivations, and sustainable development goals.The approach suggested that private ownership remains the primary driving force, but now with communal interests. This shift could impact the balance between private, public, and common ownership and company structure. However, this approach is inconsistent with public policies and individual investor interests, as capitalism's limitations and challenges are acknowledged.

Comparison of the effect on principles of different motivations provided by Nicholls [42]. The principles can remain the same, but their application must change. If the motivation is divided into two parts, financial returns and social and environmental returns, each part may necessitate a different approach to determining reliability, but they will still be commensurate. This study suggested incorporating valuations as a note to accounts, with or without detailed analysis, and linking results to accounting policy or a separate sustainability report. This treatment would have a low effect on share demand as there is no link to financial reserves. The treatment integrates values, but net negative social and environmental values reduce distributable reserves, while net positive values increase them. This treatment does not provide an analysis of positive and negative outcomes.

Consider the example of BASF's value to society (is a method for measuring and valuing the societal impact of business activities. It takes a macro-societal look at BASF's contribution to a more sustainable future.) for the year 2021 which is shown in Figure 7(https://www.basf.com/global/en/who-we-are/sustainability/we-drive-sustainable-solutions/quantifying-sustainability/value-to-society).

The results show that the positive effects of our economic activity exceed the negative effects at every stage of the value chain under consideration. Kering's environmental profit and loss account in the year 2020 in three sectors namely manufacture of chemical fibers, manufacture of textiles, and manufacture of textile, wearing apparel and accessories which is taken as an example from Hao et al. [43]. In this environmental profit and loss value is converted from CO2emission and water consumption of three sub-sectors for the year 2011-2018 is shown in Figure 8.

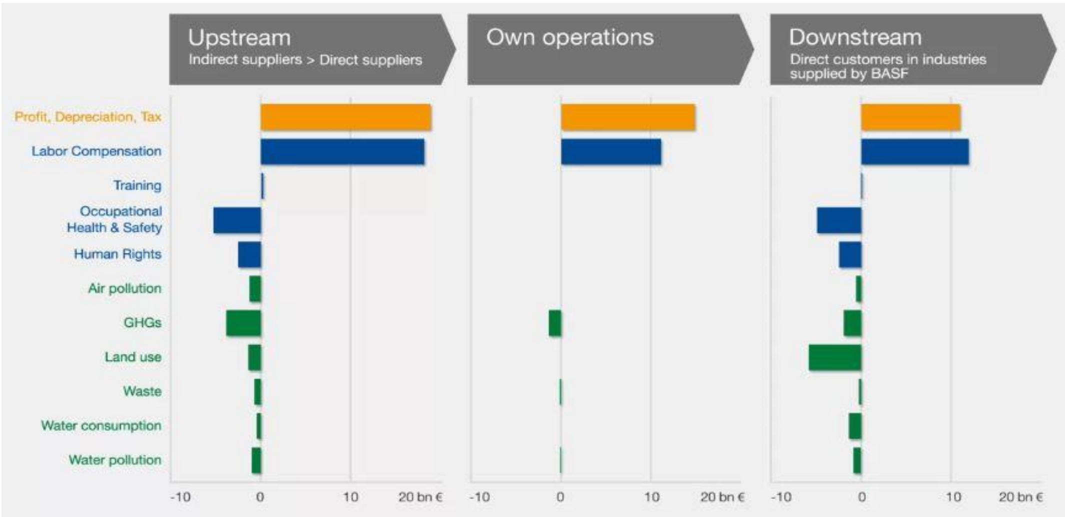
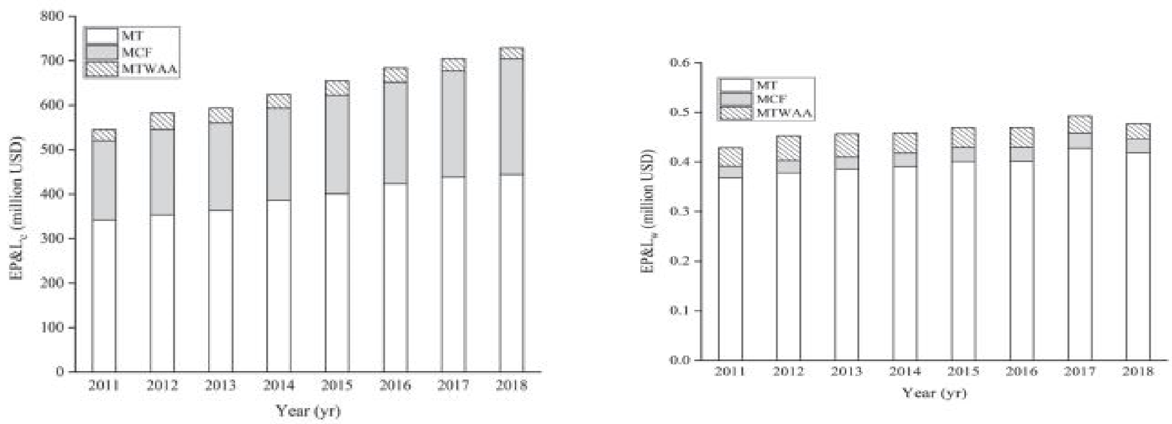


Figure 7: BASF Value to Society 2021



(a) EP&L value converted from CO_2 emission

(b) EP &L value converted from water consumption

Figure 8: EP&L converted value

In 2020, Kering's EC, valued at €515.9 million, covered six environmental impacts at every tier in the supply chain.The EP&L of GHGs accounted for 35% of the six life cycle impact categories studied, while water consumption accounted for 7%. [44]. Each of these strategies would result in two profit and loss statements, as shown in Table 15.

Table 15: Profit / Loss Accounts

Financial profit and loss		environmental P & L	
Income	x	Positive impact	x
Expenditure	(x)	Negative impact	(x)
	---------		--------
Net profit	x	Net impact	x

Finally, showing these as a fluctuation in savings would be possible, but would require national governments to acknowledge the accounting treatments that were not consistent with IASB (International Accounting Standard Boards) to integrate within the balance sheet of environmental impact xx inrespective year, as shown in Table 16.

Table: 16 Integration in the Balance Sheet

Balance Sheet		20xx
Fixed Assets		x
Current Assets		x
Current Liabilities		x
Net current assets		x
Social and environmental Asset		x
Long term liabilities	(x)	
Environmental Liability	(x)	
Net assets		x
Financed by		
Brought forward		x
Movement in period		x
Carried forward		x

Thus, companies can provide a more complete and transparent view of their financial health, risk management, and overall sustainability by incorporating environmental considerations into their balance sheets. This integration aids decision-making processes and assists stakeholders in assessing a company's long-term viability and responsibility.
This integration enables a more nuanced understanding of the financial consequences of environmental activities, allowing for more informed investment decisions. Furthermore, it aligns with the broader global sustainability movement by requiring businesses to account for and mitigate their environmental impact. Finally, the integration promotes a balanced approach to decision-making that takes into account both financial and environmental factors, thereby contributing to responsible and transparent corporate governance in the context of evolving environmental concerns.

6 CONCLUSIONS

The integration of EA with financial accounting is a strategic imperative, establishing performance indicators and reporting frameworks. This allows businesses to accurately represent environmental impacts, enhancing reporting accuracy and enabling stakeholders to make informed decisions. The resultant enhancement in reporting accuracy empowers stakeholders to make well-informed decisions by comprehending the financial implications of environmental activities. This approach fosters a balanced business model and aligns with global sustainability efforts.Future efforts should focus on expanding the scope of Environmental Indicators and advancing the integration process to encompass a broader spectrum of business activities.

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