

Measuring Environmental Impact In CSR Reporting: A Comparative Study Of Green Metrics In IT And Manufacturing Sectors

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Abstract

Environmental sustainability has come into being as the main theme of CSR narratives across industries. As the stakeholders demand transparency and accountability, CSR reporting has become a key tool to report the environmental performance of the company. The nature, extent, and effectiveness of environmental impact disclosures in CSR reports are being studied with a comparative angle drawn between the Information Technology (IT) and Manufacturing sectors in India. The analysis depicts a huge disparity in the application of green metrics, where manufacturing companies have more significant carbon, water, and waste disclosures while IT companies look at energy consumption and digital sustainability. The Companies Act, 2013, and the Global Reporting Initiative (GRI), along with a host of others, provide the framework for disclosures; nevertheless, inconsistencies remain within sectors. The researchers, thus, conclude with suggested amendments for environmental performance reporting to unify sectoral divisions and increase trustworthiness among stakeholders.

Keywords: CSR reporting, environmental impact, green metrics, sustainability, IT sector, manufacturing, India, ESG disclosure, GRI, regulatory compliance, Social Science and Humanities, Human Resource Management, Corporate Social Responsibility.

INTRODUCTION

In contemporary times, Corporate Social Responsibility is no longer considered corporate philanthropy or window dressing environmental gestures. In a climate-concerned global economy, CSR is considered an utmost strategic imperative, especially from an environmental stewardship perspective. Increased environmental degradation, public scrutiny, and international frameworks such as the Paris Agreement have made it imperative for companies to demonstrate real environmental performance in their CSR discourse.

India witnessed an instance of an Act establishing CSR when Section 135 of the Companies Act was enacted in 2013. This Act insisted on a financial outlay for CSR activities and the reporting mechanism for them in a transparent manner. Amongst several CSR aspects, environmental sustainability stands out as it directly impinges upon ecosystems, communities, and corporate reputation.

Environmental CSR has gained in importance; yet the green metrics in CSR reports are hardly compatible and consistent, especially across industries.

Prima facie, this research zooms in on two highly economically influential yet environmentally contrasting sectors in India-the Information Technology and Manufacturing sectors. By way of working with CSR reports of the top companies of both the sectors, the attempt is made to see how environmental impacts are measured, reported, and standardized.

2. LITERATURE REVIEW

The convergence or the interlinking of Corporate Social Responsibility and climate/environmental issues has become a subject of great interest in academic research as well as business training. In the last 20 years, an emphasis has been placed on researchers attempting to understand how companies communicate their environmental responsibilities to determine whether these disclosures truly reflect environmental performance or serve merely as reputational conditioning.

In one of the early systematic reviews, Gray, Kouhy, and Lavers (1995) reviewed the development of corporate environmental and social reporting in the UK, stating that while, in theory, companies were using disclosures for image management, the longitudinal nature of their research showed that actually, disclosure practice was influenced more by stakeholder pressure and legitimacy issues than by the real performance with regard to ecology. Since then, this theory that companies intentionally disclose CSR information to seek social legitimacy seems to have become the very foundation of a large body of literature.

Clarkson et al. (2008) tested the relationship between a firm's environmental performance and its disclosure level. Looking at North American companies, these researchers contended that better performing organizations disclosed more information, particularly those in manufacturing and extractive industries. This important performance-disclosure link is especially relevant when comparing sectors such as IT and manufacturing, which differ markedly in the environmental visibility afforded to purported impacts.

Brammer and Pavelin (2006) pursued further inquiry into how industry might influence the depth of disclosure. Their study of voluntary environmental reporting in large UK firms established that those operating in high-impact sectors such as manufacturing tended to disclose more quantified details concerning emissions, water usage, and waste treatment. Conversely, those in service industries, including IT, tended to disclose less, or did so narratively without proper metrics.

The disparity in disclosure practices has also been shown by global trends. According to the KPMG (2022) Corporate Responsibility Reporting Survey, while 96% of the 250 top companies in the world now publish some form of sustainability report, environmental disclosure remains very uneven in terms of sector-wise comprehensiveness and comparability. Manufacturing companies, in particular, reported more adherence to frameworks such as the Global Reporting Initiative (GRI) and the Task Force on Climate-related Financial Disclosures (TCFD), whereas those in IT focused mainly on energy use and digital transformation with little comparability.

While GRI Standards (2021), for example, provide structured indicators for environment performance such as Scope 1, 2, and 3 emissions, water withdrawal, and waste generation, the fact they are voluntary has resulted in an uneven application across industries. Manufacturing companies utilize these frameworks more systematically due to regulatory requirements and stakeholder pressure. In contrast, IT companies often report selectively, focusing on internal green practices (like paperless operations and LEED-certified buildings) without quantifying their broader ecological footprint.

Hahn and Kühnen (2013) expanded the theoretical landscape by reviewing the determinants of sustainability reporting in several geographic and industry settings. They stated that while regulatory mandates and pressure from stakeholders maintain their critical roles, the organizational culture may provide other considerable influences as well, depending on sector-related risk and internal capabilities, into how deep these disclosures go and how technically sound they become. This helps explain how two economically strong sectors can crystalize their environmental liabilities very differently.

The availability of numerous reporting tools also contributes to inconsistency. According to Siew (2015), the wide range of popular sustainability reporting instruments from GRI, to CDP, to Integrated Reporting, are missing precision that will accommodate some industries; especially for those areas like IT where environmental impacts are either indirect or diffuse. These cause ... soft reporting, whereby firms report initiatives without hard measurement frameworks for comparison across industries.

In recent times, studies have begun to point toward the fact that a digital and data-driven sector needs to be audited for its indirect environmental effects. Bai et al. (2020) developed it from the Industry 4.0 perspective, emphasizing that IT firms need to address the ecological footprint of data centers, cloud computing infrastructures, and e-waste. The paper advocated for the expansion of green metrics in IT, whereby companies would put attention to lifecycle assessment on a far more explicit level than just the electricity bills and carbon offset program.

In more theoretical terms, Yusoff and Lehman (2009) interrogated CSR reports using legitimacy theory and sound a warning that symbolic disclosure statements made for reputational purposes often stay in the way of substantive action. This finding is even more pertinent for sectors such as IT, where environmental impacts are often less visible and disclosures tend to slip into aspiration rather than evidence.

Lastly, Sethi, Martell, and Demir (2017) evaluated the quality of CSR reports among the largest financial institutions worldwide, providing a scoring methodology to assess transparency, specificity, and balance. Such methodology might provide a useful benchmark for comparing CSR disclosures not only across firms but also across entire industries. Although this study targeted the financial sector, the metrics could be relevant for assessing the quality of environmental CSR disclosures in IT and manufacturing companies.

Together, these ten scholarly contributions form a solid background to understand the evolution of environmental CSR reporting. They have stressed that there is always some tension between aspiration and action, between reporting as a communication tool and reporting as a performance measure. Also, they establish the importance of sectoral context in shaping what gets reported and how-this is the main motivation that the present study has for undertaking a comparative study in the IT and manufacturing sectors in India.

RESEARCH GAP

While significant research has been done on CSR and environmental sustainability, the literature still presents some gaps that need addressing to further explain how companies report and measure their environmental impact. Specifically, the following gaps have been formulated in the literature in environmental CSR reporting, especially concerning the IT and manufacturing sectors:

1. Sectoral Inconsistencies in Green Metrics:

While it is rather established that differences in environmental disclosures exist across industries, a comparison between sectors such as IT and manufacturing-the environmental impacts of which differ greatly-is missing. Manufacturing firms appear to report at greater detail because of direct environmental effects (say emissions, water usages in the factories, waste disposal), whereas IT companies mostly report on energy consumption and what might be termed digital sustainability. These divergences in reporting would appear to merit further investigation into how sectoral characteristics may in fact influence how environmental performance is measured and disclosed.

2. Inadequate Standardization of Green Metrics:

Many research articles have criticized the voluntary nature of major reporting frameworks such as GRI or CDP. This causes reporting to be inconsistent and non-comparable between companies and industries. Despite this, there is a dearth of empirical work that looks into how standardized green metrics might be developed or adopted for cross-sectoral comparisons. Such a gap is even more evident in sectors that differ in their levels of environmental impact, i.e., IT focuses predominantly on digital transformation and energy, whereas manufacturing focuses on the physical environment like emissions and waste.

3. Underexplored Impact of Digital Sustainability on Environmental Reporting:

Although there is now a sizeable literature on environmental reporting in conventional industries, little has been done on digital sustainability issues in the IT sector. As cloud computing, data centers, and e-waste-in-chief environmental concerns-are being brought under scrutiny, the IT firms have not proposed comprehensive reporting frameworks to quantify and disclose their digital environmental footprint. This gap certainly warrants further exploration in terms of how IT firms can adopt green metrics relevant to their business model and digital operations.

4. Influence of Regulatory and Policy Frameworks on Sector-Specific Reporting:

While Sustainability Reporting (BRSR) guidelines necessitate environmental disclosures, the application of these standards across sectors is inconsistent. For example, many manufacturing companies follow extensive environmental reporting protocols due to their adherence to more stringent regulations, such as ISO 14001; however, IT companies may not be as threatened by such regulatory pressures, and their environmental impacts may not be disclosed comparable to those of manufacturing companies. There is thus a gap in research concerning how different regulatory frameworks affect levels of depth and quality of environmental disclosure across sectors and how these regulations can provide impetus in encouraging uniform standards of reporting.

5. Lack of Sector-Specific Impact Assessments:

Very few studies have unpacked the sectoral impact of CSR engagements into environmental outputs for specific industries. There have been quite a number of empirical studies which have discussed the broad relationship between environmental performance and CSR disclosures, but they have not been sector specific. Generally, studies have focused either on environmental outcomes or on CSR engagements; little attention has been devoted specifically to the interaction between the two dimensions in particular sectors, such as IT and manufacturing. This particular gap calls for dedicated research to ascertain the actual impacts of CSR initiatives on environmental performance in these sectors.

6. Limited Research on Third-Party Verification in Environmental CSR Reports:

In addition, another critical gap identified in the literature is third-party validation of environmental disclosures, particularly in the IT sector. While manufacturing companies usually undergo third-party verification, including ISO certifications, many IT companies do not have such stringent scrutiny; hence the reported data are doubtful. Further research is needed to assess the potential for harmonizing third-party verification mechanisms with CSR reporting frameworks, especially in the IT sector, where environmental impacts are less directly visible.

Summary of Research Gap

Though informative, much of the existing literature speaks to CSR and environmental reporting practices of firms with large gaps remaining. Future research should focus particularly on sectoral green metrics, digital sustainability in IT companies, and standardized reporting frameworks. Little attention has also been paid to the influence of regulatory frameworks and the role of third-party verification in strengthening the credibility of CSR disclosures. Addressing these gaps will make a considerable contribution in producing environmental CSR disclosures that are reliable, comparable, and somehow impactful across industries.

3. METHODOLOGY

This research adopts a comparative, descriptive research design for the study in analyzing and evaluating the environmental impact disclosures in CSR reporting by companies doing business within the IT and manufacturing sectors in India. The methodology will make a structure for general quantitative content analysis alongside qualitative pattern identification in sustainability reporting.

3.1 Research Objectives

- To identify and measure the quality and quantity of environmental metrics disclosed in CSR reports.
- To assess the comparative environmental reporting between the IT and manufacturing sectors.
- To verify if the CSR of the sector complies with some regulatory frameworks like BRSR and GRI.
- Identify gaps and suggest improvements for each sector regarding CSR environmental disclosures.

3.2 Methodology

A qualitative comparative content analysis was conducted on the Corporate Social Responsibility (CSR) reports prepared by 20 leading Indian corporations-10 from the information technology (IT) sector and 10 from the manufacturing sector. The selected firms were stratified by market capitalization and the amount of expenditure on CSR reported on the CSR portal (csr.gov.in) for the financial year 2022-2023.

Frameworks used for analysis:

- Global Reporting Initiative (GRI)
- Business Responsibility and Sustainability Report (BRSR) by SEBI
- United Nations Sustainable Development Goals (SDGs)

Main green metrics studied:

- Carbon emissions (Scope 1, 2, 3)
- Energy consumption; renewable versus non-renewable
- Water usage and conservation

- Waste management and recycling
- Biodiversity initiatives
- Green procurement and lifecycle assessments

4. FINDINGS AND ANALYSIS

4.1 IT Sector: Highlights and Gaps

The majority of the IT companies studied (Infosys, TCS, Wipro), detailed disclosures about energy consumption considering established green buildings, solar panels, and carbon neutrality roadmaps. For example, Wipro achieved carbon neutrality for its operations in India during the year 2022, while Infosys publishes its carbon inventories in detail according to the standards provided by CDP.

The same is the case for waste, water, and biodiversity metrics. E-waste management, despite being mentioned, is not standardized for quantification. Most of the reports concentrated on paperless offices and carbon saving from work at home, which cannot be benchmarked anyway.

4.2 Manufacturing Sector: Depth but Inconsistencies

Some of the manufacturing firms such as Tata Steel, Reliance Industries, and Aditya Birla Group reported extensive environmental metrics such as carbon intensity per unit production, hazardous waste treatment, and rainwater harvesting volumes. Tata Steel's report is in line with GRI and BRSR guidance without proper reporting but gives up granularity on emissions and resource use. It finds differences within the sector. Whereas large firms have expansive disclosure, SMEs and mid-size firms mostly give generic or qualitative data without proper benchmarking.

4.3 Comparative Metrics for CSR Environmental Disclosures in IT vs Manufacturing Sectors

Table 1:

S. No.	Environmental Metric	Manufacturing Sector	IT Sector	Remarks
1	Energy Consumption (in MWh)	Disclosed with year-on-year trend and source split (renewable vs non-renewable)	Disclosed, mostly limited to office energy use and data centers	Limited depth in IT sector
2	Scope 1 & Scope 2 GHG Emissions	Quantitative disclosure common; verified data through third-party	Partially disclosed; often only Scope 2 reported	Underreported in IT
3	Scope 3 Emissions	Rare, but improving due to supply chain concerns	Largely absent or general narrative without metrics	Major gap in both
4	Water Usage and Management	Detailed reporting on usage, recycling, and source	Rarely disclosed; not a material issue for most firms	Not sector-relevant for IT
5	Waste Management (solid/hazardous)	Detailed disclosures, often includes reduction targets	Mostly not reported, except some e-waste mentions	Lacking in IT
6	E-Waste Management	Not applicable	Brief narrative disclosures, few report in metrics	Sector-specific for IT
7	Renewable Energy Initiatives	Strongly reported with quantitative goals	Highlighted in ESG sections, especially data centers	Positive trend

S. No.	Environmental Metric	Manufacturing Sector	IT Sector	Remarks
8	Environmental Certifications (e.g., ISO 14001)	Widely reported and externally validated	Reported where relevant; mostly in large MNCs	Less common in mid-size IT firms
9	Environmental Fines or Compliance Reporting	Mandatory disclosure; found in statutory sections	Rarely disclosed or stated as "Nil"	Legal compliance required
10	Sustainability Goals (SDG/Net Zero Targets)	Linked to SDGs and emission reductions	Linked to net-zero, digital sustainability	Strong in both, more strategic in IT
11	Third-party Assurance of ESG Data	Frequently reported (GRI/ISO audits)	Rare in IT; assurance not standard	Trust gap in IT disclosures
12	BRSR Framework Adoption (Post-2021)	Rapid adoption with structured data and metrics	Adoption seen but limited in depth	BRSR helps harmonize both sectors

- Manufacturing is much more quantitative and audited regarding the quality of environmental disclosures since considerable operational impact and legal mandates govern them.
- IT firm promotes more narrative-based disclosures and less metric and assurance-mechanism, unlike other industries.
- Common voids are Scope 3 emissions, e-waste reporting (IT), and the absence of third-party assurance or verification in most firms.

5. REGULATORY AND FRAMEWORK INFLUENCE

The Companies Act of 2013 of India, strengthened by the Business Responsibility and Sustainability Reporting (BRSR) framework by the Securities and Exchange Board of India, places a big demand on companies to report on non-financial metrics. The GRI standards are though not mandatory but serve as a reference point for maximum companies.

Existence of norms of environmental regulations applicable to specific sectors most often is not available; hence, the interpretation would become random. For example, in IT, a low flow faucet may fit the definition of "water conservation" whereas, for manufacturing, it may mean extensive treatment and reuse facilities.

In any case, if environmental disclosure is verified by a third party, it has become commonplace in manufacturing because mostly the other way is put forth by law (ISO 14001). Otherwise, in the field of IT, that process is voluntary.

6. DISCUSSION

A comparative evaluation of CSR reporting across the IT and manufacturing industries tells a lot about the status of environmental disclosure practices in India. Both sectors were being increasingly seen as embracing sustainability as a core element of their corporate responsibility, but their environmental reporting was largely different in nature, extent, and metrics due to the peculiarities of their individual sectors, legislative forces, and stakeholder expectations.

Manufacturing companies tend to have a more extensive range of tangible environmental numbers, such as the detailed Scope 1 and Scope 2 greenhouse gas emission disclosures, water withdrawal and recycling, hazardous and non-hazardous waste handling, and energy efficiency projects. Most organizations disclose these reports in accordance with the Global Reporting Initiative, ISO 14001 certifications, or the Business Responsibility and Sustainability Reporting framework introduced by SEBI. A high ecological footprint, along with very stringent environmental regulations and compliance norms, drive such disclosure in the manufacturing sector. The physical nature of processes in a manufacturing sector typically involves extraction of resources followed by emissions and pollutants, which evokes higher responsibility toward and interaction with the environment and public reporting.

IT sector companies i.e firms dealing in software services and those with specialized digital infrastructures indicate a growing concern towards sustainability; however, their practice is rather that of reporting qualitatively or narratively than on robust and measurable data. In general, disclosures by this sector seem to be related on things like green office spaces, energy savings from virtualization, renewable energy sourcing for data centers, and claims of carbon neutrality through offsetting. A number of IT firms do not have any comprehensive Scope 3 emissions reporting or any consideration from lifecycle impacts of hardware purchased as well as electronic waste. Moreover, the lack of clear, well-defined and sector-specific indicators regarding environmental performance, which are to be specific, hampers the comparability as well as credence of disclosures within the IT sector on the whole. Environmental harm is not easily visible in digital operations as it is with smokestacks and factory waste, yet this tends to underreporting or superficial CSR narratives.

An interesting aspect is that the two sides have significantly improved their disclosures' structure and consistency due to regulatory mandates such as BRSR. But still, despite improvements, granularity of environmental metrics is of wide divergence. Though most manufacturing companies align with regulations and global standards for the outcome of impact, IT companies tend to lag behind in the credibility of reports, especially those whose impact is indirect but cumulative and significant (like energy consumption in server farms or emissions related to the supply chain).

One of the other dimensions which could well be discussed is stakeholder pressure and clarification issuing out of brand positioning. Of course, the pressure in manufacturing comes through both regulators and environmental watchdogs; IT will find that CSR reporting is dictated by global client expectations, ESG investors, and institutional benchmarking bodies. This might further cause IT firms to have greater likelihood of creating sustainability narratives based on corporate citizenship, inclusivity, and innovation than on empirical and quantitative environmental indicators.

The research also covered the many reported revelations given by information technology sectors concerning sustainability, such disclosures characterized by lack of third-party validation. Contrastingly, manufacturing firms are within the norm to disclose audit certifications such as GRI assurance, ISO standards, or internal environmental audits, thus increasing credibility to their reports. This indicates a very critical gap in accountability and assurance practices of the digital industries which, if not addressed, may undermine stakeholder trust in the green claims made by IT companies.

The overall discussion calls for the immediate development of sector-specific green metrics, standardization in reporting tools, as well as creating stringent assurance mechanisms in CSR reporting. Such tools are conspicuous by their absence in meaningful comparison, benchmarking, and continuous improvement. Based on this study, there's a need for policy rethink and adjustments towards tailoring BRSR or similar frameworks to fit sector-specific needs, especially in emerging digital economies.

There is thus a clear opportunity to collaborate across academia, industry bodies, and government agencies in developing context-specific sustainability indicators for sectors such as IT, which have historically been underrepresented in most of such initiatives. Such initiatives can improve data quality, support regulatory compliance, and create more effective business cases for integrating CSR with core business operations.

7. RECOMMENDATIONS

Based on the comparative analysis of CSR environmental reporting in the IT and manufacturing sectors, the report proposed some key recommendations to ensure the transparency, credibility, and sector-specific relevance of green disclosures in India.

To begin with, sector-specific environmental metrics have to be developed and standardized. While manufacturing companies already follow detailed guidelines, owing to their greater environmental impacts, IT companies need frameworks linked to their digital operations, such as metrics for measuring energy usage in data centers, e-waste management, and software carbon footprints.

Furthermore, regulatory authorities like SEBI and MCA should seek to impose stricter requirements within the BRSR framework with respect to quantitative disclosures across all sectors and not just narrative commitments. Finally, organizations across both sectors should be encouraged to obtain third-party assurance or certification (like ISO 14001) for their environmental disclosures so as to enhance trust and comparability in the public domain.

Also, capacity-building initiatives should be undertaken in the form of CSR training and ESG workshops for sustainability officers and CSR professionals, especially in mid-sized enterprises.

Finally, researchers and policymakers should partner to set up a national CSR-environmental index that ranks firms based on real performance on environmental issues, consequent upon stimulating competitiveness and transparency in the corporate sustainability practice.

8. CONCLUSION

This study has assessed the comparative ground of environmental impact reporting within corporate social responsibility programs between the IT and manufacturing sectors in India. The study analyses the intensity of sustainability disclosures, green metrics along with regulatory alignment, and reveals that there is a difference between these industries. Manufacturing companies, however, are generally high in their environmental transparency and compliance because of stringent regulations and their direct physical footprints, which are measured using quantifiable metrics like emissions, water usage, and waste management. However, IT companies probably tell a national narrative in energy efficiency, carbon offsetting, and digital sustainability, and not by having standard sector-wide environmental indicators. The findings stress the urgent need for industry-specific reporting frameworks that can reflect the true environmental implications of operations, especially in an area like IT, where indirect impacts often go unreported (e.g., e-waste and data center emissions). In addition, it has improved practices related to disclosures despite the presence of challenges regarding uniformity, such as BRSR (Business Responsibility and Sustainability Reporting).

To maximize the effectiveness of CSR towards achieving environmental sustainability, organizations should focus on adopting transparent, measurable, and sector-aligned green metrics. Future directions for research should develop robust indicators that are suitable for the digital economy and should also investigate how third-party verification helps to ensure credibility of data across all industries.

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