An Analysis of Environmental Disclosure and Emission Reporting by Indian Companies

सत्यमेव जयते
Government of India

NCGG
National Centre for Good Governance
The Torch Bearer of Good Governance

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Date of Submission: 2nd July 2024

Declaration

I, Vinayak Gupta, hereby declare that this report entitled "An Analysis of Environmental Disclosure and Emission Reporting by Indian Companies" is the outcome of my own study undertaken under the guidance of Dr. Shyamli Singh, Assistant Professor, Environment Management & Climate Change, Indian Institute of Public Administration, New Delhi, India. I confirm that this report is my original work with no prior publications partly or fully. I also confirm that all the sources of information, references, and contributions from other scholars have been duly acknowledged in the report.

Date: 2nd July 2024 **Signature**

Vinayak Gupta

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CERTIFICATE

This is to certify that **Vinayak Gupta**, a student of **Tata Institute of Social Sciences**, has satisfactorily concluded the research report titled **"An Analysis of Environmental Disclosure and Emission Reporting by Indian Companies"** as part of the internship program at the National Centre for Good Governance (NCGG) under my mentorship.

I, **Dr. Shyamli Singh**, hereby validate the successful completion of the internship report within the internship program at the National Centre for Good Governance (NCGG). The report submitted by **Vinayak Gupta**, is an authentic work carried out by him under my supervision and guidance. I have reviewed and assessed the intern's performance throughout the internship period.

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ACKNOWLEDGEMENT

I would like to express my profound gratitude to Dr. Shyamli Singh for believing in me and guiding all the way for my Research, Analysis and Report Writing and being a constant support by motivating and pushing me throughout. Her insightful input, constructive suggestions, and constant motivation were the driving forces that enabled me to navigate the research with confidence and determination.

I am deeply indebted to Shri V. Srinivas Sir, Dr. Gazala Hasan, and NCGG Professionals Akash Sikdar and Megha Tomar who have been constant pillars of support and motivation throughout this internship. Their encouragement and mentorship have played a pivotal role in shaping my academic and personal growth.

I would like to extend my sincere gratitude to my family, whose unconditional love, support, and understanding have been really important. Their unwavering belief in me has been a constant source of strength, enabling me to overcome every obstacle with resilience and determination. I would also like to thank my friends and fellow interns during this internship for their support and helpful working environment. Finally, I want to thank the National Centre for Good Governance for giving me the opportunity to take a systemic approach to research in my field of interest and enabling me on a journey of personal growth and learning.

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List of Abbreviations

Abbreviation	Full Form
BRSR	Business Responsibility and Sustainability Reporting
ESG	Environmental, Social, and Governance
CSR	Corporate Social Responsibility
SEBI	Securities and Exchange Board of India
MCA	Ministry of Corporate Affairs
NVGs	National Voluntary Guidelines on Social, Environmental, and Economic Responsibilities of Business
BRR	Business Responsibility Report
IICA	Indian Institute of Corporate Affairs
NGRBCs	National Guidelines on Responsible Business Conduct
GRI	Global Reporting Initiative
SASB	Sustainability Accounting Standards Board
IR	Integrated Reports
IFC	International Finance Corporation
ISSB	International Sustainability Standards Board
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
NDCs	Nationally Determined Contributions
MtCO2e	Metric Tons of Carbon Dioxide Equivalent
IQR	Interquartile Range
EDA	Exploratory Data Analysis
TCFD	Task Force on Climate-related Financial Disclosures
KL	Kilo Liter
Rs	Rupees
GJ	Gigajoules
TJ	Terajoules
MJ	Megajoules
KWh	Kilowatt-hours
MWh	Megawatt-hours
Wh	Watt-hours
mg/NM3	Milligrams per Normal Cubic Meter
ug/NM3	Micrograms per Normal Cubic Meter
ppm	Parts Per Million
R&D	Research and Development
PAT	Profit After Tax

UNICEF	United Nations Children's Fund
IIRC	International Integrated Reporting Council
GDP	Gross Domestic Product
SDGs	Sustainable Development Goals
CDP	Carbon Disclosure Project
IFRS	International Financial Reporting Standards
UN	United Nations
BSE	Bombay Stock Exchange
NSE	National Stock Exchange
SMEs	Small and Medium-sized Enterprises
KJ	Kilojoules
Capex	Capital Expenditure
g/m^3	Grams per Cubic Meter
mg/m^3	Milligrams per Cubic Meter
$\mu g/m^3$	Micrograms per Cubic Meter
MT	Metric Tons

NCGG Internship Programme 2024

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"An Analysis of Environmental Disclosure and Emission Reporting" by Indian Companies

Abstract

Climate change is undoubtedly one of the most trenchant challenges of the 21st century, necessitating urgent action across the globe to mitigate its impacts. India, as a rapidly developing economy and a significant contributor to global greenhouse gas emissions, plays a pivotal role in the global climate agenda. This research work examines the alignment of growth with sustainability through an in-depth analysis of emissions reporting by India's top 1000 companies. Leveraging the Business Responsibility and Sustainability Reporting (BRSR) framework introduced by the Securities and Exchange Board of India (SEBI), this study provides a critical assessment of the current state of corporate emissions disclosures and identifies pathways for enhancing sustainability practices within the Indian corporate sector.

Employing a mixed-methods approach, this research meticulously compiles, validates, and analyses environmental, social, and governance (ESG) data along with financial performance indicators across a diverse array of industries. The study utilizes descriptive and exploratory data analysis techniques to quantify Scope 1, 2, and 3 emissions and assess emission intensities within and across sectors. Furthermore, the research critically evaluates the BRSR template's adoption, highlighting challenges and recommending improvements to bolster the framework's effectiveness in promoting transparent and accountable sustainability reporting. Further the analysis goes on to reveal significant disparities in emissions reporting practices among the evaluated companies, with a particular emphasis on the variance in Scope 1, 2, and 3 emissions across sectors. The Power & Energy, Metals & Mining, and Cement sectors emerge as substantial contributors to Scope 1 emissions, largely due to their reliance on fossil fuel combustion and energy-intensive operations. Conversely, Scope 2 and 3 emissions underscore the indirect environmental impacts of corporate

activities, particularly in the Manufacturing sector, which leads in Scope 3 emission intensity due to its complex value chain interactions.

The study also identifies several challenges associated with the BRSR template's implementation, including data management difficulties, inconsistencies in data standardization, and variances in comparability and materiality assessments. Notably, a considerable number of companies fail to disclose crucial emissions data, underscoring a pressing need for enhanced regulatory mechanisms and incentives to ensure comprehensive and transparent reporting. This research work underscores the critical role of standardized, robust emissions reporting in aligning corporate growth with sustainability goals. The findings advocate for the refinement of the BRSR framework to address existing shortcomings, emphasizing the importance of sector-specific guidelines, enhanced data validation processes, and the incorporation of global best practices in sustainability reporting. Moreover, the study highlights the necessity of fostering a culture of sustainability within the corporate sector, recommending targeted capacity-building initiatives and the promotion of internal and external collaborations to drive meaningful environmental improvements. Aligning growth with sustainability presents a multifaceted challenge for Indian companies, necessitating a concerted effort to enhance emissions reporting and embed sustainability practices across all levels of corporate operations. By addressing the identified gaps in the BRSR framework and leveraging the insights gained from this analysis, policymakers, regulators, and corporate leaders can advance India's sustainability agenda, contributing to global efforts to fight climate change and achieve the United Nations Sustainable Development Goals.

1. Introduction

Climate change stands as a pressing global challenge, demanding immediate and concerted action from all nations to mitigate its severe consequences. India, as a major emitter of greenhouse gases and a country highly susceptible to the impacts of climate change, has intensified its efforts to address this critical issue over the past decade. This transition has encompassed the establishment of ambitious policy targets for renewable energy expansion, emissions reductions across sectors, electric mobility, energy efficiency improvements, restoration of forests and lands to act as carbon sinks, and more. These climate-focused endeavors are intrinsically linked to the broader pursuit of sustainable development. In 2015, India adopted the United Nations Sustainable Development Goals (SDGs) – a comprehensive global framework comprising 17 interconnected economic, social, and environmental objectives to be realized by 2030 (United Nations, 2015). Several SDGs are directly related to climate change mitigation and adaptation, such as Goal 7 (Affordable and Clean Energy), Goal 11 (Sustainable Cities and Communities), and Goal 13 (Climate Action). Other goals encompass the transition to an inclusive green economy, sustainable food systems, universal access to quality education and healthcare, reduced income inequalities, and multi-stakeholder partnerships to achieve these ambitious development objectives.

To track national progress across the wide-ranging SDG targets and indicators, standardized corporate sustainability reporting is crucial. This is where Environmental, Social, and Governance

(ESG) metrics and disclosure frameworks come into play. Companies report on ESG factors such as energy usage, greenhouse gas emissions, waste generation, water usage, biodiversity impacts, labor rights and practices, diversity and inclusion, supply chain ethics, and governance issues based on accepted sustainability reporting frameworks (World Economic Forum, 2020). Global ESG reporting has expanded exponentially as investors and regulators increasingly expect transparency on sustainability performance. In India, guidelines from the Securities and Exchange Board of India (SEBI), corporate codes of conduct, and growing investor demand have led more companies to publish annual sustainability or integrated reports in recent years. However, this practice remains limited primarily to larger companies at present. The quality, completeness, rigor, and transparency of sustainability disclosures by Indian companies vary extensively across firms. Different formats are followed without alignment to consistent global ESG reporting standards. To address these gaps and expand standardized sustainability reporting, SEBI set up a committee in 2019 to formulate mandatory ESG disclosure guidelines for the top 1,000 listed companies based on market capitalization (SEBI, 2021). This initiative built on voluntary reporting frameworks namely the Carbon Disclosure Project (CDP), Global Reporting Initiative (GRI), the International Finance Corporation (IFC), Sustainability Accounting Standards Board (SASB), and companies' Integrated Reports (IR).

After extensive consultations, SEBI announced the proposed Business Responsibility and Sustainability Report (BRSR) framework in 2021 (SEBI, 2021). BRSR draws on integrated reporting principles, covering both financial and ESG materiality. The extensive disclosures mandated in the report template cover ecosystems, community impact, labour practices, respect for human rights, governance, and other sustainability topics. BRSR aims to be a milestone towards transparent, consistent, and auditable sustainability reporting by Indian businesses that meets the needs of diverse stakeholders. It is envisioned as a tool to propel India's ambitious climate change and sustainable development policy goals by driving sustainability performance and accountability at the ground level. BRSR guidelines also indicate India's commitment as a member of the new International Sustainability Standards Board (ISSB) towards globally aligned and consistent reporting standards (IFRS Foundation, 2022). However, to realize BRSR's full potential, the reporting requirements could be further strengthened through compulsory auditing, extensive training and capacity building, incentives for small and medium enterprises (SMEs) to comply, and greater emphasis on metrics around cleaner production, circularity, life cycle analysis, and scenario planning. Companion regulations on emissions, renewable energy, waste management, and resource efficiency are equally critical to translate high-level reporting into on ground sustainability action and impact. India's journey from voluntary sustainability reporting by a few companies to proposed mandatory BRSR disclosure for 1,000 listed entities indicates growing alignment of Indian regulators and industry with the global ESG movement. However, this transition still has a long path ahead. Robust reporting frameworks, technological capacity building, regulatory sticks and carrots, extensive multi-stakeholder consultations, incentives, and collaborations will be key to ensuring BRSR and related policies succeed in driving urgent climate action and inclusive, sustainable development.

1.1 Background of the Study

The impetus for this study stems from the recognition that climate change poses an existential threat to humanity and the natural world. There has been a scientific consensus on the anthropogenic causes of climate change which has led to the global urgency to mitigate its impacts and collective call for decisive action (IPCC, 2021). The Paris Agreement, adopted by 196 parties in 2015, set the goal of limiting global temperature rise to below 2°C above pre-industrial levels, with additional efforts to limit the increase to 1.5°C (United Nations, 2015). To achieve this ambitious target, countries have committed to undertaking Nationally Determined Contributions (NDCs) to reduce greenhouse gas emissions and enhance climate resilience. India, as the third largest emitter of greenhouse gases globally (instead of the fact that its per capita emission is far behind than other major contributors), plays a crucial role in this collective effort (World Resources Institute, 2022). The country has set ambitious targets under its NDCs, including reducing the emissions intensity of its GDP by 33-35% by 2030 from 2005 levels, achieving about 40% cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030, and creating an additional carbon sink of 2.5-3 billion tons of CO2 equivalent through additional forest and tree cover. To effectively monitor and drive progress towards these climate commitments, robust and transparent emissions reporting by businesses is essential. Scope 1, 2, and 3 emissions, as defined by the Greenhouse Gas Protocol, provide a comprehensive framework for measuring and reporting an organization's direct and12 indirect greenhouse gas emissions (World Resources Institute & World Business Council for Sustainable Development, 2004). Scope 1 emissions are direct emissions from owned or controlled sources, such as fuel combustion in boilers or vehicles. Scope 2 emissions are indirect emissions generated from purchased electricity, heat, or steam. Scope 3 emissions are essentially other indirect emissions that occur in the value chain of the reporting organization, including both upstream and downstream activities (World Resources Institute & World Business Council for Sustainable Development, 2004). Comprehensive reporting of Scope 1, 2, and 3 emissions is crucial for companies to understand their full carbon footprint and take targeted actions to reduce emissions across their operations and value chains. This data also enables stakeholders, such as investors, regulators, and consumers, to assess a company's climate impact and transition risks. In India, the BRSR framework aims to standardize and enhance the quality of sustainability reporting by listed companies, including emissions disclosures (SEBI, 2021). By mandating the top 1,000 listed companies by market capitalization to report on their environmental, social, and governance performance, BRSR seeks to drive sustainability accountability and performance at the ground level.

1.2 Significance of the study

This study holds significance in the context of India's commitment to combating climate change and achieving sustainable development goals. By undertaking a comprehensive analysis of Scope 1, 2, and 3 emissions reporting across the BRSR-mandated 1,000 Indian companies, this research

will provide invaluable insights into the current state of emissions disclosure practices and identify areas for improvement. Existing research highlights the importance of such an endeavor. A study by Sharma and Kumar (2021) found that the quality and completeness of environmental and social disclosures among Indian companies vary significantly, underscoring the need for standardized and transparent reporting frameworks. Similarly, Jain and Aggarwal (2021) observed inconsistencies in carbon footprint reporting and disclosure practices across various sectors in India, emphasizing the significance of sector-specific analysis and benchmarking.

Assembling an Extensive Emissions Database

One of the key contributions of this study will be the assembly of an extensive emissions dataset, encompassing financial and emission variables across diverse Indian industry sectors and the 1,000 largest companies. This unprecedented endeavor will provide a quantified and holistic view of the carbon footprint of corporate India, transcending the current fragmented landscape of emissions data scattered across states and sectors. The aggregated dataset will reveal profound insights by quantifying absolute emissions volumes across industries, enabling the identification of the most significant emitting sectors. Establishing a Baseline and Informing Forward-Looking Targets Analysis of historical emissions data will unveil a crucial baseline, discerning carbon efficiency improvements by sectors before the implementation of explicit climate policies. This retrospective understanding will inform the development of realistic and achievable forward looking targets, accounting for the progress already achieved and the challenges encountered, as highlighted in the context of sustainability reporting practices by Shukla and Vyas (2020).

Moreover, the breakdown of emissions data into Scope 1, 2, and 3 categories will illuminate sectors warranting direct emissions regulation versus those where supplier codes of conduct and value chain engagement may be more effective in addressing the broader environmental footprint, aligning with the principles of the Greenhouse Gas Protocol (World Resources Institute & World Business Council for Sustainable Development, 2004). Unveiling Interlinkages between Environmental and Financial Performance Conducting correlation analyses between emissions, energy usage, and financial performance metrics will unravel crucial interlinkages between environmental and economic parameters, as explored by Shrivastava and Tamvada (2019) in their study on sustainability reporting practices of top Indian companies. Positive correlations could indicate the current reliance of business models on fossil fuels, underscoring the need for carbon-efficient disruption, while negative correlations could spotlight potential adoption challenges, necessitating policy interventions.

Further, this analysis may reveal outliers – high-emitting profitable companies showcasing effective management capabilities, and low-emitting companies with weaker financials, indicating a need for transitional assistance, as suggested by the findings of Sharma and Goel (2021) on the relationship between emissions intensity and firm value in the Indian manufacturing sector.

Tailoring Climate Policies and Interventions

Categorizing the emissions dataset by economic sectors will illuminate the industries that are most emissions-intensive, based on absolute emissions volumes and emissions per rupee of revenue generated. This differentiation is pivotal for pragmatic policymaking, enabling the prioritization of stringent emissions regulations, carbon pricing mechanisms, and incentives for technology upgrades in highly intensive sectors, as recommended by various industry-specific studies and reports (e.g., cement, steel, oil and gas sectors). Simultaneously, segmentation by market capitalization will distinguish emissions patterns between large, mid-sized, and smaller companies within each sector, aligning with the findings of Shrivastava and Tamvada (2019) on the variations in sustainability reporting practices among Indian companies of different sizes.

1.3 Research Objectives:

• Evaluate the comprehensive status including scale, scope and credibility of Environmental disclosures within major Indian companies operating and leading the both the Power & Energy Sector and the Manufacturing Sector.

• Propose a set of reformative measures that the Government of India authorities can implement to regulate the environmental impact caused by major Indian companies operating in the Power & Energy and Manufacturing sectors as a proactive measure towards fostering good governance in the realm of environmental sustainability.

• Propose reforms to the existing regulatory framework governing ESG reporting within the Indian context.

Literature Review

2.1 Theoretical Framework: Analyzing Emissions of BRSR Mandated Indian Industries

This research investigates the emissions profile of the major Indian companies operating in the Power & Energy and Manufacturing sectors among the top 1000 Indian companies mandated to report under the Business Responsibility and Sustainability Reporting (BRSR) framework. The theoretical framework draws upon concepts from environmental accounting, corporate sustainability, and industrial ecology to analyze the reported Scope 1, 2, and 3 emissions data across various sectors.

Core Concepts:

Environmental Accounting: This framework incorporates principles of environmental accounting to quantify and analyze the environmental impacts of the companies' activities. Specifically, it focuses on integrating emissions data (Scope 1, 2, and 3) with financial data to understand the environmental costs associated with business operations.

Corporate Sustainability:

The research leverages principles of corporate sustainability to assess the companies' environmental performance and commitment to sustainable practices. By analyzing emissions data, we can evaluate how companies are managing their environmental footprint and contributing to broader sustainability goals. Industrial Ecology: This framework draws upon concepts from industrial ecology to understand the interconnectedness between industrial activities and the environment. By analyzing emissions data across sectors, we can identify potential areas for collaboration and resource optimization within the Indian industrial landscape.

2.2 Evaluation of Existing Literature:

The issue of greenhouse gas (GHG) emissions and their contribution to climate change has garnered significant attention globally. Since India is a signatory to the Paris Agreement, it has committed to reducing its emissions intensity by 33-35% by 2030 from the 2005 levels (Ministry of Environment, Forest and Climate Change, 2015). In this context, the Business Responsibility and Sustainability Reporting (BRSR) framework, introduced by the Ministry of Corporate Affairs in 2021, has emerged as a crucial regulatory development mandating the disclosure of Scope 1, Scope 2, and Scope 3 emissions for the top 1000 listed companies in India. "The BRSR seeks to provide a standardized reporting format for companies to report their performance against the core

elements and nine principles of the 'National Guidelines on Responsible Business Conduct'" (Ministry of Corporate Affairs, 2021). This framework aims to promote transparency, accountability, and responsible business practices among Indian corporations, with a specific emphasis on environmental sustainability and climate change mitigation.

Historical Context

Corporate environmental reporting in India has evolved significantly over the past few decades, driven by a combination of regulatory changes, stakeholder pressure, and the growing recognition of the importance of sustainable business practices. Initially, environmental reporting was voluntary, with companies disclosing limited information in their annual reports or sustainability reports. However, the Companies Act of 2013 introduced mandatory requirements for certain classes of companies to report on their environmental and social performance (Kansal et al., 2014). "Before the introduction of the BRSR framework, the majority of Indian companies followed the National Voluntary Guidelines on Social, Environmental and Economic Responsibilities of Business (NVGs) issued by the Ministry of Corporate Affairs in 2011" (Mahajan, 2022). While the NVGs provided a comprehensive set of principles and guidelines for responsible business conduct, their voluntary nature resulted in varying levels of compliance and disclosure among companies. The BRSR framework represents a significant step towards standardizing and mandating sustainability reporting in India. It builds upon the NVGs and incorporates globally recognized frameworks such as the Global Reporting Initiative (GRI) and the Task Force on Climate-related Financial Disclosures (TCFD) (Ministry of Corporate Affairs, 2021).

India is gradually advancing towards establishing regulations for ESG (Environmental, Social, and Governance) practices. With the introduction of the BRSR (Business Responsibility and Sustainability Report) framework, SEBI has aligned itself with countries and international organizations that have implemented comprehensive sustainability reporting standards. Currently, the reporting requirement applies to the top 1,000 listed companies by market capitalization. However, based on the experience with the BRR (Business Responsibility Report), it is anticipated that the BRSR framework will soon encompass a broader range of companies.

BRSR Framework Analysis

The BRSR framework requires companies to report on nine principles, including "Principle 6: Businesses should respect, protect, and make efforts to restore the environment" (Ministry of Corporate Affairs, 2021). Under this principle, companies are required to disclose their Scope 1, Scope 2, and Scope 3 GHG emissions, as well as their energy consumption and water consumption patterns. "The inclusion of Scope 3 emissions reporting is particularly noteworthy, as it encompasses indirect emissions from a company's value chain, including upstream and downstream activities" (Jain & Winner, 2016). This holistic approach to emissions reporting is expected to provide stakeholders with a comprehensive understanding of a company's

environmental impact and its efforts to mitigate climate change. The BRSR framework also mandates the disclosure of specific metrics and targets related to GHG emissions reduction, energy efficiency, and the use of renewable energy sources. This emphasis on measurable goals and progress tracking is designed to drive tangible action towards environmental sustainability (Ministry of Corporate Affairs, 2021).

Emissions Review

Scope 1 emissions refer to direct GHG emissions from sources owned or controlled by a company, such as fuel combustion in boilers or vehicles. Scope 2 emissions encompass indirect emissions from the generation of purchase of electricity, heat, or steam. Scope 3 emissions are all other indirect emissions that occur in a company's value chain, including upstream and downstream activities (GHG Protocol, 2011). In the context of India, research has highlighted the challenges faced by companies in accurately reporting their Scope 1 and Scope 2 emissions.

Garg (2014) noted the "lack of awareness, inadequate technical capacity, and lack of robust institutional arrangements for monitoring and reporting GHG emissions" as key barriers. Furthermore, the study found that "the quality of emissions data reported by companies is often questionable due to the lack of standardized methodologies and third-party verification" (Garg, 2014). Scope 3 emissions reporting presents even greater challenges due to the complexity of value chain activities and the reliance on data from third-party suppliers and partners. Jain and Winner (2016) observed that "most companies do not report their Scope 3 emissions or provide only limited information, citing data availability and measurement difficulties." "The inclusion of Scope 3 emissions in the BRSR framework is a significant step towards promoting transparency and accountability in supply chain emissions. However, it also poses substantial challenges for companies in terms of data collection, calculation methodologies, and stakeholder engagement" (Chakrabarty & Wang, 2016).

Challenges in Reporting

Several challenges have been identified in the literature regarding the accurate and comprehensive reporting of GHG emissions by Indian companies. One major challenge is the lack of standardized methodologies and protocols for emissions measurement and calculation (Garg, 2014). Inconsistent approaches and assumptions can lead to variations in reported emissions data, making it difficult to compare performance across companies or sectors.

"Another challenge is the limited technical capacity and expertise within companies to conduct emissions inventories and assessments" (Das & Bhattacharya, 2015). This can result in incomplete or inaccurate data collection, particularly for Scope 3 emissions, which require a thorough understanding of complex value chain activities. Data availability and quality also pose significant challenges, especially for Scope 3 emissions, where companies rely on information from external

sources. Kansal et al. (2014) highlighted the "lack of reliable and verifiable data from suppliers and partners" as a barrier to comprehensive emissions reporting.

Furthermore, the cost and resource implications of conducting comprehensive emissions assessments and implementing mitigation strategies can be a deterrent for companies, particularly smaller ones (Jain & Winner, 2016). This underscores the need for capacity building initiatives and support mechanisms to assist companies in complying with the BRSR requirements.

Sector-Specific Insights

The literature provides insights into the unique challenges and opportunities for GHG emissions reporting across different sectors in India. For instance, the energy sector as a significant contributor to overall emissions, faces challenges in accurately accounting for emissions from various fuel sources and complex supply chains (Garg, 2014).

"The manufacturing sector, which encompasses a wide range of industries, presents diverse challenges depending on the specific processes and materials involved" (Das & Bhattacharya, 2015). For example, emissions from cement production and chemical processes require specialized measurement techniques and industry-specific protocols. On the other hand, the information technology and services sectors, which have a relatively smaller direct emissions footprint, may face challenges in quantifying and reporting Scope 3 emissions associated with employee commuting, business travel, and data center operations (Chakrabarty & Wang, 2016).

Despite these challenges, some sectors have demonstrated exemplary practices in emissions reporting and mitigation strategies. For example, the renewable energy sector has been at the forefront of promoting transparency and accountability, with companies voluntarily disclosing their emissions and setting ambitious reduction targets (Jain & Winner, 2016).

Impact on Corporate Sustainability

The literature highlights the potential impact of GHG emissions reporting on broader corporate sustainability efforts. Transparent and comprehensive emissions reporting can serve as a catalyst for companies to identify opportunities for energy efficiency improvements, adoption of cleaner technologies, and incorporation of renewable energy sources into their operations (Kansal et al., 2014). "By quantifying and disclosing their environmental impact, companies can better engage with stakeholders, such as investors, customers, and local communities, on their sustainability commitments and progress" (Chakrabarty & Wang, 2016). This increased transparency can enhance stakeholder trust, improve brand reputation, and potentially provide a competitive advantage in the long run. The BRSR framework then encourages companies to set specific targets and goals for emissions reduction and environmental performance improvement. This goal-setting approach can drive continuous improvement and foster a culture of sustainability within organizations (Ministry of Corporate Affairs, 2021)

2.3 Research Gaps and Future Directions

While the reviewed literature provides valuable insights into the current state of GHG emissions reporting in India, several gaps and areas for future research have been identified:

1. ***Impact assessment of the BRSR framework:*** As the BRSR framework is relatively new, there is a need for longitudinal studies to assess its effectiveness in driving improved emissions reporting practices and actual emissions reductions among Indian companies.

2. ***Scope 3 emissions reporting challenges:*** Given the significant challenges associated with Scope3 emissions reporting, further research is needed to develop robust methodologies, data collection strategies, and stakeholder engagement approaches specifically tailored to the Indian context.

3. ***Sector-specific best practices:*** While some sector-specific insights are available, there is a need for comprehensive research that identifies and disseminates best practices in emissions reporting and mitigation strategies across various industries in India.

4. ***Role of technology and innovation:*** Exploring the potential of emerging technologies, such as blockchain, artificial intelligence, and Internet of Things (IoT), in streamlining emissions data collection, verification, and reporting processes could be a valuable area of research.19

5. ***Stakeholder perspectives:*** Understanding the perspectives and information needs of various stakeholders, including investors, regulators, civil society organizations, and consumers, could inform the development of more effective and relevant emissions reporting frameworks.

While the BRSR framework represents a significant step towards mandating and standardizing emissions reporting in India, the literature has identified several research gaps that need to be addressed. These include assessing the effectiveness of the BRSR framework, developing robust methodologies for Scope 3 emissions reporting, identifying sector-specific best practices, exploring the role of technology and innovation, understanding stakeholder perspectives, and analyzing the challenges faced by SMEs and local-level businesses (Deegan & Islam, 2014; Narayanan & Soonawala, 2017; Rangan et al., 2015).

Methodology

The present research embarked on a comprehensive and rigorous methodology to systematically compile, validate, and analyze a granular environmental, social, and governance (ESG) dataset,

coupled with financial performance indicators, for operating and leading Indian corporations in both the Power & Energy Sector and the Manufacturing Sector. This multifaceted approach aimed to derive actionable insights into the maturity of sustainability reporting practices and the broader integration of ESG considerations into corporate performance. The methodology comprised three distinct phases, each characterized by meticulously attending to details and adhering to industry best practices.

3.1 Phase I: Data Collation

The initial phase involved a process of compiling sustainability report disclosures, quantitative Emission data for each company into a comprehensive master database. This process necessitated a thorough review of a diverse range of sources, including corporate reports, regulatory filings, publicly available databases, and industry-specific resources. Relevant disclosures and metrics were meticulously captured and categorized under broad themes, such as greenhouse gas emissions, Scope 1, Scope 2, Scope 3 emissions. This comprehensive data collection approach ensured that a holistic perspective was maintained, encompassing the multifaceted nature of environmental, social, and governance considerations.

Any data gaps or inconsistencies encountered during the compilation process were meticulously documented and flagged for further investigation and rectification in subsequent phases of the research methodology.

1. Data Frame

This research utilized secondary dataset comprising both qualitative and quantitative ESG and financial data for operating and leading Indian corporations in both the Power & Energy Sector and the Manufacturing Sector among top 1000 Indian companies. The key materials used were: Annual reports, integrated reports and sustainability reports for the latest financial year were collected for 1000 companies listed on the BSE and NSE across sectors Power & Energy Sector and the Manufacturing Sector etc. These disclosures are a rich source of qualitative information on ESG strategies, policies, risks, performance and governance.

Quantitative financial data was also obtained from BSE, NSE and Screener for material financial performance indicators like revenue, profit, stock price, market capitalization etc. The large sample size of 1000 companies allowed for segmentation by sector, market cap and other parameters to discern specific trends. The combination of qualitative and quantitative data enabled a multidimensional perspective on ESG integration by Indian businesses. Quantitative ESG data was obtained from sustainability reports as well as ESG data providers like BSE, NSE, Trendlyne and Screener. This included parameters including GHG emissions, energy intensity etc. The variables and their importance in data collection and analysis is subsequently discussed.

2. Description of Variables

Variables are key elements that are studied and analyzed to understand relationships, patterns, and causal effects within a research study. Understanding and defining these variables is crucial for designing a sound research methodology and interpreting the results accurately. The significance of these variables in the context of the thesis on "An analysis of Scope-1, 2, 3 emissions of BRSR mandated 1000 Indian Industries" is explained below:

Variable Name	Type	Measurement (Unit)	Description
Symbol	Categorical	NA	The symbol of the company in the stock market.
Company_Name	Categorical	NA	The name of the company.
Market capitalization	Numerical	Lakhs	The market capitalization of the company in lakhs.
Sector	Categorical	NA	The sector in which the company operates.
Industry	Categorical	NA	The industry in which the company operates.
R&D_Expenditure (Binary)	Binary	NA	Indicates whether the company has R&D expenditure (Yes/No).
R&D_Expenditure (Numerical)	Numerical	Percentage/ Crore	The amount of research and development expenditure by the company.
Energy_Intensity	Numerical	Joule/INR	The energy intensity of the company measured in joules per Indian rupee.

S1_Emission (Binary)	Binary	NA	Indicates whether the company emits Scope 1 emissions (Yes/No).
S1_Emission (Numerical)	Numerical	tCO2e	The amount of Scope 1 emissions emitted by the company in metric tons of carbon dioxide equivalent.
S2_Emission (Binary)	Binary	NA	Indicates whether the company emits Scope 2 emissions (Yes/No).
S2_Emission (Numerical)	Numerical	tCO2e	The amount of Scope 2 emissions emitted by the company in metric tons of carbon dioxide equivalent.
Emission_Intensity_(S1+ S2)/Turnover	Numerical	tCO2e/Crore	The emission intensity of the company, calculated as the sum of Scope 1 and Scope 2 emissions divided by turnover, measured in metric tons of carbon dioxide equivalent per crore rupees.
S3_Emission (Binary)	Binary	NA	Indicates whether the company emits Scope 3 emissions (Yes/No).
S3_Emission (Numerical)	Numerical	tCO2e	The amount of Scope 3 emissions emitted by the company in metric tons of carbon dioxide equivalent.

By incorporating categorical, numerical, and binary variables in the analysis can reflect on a comprehensive understanding of the factors influencing emissions reporting practices, waste management strategies, and environmental performance among the BRSR-mandated Indian industries. This multifaceted approach allows for the identification of patterns, relationships, and insights that can inform policy decisions, industry best practices, and strategies for enhancing corporate environmental accountability and sustainability.

3.2 Data Validation

The compiled data underwent a rigorous validation process to ensure accuracy, consistency and alignment with established reporting norms and frameworks. This phase involved a series of systematic steps to enhance the reliability and integrity of the dataset:

1. ***Missing Information Rectification:*** In instances where information was missing or incomplete, the research team diligently referred back to the original source reports and filings to rectify the gaps. In cases where data remained unavailable despite exhaustive efforts, a thorough assessment was conducted to determine the significance and potential impact of the missing data on the overall analysis. Appropriate measures, such as exclusion or imputation techniques, were then employed to mitigate the effects of missing data on the robustness of the findings.

2. ***Outlier Identification and Verification:*** Potential outliers in quantitative metrics were systematically identified using robust statistical techniques. Each identified outlier was meticulously cross-checked against the source reports to eliminate the possibility of data entry errors or discrepancies. This rigorous process ensured that any deviations from the norm were accurately captured and accounted for in the subsequent analysis phases.

3. ***Unit Standardization:*** To facilitate consistent comparison and analysis across the diverse dataset, all ESG metrics were standardized to uniform units of measurement. For instance, greenhouse gas emissions were consistently recorded in metric tons of carbon dioxide equivalent (tCO2e), and energy intensity in joules/rs.

4. ***Compliance Validation:*** The compiled data underwent a comprehensive validation process to ensure alignment with widely accepted sustainability reporting frameworks, such as the Global Reporting Initiative (GRI) Standards and the Business Responsibility and Sustainability Reporting (BRSR) guidelines mandated by the Securities and Exchange Board of India (SEBI). This validation step ensured that the dataset adhered to established reporting norms and best practices, enhancing the credibility and comparability of the analysis.

The rigorous validation process undertaken in this phase ensured the accuracy, coherence, and comparability of the dataset, laying a solid foundation for the subsequent analysis phase.

3.3 Data Analysis

The validated dataset underwent a comprehensive statistical analysis using advanced tools and techniques, including Microsoft Excel and SPSS (Statistical Package for the Social Sciences) and Power BI for data visualization. The analysis phase employed a diverse range of quantitative and

qualitative methods to derive meaningful insights and facilitate a holistic understanding of the Indian corporate landscape:

1. ***Descriptive Statistics:*** Summary statistics, such as means, standard deviations, minima, and maxima, were calculated for key ESG and financial performance metrics. These descriptive measures established baseline performance levels, identified potential outliers or deviations from industry norms, and provided a foundation for further comparative analyses.

2. ***Segmentation and Comparative Analysis:*** The dataset was segmented based on industry sectors, market capitalization, and other relevant factors to discern specific trends, challenges, and opportunities within different segments of the Indian corporate landscape. This approach facilitated the identification of industry-specific nuances and tailored recommendations for enhancing sustainability practices and reporting.

3. ***Visual Representation:*** Graphical techniques, including box plots, histograms, and scatter plots, were employed to visually represent the distribution and spread of ESG data across different companies and sectors. These visual representations facilitated effective communication and interpretation of findings, enabling stakeholders to gain a comprehensive understanding of the corporate sustainability landscape.

The methodology, combining comprehensive data sources, rigorous validation processes, and multivariate statistical analysis techniques, facilitated the generation of data-driven insights into the current state of sustainability reporting maturity, the integration of ESG considerations into corporate performance, and the identification of potential linkages between ESG practices and financial outcomes among Indian corporations. The insights derived from this comprehensive study serve as a valuable resource for regulators, policymakers, corporate decision-makers, and other stakeholders in the Indian sustainability landscape. The research findings can inform strategies and initiatives to further strengthen ESG integration, enhance transparency in susainability reporting, and drive meaningful progress toward a more sustainable and responsible corporate ecosystem in India.

The BRSR Template: Applications and Potential Improvements

The concept of Business Responsibility and Sustainability Reporting (BRSR) marks a significant milestone in India's journey towards a more sustainable future. Its genesis can be traced back to the growing global discourse on Environmental, Social, and Governance (ESG) practices and the increasing recognition of their importance for businesses. This discourse has ignited a debate around the very notion of business sustainability, prompting countries like India to take proactive steps towards integrating these considerations into their corporate governance landscape.

4.1 India's Position on ESG and Business Sustainability:

India has actively participated in the evolving conversation surrounding ESG and business sustainability. Over the past decade, the country has witnessed several crucial initiatives aimed at promoting responsible business conduct and fostering a culture of sustainability within its corporate sector. These initiatives highlight India's commitment to aligning its economic growth with broader environmental and social considerations.

The seeds of BRSR were sown in 2009 when the Ministry of Corporate Affairs (MCA) issued the Voluntary Guidelines on Corporate Social Responsibility (CSR). This marked the beginning of a concerted effort to mainstream responsible business practices in India. Recognizing the growing importance of encompassing a wider range of sustainability concerns, the MCA went on to release the National Voluntary Guidelines on Social, Environmental and Economic Responsibilities of Business (NVGs) in 2011. These comprehensive guidelines established a framework for business responsibility reporting, outlining nine core principles spanning various aspects of responsible business conduct, including ethics, product responsibility, employee well-being, stakeholder engagement, and environmental protection.

Taking the lead in promoting sustainability reporting, the Securities and Exchange Board of India (SEBI) mandated the top 100 listed companies to file Business Responsibility Reports (BRRs) based on the NVG framework in 2012. This requirement was subsequently extended to include the top 500 companies by 2015. The Companies Act, 2013 further bolstered these efforts by mandating specific non-financial disclosures from companies. These early regulatory steps positioned India as a forerunner in sustainability reporting compared to several other countries that relied primarily on voluntary frameworks.

Despite the initial regulatory push, concerns were raised regarding the quality of disclosures submitted by companies. A study conducted by the Indian Institute of Corporate Affairs (IICA) and UNICEF in 2019 revealed inconsistencies in the completeness, accuracy, and clarity of reported information, particularly in areas related to supply chains, contract labor, and environmental indicators. These findings highlighted the need for a more robust and standardized approach to ensure transparency and comparability in sustainability reporting practices.

Year	Event
2009	Ministry of Corporate Affairs ("**MCA**") issued the National Voluntary Guidelines ("**NGVs**") on CSR.
2012	SEBI mandated the top 100 listed companies by market capitalization to file BRR based on the NGVs along with their annual reports.
2014	CSR was mandated and CSR Rules came into force.

2015	BRR was extended by SEBI to the top 500 listed companies by market capitalisation.
2017	SEBI advised that IR may be adopted by companies on a voluntary basis from financial year 2017-18 by the top 500 listed companies.
2019	MCA released the NGBRC.
2019	BRR was extended by SEBI to the top 1000 listed companies by market capitalisation.
2021	SEBI introduced BRSR in May 2021.

4.2 Addressing the Gaps: The Genesis of BRSR

In response to these identified shortcomings, SEBI constituted a committee in 2019 to revise the existing BRSR format for both listed and unlisted companies. This committee undertook a comprehensive analysis of existing BRR disclosures submitted by the top 500 companies, along with valuable insights gleaned from the IICA-UNICEF study. The committee's analysis served as the foundation for proposing the 'BRSR', a more comprehensive and standardized framework for sustainability reporting in India.

The BRSR framework comprises three distinct sections:

Section A:

General Disclosures: This section focuses on capturing essential company information, including size, product offerings, operational locations, details of CSR activities, and proximity to ecologically sensitive areas.

Section B:

Management and Process Disclosures: This section delves deeper into the company's management processes and stakeholder engagement mechanisms established to uphold responsible business conduct principles.

Section C:

Leadership Indicators: This section evaluates the company's performance and impact related to each of the nine National Guidelines on Responsible Business Conduct (NGRBCs). These guidelines, updated in 2019, serve as the foundation for assessing responsible business practices,

encompassing core elements like ethical conduct, safety, human rights, environmental stewardship, and stakeholder engagement.

Acknowledging the unique challenges faced by smaller companies with limited experience in sustainability reporting, the committee proposed a simplified BRSR Lite version. This version caters specifically to smaller companies, encouraging them to participate in the BRSR framework by simplifying the disclosure requirements. Additionally, comprehensive 'guidance notes' are provided alongside the framework, offering clear definitions and explanations for each question, ensuring consistent interpretation and application across companies.

The BRSR framework is designed to seamlessly integrate with existing filing mechanisms employed by companies through the MCA21 portal. This integration fosters standardized and transparent data collection, facilitating efficient analysis and comparison. Recognizing the need for a smooth transition, the committee recommended a phased implementation strategy. The initial phase would target the top 1000 listed companies, leveraging their existing experience with SEBI-BRR filings. Subsequently, the framework could be gradually extended to encompass unlisted companies exceeding specified thresholds in terms of paid-up capital or turnover.

4.3 SEBI's Role and the Journey from Voluntary to Mandatory

SEBI played a pivotal role in the evolution of BRSR, acting as a catalyst for its development and implementation. While the initial BRR framework adopted a voluntary approach, SEBI's29 decision to mandate BRSR reporting for the top 1000 listed companies represents a significant shift towards standardization and mandatory sustainability disclosures in India. This move underscores the increasing importance of ESG considerations within the corporate landscape and the growing expectations from stakeholders for transparency and accountability on these critical issues. While BRSR mandates sustainability reporting for specific categories of companies, it is crucial to acknowledge the ongoing debate surrounding its classification as a full-fledged regulation. Some experts argue that the framework lacks certain features typically associated with regulations, such as clearly defined penalties for non-compliance. Others emphasize its potential to evolve into a stricter regulatory framework in the future, as evidenced by the phased implementation approach and the possibility of introducing penalties at a later stage.

The emergence of BRSR signifies a turning point in India's approach to sustainability reporting. By establishing a standardized framework and mandating disclosures from a significant portion of the corporate sector, BRSR has the potential to enhance transparency, promote responsible business practices, and encourage greater stakeholder engagement on matters related to environmental and social responsibility. As the framework evolves and potentially incorporates stricter enforcement mechanisms, BRSR has the potential to position India as a leader in mandating corporate sustainability reporting practices and pave the way for a more sustainable and responsible business ecosystem.

4.4 Challenges Associated with the BRSR Template

Data Management Issues: The sheer volume of data demanded by BRSR's nine core principles and 120+ parameters presents a significant hurdle for companies. Many lack the systems and expertise to gather complete, reliable data from various departments, facilities, and formats. Inconsistent data collection methods further complicate matters, making accurate consolidation and reporting a challenge. To add to this, BRSR's relative newness means companies may lack the internal expertise to navigate its intricacies and collect data accurately.

This, coupled with limited awareness of nuances and best practices, can lead to misinterpretations and errors. Addressing these challenges requires tailored training and capacity building for personnel involved in data collection and reporting. Data Standardisation issues: Some parameters within the format lack clear definitions or specific measurement methodologies, leading to inconsistencies in how companies interpret and report the data. This can result in variations in data quality and comparability across industries and companies. The BRSR format allows for qualitative and quantitative data, which can be helpful for flexibility, but also contributes to potential misinterpretations and difficulty in aggregating data across companies. While BRSR attempts to unify reporting, it doesn't fully align with established international sustainability reporting frameworks like GRI or SASB.

This creates additional work for companies already using these frameworks, and hinders international comparability of Indian company data. The BRSR format applies to a wide range of industries with diverse activities and data availability. This "one-size-fits-all" approach might not capture the nuances of each sector, leading to challenges in providing relevant and comparable data across industries.

Difficulty with normalization and benchmarking: The lack of standardized units or normalization factors for certain parameters makes it difficult to compare data across companies or track progress over time. This hinders benchmarking and industry-wide analysis of performance.

Comparability and Materiality: Ensuring comparability of ESG disclosures across companies and sectors can be challenging given the diversity of businesses. Additionally, identifying material ESG issues specific to each company’s operations can be a complex task. Guideline issues (Annexure based issues): While Annexure I offers clear guidelines on presenting quantitative and qualitative data for NGRBC's 9 principles, collecting data for these principles can still be challenging for those unfamiliar with the process. The absence of awareness about how to gather data might make this task seem complex and overwhelming.

Data Validation issues: Ensuring the accuracy and reliability of reported ESG information may necessitate third-party assurance or verification. This can prove to be a costly and time-consuming

process for companies. The global frameworks had already made it mandatory to have a third party assurance, so taking rigid initiatives in that direction is the need of the hour. Regulation Based issue (Penalty & Incentive): The BRSR framework currently lacks a defined incentive structure, offering neither explicit rewards nor penalties for company participation. Within a sector it has been seen that a lot of companies follows BRSR seriously while others don't. This does not appreciate the companies which follows and makes them inferior to others. An example of this is the financial services sector where most reputed and well-established banks have not disclosed anything about their emission, energy intensity and waste. Although they are least responsible for these but as a matter of fact it can be seen that other organizations in the same sector and falling in the same category in terms of their turnover & PAT are disclosing about all ESG parameters. So there is no incentive to them and neither any penalty for the former one.

Alignment with other disclosure: The BRSR template has partial alignment with TCFD recommendations focused on climate-related financial disclosures. On governance, BRSR incorporates disclosure of board and management oversight of climate issues. The strategic impact of climate-related risks and opportunities is covered as well. However, BRSR falls short on requiring scenario analysis and clear metrics/targets to assess climate resilience. While climate risk management is referenced in BRSR, detailed disclosure expectations around processes, tools and metrics are lacking unlike TCFD. More granular disclosures on risk identification, assessment and mitigation activities can be integrated. Strengthening the strategic planning, target setting and risk management aspects will significantly bolster BRSR's climate focus.

As ISSB provides comprehensive sustainability disclosure standards spanning environmental, social and governance factors, substantial potential exists for BRSR to integrate relevant metrics and disclosures across material topics where its coverage is limited. On environmental factors like water, biodiversity and circular economy, ISSB sets out detailed disclosure expectations which can significantly widen BRSR's scope. Similarly, on social factors – labor practices, human rights and community relations - BRSR's disclosure requirements are generic in comparison to ISSB standards. For example, categories of Scope 3 GHG emissions, breakdown of workforce diversity data, regional expenditures and taxes paid are sought by ISSB. Adopting relevant metrics and granular disclosure requirements from ISSB can address BRSR's gaps on material issues like supply chain impacts, human capital management and business ethics. This will ensure more comprehensive sustainability reporting by Indian businesses.

Additionally, BRSR can benefit by aligning with other established global frameworks like GRI, SASB and IIRC that investors are accustomed to. For instance, adopting GRI's reporting principles like sustainability context, materiality and completeness can strengthen BRSR disclosures. SASB's sector-specific and financially material metrics can enhance the template's relevance for investors. Integrated reporting elements like connecting sustainability performance with strategy and risks are also valuable.

Another key limitation versus global frameworks is lack of assurance requirements in BRSR which hampers disclosure credibility. Requiring reasonable/limited assurance by accredited providers as mandated by GRI, IIRC and ISSB can significantly add value. Reasonable assurance for environmental and social data over time can be considered given data accuracy challenges. BRSR makes an important start in setting sustainability reporting expectations in India. However, integrating metrics and disclosure requirements from globally accepted reporting frameworks can address gaps in materiality, completeness, comparability, balance and reliability. This will drive increased transparency and position India as an attractive ESG investment destination.

4.5 Analysis of BRSR Template Adoption by companies

In the examination of data disclosure within BRSR reports, standardization issues have been identified, particularly in the representation of missing data and units of the indicators. Instances where data are denoted as 'N/A', 'Not Available', 'Nil', a dash ('-'), or 'blank' present challenges in interpretation and analysis. This discrepancy raises concerns regarding the clarity and consistency of reporting practices, prompting questions about the guidelines provided by a regulatory body, the Securities and Exchange Board of India (SEBI). Of particular interest is the comparison between blank spaces and entries denoted as "Nil." The stakeholders may interpret these representations differently, leading to potential misinterpretations or inaccuracies in data analysis. A blank space may imply that the data point was not applicable or not reported, whereas the entry "Nil" explicitly indicates that the value is zero or that the data point has been intentionally reported as having no value.

The lack of coherence in the unit of key performance indicators (KPIs) within 1000 BRSR reports raises significant concerns about the consistency of sustainability reporting practices among companies. Specifically, the data discrepancies in reporting water intensity, a critical indicator outlined in the BRSR guidance document, exemplify the prevailing issue. While the guidance clearly indicates the unit as KL (Kilo Liter)/ Rupee, the collected data from the companies revealed a diverse array of units, including KL/Rs, KL/Th Rs, KL/lakhs, KL/Mn, KL/Crores, without unit, L/Rs, L/Lacs, and L/crore. Additionally, some companies opted not to indicate the unit for water intensity, while others presented values by directly calculating total water consumption divided by turnover. Notably, instances where both values of the total water consumption and turnover were provided, but water intensity presented as an "NA" indication further underscore the lack of standardised reporting practices.

The inconsistency in units persists in the case of the second indicator, Energy Intensity, as outlined in the BRSR format. Despite the prescribed units of joules or multiples of joules, such as gigajoules per rupee turnover, the dataset reveals a wide range of units utilized by companies. These include KJ/Rs, GJ/Rs, GJ/Mn, J/Rs, TJ/Rs, MJ/Rs, kWh/Rs, TJ/Lac, MWh/Rs, MJ/Lac, kWh/Lac, GJ/Cr, TJ/Cr, GJ/Lac, Wh/Rs, TJ/Mn, MWh/Cr, and MJ/Mn. Furthermore, sectorwise filtering of the data reveals a consistent pattern of inconsistency across various sectors.

For example - The data presented for energy intensity within the capital goods sector exhibits inconsistencies in measurement units. Examples include 211 GJ/Million Rs, 1,289 GJ/Billion INR, 0.003 KWh/Rs, 52.24 GJ/Cr, and 4.002 GJ/Lacs. This lack of standardization hinders meaningful comparison and analysis across companies, as it is impossible to directly compare energy intensity values expressed in different units.

The challenges surrounding the disclosure of air emissions (other than GHGs) within the BRSR framework highlight critical issues in corporate sustainability reporting practices. As per the guidance document Annexure 2 provided by SEBI mentions that 'Entities should disclose any contextual information is necessary in order to understand how the data has been compiled, such as any standards, methodologies, assumptions and/or calculation tools used.'

According to BRSR format, under principle 6 in the air emission table, there is a specific column named 'please specify unit'. The first challenge emerges from discrepancies between the units specified in the "please specify unit" column and the actual values provided, with companies presenting values in metric tons (MT) instead of the designated units such as mg/NM3. The second challenge arises from the varied units used to report air emission parameters, including mg/NM3, ug/NM3, ppm, and tonnes, further complicating intercompany comparisons within the same sector. Examples include 1.88g/kWh, 722 mg/nm^3, 127.7 µg/m^3, 3.02 tonnes, and 20.14 ppm. Even the units of scope 1 and scope 2 emissions of two companies are not up to any guidelines or framework and written as "Gco2/Littre" which is hard to quantify as what is the company trying to convey over there. This is how irresponsible the organisation is towards the most important environment disclosure from the perspective of sustainability. Some strict penalties are required to sensitize these type of companies.

Finally, the inconsistent use of NA, blank cells, dashes (-), or "nil" entries in reporting exacerbates the ambiguity surrounding companies' disclosure practices, hindering stakeholders' ability to assess and interpret air emission data effectively. Example: 5 out of 36 companies in banking sector disclosed data on air emissions (excluding greenhouse gases) in the provided dataset. The remaining companies either stated "not applicable" in their reports, used notations like "NA" or "-", or left the data cell entirely blank.

The discrepancies observed in the reporting of Research and Development (R&D) expenditures within the BRSR framework, as outlined under Principle 2 of Section C, 'Percentage of R&D and capital expenditure (capex) investments in specific technologies to improve the environmental and social impacts of product and processes to total R&D and capex investments made by the entity, respectively.'

Despite the explicit requirement to provide data as a percentage of R&D and capital expenditure investments in specific technologies, many companies opt to report R&D expenditures in monetary terms, such as crore rupees or million rupees, deviating from the specified format. Furthermore,

the absence of guidance in Annexure 2 exacerbates the confusion surrounding data disclosure requirements. The indiscriminate use of a dash (-) further compounds the issue, as it can be interpreted in various ways, ranging from no data available to not applicable or simply a refusal to disclose. For example- Among the 63 companies in the Automobile and Auto Components sector, 19 did not disclose research and development (R&D) expenditure in technologies aimed at improving the social and environmental impacts of their products and processes. These companies instead left the corresponding data cell empty. Additionally, 3 companies stated that disclosing such information was not applicable within the context of the report.

In another example A company (sector: manufacturing, sub-sector: cables & electricals), with a turnover of 69,123.30 crores, reports no R&D expenditure under relevant accounting principles and makes no mention of an R&D fund. However, the company acknowledges spending 2.6 crores on energy efficiency and plastic waste reduction initiatives as part of its capital expenditure (capex). This discrepancy raises concerns about the potential for irregularities, as activities like these could be categorized as R&D, and the company might not have established a dedicated R&D fund, potentially leading to a 0% disclosure of its total R&D expenditure. Such inconsistencies and ambiguities in reporting hinder stakeholders' ability to accurately assess and compare companies' efforts in improving environmental and social impacts through R&D investments.
These ambiguities about the interpretations underscore the importance of clear and consistent data reporting standards within the BRSR framework. Stakeholders, including investors, analysts, and policymakers, rely on accurate and transparent disclosure to make informed decisions and assess the sustainability performance of organizations. Inconsistencies in reporting practices may undermine the credibility and reliability of sustainability reports, hindering efforts to promote transparency and accountability in corporate disclosures.

4.6 Addressing BRSR Challenges and Avoiding Greenwashing

The Business Reporting on Sustainability Reporting (BRSR) framework offers a valuable step towards transparent and accountable sustainability reporting in India. However, several challenges currently hinder its effectiveness, requiring solutions regarding awareness, focus and capacity building. Addressing these issues, alongside vigilance against greenwashing, is crucial for BRSR to achieve its full potential.

Tackling Data Management Hurdles

Standardization and Capacity Building: Ambiguous definitions and inconsistent interpretations can lead to unreliable data. To address this, the BRSR framework needs to clearly define each parameter, provide standardized measurement methodologies, and utilize consistent units. For instance, instead of accepting data in diverse formats like "N/A," "Nil," or blank spaces, a standard terminology like "Not Applicable" could be implemented. Additionally, training programs for personnel engaged in data collection, analysis, and reporting should be organized.

These programs can equip individuals with the necessary skills to accurately interpret BRSR requirements and better ensure consistent application across the organization.

Example: Consider the case of water intensity, a key BRSR indicator. Currently, companies report water intensity using various units like KL/Rs, KL/Th Rs, KL/lakhs, KL/Mn, KL/Crores, etc. Standardizing the unit to KL/Rupee will enable meaningful comparison

Data Management Systems: Companies should be encouraged to invest in robust data management systems capable of efficiently collecting, storing, and analyzing large volumes of sustainability data. These systems can streamline data collection processes, ensure data integrity, and facilitate easier reporting.

Internal Expertise: Fostering a culture of sustainability within organizations is crucial. This can be achieved by promoting internal awareness about the importance of sustainability reporting and building dedicated teams responsible for BRSR reporting. These teams can be responsible for data collection, analysis, and ensuring adherence to BRSR guidelines.

Overcoming Standardization Issues

Refined BRSR Template: The BRSR template should undergo continuous review and updates to reflect evolving trends, address emerging issues, and align with established international frameworks like GRI and SASB. Additionally, incorporating sector-specific nuances can further enhance its effectiveness. For instance, the template could mandate the disclosure of specific water stress indicators for companies operating in water-scarce regions, but not for those in water-abundant areas.

Detailed Guidelines: Alongside the template, comprehensive guidelines offering clear instructions on data collection, interpretation, and reporting for each parameter should be35 developed. These guidelines should address ambiguities and provide concrete examples to minimize misinterpretations and ensure consistent application. For example: The BRSR framework currently lacks clarity on how to report air emissions (excluding greenhouse gases) other than in metric tons (MT). To address this, the guidelines could specify acceptable alternative units like grams per cubic meter (g/m^3) or milligrams per cubic meter (mg/m^3), along with conversion factors to ensure consistency.

Enhancing Comparability and Materiality

Sector-Specific Templates: Developing sector-specific BRSR templates can improve the comparability of data within industries. These templates can include tailored parameters and disclosure requirements relevant to the specific environmental and social challenges faced by each sector.

Materiality Assessment Tools: Robust and accessible materiality assessment tools can be provided to help companies prioritize the most significant sustainability issues relevant to their operations. This ensures that BRSR reports focus on material aspects and avoid distractions by irrelevant information.

Standardized Normalization Factors: To enable meaningful comparison beyond just raw numbers, BRSR can introduce standardized normalization factors. These factors could consider metrics like production volume, revenue, or employee count, allowing for the comparison of data from companies of various sizes and operating within different contexts.

Addressing Guideline and Data Validation Issues

Clarification and Support: To minimize ambiguity and ensure consistent data collection across companies, detailed clarifications and examples should be provided for Annexure-based guidelines. This could involve offering online resources, holding clarification workshops, or establishing a dedicated support mechanism for companies seeking guidance on specific aspects of BRSR reporting.

Assurance Options: Implementing a tiered assurance structure can cater to companies of varying sizes and resource constraints. This could involve offering options like limited or reasonable assurance by accredited providers. While mandatory assurance may be challenging for all companies, encouraging some form of assurance can enhance the credibility and reliability of BRSR data.

Incentive-based Approach: Implementing an incentive-based system can motivate companies to prioritize high-quality and transparent BRSR reporting. This could involve recognizing companies with exemplary reports through awards, granting them preferential treatment in government procurement processes, or providing access to specific financing options.

Emission Scenario Analysis of Indian Industries

5.1 Understanding and Analyzing the Emission Trends:

Analyzing Scope 1, Scope 2, and Scope 3 emissions reveals the varied sources of emissions and underscores the necessity for specific mitigation strategies in each sector. The Power & Energy sector emerges as the most significant contributor to Scope 1 emissions, with a staggering 513,818,252 metric tons of CO2 equivalent (MtCO2e). This substantial figure can be attributed to the sector's heavy reliance on fossil fuel combustion for electricity generation and other operational processes. The direct burning of coal, natural gas, and other fossil fuels releases vast amounts of carbon dioxide, methane, and other greenhouse gases into the atmosphere, contributing to the sector's substantial Scope 1 emissions.

Turning to Scope 2 emissions, which encompass indirect emissions from purchased electricity, heat, and cooling, the Manufacturing sector emerges as the most significant contributor, emitting 27,177,810 MtCO2e. This highlights the sector's dependence on electricity for various manufacturing processes, such as powering machinery, lighting, and heating/cooling systems. The source of electricity generation plays a crucial role in determining the magnitude of Scope 2 emissions, with fossil fuel-based power plants contributing to higher emissions compared to renewable energy sources. The Metals & Mining sector also exhibits relatively high Scope 2 emissions of 50,670,626 MtCO2e, potentially due to the energy-intensive nature of its operations. Processes such as mineral processing, smelting, and refining require substantial amounts of electricity, contributing to the sector's Scope 2 emissions.

With respect to Scope 3 emissions, which encompass all other indirect emissions within a company's value chain, the Manufacturing sector once again dominates. These emissions can stem from various sources along the supply chain, including raw material extraction, transportation, product distribution, and end-use. The complexity of manufacturing processes and the involvement of numerous suppliers and partners contribute to the sector's significant Scope 3 emissions. The Oil, Gas & Consumable Fuels sector also exhibits substantial Scope 3 emissions of 154,857,149.48 MtCO2e. This can be attributed to the emissions associated with the extraction, refining, transportation, and end-use of fossil fuel products. The combustion of these fuels by consumers, such as in transportation or industrial processes, contributes significantly to the sector's Scope 3 emissions.

Non-Disclosure: A Concerning Trend

It is observed that few number of companies are not reporting their emission across all the three scopes from all the sectors, this shows the lack of sincerity and regulatory compliances (discussed broadly in previous chapter). A noteworthy observation from the data is the considerable number of companies across sectors that did not disclose their Scope 1, 2, and 3 emissions data. For instance, in the Manufacturing sector, a staggering 380 companies did not report their Scope 3 emissions, potentially indicating challenges in tracking or reporting these indirect emissions along their value chains.

The high rate of non-disclosure could stem from various factors, including the complexity of measuring Scope 3 emissions, lack of regulatory pressure or incentives, limited technical capabilities, or a lack of awareness regarding the importance of environmental reporting. Additionally, some companies may perceive the disclosure of emissions data as a competitive disadvantage or a risk to their reputation. However, it is crucial to recognize that non-disclosure hinders transparency and accurate assessments of a company's environmental impact. Without comprehensive data, it becomes challenging to identify areas for improvement, set meaningful targets, and monitor progress towards sustainability goals.

Variations and Influencing Factors

The distribution of emissions across sectors highlights the need for tailored mitigation strategies and improved environmental governance. Sectors with high Scope 1 emissions, such as Power & Energy, Metals & Mining, and Cements, should prioritize the adoption of cleaner production technologies, energy efficiency measures, and a transition towards renewable energy sources. This could involve investments in solar, wind, or other low-carbon energy alternatives, as well as the implementation of carbon capture and storage technologies.

Sectors with significant Scope 2 emissions, like Manufacturing, may benefit from increasing their reliance on renewable energy sources for electricity generation or implementing energy efficiency measures within their facilities. Collaboration with utility companies and the promotion of green energy procurement can contribute to reducing Scope 2 emissions. Addressing Scope 3 emissions necessitates a collaborative effort throughout the value chain, involving suppliers, transportation partners, and consumers. This could involve optimizing supply chain logistics, implementing sustainable procurement practices, promoting product stewardship, and encouraging sustainable consumption patterns among customers. It is crucial to acknowledge that variations in emission levels and disclosure rates may also be influenced by factors beyond sector-specific characteristics, such as company size, ownership structure, and regulatory frameworks. Larger companies may have greater resources and capabilities to measure and report emissions, while smaller firms may face challenges in implementing comprehensive environmental management systems.

Additionally, the regulatory landscape and incentives for emission reduction can vary across sectors and regions, potentially influencing a company's willingness or ability to disclose emissions data and implement mitigation measures. Enhancing transparency and standardizing emission reporting practices across all sectors could facilitate more accurate assessments and targeted interventions. Strengthening regulatory frameworks, providing technical assistance, and promoting voluntary disclosure initiatives could encourage greater participation and data accuracy.

5.2 Descriptive Analysis of Emission Across Various Sectors

For this analysis, Power BI was employed for data analysis and visualization purposes. The study focused on three specific industry sectors:

1. Power and Energy Sector
2. Metal & mining Manufacturing Sector
3. Cement Manufacturing Sector

The primary objective was to perform a comparative analysis of these industries based on several key metrics. These metrics included Scope 1, Scope 2, and Scope 3 emissions, market capitalization, and energy intensity. Each sector was meticulously evaluated to provide a comprehensive understanding of its environmental impact and economic performance.

Scope 1 emissions refer to direct greenhouse gas emissions from sources that are owned or controlled by the company. Scope 2 emissions account for indirect greenhouse gas emissions from the consumption of purchased electricity, steam, heating, and cooling. Scope 3 emissions encompass all other indirect emissions that occur in a company's value chain. By analyzing these emissions across the three industry sectors, the study aimed to identify which industries contribute most to greenhouse gas emissions and to what extent. Market capitalization, representing the total market value of a company's outstanding shares, was analyzed to gauge the economic size and market value of companies within these sectors. This metric provided insight into the financial health and economic impact of the industries.

Energy intensity, measured as the amount of energy consumed per unit of output or economic activity, was also analyzed. This metric is crucial for understanding how efficiently each industry uses energy, which has direct implications for both cost and environmental sustainability.

The visualization created in Power BI included various charts and graphs to depict these metrics clearly and concisely. For instance, a stacked area chart was used to show the sum of Scope 1, Scope 2, and Scope 3 emissions across the three industry sectors. This allowed for easy comparison of the total emissions contributions of each sector.

Scope 1, Scope 2 and Scope 3 among various Sectors

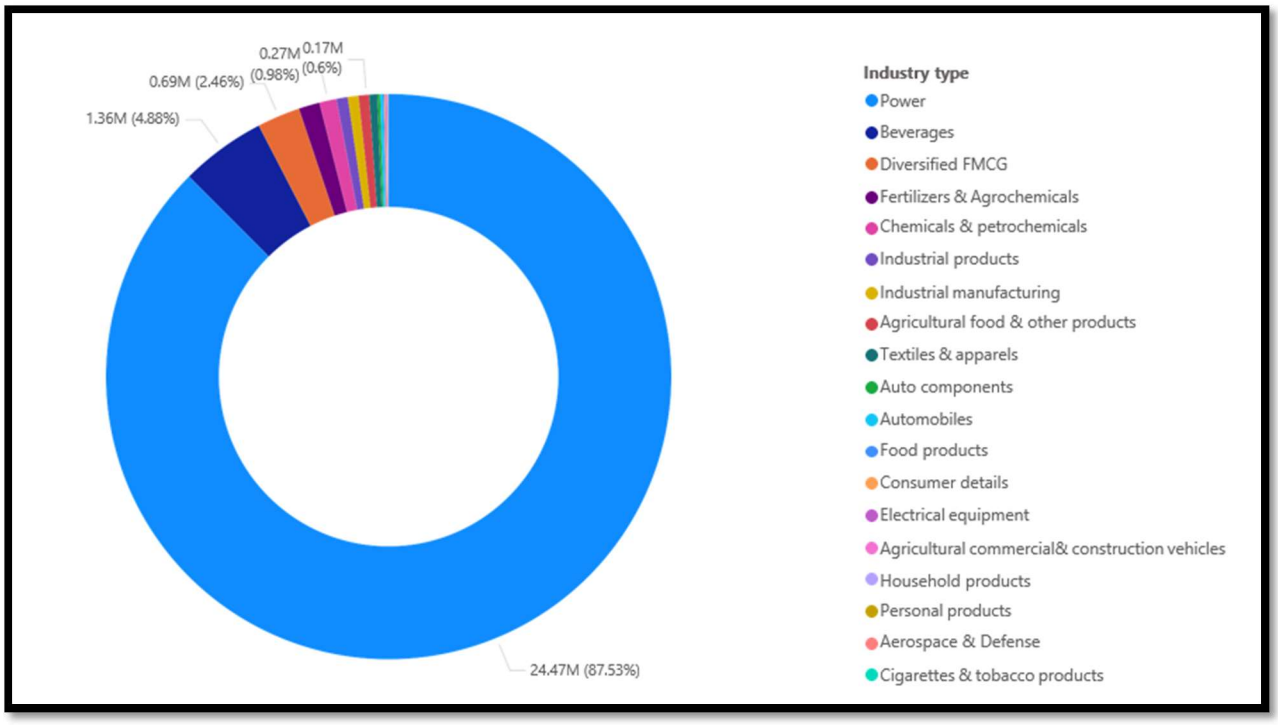

Fig 1: Chart 5.2.1: Scope 1 emissions across various industry types

The chart 5.2.1 illustrates Scope 1 emissions across various industry types. Power dominates with 87.53% of emissions. Industrial manufacturing (4.88%) and Chemicals & petrochemicals (2.46%) are notable contributors. Other sectors like Diversified FMCG and Automobiles have minimal impact. This indicates a significant need for emission reduction in the power sector. This data is critical for identifying industry-specific targets and performance benchmarks for emissions reduction initiatives.

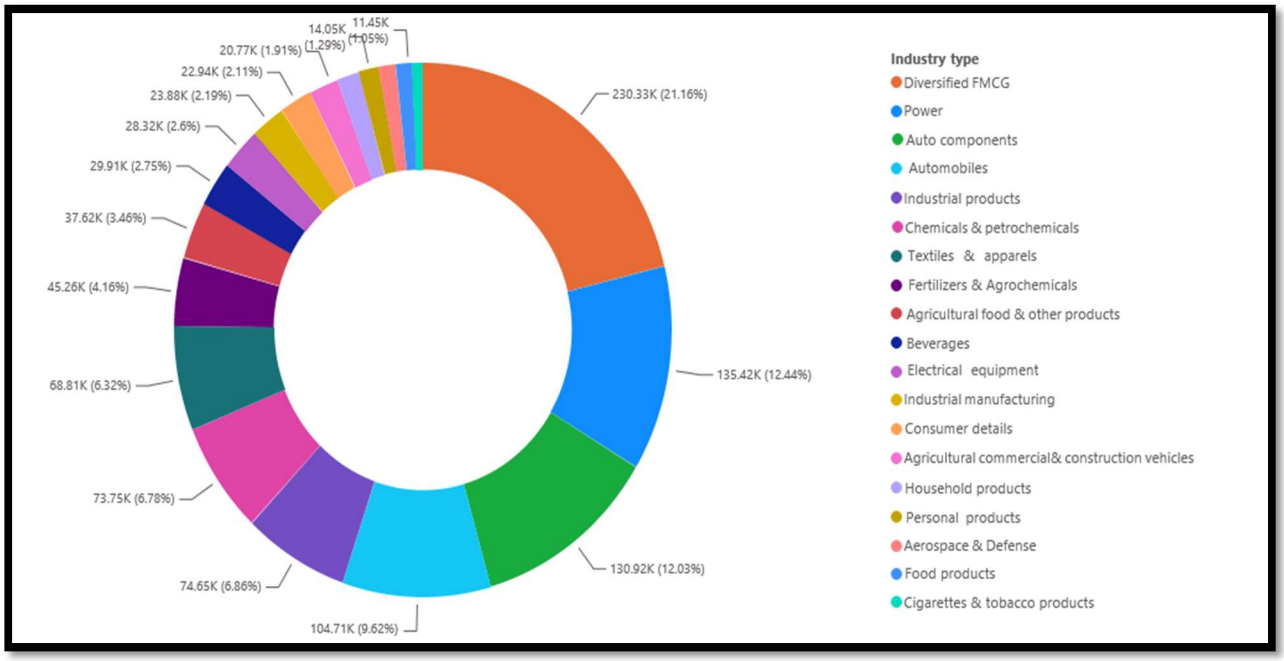

Fig 2: Chart 5.2.2: Scope 2 emissions across various industry

The chart depicts Scope 2 emissions across various industries. Diversified FMCG leads with 21.16%, followed by Power (12.44%) and Chemicals & petrochemicals (12.03%). Household products (6.86%) and Textiles & apparels (6.78%) also contribute significantly. Emissions are more evenly distributed across sectors compared to Scope 1, highlighting diverse energy consumption patterns.

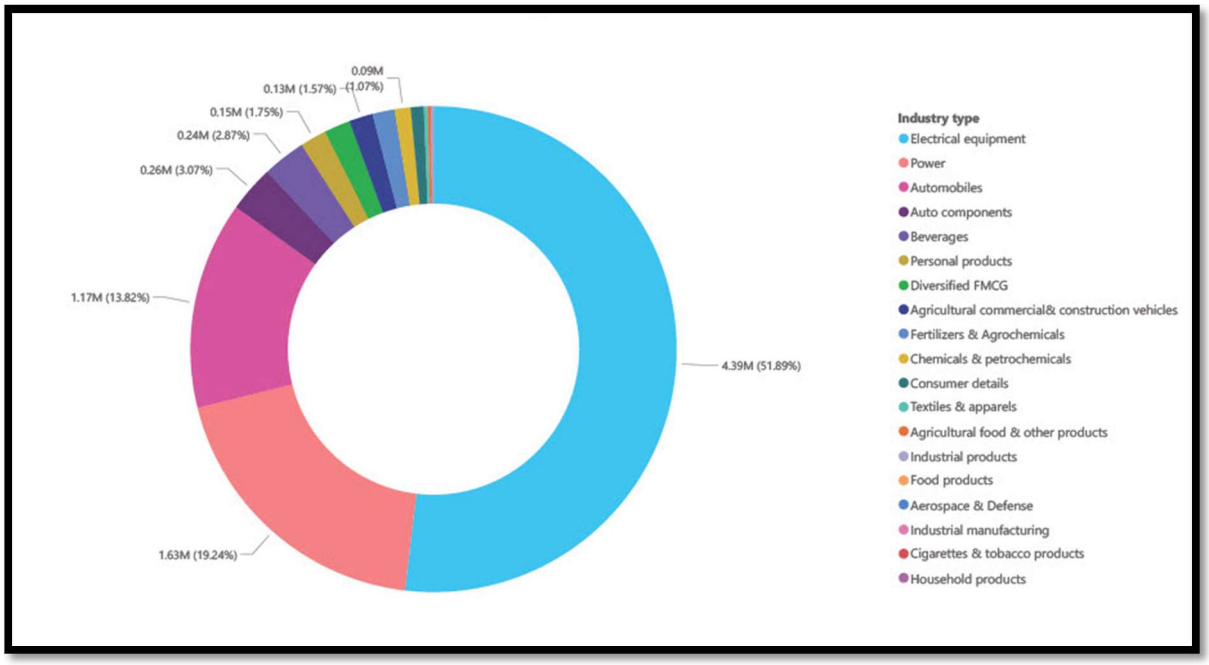

Fig 3: Chart 5.2.3: Scope 3 emissions across various industry

The chart shows Scope 3 emissions across different industries. Power is the largest contributor at 51.89%, followed by Automobiles (19.24%) and Industrial products (13.82%). The rest of the sectors have relatively minor contributions. This emphasizes the significant indirect emissions from power and automobile industries, requiring focused mitigation strategies

Metal and Mining Manufacturing Industries

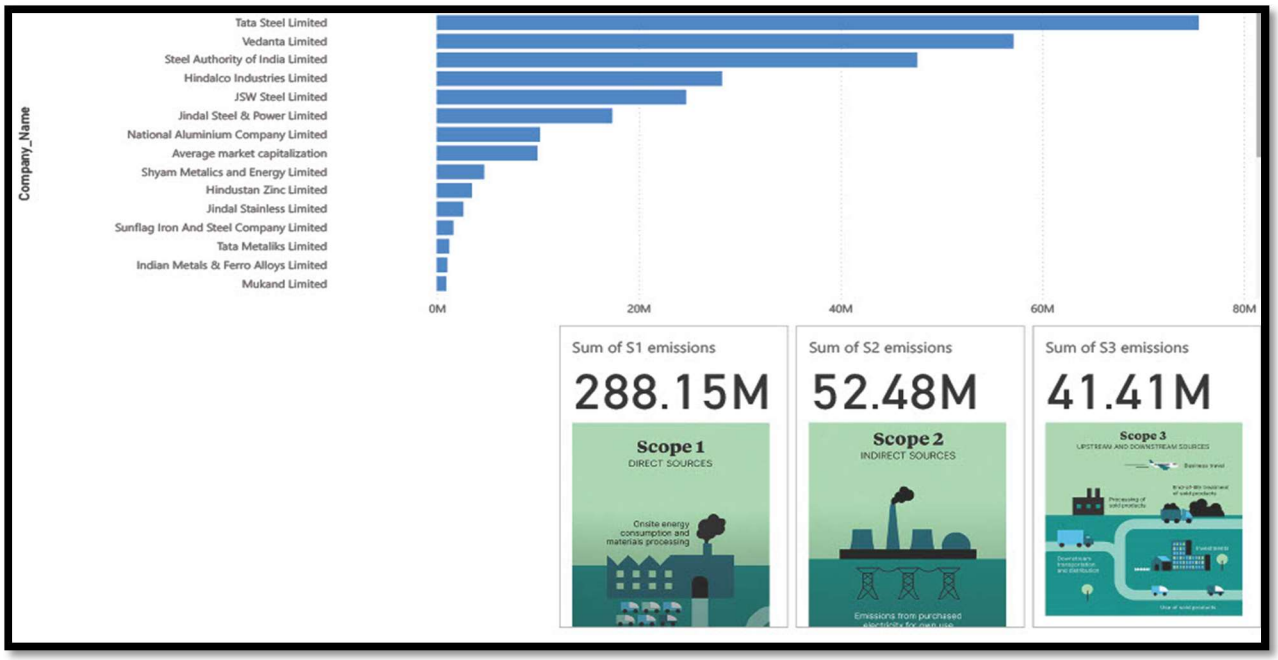

Fig 4: Chart 5.2.4: Scope 1, 2 & 3 emissions Metal and Mining Manufacturing Industries

The plot depicts the Scope 1 emissions for the industries in the sector with the highest emissions by TATA steel limited and lowest by Orissa Minerals Development Company limited. It also shows the metrics for the sum of scope 1 scope 2 and scope 3 emissions.

Cement Manufacturing Industry

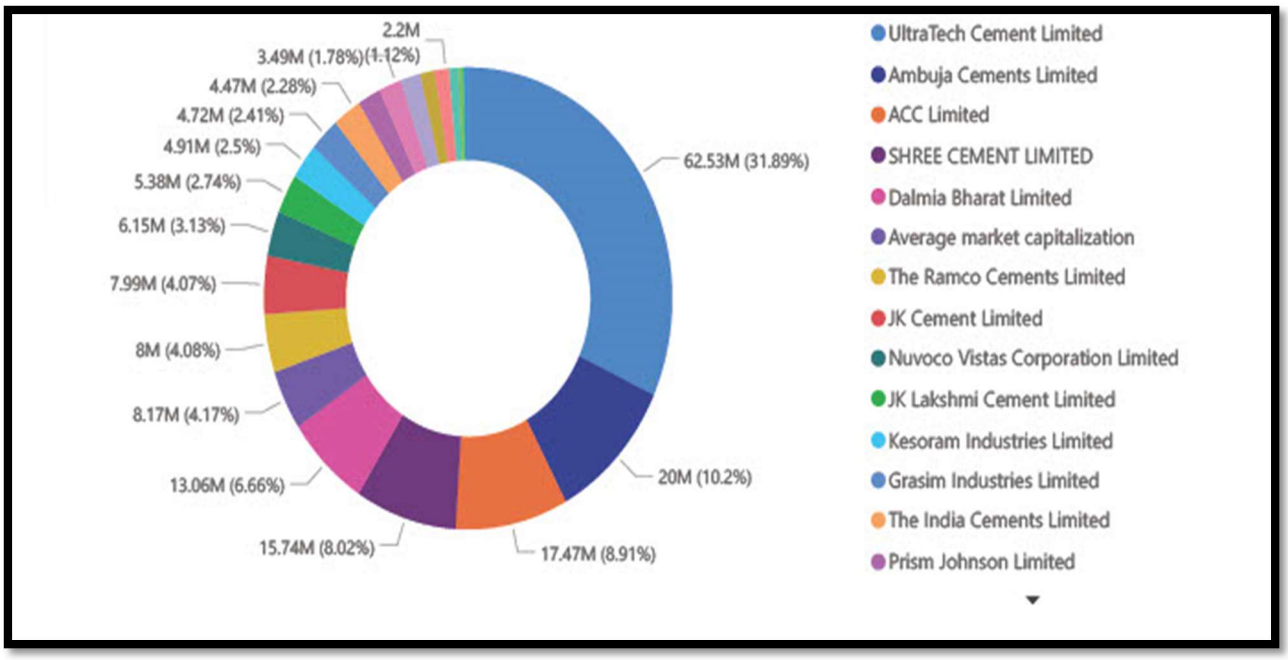

Fig 5: Chart 5.2.5: Scope 1, 2 & 3 emissions Cement Manufacturing Industries

The donut plot illustrates Scope 1 emissions for 23 companies in the cement manufacturing industry included in the study. With sum of scope 1 emissions of 196.11 M, sum of scope 2 emissions of 9.68M, sum of scope 3 emissions of 17.35M. Ultra Tech Cement Limited exhibits the highest Scope 1 emissions, while KCP Limited has the lowest. Additionally, the plot, created in Power BI, presents the total emissions for Scope 1, Scope 2, and Scope 3 across all companies in the cement manufacturing sector. . Cement sun sector under manufacturing sector shows a mean of 86.44, also exhibit considerable emissions, albeit with moderate variability. This comprehensive visualization emphasizes the disparities in emissions among the companies, providing a clear picture of each company's environmental impact within the industry.

5.3 Descriptive Analysis of Emission Intensities

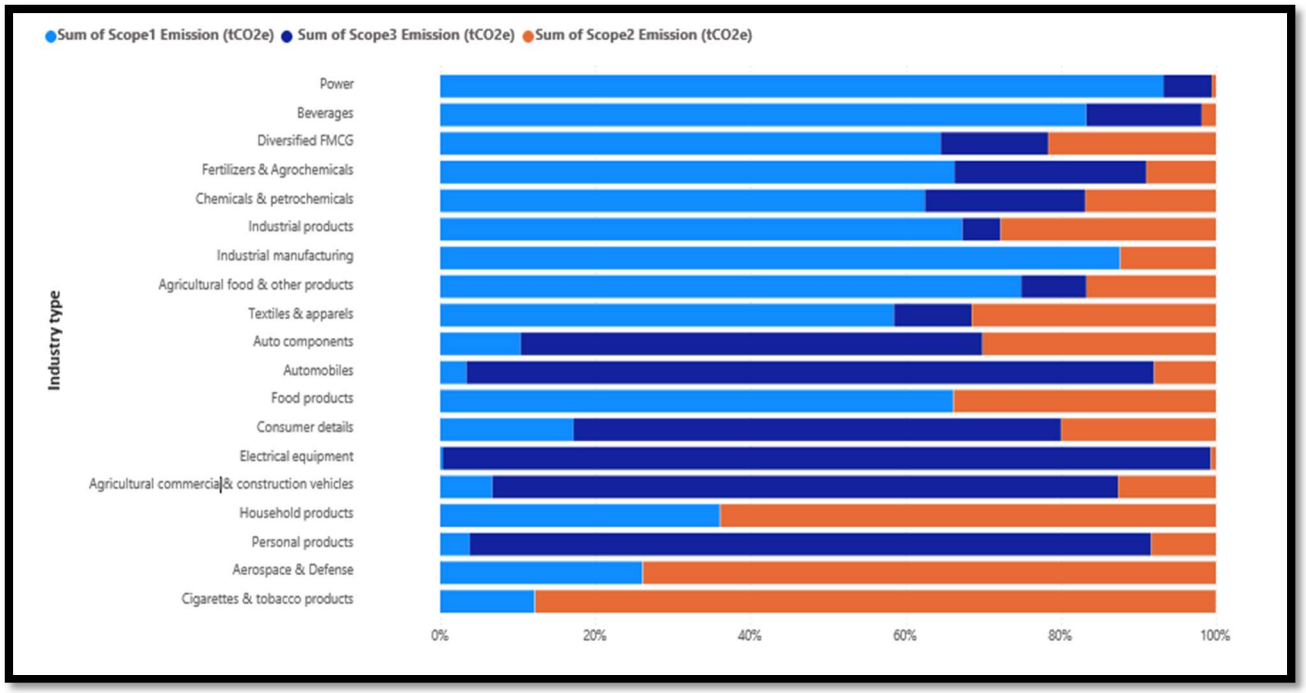

Fig 6: Chart 5.3.1: Descriptive Analysis of Emission Intensities across Various Sectors.

The above Donut chart represents the emission intensity distribution across various industry types. The Power sector dominates with 45.51% of total emissions. Other significant contributors include Chemicals & Petrochemicals (10.95%), Auto Components (9.65%), and Fertilizers & Agrochemicals (6.39%). The chart visually emphasizes the disproportionate contribution of the Power sector to overall emissions, highlighting areas for potential emission reduction efforts.

1. Scope-1 Emission Intensity

On observing Scope 1 emission intensity across the two sectors among 1000 Indian companies, it is evident that the Power & Energy sector has the highest mean emission intensity at approximately 5429 units, followed by Metals & Mining, and Cement sub-sectors under manufacturing sector with mean intensities of around 1237 and 895 units, respectively. This data is critical for identifying industry-specific targets and performance benchmarks for emissions reduction initiatives.

2. Scope-2 Emission Intensity

The Scope-2 emission intensity data for various industrial sectors shows significant variability. The Manufacturing sector has the highest average intensity at 55.91, with a notably high standard deviation, indicating diverse emission levels among companies.

3. Scope-3 Emission Intensity

The Scope 3 emission intensity data reflects the varied indirect emissions across sectors for Indian companies. Manufacturing leads with a high mean intensity of 186.17, but a large standard deviation suggests uneven distribution among companies. Cement sun sector under manufacturing sector shows a mean of 86.44, also exhibit considerable emissions, albeit with moderate variability.

The considerable variation within these sectors points to a pressing need for standardized reporting and targeted reduction strategies. It is important to note that the standard deviations for some sectors, particularly in scope 2 and scope 3 emission intensities, are relatively high, indicating a wide range of values and potential outliers or variations within the sector.

Conclusion

Thus the Emission Disclosure framework in India is very recent and new, not only for professionals and companies across various sectors but also for regulating agencies. Therefore, there is significant scope for enhancing reporting frameworks, standardizing reporting processes, and supporting smaller players across sectors. Assisting companies and incentivizing them with better and easier access to technology and reporting services will help. This will not only advance the country toward Sustainable Development Goals 10 and 13, which focus on responsible production and consumption, and climate action, respectively, but also an Environment friendly growth model ensuring "*Sabka Sath, Sabka Vikas*" ensuring inclusive stakeholder engagement for "*Sabka Vishwas and Sabka Prayas*"

Future Scope and Recommendations

Looking ahead, the research work outlines several areas for future research and development:

1. ***Enhanced Reporting Frameworks:*** There's a need for more robust and detailed guidelines within the BRSR to improve the clarity and comparability of emissions reporting. Future research could explore the development of sector-specific reporting standards and the integration of international sustainability reporting frameworks to enhance the global comparability of Indian companies' disclosures.

2. ***Technology and Innovation:*** Leveraging emerging technologies such as blockchain, AI, and IoT could streamline the data collection and reporting process, ensuring more accurate and

verifiable sustainability disclosures. Further studies could examine the potential of these technologies in overcoming the current challenges of sustainability reporting.

3. ***Stakeholder Engagement:*** Engaging a broader spectrum of stakeholders, including investors, consumers, and regulatory bodies, in the development and implementation of sustainability reporting standards can provide more holistic and relevant frameworks. Future initiatives could focus on understanding the needs and expectations of these stakeholders to drive more targeted and effective reporting.

4. ***Policy and Regulatory Developments:*** The research work suggests the exploration of policy instruments and incentives to encourage more comprehensive and transparent emissions reporting among Indian companies. Future research could further investigate the impact of regulatory changes on corporate sustainability practices and the overall effectiveness of sustainability reporting in driving environmental improvements.

5. ***Comparative International Studies:*** Finally, comparing the BRSR framework and its implementation with sustainability reporting practices in other countries could offer valuable insights into best practices and lessons learned. Such comparative studies could inform the further evolution of the BRSR and contribute to the global discourse on corporate sustainability reporting.

This research work not only provides a comprehensive analysis of the current state of emissions reporting among Indian companies but also highlights the critical role of standardized sustainability reporting in driving environmental accountability and improvements. By addressing the identified challenges and leveraging the outlined opportunities, there is a significant potential to enhance the effectiveness of the BRSR framework and, ultimately, contribute to the broader goals of sustainable development and climate action in India and the world.

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Abstract Climate change is undoubtedly one of the most trenchant challenges of the 21st century, necessitating urgent action across the globe to mitigate its impacts. India, as a rapidly developing economy and a significant contributor to global greenhouse gas emissions, plays a pivotal role in the global climate agenda. This dissertation examines the alignment of growth with sustainability through an in-depth analysis of emissions reporting by India's top 1000 companies. Leveraging the Business Responsibility and Sustainability Reporting (BRSR) framework introduced by the Securities and Exchange Board of India (SEBI), this study provides a critical assessment of the current state of corporate emissions disclosures and identifies pathways for enhancing sustainability practices within the Indian corporate sector. Employing a mixed-methods approach, this research meticulously compiles, validates, and analyses environmental, social, and governance (ESG) data along with financial performance indicators across a diverse array of industries. The study utilizes descriptive and exploratory data analysis techniques to quantify Scope 1, 2, and 3 emissions and assess emission intensities within and across sectors. Furthermore, the research critically evaluates the BRSR template's adoption, highlighting challenges and recommending improvements to bolster the framework's effectiveness in promoting transparent and accountable sustainability reporting. Further the analysis goes on to reveal significant disparities in emissions reporting practices among the evaluated companies, with a particular emphasis on the variance in Scope 1, 2, and 3 emissions across sectors. The Power & Energy, Metals & Mining, and Cement sectors emerge as substantial contributors to Scope 1 emissions, largely due to their reliance on fossil fuel combustion and energy-intensive operations. Conversely, Scope 2 and 3 emissions underscore the indirect environmental impacts of corporate activities, particularly in the Manufacturing sector, which leads in Scope 3 emission intensity due to its complex value chain interactions. The study also identifies several challenges associated with the BRSR template's implementation, including data management difficulties, inconsistencies in data

standardization, and variances in comparability and materiality assessments. Notably, a considerable number of companies fail to disclose crucial emissions data, underscoring a pressing need for enhanced regulatory mechanisms and incentives to ensure comprehensive and transparent reporting. This dissertation underscores the critical role of standardized, robust emissions reporting in aligning corporate growth with sustainability goals. The findings advocate for the refinement of the BRSR framework to address existing shortcomings, emphasizing the importance of sector-specific guidelines, enhanced data validation processes, and the incorporation of global best practices in sustainability reporting. Moreover, the study highlights the necessity of fostering a culture of sustainability within the corporate sector, recommending targeted capacity-building initiatives and the promotion of internal and external collaborations to drive meaningful environmental improvements. Aligning growth with sustainability presents a multifaceted challenge for Indian companies, necessitating a concerted effort to enhance emissions reporting and embed sustainability practices across all levels of corporate operations. By addressing the identified gaps in the BRSR framework and leveraging the insights gained from this analysis, policymakers,9 regulators, and corporate leaders can advance India's sustainability agenda, contributing to global efforts to fight climate change and achieve the United Nations Sustainable Development Goals. Introduction Climate change stands as a pressing global challenge, demanding immediate and concerted action from all nations to mitigate its severe consequences. India, as a major emitter of greenhouse gases and a country highly susceptible to the impacts of climate change, has intensified its efforts to address this critical issue over the past decade. This transition has encompassed the establishment of ambitious policy targets for renewable energy expansion, emissions reductions across sectors, electric mobility, energy efficiency improvements, restoration of forests and lands to act as carbon sinks, and more. These climate-focused endeavors are intrinsically linked to the broader pursuit of sustainable development. In 2015, India adopted the United Nations Sustainable Development Goals (SDGs) – a comprehensive global framework comprising 17 interconnected economic, social, and environmental objectives to be realised by 2030 (United Nations, 2015). Several SDGs are directly related to climate change mitigation and adaptation, such as Goal 7 (Affordable and Clean Energy), Goal 11 (Sustainable Cities and Communities), and Goal 13 (Climate Action). Other goals encompass the transition to an inclusive green economy, sustainable food systems, universal access to quality education and healthcare, reduced income inequalities, and multi-stakeholder partnerships to achieve these ambitious development objectives. To track national progress across the wide-ranging SDG targets and indicators, standardized corporate sustainability reporting is crucial. This is where Environmental, Social, and Governance (ESG) metrics and disclosure frameworks come into play. Companies report on ESG factors such as energy usage, greenhouse gas emissions, waste generation, water usage, biodiversity impacts, labor rights and practices, diversity and inclusion, supply chain ethics, and governance issues based on accepted sustainability reporting frameworks (World Economic Forum, 2020). Global ESG reporting has expanded exponentially as investors and regulators increasingly expect transparency on sustainability performance. In India, guidelines from the Securities and Exchange Board of India (SEBI), corporate codes of conduct, and growing investor demand have led more companies to publish annual sustainability or integrated reports in recent years. However, this practice remains limited primarily to larger companies at present. The quality, completeness, rigor, and transparency of sustainability disclosures by Indian companies vary extensively across firms. Different formats are followed without alignment to consistent global ESG reporting standards. To address these gaps and expand standardized sustainability reporting, SEBI set up a committee in 2019 to formulate mandatory ESG disclosure guidelines for the top 1,000 listed companies based on market capitalization (SEBI, 2021). This initiative built on voluntary reporting frameworks namely the Carbon Disclosure Project (CDP), Global Reporting Initiative (GRI), the International Finance Corporation (IFC), Sustainability Accounting Standards Board (SASB), and companies' Integrated Reports (IR). After extensive consultations, SEBI announced the proposed Business Responsibility and Sustainability Report (BRSR) framework in 2021 (SEBI, 2021). BRSR draws on integrated reporting principles, covering both financial and ESG materiality. The extensive disclosures mandated in the report template cover ecosystems, community impact, labour practices, respect for human rights, governance, and other sustainability topics. BRSR aims to be a milestone towards transparent, consistent, and auditable sustainability reporting by Indian businesses that meets the needs of diverse stakeholders. It is envisioned as a tool to propel India's ambitious climate change and sustainable development policy goals by driving sustainability performance and accountability at the ground level. BRSR guidelines also indicate India's commitment as a member of the new International Sustainability Standards Board (ISSB) towards globally aligned and consistent reporting standards (IFRS Foundation, 2022). However, to realize BRSR's full potential, the reporting requirements could be further strengthened through compulsory auditing, extensive training and capacity building, incentives for small and medium enterprises (SMEs) to comply, and greater emphasis on metrics around cleaner production, circularity, life cycle analysis, and scenario planning. Companion regulations on emissions, renewable energy, waste management, and resource efficiency are equally critical to translate high-level reporting into on-ground sustainability action and impact. India's journey from voluntary sustainability reporting by a few companies to proposed mandatory BRSR disclosure for 1,000 listed entities indicates growing alignment of Indian regulators and industry with the global ESG movement. However, this transition still has a long path ahead. Robust reporting frameworks, technological capacity building, regulatory sticks and carrots, extensive multi-stakeholder consultations, incentives, and collaborations will be key to ensuring BRSR and related policies succeed in driving urgent climate action and inclusive, sustainable development. 1.1 Background of the Study The impetus for this study stems from the recognition that climate change poses an existential threat to humanity and the natural world. There has been a scientific consensus on the anthropogenic causes of climate change which has led to the global urgency to mitigate its impacts and collective call for decisive action (IPCC, 2021). The Paris Agreement, adopted by 196 parties in 2015, set the goal of limiting global temperature rise to below 2°C above pre-industrial levels, with

additional efforts to limit the increase to 1.5°C (United Nations, 2015). To achieve this ambitious target, countries have committed to undertaking Nationally Determined Contributions (NDCs) to reduce greenhouse gas emissions and enhance climate resilience. India, as the third- largest emitter of greenhouse gases globally (instead of the fact that it's per capita emission is far behind than other major contributors), plays a crucial role in this collective effort (World Resources Institute, 2022). The country has set ambitious targets under its NDCs, including reducing the emissions intensity of its GDP by 33-35% by 2030 from 2005 levels, achieving about 40% cumulative electric power installed capacity from non-fossil fuelbased energy resources by 2030, and creating an additional carbon sink of 2.5-3 billion tonnes of CO2 equivalent through additional forest and tree cover. To effectively monitor and drive progress towards these climate commitments, robust and transparent emissions reporting by businesses is essential. Scope 1, 2, and 3 emissions, as defined by the Greenhouse Gas Protocol, provide a comprehensive framework for measuring and reporting an organization's direct and12 indirect greenhouse gas emissions (World Resources Institute & World Business Council for Sustainable Development, 2004). Scope 1 emissions are direct emissions from owned or controlled sources, such as fuel combustion in boilers or vehicles. Scope 2 emissions are indirect emissions generated from purchased electricity, heat, or steam. Scope 3 emissions are essentially other indirect emissions that occur in the value chain of the reporting organization, including both upstream and downstream activities (World Resources Institute & World Business Council for Sustainable Development, 2004). Comprehensive reporting of Scope 1, 2, and 3 emissions is crucial for companies to understand their full carbon footprint and take targeted actions to reduce emissions across their operations and value chains. This data also enables stakeholders, such as investors, regulators, and consumers, to assess a company's climate impact and transition risks. In India, the BRSR framework aims to standardize and enhance the quality of sustainability reporting by listed companies, including emissions disclosures (SEBI, 2021). By mandating the top 1,000 listed companies by market capitalization to report on their environmental, social, and governance performance, BRSR seeks to drive sustainability accountability and performance at the ground level. Significance of the study This study holds significance in the context of India's commitment to combating climate change and achieving sustainable development goals. By undertaking a comprehensive analysis of Scope 1, 2, and 3 emissions reporting across the BRSR-mandated 1,000 Indian companies, this research will provide invaluable insights into the current state of emissions disclosure practices and identify areas for improvement. Existing research highlights the importance of such an endeavor. A study by Sharma and Kumar (2021) found that the quality and completeness of environmental and social disclosures among Indian companies vary significantly, underscoring the need for standardized and transparent reporting frameworks. Similarly, Jain and Aggarwal (2021) observed inconsistencies in carbon footprint reporting and disclosure practices across various sectors in India, emphasizing the significance of sector-specific analysis and benchmarking. Assembling an Extensive Emissions Database One of the key contributions of this study will be the assembly of an extensive emissions dataset, encompassing financial and operational variables across diverse Indian industry sectors and the 1,000 largest companies. This unprecedented endeavor will provide a quantified and holistic view of the carbon footprint of corporate India, transcending the current fragmented landscape of emissions data scattered across states and sectors. The aggregated dataset will reveal profound insights by quantifying absolute emissions volumes across industries, enabling the identification of the most significant emitting sectors. Furthermore, segmentation by financial metrics will facilitate the calculation of emissions intensity per rupee of revenue13 earned, guiding differential regulation and tailored strategies, as suggested by the findings of Sharma and Goel (2021) on the relationship between emissions intensity and firm value. Establishing a Baseline and Informing Forward-Looking Targets Analysis of historical emissions data will unveil a crucial baseline, discerning carbon efficiency improvements by sectors before the implementation of explicit climate policies. This retrospective understanding will inform the development of realistic and achievable forwardlooking targets, accounting for the progress already achieved and the challenges encountered, as highlighted in the context of sustainability reporting practices by Shukla and Vyas (2020). Moreover, the breakdown of emissions data into Scope 1, 2, and 3 categories will illuminate sectors warranting direct emissions regulation versus those where supplier codes of conduct and value chain engagement may be more effective in addressing the broader environmental footprint, aligning with the principles of the Greenhouse Gas Protocol (World Resources Institute & World Business Council for Sustainable Development, 2004). Unveiling Interlinkages between Environmental and Financial Performance Conducting correlation analyses between emissions, energy usage, and financial performance metrics will unravel crucial interlinkages between environmental and economic parameters, as explored by Shrivastava and Tamvada (2019) in their study on sustainability reporting practices of top Indian companies. Positive correlations could indicate the current reliance of business models on fossil fuels, underscoring the need for carbon-efficient disruption, while negative correlations could spotlight potential adoption challenges, necessitating policy interventions. Further, this analysis may reveal outliers – high-emitting profitable companies showcasing effective management capabilities, and low-emitting companies with weaker financials, indicating a need for transitional assistance, as suggested by the findings of Sharma and Goel (2021) on the relationship between emissions intensity and firm value in the Indian manufacturing sector. Tailoring Climate Policies and Interventions Categorizing the emissions dataset by economic sectors will illuminate the industries that are most emissions-intensive, based on absolute emissions volumes and emissions per rupee of revenue generated. This differentiation is pivotal for pragmatic policymaking, enabling the prioritization of stringent emissions regulations, carbon pricing mechanisms, and incentives for technology upgrades in highly intensive sectors, as recommended by various industry-specific studies and reports (e.g., cement, steel, oil and gas sectors). Simultaneously, segmentation by market capitalization will distinguish emissions patterns between large, mid-sized, and smaller companies within each sector, aligning with the findings of Shrivastava and Tamvada (2019) on the variations in sustainability reporting practices among Indian

companies of different sizes. Research Objectives: • Evaluate the comprehensive status including scale, scope and credibility of Environmental disclosures within major Indian companies operating and leading the both the Power & Energy Sector and the Manufacturing Sector. • Propose a set of reformative measures that the Government of India authorities can implement to regulate the environmental impact caused by major Indian companies operating in the Power & Energy and Manufacturing sectors as a proactive measure towards fostering good governance in the realm of environmental sustainability. • Propose reforms to the existing regulatory framework governing ESG reporting within the Indian context. Literature Review 2.1 Theoretical Framework: Analyzing Emissions of BRSR Mandated Indian Industries This research investigates the emissions profile of the top 1000 Indian companies mandated to report under the Business Responsibility and Sustainability Reporting (BRSR) framework. The theoretical framework draws upon concepts from environmental accounting, corporate sustainability, and industrial ecology to analyze the reported Scope 1, 2, and 3 emissions data across various sectors. Core Concepts: Environmental Accounting: This framework incorporates principles of environmental accounting to quantify and analyze the environmental impacts of the companies' activities. Specifically, it focuses on integrating emissions data (Scope 1, 2, and 3) with financial data to understand the environmental costs associated with business operations. Corporate Sustainability: The research leverages principles of corporate sustainability to assess the companies' environmental performance and commitment to sustainable practices. By analyzing emissions data, we can evaluate how companies are managing their environmental footprint and contributing to broader sustainability goals. Industrial Ecology: This framework draws upon concepts from industrial ecology to understand the interconnectedness between industrial activities and the environment. By analyzing emissions data across sectors, we can identify potential areas for collaboration and resource optimization within the Indian industrial landscape. 2.2 Evaluation of Existing Literature: The issue of greenhouse gas (GHG) emissions and their contribution to climate change has garnered significant attention globally. Since India is a signatory to the Paris Agreement, it has committed to reducing its emissions intensity by 33-35% by 2030 from the 2005 levels (Ministry of Environment, Forest and Climate Change, 2015). In this context, the Business Responsibility and Sustainability Reporting (BRSR) framework, introduced by the Ministry of Corporate Affairs in 2021, has emerged as a crucial regulatory development mandating the disclosure of Scope 1, Scope 2, and Scope 3 emissions for the top 1000 listed companies in India. "The BRSR seeks to provide a standardized reporting format for companies to report their performance against the core elements and nine principles of the 'National Guidelines on Responsible Business Conduct'" (Ministry of Corporate Affairs, 2021). This framework aims to promote transparency, accountability, and responsible business practices among Indian corporations, with a specific emphasis on environmental sustainability and climate change mitigation. Historical Context16 Corporate environmental reporting in India has evolved significantly over the past few decades, driven by a combination of regulatory changes, stakeholder pressure, and the growing recognition of the importance of sustainable business practices. Initially, environmental reporting was voluntary, with companies disclosing limited information in their annual reports or sustainability reports. However, the Companies Act of 2013 introduced mandatory requirements for certain classes of companies to report on their environmental and social performance (Kansal et al., 2014). "Before the introduction of the BRSR framework, the majority of Indian companies followed the National Voluntary Guidelines on Social, Environmental and Economic Responsibilities of Business (NVGs) issued by the Ministry of Corporate Affairs in 2011" (Mahajan, 2022). While the NVGs provided a comprehensive set of principles and guidelines for responsible business conduct, their voluntary nature resulted in varying levels of compliance and disclosure among companies. The BRSR framework represents a significant step towards standardizing and mandating sustainability reporting in India. It builds upon the NVGs and incorporates globally recognized frameworks such as the Global Reporting Initiative (GRI) and the Task Force on Climate-related Financial Disclosures (TCFD) (Ministry of Corporate Affairs, 2021). BRSR Framework Analysis The BRSR framework requires companies to report on nine principles, including "Principle 6: Businesses should respect, protect, and make efforts to restore the environment" (Ministry of Corporate Affairs, 2021). Under this principle, companies are required to disclose their Scope 1, Scope 2, and Scope 3 GHG emissions, as well as their energy consumption and water consumption patterns. "The inclusion of Scope 3 emissions reporting is particularly noteworthy, as it encompasses indirect emissions from a company's value chain, including upstream and downstream activities" (Jain & Winner, 2016). This holistic approach to emissions reporting is expected to provide stakeholders with a comprehensive understanding of a company's environmental impact and its efforts to mitigate climate change. The BRSR framework also mandates the disclosure of specific metrics and targets related to GHG emissions reduction, energy efficiency, and the use of renewable energy sources. This emphasis on measurable goals and progress tracking is designed to drive tangible action towards environmental sustainability (Ministry of Corporate Affairs, 2021). Emissions Review Scope 1 emissions refer to direct GHG emissions from sources owned or controlled by a company, such as fuel combustion in boilers or vehicles. Scope 2 emissions encompass indirect emissions from the generation of purchase of electricity, heat, or steam. Scope 3 emissions are all other indirect emissions that occur in a company's value chain, including upstream and downstream activities (GHG Protocol, 2011). In the context of India, research has highlighted the challenges faced by companies in accurately reporting their Scope 1 and Scope 2 emissions. Garg (2014) noted the "lack of awareness, inadequate technical capacity, and lack of robust institutional arrangements for monitoring and reporting GHG emissions" as key barriers. Furthermore, the study found that "the quality of emissions data reported by companies is often17 questionable due to the lack of standardized methodologies and third-party verification" (Garg, 2014). Scope 3 emissions reporting presents even greater challenges due to the complexity of value chain activities and the reliance on data from third-party suppliers and partners. Jain and Winner (2016) observed that "most companies do not report their Scope 3 emissions or provide only limited information, citing data availability and measurement difficulties." "The inclusion of Scope 3 emissions

in the BRSR framework is a significant step towards promoting transparency and accountability in supply chain emissions. However, it also poses substantial challenges for companies in terms of data collection, calculation methodologies, and stakeholder engagement" (Chakrabarty & Wang, 2016). Challenges in Reporting Several challenges have been identified in the literature regarding the accurate and comprehensive reporting of GHG emissions by Indian companies. One major challenge is the lack of standardized methodologies and protocols for emissions measurement and calculation (Garg, 2014). Inconsistent approaches and assumptions can lead to variations in reported emissions data, making it difficult to compare performance across companies or sectors. "Another challenge is the limited technical capacity and expertise within companies to conduct emissions inventories and assessments" (Das & Bhattacharya, 2015). This can result in incomplete or inaccurate data collection, particularly for Scope 3 emissions, which require a thorough understanding of complex value chain activities. Data availability and quality also pose significant challenges, especially for Scope 3 emissions, where companies rely on information from external sources. Kansal et al. (2014) highlighted the "lack of reliable and verifiable data from suppliers and partners" as a barrier to comprehensive emissions reporting. Furthermore, the cost and resource implications of conducting comprehensive emissions assessments and implementing mitigation strategies can be a deterrent for companies, particularly smaller ones (Jain & Winner, 2016). This underscores the need for capacity building initiatives and support mechanisms to assist companies in complying with the BRSR requirements. Sector-Specific Insights The literature provides insights into the unique challenges and opportunities for GHG emissions reporting across different sectors in India. For instance, the energy sector as a significant contributor to overall emissions, faces challenges in accurately accounting for emissions from various fuel sources and complex supply chains (Garg, 2014). "The manufacturing sector, which encompasses a wide range of industries, presents diverse challenges depending on the specific processes and materials involved" (Das & Bhattacharya, 2015). For example, emissions from cement production and chemical processes require specialized measurement techniques and industry-specific protocols. On the other hand, the information technology and services sectors, which have a relatively smaller direct emissions footprint, may face challenges in quantifying and reporting Scope 3 emissions associated with18 employee commuting, business travel, and data center operations (Chakrabarty & Wang, 2016). Despite these challenges, some sectors have demonstrated exemplary practices in emissions reporting and mitigation strategies. For example, the renewable energy sector has been at the forefront of promoting transparency and accountability, with companies voluntarily disclosing their emissions and setting ambitious reduction targets (Jain & Winner, 2016). Impact on Corporate Sustainability The literature highlights the potential impact of GHG emissions reporting on broader corporate sustainability efforts. Transparent and comprehensive emissions reporting can serve as a catalyst for companies to identify opportunities for energy efficiency improvements, adoption of cleaner technologies, and incorporation of renewable energy sources into their operations (Kansal et al., 2014). "By quantifying and disclosing their environmental impact, companies can better engage with stakeholders, such as investors, customers, and local communities, on their sustainability commitments and progress" (Chakrabarty & Wang, 2016). This increased transparency can enhance stakeholder trust, improve brand reputation, and potentially provide a competitive advantage in the long run. The BRSR framework then encourages companies to set specific targets and goals for emissions reduction and environmental performance improvement. This goal-setting approach can drive continuous improvement and foster a culture of sustainability within organizations (Ministry of Corporate Affairs, 2021) 2.3 Research Gaps and Future Directions While the reviewed literature provides valuable insights into the current state of GHG emissions reporting in India, several gaps and areas for future research have been identified: 1. Impact assessment of the BRSR framework: As the BRSR framework is relatively new, there is a need for longitudinal studies to assess its effectiveness in driving improved emissions reporting practices and actual emissions reductions among Indian companies. 2. Scope 3 emissions reporting challenges: Given the significant challenges associated with Scope 3 emissions reporting, further research is needed to develop robust methodologies, data collection strategies, and stakeholder engagement approaches specifically tailored to the Indian context. 3. Sector-specific best practices: While some sector-specific insights are available, there is a need for comprehensive research that identifies and disseminates best practices in emissions reporting and mitigation strategies across various industries in India. 4. Role of technology and innovation: Exploring the potential of emerging technologies, such as blockchain, artificial intelligence, and Internet of Things (IoT), in streamlining emissions data collection, verification, and reporting processes could be a valuable area of research.19 5. Stakeholder perspectives: Understanding the perspectives and information needs of various stakeholders, including investors, regulators, civil society organizations, and consumers, could inform the development of more effective and relevant emissions reporting frameworks. While the BRSR framework represents a significant step towards mandating and standardizing emissions reporting in India, the literature has identified several research gaps that need to be addressed. These include assessing the effectiveness of the BRSR framework, developing robust methodologies for Scope 3 emissions reporting, identifying sector-specific best practices, exploring the role of technology and innovation, understanding stakeholder perspectives, and analyzing the challenges faced by SMEs and local-level businesses (Deegan & Islam, 2014; Narayanan & Soonawala, 2017; Rangan et al., 2015). Methodology The present research embarked on a comprehensive and rigorous methodology to systematically compile, validate, and analyze a granular environmental, social, and governance (ESG) dataset, coupled with financial performance indicators, for Indian corporations. This multifaceted approach aimed to derive actionable insights into the maturity of sustainability reporting practices and the broader integration of ESG considerations into corporate performance. The methodology comprised three distinct phases, each characterized by meticulously attending to details and adhering to industry best practices. 3.1 Phase I: Data Collation The initial phase involved a process of compiling sustainability report disclosures, quantitative ESG data, and financial performance data for each company into a comprehensive master database. This process necessitated a

thorough review of a diverse range of sources, including corporate reports, regulatory filings, publicly available databases, and industry-specific resources. Relevant disclosures and metrics were meticulously captured and categorized under broad themes, such as greenhouse gas emissions, water consumption, waste management, energy usage, diversity and inclusion practices, and corporate governance frameworks. This comprehensive data collection approach ensured that a holistic perspective was maintained, encompassing the multifaceted nature of environmental, social, and governance considerations. Any data gaps or inconsistencies encountered during the compilation process were meticulously documented and flagged for further investigation and rectification in subsequent phases of the research methodology. 1. Data Frame This research utilized secondary dataset comprising both qualitative and quantitative ESG and financial data for 1000 Indian companies. The key materials used were: Annual reports, integrated reports and sustainability reports for the latest financial year were collected for 1000 companies listed on the BSE and NSE across sectors like IT, banking, auto, pharma etc. These disclosures are a rich source of qualitative information on ESG strategies, policies, risks, performance and governance. Quantitative financial data was also obtained from BSE, NSE and Screener for material financial performance indicators like revenue, profit, stock price, market capitalization etc. The large sample size of 1000 companies allowed for segmentation by sector, market cap and other parameters to discern specific trends. The combination of qualitative and quantitative data enabled a multidimensional perspective on ESG integration by Indian businesses. Quantitative ESG data was obtained from sustainability reports as well as ESG data providers like BSE, NSE, Trendlyne and Screener. This included around 50 material ESG parameters including GHG emissions, water withdrawal, energy intensity, waste generation, community investments etc. The variables and their importance in data collection and analysis is subsequently discussed.21 2. Description of Variables Variables are key elements that are studied and analyzed to understand relationships, patterns, and causal effects within a research study. Understanding and defining these variables is crucial for designing a sound research methodology and interpreting the results accurately. The significance of these variables in the context of the thesis on "An analysis of Scope-1, 2, 3 emissions of BRSR mandated 1000 Indian Industries" is explained below: There is a table here By incorporating categorical, numerical, and binary variables in the analysis can reflect on a comprehensive understanding of the factors influencing emissions reporting practices, waste management strategies, and environmental performance among the BRSR-mandated Indian industries. This multifaceted approach allows for the identification of patterns, relationships, and insights that can inform policy decisions, industry best practices, and strategies for enhancing corporate environmental accountability and sustainability. Data Validation The compiled data underwent a rigorous validation process to ensure accuracy, consistency, and alignment with established reporting norms and frameworks. This phase involved a series of systematic steps to enhance the reliability and integrity of the dataset: 1. Missing Information Rectification: In instances where information was missing or incomplete, the research team diligently referred back to the original source reports and filings to rectify the gaps. In cases where data remained unavailable despite exhaustive efforts, a thorough assessment was conducted to determine the significance and potential impact of the missing data on the overall analysis. Appropriate measures, such as exclusion or imputation techniques, were then employed to mitigate the effects of missing data on the robustness of the findings.25 2. Outlier Identification and Verification: Potential outliers in quantitative metrics were systematically identified using robust statistical techniques. Each identified outlier was meticulously cross-checked against the source reports to eliminate the possibility of data entry errors or discrepancies. This rigorous process ensured that any deviations from the norm were accurately captured and accounted for in the subsequent analysis phases. 3. Unit Standardization: To facilitate consistent comparison and analysis across the diverse dataset, all ESG metrics were standardized to uniform units of measurement. For instance, greenhouse gas emissions were consistently recorded in metric tons of carbon dioxide equivalent (tCO2e), water consumption in kiloliters, waste generation in metric tons, and energy intensity in joules/rs. 4. Compliance Validation: The compiled data underwent a comprehensive validation process to ensure alignment with widely accepted sustainability reporting frameworks, such as the Global Reporting Initiative (GRI) Standards and the Business Responsibility and Sustainability Reporting (BRSR) guidelines mandated by the Securities and Exchange Board of India (SEBI). This validation step ensured that the dataset adhered to established reporting norms and best practices, enhancing the credibility and comparability of the analysis. The rigorous validation process undertaken in this phase ensured the accuracy, coherence, and comparability of the dataset, laying a solid foundation for the subsequent analysis phase. 3.3 Data Analysis The validated dataset underwent a comprehensive statistical analysis using advanced tools and techniques, including Microsoft Excel and SPSS (Statistical Package for the Social Sciences). The analysis phase employed a diverse range of quantitative and qualitative methods to derive meaningful insights and facilitate a holistic understanding of the Indian corporate landscape: 1. Descriptive Statistics: Summary statistics, such as means, standard deviations, minima, and maxima, were calculated for key ESG and financial performance metrics. These descriptive measures established baseline performance levels, identified potential outliers or deviations from industry norms, and provided a foundation for further comparative analyses. 2. Segmentation and Comparative Analysis: The dataset was segmented based on industry sectors, market capitalization, and other relevant factors to discern specific trends, challenges, and opportunities within different segments of the Indian corporate landscape. This approach facilitated the identification of industry-specific nuances and tailored recommendations for enhancing sustainability practices and reporting. 3. Visual Representation: Graphical techniques, including box plots, histograms, and scatter plots, were employed to visually represent the distribution and spread of ESG data across different companies and sectors. These visual representations facilitated effective communication and interpretation of findings, enabling stakeholders to gain a comprehensive understanding of the corporate sustainability landscape.26 The methodology, combining comprehensive data sources, rigorous validation processes, and multivariate statistical

analysis techniques, facilitated the generation of data-driven insights into the current state of sustainability reporting maturity, the integration of ESG considerations into corporate performance, and the identification of potential linkages between ESG practices and financial outcomes among Indian corporations. The insights derived from this comprehensive study serve as a valuable resource for regulators, policymakers, corporate decision-makers, and other stakeholders in the Indian sustainability landscape. The research findings can inform strategies and initiatives to further strengthen ESG integration, enhance transparency in sustainability reporting, and drive meaningful progress toward a more sustainable and responsible corporate ecosystem in India. The BRSR Template: Applications and Potential Improvements The concept of Business Responsibility and Sustainability Reporting (BRSR) marks a significant milestone in India's journey towards a more sustainable future. Its genesis can be traced back to the growing global discourse on Environmental, Social, and Governance (ESG) practices and the increasing recognition of their importance for businesses. This discourse has ignited a debate around the very notion of business sustainability, prompting countries like India to take proactive steps towards integrating these considerations into their corporate governance landscape. 4.1 India's Position on ESG and Business Sustainability: India has actively participated in the evolving conversation surrounding ESG and business sustainability. Over the past decade, the country has witnessed several crucial initiatives aimed at promoting responsible business conduct and fostering a culture of sustainability within its corporate sector. These initiatives highlight India's commitment to aligning its economic growth with broader environmental and social considerations. The seeds of BRSR were sown in 2009 when the Ministry of Corporate Affairs (MCA) issued the Voluntary Guidelines on Corporate Social Responsibility (CSR). This marked the beginning of a concerted effort to mainstream responsible business practices in India. Recognizing the growing importance of encompassing a wider range of sustainability concerns, the MCA went on to release the National Voluntary Guidelines on Social, Environmental and Economic Responsibilities of Business (NVGs) in 2011. These comprehensive guidelines established a framework for business responsibility reporting, outlining nine core principles spanning various aspects of responsible business conduct, including ethics, product responsibility, employee well-being, stakeholder engagement, and environmental protection. Taking the lead in promoting sustainability reporting, the Securities and Exchange Board of India (SEBI) mandated the top 100 listed companies to file Business Responsibility Reports (BRRs) based on the NVG framework in 2012. This requirement was subsequently extended to include the top 500 companies by 2015. The Companies Act, 2013 further bolstered these efforts by mandating specific non-financial disclosures from companies. These early regulatory steps positioned India as a forerunner in sustainability reporting compared to several other countries that relied primarily on voluntary frameworks. Despite the initial regulatory push, concerns were raised regarding the quality of disclosures submitted by companies. A study conducted by the Indian Institute of Corporate Affairs (IICA) and UNICEF in 2019 revealed inconsistencies in the completeness, accuracy, and clarity of reported information, particularly in areas related to supply chains, contract labor, and environmental indicators. These findings highlighted the need for a more robust and standardized approach to ensure transparency and comparability in sustainability reporting practices.28 4.2 Addressing the Gaps: The Genesis of BRSR In response to these identified shortcomings, SEBI constituted a committee in 2019 to revise the existing BRR format for both listed and unlisted companies. This committee undertook a comprehensive analysis of existing BRR disclosures submitted by the top 500 companies, along with valuable insights gleaned from the IICA-UNICEF study. The committee's analysis served as the foundation for proposing the 'BRSR', a more comprehensive and standardized framework for sustainability reporting in India. The BRSR framework comprises three distinct sections: Section A: General Disclosures: This section focuses on capturing essential company information, including size, product offerings, operational locations, details of CSR activities, and proximity to ecologically sensitive areas. Section B: Management and Process Disclosures: This section delves deeper into the company's management processes and stakeholder engagement mechanisms established to uphold responsible business conduct principles. Section C: Leadership Indicators: This section evaluates the company's performance and impact related to each of the nine National Guidelines on Responsible Business Conduct (NGRBCs). These guidelines, updated in 2019, serve as the foundation for assessing responsible business practices, encompassing core elements like ethical conduct, safety, human rights, environmental stewardship, and stakeholder engagement. Acknowledging the unique challenges faced by smaller companies with limited experience in sustainability reporting, the committee proposed a simplified BRSR Lite version. This version caters specifically to smaller companies, encouraging them to participate in the BRSR framework by simplifying the disclosure requirements. Additionally, comprehensive 'guidance notes' are provided alongside the framework, offering clear definitions and explanations for each question, ensuring consistent interpretation and application across companies. The BRSR framework is designed to seamlessly integrate with existing filing mechanisms employed by companies through the MCA21 portal. This integration fosters standardized and transparent data collection, facilitating efficient analysis and comparison. Recognizing the need for a smooth transition, the committee recommended a phased implementation strategy. The initial phase would target the top 1000 listed companies, leveraging their existing experience with SEBI-BRR filings. Subsequently, the framework could be gradually extended to encompass unlisted companies exceeding specified thresholds in terms of paid-up capital or turnover. 4.3 SEBI's Role and the Journey from Voluntary to Mandatory SEBI played a pivotal role in the evolution of BRSR, acting as a catalyst for its development and implementation. While the initial BRR framework adopted a voluntary approach, SEBI's29 decision to mandate BRSR reporting for the top 1000 listed companies represents a significant shift towards standardization and mandatory sustainability disclosures in India. This move underscores the increasing importance of ESG considerations within the corporate landscape and the growing expectations from stakeholders for transparency and accountability on these critical issues. While BRSR mandates sustainability reporting for specific categories of companies, it is crucial to acknowledge the ongoing debate surrounding its classification as

a full-fledged regulation. Some experts argue that the framework lacks certain features typically associated with regulations, such as clearly defined penalties for non-compliance. Others emphasize its potential to evolve into a stricter regulatory framework in the future, as evidenced by the phased implementation approach and the possibility of introducing penalties at a later stage. The emergence of BRSR signifies a turning point in India's approach to sustainability reporting. By establishing a standardized framework and mandating disclosures from a significant portion of the corporate sector, BRSR has the potential to enhance transparency, promote responsible business practices, and encourage greater stakeholder engagement on matters related to environmental and social responsibility. As the framework evolves and potentially incorporates stricter enforcement mechanisms, BRSR has the potential to position India as a leader in mandating corporate sustainability reporting practices and pave the way for a more sustainable and responsible business ecosystem. 4.4 Challenges Associated with the BRSR Template Data Management Issues: The sheer volume of data demanded by BRSR's nine core principles and 120+ parameters presents a significant hurdle for companies. Many lack the systems and expertise to gather complete, reliable data from various departments, facilities, and formats. Inconsistent data collection methods further complicate matters, making accurate consolidation and reporting a challenge. To add to this, BRSR's relative newness means companies may lack the internal expertise to navigate its intricacies and collect data accurately. This, coupled with limited awareness of nuances and best practices, can lead to misinterpretations and errors. Addressing these challenges requires tailored training and capacity building for personnel involved in data collection and reporting. Data Standardisation issues: Some parameters within the format lack clear definitions or specific measurement methodologies, leading to inconsistencies in how companies interpret and report the data. This can result in variations in data quality and comparability across industries and companies. The BRSR format allows for qualitative and quantitative data, which can be helpful for flexibility, but also contributes to potential misinterpretations and difficulty in aggregating data across companies. While BRSR attempts to unify reporting, it doesn't fully align with established international sustainability reporting frameworks like GRI or SASB. This creates additional work for companies already using these frameworks, and hinders international comparability of Indian company data. The BRSR format applies to a wide range of industries with diverse activities and data availability. This "one-size-fits-all" approach30 might not capture the nuances of each sector, leading to challenges in providing relevant and comparable data across industries. Difficulty with normalization and benchmarking: The lack of standardized units or normalization factors for certain parameters makes it difficult to compare data across companies or track progress over time. This hinders benchmarking and industry-wide analysis of performance. Comparability and Materiality: Ensuring comparability of ESG disclosures across companies and sectors can be challenging given the diversity of businesses. Additionally, identifying material ESG issues specific to each company’s operations can be a complex task. Guideline issues(Annexure based issues): While Annexure I offers clear guidelines on presenting quantitative and qualitative data for NGRBC's 9 principles, collecting data for these principles can still be challenging for those unfamiliar with the process. The absence of awareness about how to gather data might make this task seem complex and overwhelming. Data Validation issues: Ensuring the accuracy and reliability of reported ESG information may necessitate third-party assurance or verification. This can prove to be a costly and time- consuming process for companies.The global frameworks had already made it mandatory to have a third party assurance, so taking rigid initiatives in that direction is the need of the hour. Regulation Based issue (Penalty & Incentive): The BRSR framework currently lacks a defined incentive structure, offering neither explicit rewards nor penalties for company participation. Within a sector it has been seen that a lot of companies follows BRSR seriously while others don’t. This does not appreciate the companies which follows and makes them inferior to others. An example of this is the financial services sector where most reputed and well-established banks have not disclosed anything about their emission, energy intensity and waste. Although they are least responsible for these but as a matter of fact it can be seen that other organizations in the same sector and falling in the same category in terms of their turnover & PAT are disclosing about all ESG parameters. So there is no incentive to them and neither any penalty for the former one. Alignment with other disclosure: The BRSR template has partial alignment with TCFD recommendations focused on climate-related financial disclosures. On governance, BRSR incorporates disclosure of board and management oversight of climate issues. The strategic impact of climate-related risks and opportunities is covered as well. However, BRSR falls short on requiring scenario analysis and clear metrics/targets to assess climate resilience. While climate risk management is referenced in BRSR, detailed disclosure expectations around processes, tools and metrics are lacking unlike TCFD. More granular disclosures on risk identification, assessment and mitigation activities can be integrated. Strengthening the strategic planning, target setting and risk management aspects will significantly bolster BRSR's climate focus.31 As ISSB provides comprehensive sustainability disclosure standards spanning environmental, social and governance factors, substantial potential exists for BRSR to integrate relevant metrics and disclosures across material topics where its coverage is limited. On environmental factors like water, biodiversity and circular economy, ISSB sets out detailed disclosure expectations which can significantly widen BRSR's scope. Similarly, on social factors - labor practices, human rights and community relations - BRSR's disclosure requirements are generic in comparison to ISSB standards. For example, categories of Scope 3 GHG emissions, breakdown of workforce diversity data, regional expenditures and taxes paid are sought by ISSB. Adopting relevant metrics and granular disclosure requirements from ISSB can address BRSR's gaps on material issues like supply chain impacts, human capital management and business ethics. This will ensure more comprehensive sustainability reporting by Indian businesses. Additionally, BRSR can benefit by aligning with other established global frameworks like GRI, SASB and IIRC that investors are accustomed to. For instance, adopting GRI's reporting principles like sustainability context, materiality and completeness can strengthen BRSR disclosures. SASB's sector-specific and financially material metrics can enhance the template's relevance for investors. Integrated

reporting elements like connecting sustainability performance with strategy and risks are also valuable. Another key limitation versus global frameworks is lack of assurance requirements in BRSR which hampers disclosure credibility. Requiring reasonable/limited assurance by accredited providers as mandated by GRI, IIRC and ISSB can significantly add value. Reasonable assurance for environmental and social data over time can be considered given data accuracy challenges. BRSR makes an important start in setting sustainability reporting expectations in India. However, integrating metrics and disclosure requirements from globally accepted reporting frameworks can address gaps in materiality, completeness, comparability, balance and reliability. This will drive increased transparency and position India as an attractive ESG investment destination. 4.5 Analysis of BRSR Template Adoption by companies In the examination of data disclosure within BRSR reports, standardization issues have been identified, particularly in the representation of missing data and units of the indicators. Instances where data are denoted as 'N/A', 'Not Available', 'Nil', a dash ('-'), or 'blank' present challenges in interpretation and analysis. This discrepancy raises concerns regarding the clarity and consistency of reporting practices, prompting questions about the guidelines provided by a regulatory body, the Securities and Exchange Board of India (SEBI). Of particular interest is the comparison between blank spaces and entries denoted as "Nil." The stakeholders may interpret these representations differently, leading to potential misinterpretations or inaccuracies in data analysis. A blank space may imply that the data point was not applicable or not reported, whereas the entry "Nil" explicitly indicates that the value is zero or that the data point has been intentionally reported as having no value.32 The lack of coherence in the unit of key performance indicators (KPIs) within 1000 BRSR reports raises significant concerns about the consistency of sustainability reporting practices among companies. Specifically, the data discrepancies in reporting water intensity, a critical indicator outlined in the BRSR guidance document, exemplify the prevailing issue. While the guidance clearly indicates the unit as KL (Kilo Liter)/ Rupee, the collected data from the companies revealed a diverse array of units, including KL/Rs, KL/Th Rs, KL/lakhs, KL/Mn, KL/Crores, without unit, L/Rs, L/Lacs, and L/crore. Additionally, some companies opted not to indicate the unit for water intensity, while others presented values by directly calculating total water consumption divided by turnover. Notably, instances where both values of the total water consumption and turnover were provided, but water intensity presented as an "NA" indication further underscore the lack of standardised reporting practices. The inconsistency in units persists in the case of the second indicator, Energy Intensity, as outlined in the BRSR format. Despite the prescribed units of joules or multiples of joules, such as gigajoules per rupee turnover, the dataset reveals a wide range of units utilised by companies. These include KJ/Rs, GJ/Rs, GJ/Mn, J/Rs, TJ/Rs, MJ/Rs, kWh/Rs, TJ/Lac, MWh/Rs, MJ/Lac, kWh/Lac, GJ/Cr, TJ/Cr, GJ/Lac, Wh/Rs, TJ/Mn, MWh/Cr, and MJ/Mn. Furthermore, sectorwise filtering of the data reveals a consistent pattern of inconsistency across various sectors. For example - The data presented for energy intensity within the capital goods sector exhibits inconsistencies in measurement units. Examples include 211 GJ/Million Rs, 1,289 GJ/Billion INR, 0.003 KWh/Rs, 52.24 GJ/Cr, and 4.002 GJ/Lacs. This lack of standardization hinders meaningful comparison and analysis across companies, as it is impossible to directly compare energy intensity values expressed in different units. The challenges surrounding the disclosure of air emissions (other than GHGs) within the BRSR framework highlight critical issues in corporate sustainability reporting practices. As per the guidance document Annexure 2 provided by SEBI mentions that 'Entities should disclose any contextual information is necessary in order to understand how the data has been compiled, such as any standards, methodologies, assumptions and/or calculation tools used'. According to BRSR format, under principle 6 in the air emission table, there is a specific column named 'please specify unit'. The first challenge emerges from discrepancies between the units specified in the "please specify unit" column and the actual values provided, with companies presenting values in metric tons (MT) instead of the designated units such as mg/NM3. The second challenge arises from the varied units used to report air emission parameters, including mg/NM3, ug/NM3, ppm, and tonnes, further complicating intercompany comparisons within the same sector. For example - The disclosed air emission data (excluding greenhouse gases) for nitrogen oxides (NOx) from companies within the consumer services sector exhibits a lack of standardization in measurement units. Examples include 1.88 g/kWh, 722 mg/nm³, 127.7 µg/m³, 3.02 tonnes, and 20.14 ppm. Even the units of scope 1 and scope 2 emissions of two companies are not upto any guidelines or framework and written as "Gco2/Littre" which is hard to quantify as what is the company trying to convey over there. This is how irresponsible the organisation is towards the most important environment disclosure from the perspective of sustainability. Some strict penalties are required to sensitize these type of companies.33 Finally, the inconsistent use of NA, blank cells, dashes (-), or "nil" entries in reporting exacerbates the ambiguity surrounding companies' disclosure practices, hindering stakeholders' ability to assess and interpret air emission data effectively. For example - Within the Financial Services Sector, specifically the Banks industry, only 5 out of 36 companies disclosed data on air emissions (excluding greenhouse gases) in the provided dataset. The remaining companies either stated "not applicable" in their reports, used notations like "NA" or "-", or left the data cell entirely blank. The discrepancies observed in the reporting of Research and Development (R&D) expenditures within the BRSR framework, as outlined under Principle 2 of Section C, 'Percentage of R&D and capital expenditure (capex) investments in specific technologies to improve the environmental and social impacts of product and processes to total R&D and capex investments made by the entity, respectively.' Despite the explicit requirement to provide data as a percentage of R&D and capital expenditure investments in specific technologies, many companies opt to report R&D expenditures in monetary terms, such as crore rupees or million rupees, deviating from the specified format. Furthermore, the absence of guidance in Annexure 2 exacerbates the confusion surrounding data disclosure requirements. The indiscriminate use of a dash (-) further compounds the issue, as it can be interpreted in various ways, ranging from no data available to not applicable or simply a refusal to disclose. For example- Among the 63 companies in the Automobile and Auto Components sector, 19 did not disclose research and development (R&D) expenditure in technologies aimed at improving the

social and environmental impacts of their products and processes. These companies instead left the corresponding data cell empty. Additionally, 3 companies stated that disclosing such information was not applicable within the context of the report. In another example A company (sector: manufacturing, sub-sector: cables & electricals), with a turnover of 69,123.30 crores, reports no R&D expenditure under relevant accounting principles and makes no mention of an R&D fund. However, the company acknowledges spending 2.6 crores on energy efficiency and plastic waste reduction initiatives as part of its capital expenditure (capex). This discrepancy raises concerns about the potential for irregularities, as activities like these could be categorized as R&D, and the company might not have established a dedicated R&D fund, potentially leading to a 0% disclosure of its total R&D expenditure. Such inconsistencies and ambiguities in reporting hinder stakeholders' ability to accurately assess and compare companies' efforts in improving environmental and social impacts through R&D investments. These ambiguities about the interpretations underscore the importance of clear and consistent data reporting standards within the BRSR framework. Stakeholders, including investors, analysts, and policymakers, rely on accurate and transparent disclosure to make informed decisions and assess the sustainability performance of organisations. Inconsistencies in reporting practices may undermine the credibility and reliability of sustainability reports, hindering efforts to promote transparency and accountability in corporate disclosures. Addressing BRSR Challenges and Avoiding Greenwashing The Business Reporting on Sustainability Reporting (BRSR) framework offers a valuable step towards transparent and accountable sustainability reporting in India. However, several challenges currently hinder its effectiveness, requiring solutions regarding awareness, focus and capacity building. Addressing these issues, alongside vigilance against greenwashing, is crucial for BRSR to achieve its full potential. Tackling Data Management Hurdles Standardization and Capacity Building: Ambiguous definitions and inconsistent interpretations can lead to unreliable data. To address this, the BRSR framework needs to clearly define each parameter, provide standardized measurement methodologies, and utilize consistent units. For instance, instead of accepting data in diverse formats like "N/A," "Nil," or blank spaces, a standard terminology like "Not Applicable" could be implemented. Additionally, training programs for personnel engaged in data collection, analysis, and reporting should be organized. These programs can equip individuals with the necessary skills to accurately interpret BRSR requirements and better ensure consistent application across the organization. Example: Consider the case of water intensity, a key BRSR indicator. Currently, companies report water intensity using various units like KL/Rs, KL/Th Rs, KL/lakhs, KL/Mn, KL/Crores, etc. Standardizing the unit to KL/Rupee will enable meaningful comparison across companies and industries. Data Management Systems: Companies should be encouraged to invest in robust data management systems capable of efficiently collecting, storing, and analyzing large volumes of sustainability data. These systems can streamline data collection processes, ensure data integrity, and facilitate easier reporting. Internal Expertise: Fostering a culture of sustainability within organizations is crucial. This can be achieved by promoting internal awareness about the importance of sustainability reporting and building dedicated teams responsible for BRSR reporting. These teams can be responsible for data collection, analysis, and ensuring adherence to BRSR guidelines. Overcoming Standardization Issues Refined BRSR Template: The BRSR template should undergo continuous review and updates to reflect evolving trends, address emerging issues, and align with established international frameworks like GRI and SASB. Additionally, incorporating sector-specific nuances can further enhance its effectiveness. For instance, the template could mandate the disclosure of specific water stress indicators for companies operating in water-scarce regions, but not for those in water-abundant areas. Detailed Guidelines: Alongside the template, comprehensive guidelines offering clear instructions on data collection, interpretation, and reporting for each parameter should be35 developed. These guidelines should address ambiguities and provide concrete examples to minimize misinterpretations and ensure consistent application. For example: The BRSR framework currently lacks clarity on how to report air emissions (excluding greenhouse gases) other than in metric tons (MT). To address this, the guidelines could specify acceptable alternative units like grams per cubic meter (g/m^3) or milligrams per cubic meter (mg/m^3), along with conversion factors to ensure consistency. Enhancing Comparability and Materiality Sector-Specific Templates: Developing sector-specific BRSR templates can improve the comparability of data within industries. These templates can include tailored parameters and disclosure requirements relevant to the specific environmental and social challenges faced by each sector. Materiality Assessment Tools: Robust and accessible materiality assessment tools can be provided to help companies prioritize the most significant sustainability issues relevant to their operations. This ensures that BRSR reports focus on material aspects and avoid distractions by irrelevant information. Standardized Normalization Factors: To enable meaningful comparison beyond just raw numbers, BRSR can introduce standardized normalization factors. These factors could consider metrics like production volume, revenue, or employee count, allowing for the comparison of data from companies of various sizes and operating within different contexts. Addressing Guideline and Data Validation Issues Clarification and Support: To minimize ambiguity and ensure consistent data collection across companies, detailed clarifications and examples should be provided for Annexure-based guidelines. This could involve offering online resources, holding clarification workshops, or establishing a dedicated support mechanism for companies seeking guidance on specific aspects of BRSR reporting. Assurance Options: Implementing a tiered assurance structure can cater to companies of varying sizes and resource constraints. This could involve offering options like limited or reasonable assurance by accredited providers. While mandatory assurance may be challenging for all companies, encouraging some form of assurance can enhance the credibility and reliability of BRSR data. Incentive-based Approach: Implementing an incentive-based system can motivate companies to prioritize high-quality and transparent BRSR reporting. This could involve recognizing companies with exemplary reports through awards, granting them preferential treatment in government procurement processes, or providing access to specific financing options. Future Scope and Recommendations Looking ahead, the dissertation outlines several areas for future research and development: 1. Enhanced Reporting

Frameworks: There's a need for more robust and detailed guidelines within the BRSR to improve the clarity and comparability of emissions reporting. Future research could explore the development of sector-specific reporting standards and the46 integration of international sustainability reporting frameworks to enhance the global comparability of Indian companies' disclosures. 2. Technology and Innovation: Leveraging emerging technologies such as blockchain, AI, and IoT could streamline the data collection and reporting process, ensuring more accurate and verifiable sustainability disclosures. Further studies could examine the potential of these technologies in overcoming the current challenges of sustainability reporting. 3. Stakeholder Engagement: Engaging a broader spectrum of stakeholders, including investors, consumers, and regulatory bodies, in the development and implementation of sustainability reporting standards can provide more holistic and relevant frameworks. Future initiatives could focus on understanding the needs and expectations of these stakeholders to drive more targeted and effective reporting. 4. Policy and Regulatory Developments: The dissertation suggests the exploration of policy instruments and incentives to encourage more comprehensive and transparent emissions reporting among Indian companies. Future research could further investigate the impact of regulatory changes on corporate sustainability practices and the overall effectiveness of sustainability reporting in driving environmental improvements. 5. Comparative International Studies: Finally, comparing the BRSR framework and its implementation with sustainability reporting practices in other countries could offer valuable insights into best practices and lessons learned. Such comparative studies could inform the further evolution of the BRSR and contribute to the global discourse on corporate sustainability reporting. This dissertation not only provides a comprehensive analysis of the current state of emissions reporting among Indian companies but also highlights the critical role of standardized sustainability reporting in driving environmental accountability and improvements. By addressing the identified challenges and leveraging the outlined opportunities, there is a significant potential to enhance the effectiveness of the BRSR framework and, ultimately, contribute to the broader goals of sustainable development and climate action in India and the world.