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Life Cycle Assessment Integration to Improve ESG Reporting: A Path to Sustainable Decision-Making and Stakeholder Confidence

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Abstract: Companies are increasingly adding Environmental, Social, and Governance (ESG) measures to their reporting procedures as sustainability and climate change issues continue to receive attention on a global scale. ESG reporting can be significantly improved by using the Life Cycle Assessment (LCA), a tool that assesses the environmental effects of goods and services from conception to disposal. This is because LCA provides comprehensive and transparent data on companies’s environmental performance. This article initially reviews the literature on the concepts of LCA and ESG, then explores the synergy between LCA and ESG, highlights the benefits of integrating LCA into ESG reporting, and proposes a methodology for doing so. Key advantages include improved decision-making processes, better identification and management of environmental risks, and increased stakeholder confidence. By incorporating LCA into ESG reporting, companies can demonstrate a strong commitment to sustainability, strengthen their brand image, and potentially access new market opportunities.

Keywords: Environmental, Social, and Governance Reporting, Life Cycle Assessment, Sustainability

JEL classification: Q01, Q56, M14

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1. Introduction

Sustainability has become an increasingly crucial consideration for businesses, investors, and policymakers worldwide as they work to tackle urgent challenges such as climate change, resource depletion, and the rising expectations of stakeholders. In response, Life Cycle Assessment (LCA) and Environmental, Social, and Governance (ESG) reporting have emerged as vital tools for evaluating and communicating the sustainability performance of businesses and their products (Elkington, 1998; Lokuwaduge, 2017).

LCA is a systematic methodology that evaluates the environmental impacts of a product, service, or process throughout its entire life cycle, from raw material extraction to end-of-life disposal or recycling (ISO, 2006). ESG reporting involves disclosing non-financial information concerning a company’s environmental, social, and governance performance, allowing stakeholders to gain a better understanding and assess the organisation’s sustainability initiatives (KPMG, 2020). Integrating LCA into ESG reporting, as suggested by Sroufe (2017), and Molnár et al. (2023), presents a promising opportunity to enhance the rigour and credibility of sustainability disclosures. This integration can ultimately foster informed decision-making, drive improvements, and facilitate the creation of long-term value for both businesses and investors. By incorporating LCA into ESG reporting, organisations

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can provide a more comprehensive and accurate representation of their environmental performance (Molnár et al., 2023).

Despite the increasing significance of sustainability and ESG reporting, the incorporation of LCA methodologies in ESG disclosures has been limited. Studies have revealed that only a small percentage of companies utilise LCA in their sustainability reports, and the absence of widely accepted standards or guidelines for integrating LCA into ESG reporting can lead to inconsistent and incomparable disclosures (Jiang et al., 2022; Molnár et al., 2023).

This article aims to delve deeper into the role of LCA within ESG reporting, exploring the drivers, challenges, and potential benefits associated with this integration. It will provide insights into the current state of LCA and ESG reporting and offer guidance on how organisations can effectively incorporate LCA results into their ESG disclosures to enhance decision-making processes, drive continuous improvement, and improve the credibility of sustainability information.

2. Life Cycle Assessment (LCA): a comprehensive tool for sustainability

2.1. Definition and history of LCA

Life Cycle Assessment (LCA) is an integrated technique for analysing the total environmental consequences of goods or processes throughout their life cycle, from raw material extraction through final disposal. It is based on ISO 14040. It entails compiling a list of environmental inputs and outputs, assessing their effects, and interpreting the results. LCA is critical as a decision-making tool, particularly during the early phases of product development, to drive the creation of products and services while accounting for environmental repercussions and interactions throughout the life cycle (Fava et al., 1993; Rebitzer et al., 2004; Khasreen et al., 2009) (as can be seen in Figure 1).

![Figure 1: Generalized representation of the (pre)determination and the generation of environmental impacts in a product’s life cycle (adopted from Rebitzer et al., 2004)](image)

LCA research began in the late 1960s, primarily focused on energy but subsequently expanding to include resources, pollution, and waste. Although impact assessment approaches were developed in the 1980s, the discipline lacked a cohesive framework until 1990, resulting in a variety of conclusions. In 2002, Society of Environmental Toxicology and Chemistry (SETAC) and United Nations Environmental Programme (UNEP) created the Life Cycle Initiative, which highlighted LCA and gave rise to ideas such as Life Cycle Costing (LCC) and Social Life Cycle Assessment (SLCA). However, methodological inconsistencies continued because of ISO’s lack of defined LCA guidelines (Guinee, 2011).
2.2. Methodology and key principles
The ISO 14040:2006 standard defines LCA as a method for evaluating the environmental aspects and potential impacts associated with a product by examining its inputs and outputs within the product system. The standard outlines four primary phases in the LCA process: Goal and Scope Definition, Life Cycle Inventory (LCI), Life Cycle Impact Assessment (LCIA), and Interpretation. As can be seen in Figure 2 illustrates these processes, which have an interactive and iterative structure, allowing for flexibility in cases of missing data, ambiguous results, or discrepancies between the results and the study’s objectives.

![Figure 2: Environmental Management Life Cycle Assessment Principles and Framework (adopted from ISO, 2006)](image)

To ensure the credibility and reliability of LCA results, practitioners adhere to several key principles: comprehensiveness, transparency, consistency, and iterativity. Comprehensiveness involves considering all relevant environmental aspects and life cycle stages. Transparency requires clearly documenting the data sources, assumptions, and methodologies employed. Consistency necessitates assessing similar processes and products using the same methods and data. Iterativity emphasises the need for continuous improvement and refinement of LCA studies (Björklund, 2002).

3. Environmental, Social, and Governance (ESG) Reporting: a crucial component of corporate accountability
3.1. Definition and history of ESG reporting
Companies use ESG reporting to reveal their environmental, social, and governance performance, allowing stakeholders to assess sustainability and ethical issues. The method has grown in popularity as businesses strive to demonstrate their commitment to sustainability and social responsibility. Growing stakeholder engagement, particularly investor interest, has been spurred by the realisation that financial reports alone are insufficient for appraising a company's future. ESG reports are currently in high demand since they have an influence on corporate value and future strategies. ESG performance has been shown to have a favourable impact on investing decisions. ESG reporting is encouraged through mandatory regulations like the EU's Non-Financial Reporting Directive and voluntary initiatives such as the Global Reporting Initiative (GRI), Sustainability Accounting Standards Board (SASB), and Task Force on Climate-related Financial Disclosures (TCFD), which provide frameworks and guidelines for organizations to create and publish ESG reports (Mervelskemper & Streit, 2017; Inderst & Stewart, 2018).

The term "ESG" first appeared in the 2004 UN Global Compact report, which is endorsed by 20 financial institutions, including BNP Paribas, HSBC, and Morgan Stanley, is called for collaboration among
financial institutions to effectively integrate environmental, social, and corporate governance issues into asset management and related services (Compact, 2004).

3.2. Basic elements of ESG reporting

The ESG report includes three core elements: environmental, social, and corporate governance. Cek & Eyupoglu (2020) found that the social and governance pillars positively affect a firm’s economic success due to their long-term value for shareholders. Paolone et al. (2022) highlighted that the governance pillar has a particularly stronger impact on market performance compared to the other two. Understanding each element is crucial, as can be seen in Figure 3 provides brief definitions of the categories under the basic dimensions of the ESG score. It is worth noting that there is currently no universally accepted criterion for sub-categories, as mentioned by Refinitiv (2019).

<table>
<thead>
<tr>
<th>Pillars</th>
<th>Categories</th>
<th>Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental</td>
<td>Emission</td>
<td>Emissions; Waste; Biodiversity; Environmental management systems</td>
</tr>
<tr>
<td></td>
<td>Innovation</td>
<td>Product innovation; Green revenues, research, and development (R&amp;D) and capital expenditures (CapEx)</td>
</tr>
<tr>
<td></td>
<td>Resource use</td>
<td>Water; Energy; Sustainable packaging; Environmental supply chain</td>
</tr>
<tr>
<td>Social</td>
<td>Community</td>
<td>Equal important to all industry groups</td>
</tr>
<tr>
<td></td>
<td>Human rights</td>
<td>Human rights</td>
</tr>
<tr>
<td></td>
<td>Product responsibility</td>
<td>Responsible marketing; Product quality; Data privacy</td>
</tr>
<tr>
<td></td>
<td>Workforce</td>
<td>Diversity and inclusion; Career development and training; Working conditions; Health and safety</td>
</tr>
<tr>
<td>Governance</td>
<td>CSR strategy</td>
<td>CSR strategy; ESG reporting and transparency</td>
</tr>
<tr>
<td></td>
<td>Management</td>
<td>Structure (independence, diversity, committees); Compensation</td>
</tr>
<tr>
<td></td>
<td>Shareholders</td>
<td>Shareholder rights; Takeover defences</td>
</tr>
</tbody>
</table>

Figure 3: Categories included in the basic dimensions of ESG score (adopted from Refinitiv, 2019)

3.3. Calculation of ESG Scores

a)

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Collection</td>
<td>Gather data from company reports, news, and databases like Thomson Reuters ASSET4.</td>
<td>Escrig et al., 2017</td>
</tr>
<tr>
<td>Indicator Selection</td>
<td>Choose relevant indicators (e.g. emissions, energy efficiency, labour practices).</td>
<td>Calvin &amp; Street, 2020</td>
</tr>
<tr>
<td>Data Normalisation</td>
<td>Process raw data for comparability (e.g. ratios, percentages).</td>
<td>Bender, 2018</td>
</tr>
<tr>
<td>Weighting and Aggregation</td>
<td>Assign weights to indicators; calculate sub-scores for Environmental, Social, Governance dimensions.</td>
<td>Bender, 2018</td>
</tr>
<tr>
<td>Final ESG Score</td>
<td>Combine sub-scores using methods like weighted averages. Understanding methodology is key.</td>
<td>Zhang, 2021</td>
</tr>
</tbody>
</table>

b)

\[
E = \frac{1}{\text{total } E \cdot \text{weight}} \sum_{i} \text{raw score}_i \times \text{weight}_i
\]

\[
S = \frac{1}{\text{total } S \cdot \text{weight}} \sum_{i} \text{raw score}_i \times \text{weight}_i
\]

\[
G = \frac{1}{\text{total } G \cdot \text{weight}} \sum_{i} \text{raw score}_i \times \text{weight}_i
\]

Figure 4: a) ESG score calculation steps (illustrated by authors); b) Mathematically, calculation of ESG dimension can be represented as (adopted from Zhang, 2021)
Calculating ESG scores involves evaluating a company’s performance across environmental, social, and governance factors. ESG rating agencies and data providers employ diverse methodologies to calculate these scores. Some key aspects of the ESG score calculation can be seen in Figure 4.

4. Integrating Life Cycle Assessment (LCA) into ESG Reporting

4.1. Synergies between LCA and ESG reporting

Integrating LCA into ESG reporting can provide valuable insights for companies seeking to improve their sustainability performance. LCA offers in-depth and reliable information on how products and processes impact the environment, enabling businesses to present an accurate and transparent assessment of their environmental performance. The insights derived from LCA can support strategic decision-making, such as the selection of environmentally responsible suppliers, thereby improving the environmental section scores of ESG reports (Zhang et al., 2020). LCA helps companies identify the most significant environmental impacts across their value chains, allowing them to focus their efforts on addressing these critical areas and identifying opportunities for improvement. With the increasing demand for robust environmental information from investors, regulators, and customers, LCA enables organisations to meet these expectations by providing reliable data on their sustainability performance. By generating more reliable ESG reports, organisations can meet stakeholder expectations, thanks to the inclusion of LCA (Zhang et al., 2020; Jiang et al., 2022).

The product lifecycle includes infancy, development, maturity, and decline. Quality starts low and improves until maturity, where it stabilizes. The decline phase needs innovation to sustain. There’s a link between product quality and ESG compliance, with potential for exceeding sustainability in infancy through design. Development balances financial and ESG growth. Maturity has untapped potential, while decline restricts growth unless improved (Bellandi, 2022).

4.2. Methodology that integrates LCA into ESG reporting

The following methodology proposed for integrating LCA into ESG reporting can be seen in Figure 5.

| 1. Preparation | a. Define Objectives: State the goals of integrating LCA into ESG reporting (e.g., transparency, reduced environmental impact).
|                | b. Engage Stakeholders: Consult with stakeholders to understand their sustainability concerns and expectations.
|                | c. Establish Team: Create a team from different departments to manage the integration.
| 2. Life Cycle Assessment (LCA) | a. Definition of Scope: Determine which products or processes to assess and what life cycle stages to include.
|                | b. Inventory Analysis: Collect data on resource use and emissions for each life cycle stage.
|                | c. Impact Assessment: Calculate environmental impacts using LCA software.
|                | d. Interpretation: Analyze results to identify areas with high environmental impact and possibilities for improvement.
| 3. Integration into ESG Reporting | a. Select ESG Reporting Standard: Choose an appropriate ESG reporting framework (e.g., GRI, SASB).
|                | b. Social and Governance Data: Include information on social and governance aspects.
|                | c. Set Targets: Establish environmental goals based on LCA findings.
|                | d. Compile ESG Report: Incorporate LCA data into the ESG report and provide context.
|                | e. Optional: Third-party Verification: Engage an external auditor for data verification.
|                | b. Communicate to Stakeholders: Share the report and its findings with stakeholders.
| 5. Monitoring and Improvement | a. Monitor Performance: Regularly check the company’s performance against set goals.
|                | b. Update Data: Keep LCA and ESG data current.
|                | c. Engage Stakeholders for Feedback: Continuously gather stakeholder feedback for improvement.
|                | b. Document Changes and Updates: Keep a log of any changes to methodologies and assumptions for transparency.

Figure 5: Proposed methodology (illustrated by authors)
4.3. Challenges and limitations of integrating LCA into ESG reporting

Despite the potential advantages of incorporating LCA into ESG reporting, organisations face several obstacles and constraints that need to be overcome to fully leverage this integration. The primary challenge in integrating LCA into ESG reports is the difficulty in accessing reliable and comprehensive data on environmental impacts. Companies may be reluctant to share proprietary information or face privacy issues with suppliers, further complicating data gathering (Jiang et al., 2022). Differing methodologies between LCA and ESG reports cause alignment issues. LCA focuses on environmental impacts, while ESG reporting is broader. Adjusting frameworks for consistency is necessary but challenging, especially as evolving products and technologies require continuous updates to LCA data, demanding more time and resources (Molnár et al., 2023).

5. Conclusion

Incorporating LCA into ESG reporting is crucial to providing accurate, transparent, and comprehensive data on organisations' environmental performance. By including LCA results in ESG reporting, companies can effectively demonstrate their commitment to sustainability, make informed decisions, and drive continuous improvement in their environmental practises. The adoption and integration of LCA approaches into ESG reporting are influenced by various factors, such as policies, regulations, market dynamics, and technological advancements. Moreover, emerging trends like digitalization, data management, streamlined reporting, standardisation, and the increasing focus on the circular economy and regenerative practises will shape the future of LCA and ESG reporting. Companies that proactively embrace these trends and invest in LCA and ESG integration will be better positioned to meet evolving expectations from investors, customers, regulators, and other stakeholders. Ultimately, the effective integration of LCA into ESG reporting can contribute to long-term value creation and drive positive environmental, social, and economic outcomes for all stakeholders, fostering a more resilient and sustainable corporate environment.

References


